1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Diphtheria is an acute bacterial disease caused by *Corynebacterium diphtheriae.*

B. Description of Illness

- ***General facts:*** Diphtheria is an acute bacterial disease primarily involving the tonsils, pharynx, larynx, nose, occasionally other mucus membranes or skin, and sometimes conjunctivae or vagina. Diphtheria was one of the most common causes of death among children in the pre-vaccine era. Since the introduction of the vaccine, diphtheria has been well controlled in the United States. Approximately 5% of people who develop diphtheria die from the disease, and many more suffer permanent damage.
- ***Occurrence:*** Diphtheria occurs worldwide, but clinical cases are more prevalent in temperate zones. In the United States during the pretoxoid era, the highest incidence was in the Southeast during the winter. More recently, highest incidence rates have been in states with significant populations of Native Americans. No geographic concentration of cases is currently observed in the United States. The diphtheria vaccine offers the greatest protection against this disease. The fully immunized person who is exposed can become a carrier of infection, may only develop a mild case, or may not get sick at all. But if not fully vaccinated, the risk of getting severely ill is 30 times higher.
- ***Incubation period:*** Usually about 2 – 5 days (range 1 – 10 days).
- ***Common symptoms*:** There are 2 types of diphtheria causing different symptoms:

  Cutaneous diphtheria – Usually mild, typically consisting of nondistinctive sores or shallow ulcers and only rarely involves toxic complications.

  Respiratory diphtheria – May include nasal, pharyngeal, tonsillar, and laryngeal. Generally presents as a sore throat with low-grade fever; a characteristic grayish membrane is found on the tonsils, pharynx, or nose. This membrane may cause an upper airway obstruction, and neck swelling is usually present in severe disease. The bacteria can release a toxin that spreads through the bloodstream and may cause muscle paralysis, heart and kidney failure, and death. Respiratory diphtheria usually lasts several days; complications can persist for months.
- ***Treatment:*** Persons with suspected diphtheria should be given antibiotics and antitoxin in adequate dosage and placed in isolation after a provisional clinical diagnosis is made, and appropriate cultures are obtained. Respiratory support and airway maintenance should be administered as needed. Antibiotic treatment is with erythromycin orally or by injection (40 mg/kg/day; maximum, 2 gm/day) for 14 days, or procaine penicillin G daily, intramuscularly (300,000 U/day for those weighing 10 kg or less and 600,000 U/day for those weighing more than 10 kg) for 14 days. The disease is usually not contagious 48 hours after antibiotics are instituted. Elimination of the organism should be documented by 2 consecutive negative cultures after therapy is completed.
- ***Preventive Measures***: For close contacts, especially household contacts, a diphtheria booster, appropriate for age, should be given. Contacts should also receive antibiotics – benzathine penicillin G (600,000 units for persons younger than 6 years old and l,200,000 units for those 6 years old and older) or a 7- to 10-day course of oral erythromycin, (40 mg/kg/day for children and 1 g/day for adults). For compliance reasons, if surveillance of contacts cannot be maintained, they should receive benzathine penicillin G. Identified carriers in the community should also receive antibiotics. Maintain close surveillance and begin antitoxin at the first signs of illness.

C. Reservoirs

Humans, which are the only known source of infection, are usually asymptomatic. In outbreaks, high percentages of children are found to be transient carriers.

D. Modes of Transmission

Transmission is most often person-to-person spread via the respiratory tract. Rarely, transmission may occur from skin lesions or articles soiled with discharges from lesions of infected persons (fomites). Raw milk has served as a vehicle.

E. Period of Communicability

Transmission can occur as long as the organisms are present in discharge and lesions. Although it can vary, organisms usually persist for less than 2 weeks and seldom more than 4 weeks. The rare chronic carrier may shed organisms for 6 months or more. The disease is usually not contagious 48 hours after antibiotics are instituted.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Diphtheria is physician reportable by telephone immediately on the day of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of diphtheria to both the DPH and the LHD. **Additional requirements:** Isolates must be submitted to the DPH State Laboratory for confirmation. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Classification

- **Clinical description:** An upper respiratory tract illness characterized by sore throat, low grade fever, and an adherent membrane of the tonsil(s), pharynx, and/or nose.

- **Laboratory criteria for diagnosis**:
  - Isolation of *Corynebacterium diphtheriae* from a clinical specimen, **or**
  - Histopathologic diagnosis of diphtheria

- **Probable Case:** A clinically compatible case that is not laboratory confirmed and is not epidemiologically linked to a laboratory-confirmed case.

- **Confirmed Case**: A clinically compatible case that is either laboratory confirmed **or** is epidemiologically linked to a laboratory confirmed case.

- **Comment:** Cutaneous diphtheria should not be reported. Respiratory disease caused by nontoxigenic *C. diphtheriae* should be reported as diphtheria. All diphtheria isolates, regardless of association with disease, should be sent to the Diphtheria Laboratory, National Center for Infectious Diseases, CDC.

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program ensures that the appropriate diagnostic work has been completed and works in collaboration with LHD to ensure that contacts of each case-patient have been identified, and appropriate recommendations (e.g., vaccination, exclusion) have been made.

- **LHD Responsibility:** The LHD is involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH immunization Program should be contacted (860-509-7929) for guidance on measures and further action, if necessary.

Fact Sheet

What is diphtheria?
Diphtheria is an acute infection caused by a bacterium, *Corynebacterium diphtheriae.* The actual disease is caused when the bacteria release a toxin, or poison, into the person's body.

How does diphtheria spread?
Diphtheria bacteria live in the mouth, throat, and nose of an infected person and can be passed to others by coughing or sneezing. Occasionally, transmission occurs from skin sores or through articles soiled with discharge from sores of infected persons.

What are the symptoms of diphtheria?
Early symptoms of diphtheria may mimic a cold with a sore throat, mild fever, and chills. Usually, the disease causes a thick coating at the back of the throat, which can make it difficult to breathe or swallow. Other body sites besides the throat can also be affected, including the nose, larynx, eye, vagina, and skin.

How long does it take to show signs of diphtheria after being exposed?
The symptoms generally appear 2 – 5 days after exposure, with a range of 1 – 10 days.

How serious is diphtheria?
Diphtheria is a serious disease; 5% – 10% of all persons with diphtheria die. Up to 20% of cases lead to death in certain age groups of individuals (younger than 5 years; older than 40 years).

What are possible complications from diphtheria?
Most complications of diphtheria are due to the release of the toxin, or poison. The most common complications are inflammation of the heart, leading to abnormal heart rhythms, and inflammation of the nerves, which may cause temporary paralysis of some muscles. If the paralysis affects the diaphragm (the major muscle for breathing), the patient may develop pneumonia or respiratory failure. The thick membrane coating at the back of the throat may cause serious breathing problems, even suffocation.

How do I know if someone has diphtheria?
The diagnosis of diphtheria can only be confirmed after a physician takes a small sample of the infected material from the patient's throat (or other site) and has the sample tested in a laboratory. But because this disease progresses quickly, treatment usually should begin based on the health professional's assessment of the patient.

Is there a treatment for diphtheria?
Diphtheria is treated with both antibiotics and with diphtheria antitoxin. Diphtheria antitoxin is produced in horses and was first used in the United States in 1891. Antitoxin does not get rid of toxin that is already attached to the body's tissues, but will neutralize any circulating poison and will prevent the disease from getting worse. The patient should be tested for sensitivity to this antitoxin before it is given.

How long is a person with diphtheria contagious?
The disease usually becomes non-contagious 48 hours after antibiotics are started. However, some individuals continue to carry the diphtheria bacterium even after antibiotic therapy, and treatment should be continued until patients have three consecutive negative cultures.

People providing care for an individual with diphtheria should take standard contact precautions, and make sure they have been adequately immunized against diphtheria.

Is there a vaccine to prevent diphtheria?
Diphtheria toxoid (contained in Tdap, DTP, DTaP, DT, and Td vaccines) can prevent this disease.

How common is diphtheria in the United States?
Diphtheria was once a greatly feared illness in the United States. In the 1920s, there were 100,000 – 200,000 cases of diphtheria each year with 13,000 – 15,000 deaths. Because of widespread immunization and better living conditions, diphtheria is now rare in the United States (during 1998 – 2004, seven cases of respiratory diphtheria were reported to CDC). However, surveys have found that immunity decreases with age, and only 30% of US adults aged 60 – 69 years are protected against diphtheria. This is a concern because the disease continues to occur in other parts of the world. For example, after the breakup of the former Soviet Union, vaccination rates fell, and large outbreaks of diphtheria began in 1990 in the Newly Independent States. From 1990 to 1998, more than 150,000 people got sick from diphtheria and more than 5,000 people died. This situation, and other outbreaks around the world, illustrates what can happen when immunity levels fall. Outbreaks in other countries also increase the risk of diphtheria importation into the United States.

Can you get diphtheria more than once?
Yes. Even individuals recovering from diphtheria should be immunized against the disease as soon as possible.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccine Information

When did diphtheria vaccine become available?

The first inactivated toxin, or toxoid, against diphtheria was developed around 1921, but it was not widely used until the 1930s. In the 1940s, diphtheria toxoid was combined with pertussis vaccine and tetanus toxoid to make the combination DTP vaccine. In 1991, DTaP vaccine was licensed in the United States. The diphtheria component of this combination vaccine is the same as in the DTP vaccine; however, the pertussis component is a more purified "acellular" version, which produces fewer side effects. In 2005, 2 new tetanus toxoid-diphtheria-acellular pertussis (Tdap) vaccines were licensed. These vaccines are the first pertussis-containing vaccines that can be given to persons older than 7 years. Diphtheria is not available as a single vaccine.

What kind of vaccine is it?

The diphtheria vaccine is an inactivated toxin called a toxoid. It is made by growing the bacteria in a liquid medium and purifying and inactivating the toxin.

What's the difference between all the vaccines containing diphtheria toxoid?

Children younger than 7 years receive DTaP (diphtheria/tetanus/acellular pertussis). If they cannot receive the pertussis component of the combined vaccine, they can receive DT (diphtheria/tetanus). DTaP also can be given as part of 2 different combination vaccines; one includes DTaP, polio, and hepatitis B vaccines, and one contains DTaP and Hib vaccines. Children 7 years and older and adults receive a different vaccine - either Td or Tdap.

How is this vaccine given?

The diphtheria vaccine is given as a shot in the muscle.

Who should get this vaccine?

Infants should receive DTaP vaccine (or DT if they cannot receive the pertussis component) as part of their routine immunization. Adults should be given a routine booster dose of Td every 10 years. Adults without documentation of ever receiving the basic series of tetanus and diphtheria toxoids should first receive a primary series of 3 doses, properly spaced. A single dose of Tdap is recommended for persons 11 years and older in place of 1 of the Td doses, preferably the first.

How many doses of DTaP vaccine are required?

The usual schedule for infants is a series of four doses given at 2, 4, 6, and 15 – 18 months of age. A fifth shot, or booster dose, is recommended at 4 – 6 years of age, unless the fourth dose was given late (after the fourth birthday). Because immunity to diphtheria wanes with time, individuals should receive a booster dose of Td (adult tetanus and diphtheria) every 10 years. The new Tdap vaccine can be substituted for one booster dose of adult Td.

Should adults who weren't immunized as children receive this vaccine as adults?

Yes. Adults or children 7 years and older without documentation of tetanus and diphtheria vaccination should receive a primary series of 3 doses of Tetanus-diphtheria toxoid (Td). The first 2 doses should be separated by 4 – 8 weeks, and the third dose given 6 – 12 months after the second dose. Tdap vaccine can be substituted for 1 of these 3 doses, preferably the first dose for persons 11 years and older.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) all recommend this vaccine.

How safe is this vaccine?
Most people have no serious reactions from this combined vaccine. The most common reactions are local reactions at the injection site, such as soreness, redness, and swelling. Other possible reactions may include fussiness, mild fever, loss of appetite, tiredness, and vomiting. The use of the more purified DTaP instead of DTP has decreased even these mild reactions.

What side effects have been reported with this vaccine?
Moderate to serious reactions are uncommon with DTaP vaccine. Such reactions include crying for 3 hours or more (up to about 1 child out of 1,000) and high fever (about 1 child out of 16,000). More serious reactions such as seizure are even rarer. For adults receiving Td vaccine, localized non-serious side effects are common (redness, soreness, etc.) but are generally self-limiting and require no treatment.
Receiving more doses than recommended of any tetanus toxoid-containing vaccine can lead to increased local reactions, such as painful swelling of the arm, so it important for adults to keep an up-to-date record of all their vaccine doses. The most frequently reported side effects following vaccination with Tdap were headache, generalized body aches, and tiredness.

How effective is this vaccine?
Approximately 95% of individuals have a protective level of antitoxin in their blood after a properly spaced primary series of vaccine (four doses of DTaP for young children, three of Td/Tdap for adults).

Who should NOT receive diphtheria vaccine?
People who have had a serious allergic reaction to one dose of DTaP, DT, Td, or Tdap vaccine should not receive another. Persons with a moderate or severe illness should postpone receiving the vaccine until their condition has improved.

Can the vaccine cause diphtheria?
No.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Haemophilus influenzae invasive disease is caused by the bacterium *Haemophilus influenzae. H. influenzae* may be either encapsulated (typeable) or unencapsulated (nontypeable). The encapsulated strains are further classified into serotypes *a* through *f*, based on the antigenic characteristics of their polysaccharide capsules. *H. influenzae* serotype b (Hib) is the most pathogenic.

B. Description of Illness

- ***General facts:*** Before the introduction of effective vaccines, Hib accounted for 95% of all strains that caused invasive disease and was the most common cause of bacterial meningitis in children in the United States. Invasive Hib disease now occurs primarily in under immunized children and among infants too young to have completed the primary immunization series.
- ***Occurrence:*** Due to routine use of the Hib conjugate vaccine since 1990, the incidence of Hib disease in infants and young children has decreased by 99% to less than 1 case per 100,000 in children less than 5 years of age. In developing countries, where routine vaccination with Hib vaccine is not widely available, Hib remains a major cause of lower respiratory tract infections in infants and children.
- ***Incubation period:*** Unknown, probably short 2 – 4 days. Most individuals who acquire Hib infections are asymptomatically colonized.
- ***Common symptoms*:** The most common types of invasive disease are pneumonia, occult febrile bacteremia, meningitis, epiglottitis, septic arthritis, cellulitis, otitis media, purulent pericarditis, and other less common infections such as endocarditis and osteomyelitis. Fifteen to 20% percent of cases have permanent hearing loss, and 3% - 6% of cases are fatal.
- ***Treatment:*** Hib disease is treated with antibiotics for 10 – 14 days. Most cases require hospitalization. Even with antibiotic treatment, about 5% of all children with Hib meningitis die from the disease.

C. Reservoirs

Humans are the only known reservoir.

D. Modes of Transmission

Transmission occurs from person to person by respiratory droplets or direct contact with nasopharyngeal secretions of a carrier or an infected person. It is not highly infectious.

E. Period of Communicability

H. influenzae may be transmitted as long as it is present in throat or nasal discharge, which may be for a prolonged period. Communicability ends within 24 – 48 hours of effective antibiotic therapy. The contagious potential of invasive *H. influenzae* disease is considered to be limited. However, certain circumstances, particularly close contact with a case (*e.g.,* in a household, daycare center, or institutional setting), can lead to outbreaks of Hib or direct secondary transmission of the disease. Asymptomatic carriage is known to occur.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Invasive *H. influenzae* infection is physician reportable by mail within 12 hours of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). The director of any clinical laboratory must also report laboratory evidence of invasive *H. influenzae* infection to both the DPH and LHD. **Additional requirements:** All isolates yielding *H. influenzae* from invasive sterile sites must be submitted to the DPH State Laboratory for confirmation. See current list of Physician Reportable Diseases (Attachment A) and Laboratory Report of Significant Findings (Attachment C).

B. Case Definition

- **Clinical description:** Invasive disease caused by *H. influenzae* may produce any of several clinical syndromes, including meningitis, bacteremia, epiglottitis, or pneumonia.

- **Laboratory criteria for diagnosis:** Isolation of *H. influenzae* from a normally sterile site (e.g., blood or cerebrospinal fluid, or less commonly, joint, pleural, or pericardial fluid).

- **Probable Case:** A clinically compatible case with detection of *H. influenzae* type b antigen in CSF.

- **Confirmed Case:** A clinically compatible case that is laboratory confirmed.

C. Case Investigation

- **DPH Responsibility:** The DPH Epidemiology and Emerging Infections Program obtains additional case data by completing a detailed report through medical chart review. Information is forwarded to the Centers for Disease Control and Prevention.

  The DPH is available to the LHD for assistance, consultation, guidance, and to ensure that appropriate investigative and control actions are being taken.

- **LHD Responsibility:** For invasive Hib disease, contact case to identify close contacts (see Control Measures) and ensure they are provided antibiotic prophylaxis. Provide educational materials describing the nature of disease and preventive measures. No follow-up is required for other serotypes.

D. Control Measures

- **Household contacts:** Chemoprophylaxis is recommended for all household contacts in the following circumstances:
  - Household with at last 1 contact younger than 4 years of age who is unimmunized or incompletely immunized;
  - Household with a child younger than 12 months of age who has not received the primary series;

  - Household with a contact who is an immunocompromised child, regardless of that child's Hib immunization status.

- **Daycare contacts:** Chemoprophylaxis is recommended for nursery school and daycare center contacts when 2 or more cases of Hib invasive disease have occurred within 60 days.

- **Index case:** If the index case is younger than 2 years of age or member of a household with a susceptible contact and treated with a regimen other than cefotaxime or ceftriaxone, chemoprophylaxis usually is provided just before discharge from hospital.

Fact Sheet

What causes *Haemophilus influenzae* type b (Hib) disease?
Haemophilus influenzae invasive disease is caused by the bacterium *Haemophilus influenzae*. There are six different types (a - f). Before the introduction of effective vaccines, *Haemophilus influenzae* serotype b (Hib) was the cause of greater than 95% of invasive disease among children less than 5 years of age.

How does Hib disease spread?
Hib disease is spread person-to-person through respiratory droplets (coughing and sneezing).

What are the symptoms of Hib disease?
A person with invasive Hib disease can have different symptoms depending on what body systems are affected. (See next question.)

How serious is Hib disease?
Hib disease can be very serious. The most common type of invasive Hib disease is meningitis, an infection of the membranes covering the brain (50% – 65% of cases). Symptoms of Hib meningitis are fever, decreased mental status, and stiff neck. The mortality rate is 2% – 5%. In addition, 15% – 30% of survivors suffer some permanent neurologic damage, including blindness, deafness, and mental retardation.

Another 17% of invasive Hib cases include epiglottitis, an infection and swelling in the throat that can cause life-threatening airway blockage. Other, less common, types of invasive Hib disease include joint infection, skin infection, pneumonia, and bone infection.

How long does it take to show signs of Hib disease after being exposed?
The incubation period of Hib disease is unknown but could be as short as a few days.

How do I know if my child has Hib disease?
The diagnosis of Hib disease is usually made based on one or more laboratory tests using a sample of infected body fluid, such as blood or spinal fluid.

Is there a treatment for Hib disease?
Hib disease is treated with antibiotics for 10 days. Most cases require hospitalization. Even with antibiotic treatment, up to 5% of all children with Hib meningitis die from the disease.

How long is a person with Hib disease contagious?
The exact period of contagiousness is not known. Transmission may occur as long as the organism is present in respiratory secretions. Contagiousness ends within 24 – 48 hours of effective antibiotic therapy.

Is there a vaccine to prevent Hib disease?
Hib vaccine is highly effective at preventing this disease.

How common is Hib disease in the United States?
Before the introduction of a Hib vaccine, *H. influenzae* type b (Hib) was the leading cause of bacterial meningitis among children under 5 years old in the United States. Every year about 20,000 children under five got severe Hib disease and about 1,000 individuals died. More than half of children who developed severe Hib disease were less than 12 months of age.

Since 1988, when a Hib vaccine was first introduced, the incidence of Hib disease has decreased more than 99%. From 1996 – 2000, an average of about 68 children per year were reported with Hib disease.

Can you get Hib disease more than once?
Yes. A child with Hib disease may not develop protective levels of antibodies. Children less than 24 months of age who have recovered from invasive Hib disease should be considered unimmunized and receive the Hib vaccine as soon as possible.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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Fact Sheet: Vaccine Information

When did Hib vaccine become available?
The first Hib vaccine was licensed in the United States in 1985; however, it was not very effective in children age 18 months and younger. The first improved Hib vaccine, a conjugate vaccine, was licensed in December 1987.

What type of vaccine is it?
The Hib conjugate vaccine is made by chemically bonding a polysaccharide (sugar) to a protein. The sugar is one that makes up the surface capsule of the bacterium. This is an inactivated vaccine.

How is this vaccine given?
The Hib vaccine is given as an injection into the muscle.

Is there more than one brand of Hib vaccine?
There are several formulations of Hib vaccine, including two that are combined with another vaccine (one with DTaP and another with hepatitis B). The number of doses needed depends on the brand of vaccine given.

All conjugate Hib vaccines may be given interchangeably if the original brand is unknown or unavailable.

Who should get this vaccine?
All infants should receive doses of Hib vaccine as part of their routine immunization (unless they have a medical reason not to). As Hib disease is rare in children older than 5 years, Hib vaccine is not routinely recommended for people 5 years or older.

Is Hib vaccine recommended for anyone age five years or older?
Older children and adults who are at increased risk for invasive Hib disease should be vaccinated. High-risk individuals include those with asplenia (e.g., sickle cell disease, postsplenectomy), immunodeficiency, immunosuppression from cancer chemotherapy, and HIV infection. A previously unvaccinated person with one of these high-risk conditions should be given at least 1 dose of any licensed Hib vaccine.

How many doses of Hib vaccine are required for the childhood series?
Three to 4 doses are needed, depending on the brand of Hib vaccine used. Children should get Hib vaccine at 2 months, 4 months, usually 6 months (depending on the brand of vaccine), and 12 – 15 months of age. Hib vaccine should never be given to a child younger than 6 weeks of age, as this might reduce his/her response to subsequent doses.

My 18-month-old toddler has never received Hib vaccine. Does she still need to get the series?
All children age 12 months or older, and younger than age 5 years, should receive at least 1 dose of Hib vaccine. The number of doses needed to complete the series depends on the child's current age.

Will receiving the Hib shot protect my baby from ever getting meningitis?
No, because meningitis is also caused by other viruses and bacteria. Hib vaccine will only protect against meningitis caused by Hib.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) all recommend this vaccine.

How safe is this vaccine?
Adverse events following receipt of Hib conjugate vaccine are uncommon. The most common reactions are local reactions at the injection site, such as warmth, redness, and swelling, occurring in 5% – 30% of recipients. Up to 1 out of 20 children may develop a fever over 101°F.

How effective is this vaccine?
All the Hib vaccines licensed for use are good at producing immunity to invasive Hib disease. More than 95% of infants will be protected after 2 or 3 doses.

Who should NOT receive Hib disease vaccine?
Anyone who has ever had a life-threatening allergic reaction to a previous dose of Hib vaccine should not get another dose.

Children younger than 6 weeks of age should not get Hib vaccine because a dose given at this time may reduce the infant's response to subsequent doses.

Persons with a moderate or severe acute illness should postpone receiving the vaccine until their condition has improved.

Can the vaccine cause Hib disease?
No. Only the entire Hib bacterium can cause Hib disease. Hib vaccine is a fractional vaccine, containing only part of the Hib microbe.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Hepatitis B virus (HBV) is a DNA virus. There are four major subtypes.

B. Description of Illness

- ***General facts:*** HBV can cause severe illness and chronic infection with potentially serious consequences including cirrhosis, liver failure, and hepatocellular carcinoma. Individuals may be symptomatic or asymptomatic. After acute infection, the risk of developing chronic infection varies with age: 90% of infants infected at birth, 20-50% of children infected at 1-5 years of age, and about 1-10% in older children and adults.
- ***Occurrence:*** It is estimated that 17,000 Connecticut residents are chronically infected. In the United States, it is estimated that 1.25 million individuals are infected with HBV, of whom 20-30% acquired their infection in childhood. HBV is endemic in some countries.
- ***Incubation period:*** Ranges from 60-50 days, with an average of 90 days.
- ***Common symptoms*****:** Fatigue, abdominal pain, loss of appetite, nausea, and joint pain. Jaundice or dark urine may also be observed. It is estimated that 30 - 50% of persons have signs or symptoms during initial infection. Signs and symptoms are less common in children than adults.
- ***Treatment:*** No specific therapy for acute HBV infection is available. Medications for treatment of chronic HBV are available. Treatment outcome is highly variable depending on viral strain and patient factors. Patients should be referred to specialized care for evaluation of treatment options.

C. Reservoirs

Humans are the only known reservoir for HBV.

D. Modes of Transmission

- Person-to-person via blood or body fluids (e.g., wound exudates, semen, cervical secretions). Blood and serum contain the highest concentrations of virus. Common modes of transmission include sharing contaminated needles or “works” (equipment or materials used in preparing drugs for injection), sex with an infected person, contact with blood or open sores of infected person, and mother-to-child.
- Occupational exposure to blood has historically been a risk factor, but HBV vaccination has reduced that risk. The virus can exist in the environment for at least 7 days but is inactivated by common disinfectants. Environmental contamination can be a source of infection.
- Hepatitis B is <u>not</u> transmitted through food or water, sharing eating utensils, breastfeeding, hugging, kissing, hand holding, coughing, or sneezing. There is no exclusion of food handlers.

E. Period of Communicability

Hepatitis B surface antigen (HBsAg) is a protein found on the surface of the virus. All HBsAg positive (HBsAg+) persons should be considered infectious. Antigen can be

detected in blood from 1 - 9 weeks after infection, with an average of 4 weeks. Acutely infected persons can transmit HBV many weeks before the onset of symptoms. Infectiousness of chronic carriers can vary, with hepatitis B e antigen positive (HBeAg+) persons being highly infectious.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Acute HBV infection is physician reportable by mail within 12 hours of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). The director of any clinical laboratory must also report laboratory evidence of HBV infection to both the DPH and LHD.

- HBsAg+ and IgM anti-HBc+ are laboratory reportable.
- HBsAg+ in a pregnant woman is physician reportable.

B. Case Classification

- **Confirmed Acute Case:** Acute cases must meet both clinical and laboratory criteria.
  - Clinical criteria include:
    - Discrete onset of symptoms (fatigue, abdominal pain, loss of appetite, nausea, and joint pain); AND,
    - Jaundice; OR, elevated liver enzymes (ALT).
  - Laboratory criteria include:
    - IgM anti-HBc+ preferred OR HBsAg+ (if IgM anti-HBc not done).
    - IgM anti-HAV negative, if done.
- **Confirmed Chronic Case:**
  - Laboratory criteria
    - IgM anti-HBc negative, AND a positive result of one of the following: hepatitis B surface antigen (HBsAg), HBeAg, or hepatitis B virus DNA (HBV DNA).
    - Any combination of HBsAg+, HBeAg+, or HBV DNA+ two times at least 6 months apart.

C. Case Investigation

- **DPH Responsibility:**
  - DPH maintains a statewide HBV registry of laboratory reports. The DPH database registers new reports of HBV. DPH does not monitor changes in patient residence from one local health jurisdiction to another, except for when a case is confirmed as chronic. The current address is updated for newly confirmed chronic cases, but not after.
  - DPH conducts statewide follow-up on all new HBsAg+ and IgM anti-HBc+ reports with the ordering physician. The purpose of follow-up is to ascertain acute versus chronic case status, reasons for testing, risk factors, and pregnancy status.
  - DPH investigates all cases that meet the acute HBV case definition with the attending physicians to determine if the patients are aware of their diagnoses. DPH will interview all cases to provide education and determine risk factors.
  - DPH provides line lists to LHDs so that education letters can be sent to newly reported chronic cases.
  - DPH consults with LHDs about follow-up [(860) 509-7900].

- DPH conducts statewide follow-up for all pregnant women reported with HBsAg+ and their newborns to assure that perinatal prevention recommendations are followed. To report a case, contact DPH at (860) 509-7900.

- **Local Health Department Responsibility:**
  - Control measures as described below.
  - Staff conducting follow-up should be familiar with CDC HBV recommendations.

D. Control Measures

Working in conjunction with DPH, the following HBV control measures are recommended:

1. *HBV registry*
   - DPH does not recommend that LHDs maintain a registry of cases unless it is identified as a priority of the LHD and staffing resources are sufficient to keep the registry updated.

   - DPH will provide, on request, a line list of newly reported acute and chronic cases from the DPH registry. After an initial confirmed report of an acute or chronic case, DPH does not track changes in residence. LHDs should use line list information to evaluate ongoing need and to conduct activities in 2, below.

2. *Follow-up of chronic HBV patients*
   - Based on the monthly line listings received from DPH, newly reported confirmed chronic HBV patients should receive follow-up that includes a fact sheet or brochure and a list of medical resources available in the local health jurisdiction. DPH can provide a sample cover letter, one-page fact sheet, and information about how to obtain free CDC brochures.

   - Follow-up activities: LHDs should provide services that include the following:
     - Education: Inform patients about the implications of HBV infection (avoidance of alcohol and the need to discuss medications (even over-the-counter medications) with their physician). LHDs should maintain a list of locally available medical care providers where patients can receive ongoing evaluation, additional testing, and vaccination for contacts.
     - Prevention counseling: Caution about not sharing needles, limiting blood exposure to household contacts, and use of condoms to reduce the risk of sexual transmission. Offer to send a fact sheet (available from DPH). Needle, sex, and/or household contacts may need to be tested for HBV and vaccinated as necessary.
     - Additional testing: Persons in risk groups for HIV or HCV should be referred for testing, if not already done.
     - Vaccination:
       - Sex partners of persons with HBV should be tested, and if susceptible should be vaccinated against HBV. Household members of persons with chronic HBV should also be tested and vaccinated if applicable.
       - Recommendations for post-exposure use of vaccine/HBIG are provided in MMWR 55 (RR-16), Dec 2006.
       - HAV vaccination is recommended for chronically infected persons who have been diagnosed with chronic liver disease.

Fact Sheet

What is hepatitis B?
Hepatitis B is a liver disease caused by the hepatitis B virus (HBV). Acute hepatitis B is a newly acquired infection that causes inflammation of the liver for 6 months or less. Chronic hepatitis B is inflammation of the liver for greater than 6 months.

How is hepatitis B spread?
Transmission occurs when blood or body fluids from an infected person enters the body of an uninfected or unvaccinated person. HBV can be spread through sexual activity, sharing needles or "works" when "shooting" drugs, through workplace needle sticks or injuries from sharps, or from an infected mother to her baby during birth. Hepatitis B is not spread through kissing, hugging, breastfeeding, sharing eating utensils or drinking glasses, coughing, sneezing, food, water, or casual contact.

What are the symptoms of hepatitis B?
About 30% of persons have no signs or symptoms. Signs and symptoms are less common in children than adults. Some people experience abdominal pain, loss of appetite, fatigue, nausea and vomiting, dark urine, joint pain, and jaundice (yellowing of the skin and the whites of the eyes).

How soon do symptoms appear?
Usually within 60-90 days after infection but can be as short as 2 weeks and as long as 6 months.

What are the long-term effects of hepatitis B?
If the virus is not cleared during the acute phase, chronic infection may lead to liver disease including liver cancer. Chronic infection occurs in 90% of infants infected at birth, 30% of children infected at age 1-5, and in 6% of persons infected after 5 years of age. Death from chronic liver disease or liver cancer occurs in 15-25% of chronically infected people.

How long is a person able to spread hepatitis B?
Hepatitis B is present before symptoms appear and while symptoms are present. Persons with the hepatitis B virus in their blood can spread hepatitis B to others. Chronic hepatitis B persons with the virus in their blood carry the virus indefinitely.

Can you get hepatitis B more than once?
No. If you have cleared the virus during the acute infection stage, your body produces protective antibodies that will not allow you to contract the virus again.

How is hepatitis B diagnosed?
Only clinicians can diagnose hepatitis B. Diagnosis is based on a laboratory test for hepatitis B. (See Interpretation of the Hepatitis B Panel: http://www.cdc.gov/ncidod/diseases/hepatitis/b/Bserology.htm)

What is the treatment and medical management for hepatitis B?
People with hepatitis B need to be evaluated by their doctor for liver disease. If the disease progresses to chronic infection, Adefovir dipivoxil, interferon alfa-2b, pegylated interferon alfa-2a, lamivudine, entecavir, and telbivudine are six drugs used for treatment in adults. Goals of treatment consist of eliminating hepatitis B virus from the body or suppressing replication of the virus to limit damage to the liver and prevent the spread of the disease to others.

How can the risk of chronic liver disease be reduced among people chronically infected with hepatitis B?
See your doctor regularly. Additional tests may be needed to check to see if you have liver damage. Do not drink alcohol. Check with your doctor before taking any medications, even over-the-counter and herbal medicines may be toxic to your liver. You may need to get vaccinated against hepatitis A.

How can hepatitis B be prevented?

- Hepatitis B vaccine is the best protection. All children 0-18 years of age should be vaccinated plus adults in high-risk groups (injection drug users, men who have sex with men, sex or household contacts of a chronically infected person, health care and public safety workers, hemodialysis patients).
- People with hepatitis B should always be aware that their blood and some other body fluids contain the virus.
- Use of condoms may help reduce the chance of hepatitis B transmission during sex.
- Pregnant women should be tested for hepatitis B. Infants born to hepatitis B-infected mothers should receive hepatitis B immune globulin and vaccine within 12 hours after birth to prevent infection.
- Do not shoot drugs. If you do, get vaccinated and never share needles or works.
- Do not share toothbrushes, razors, or other personal care items.
- If you are a health care worker, get vaccinated against hepatitis B. Always follow barrier precautions.
- If you have or had hepatitis B, do not donate blood, organs, or tissues.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Three types of influenza virus are recognized: A, B, and C. Type A includes three subtypes (H1N1, H2N2, and H3N2) that have been associated with widespread epidemics and pandemics; type B has been infrequently associated with regional and widespread epidemics; type C has been associated with sporadic cases and minor localized outbreaks.

B. Description of Illness

- ***General facts:*** Influenza derives its importance from the rapidity with which epidemics evolve, the widespread morbidity, and the seriousness of complications, notably viral and bacterial pneumonias. During major epidemics, severe illness and death occur, primarily among the elderly and those debilitated by chronic cardiac, pulmonary, renal or metabolic disease, anemia or immunosuppression.
- ***Occurrence:*** Influenza occurs as pandemics, epidemics, localized outbreaks, and as sporadic cases. Epidemics of influenza occur in the United States almost every year (seasonal influenza); they may be caused by type A viruses, occasionally by influenza B viruses or by both.
- ***Incubation period:*** The incubation period ranges from 1 – 5 days (average 2 days).
- ***Common symptoms*:** An acute viral disease of the respiratory tract characterized by abrupt onset of fever, headache, myalgia, prostration, coryza, sore throat and cough. Cough is often severe and protracted, but other manifestations are usually self-limited, with recovery in 2 – 7 days. Additional symptoms may include runny nose, headache, a burning sensation in the chest, and eye pain and sensitivity to light. Someone who has been previously exposed to similar virus strains (through natural infection or immunization) is less likely to develop serious clinical illness.
- ***Treatment:*** There are several antiviral agents approved for preventing or treating influenza in some patients. Their use is generally limited to situations where an outbreak is underway and immediate protection of vulnerable, unvaccinated persons is critical (e.g., nursing home residents) or in persons who are expected to have an inadequate antibody response to the vaccine (e.g., persons with HIV) or who could not otherwise be vaccinated (e.g., persons with severe egg allergies).

C. Reservoirs

Humans are the primary reservoir for human infections; however, reservoirs such as swine and birds are likely sources of new human subtypes thought to emerge through genetic reassortment.

D. Modes of Transmission

Airborne transmission predominates among crowded populations in enclosed spaces; transmission may also occur by direct contact, since the influenza virus may persist for hours, particularly in cold and in low humidity.

E. Period of Communicability

The period of communicability ranges 1 – 2 days before the onset of symptoms to 4 – 5 days after onset. Children may be able to transmit the virus for 7 days or longer following onset of symptoms.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Influenza-associated deaths in children (<18 years of age) are physician reportable immediately by telephone to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of influenza infection in all persons to both the DPH and LHD. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Definition

- **Laboratory criteria for diagnosis:** Laboratory testing for influenza virus infection may be done on pre- or post-mortem clinical specimens, and include identification of influenza A or B virus infections by a positive result by at least one of the following:
    - Influenza virus isolation in tissue cell culture from respiratory specimens; **or**
    - Reverse-transcriptase PCR testing of respiratory specimens; **or**
    - Immunoflorescent antibody staining (direct or indirect) of respiratory specimens; **or**
    - Rapid influenza diagnostic testing of respiratory specimens; **or**
    - Immunohistochemical staining from influenza viral antigens in respiratory tract tissue from autopsy specimens; **or**
    - Four-fold rise in influenza hemagglutination inhibition antibody titer in paired acute and convalescent sera.

- **Confirmed case of influenza-associated pediatric mortality:** An influenza associated death in a child is defined as a death resulting from a clinically compatible illness that was confirmed to be influenza by an appropriate laboratory or rapid diagnostic test in all persons aged < 18 years of age. There should be no period of complete recovery between the illness and death.

C. Case Investigation

- **DPH Responsibility:** The DPH Epidemiology and Emerging Infections Program collects epidemiological, clinical, and laboratory information on all influenza-associated deaths in children.

- **LHD Responsibility:** The LHD is involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunization Program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What causes influenza?
Influenza (also known as the flu) is a contagious respiratory illness caused by flu viruses. Two basic types of virus circulate in the United States, group A and group B. Influenza A may cause moderate to severe illness in all age groups and infects humans and other animals. Influenza B causes milder symptoms and affects only humans, primarily children.

Subtypes of the type A influenza virus are identified by two antigens (proteins involved in the immune reaction) on the surface of the virus. These antigens can change, or mutate, over time. When a shift (major change) or a drift (minor change) occurs, a new influenza virus is born and an epidemic is likely among the unprotected population.

How does influenza spread?
Influenza is transmitted through the air from the respiratory tract of an infected person. It can also be transmitted by direct contact with respiratory droplets.

What are the symptoms of influenza?
Typical influenza disease is characterized by abrupt onset of fever, aching muscles, sore throat, and nonproductive cough. Additional symptoms may include runny nose, headache, a burning sensation in the chest, and eye pain and sensitivity to light. Typical influenza disease does not occur in every infected person. Someone who has been previously exposed to similar virus strains (through natural infection or vaccination) is less likely to develop serious clinical illness.

How long does it take to develop symptoms of influenza after being exposed?
The incubation period for influenza is usually 2 days but can range from 1 – 5 days.

How serious is influenza?
Although many people think of influenza as a type of cold, it is really a specific and serious disease. Disease complications and death are more common among young children, the elderly, and those with chronic illnesses. In the United States, the number of influenza-associated deaths has increased since 1990. This increase is due in part to the substantial increase in the number of persons age 65 years or older, who are at increased risk for death from influenza complications. An average of 36,000 influenza-associated pulmonary and circulatory deaths per season occurred during 1990 – 1999, compared to 19,000 such deaths per influenza season during 1976 – 1990.

Influenza viruses cause disease among persons of all ages. Rates of infection are highest among children, but the risks for complications, hospitalizations, and deaths from influenza are higher among persons aged 65 years or older, young children, and persons of any age who have medical conditions that place them at increased risk for complications from influenza. Case reports and several epidemiologic studies also indicate that pregnancy can increase the risk for serious medical complications of influenza.

In nursing homes, up to 60% of residents may be infected, with up to a 30% fatality rate in the infected. Risk for influenza-associated death is highest among the oldest elderly: persons aged 85 years and older are 16 times more likely to die from an influenza-associated illness than persons aged 65 – 69 years.

Children aged 2 years and younger have hospitalization rates second only to people aged 65 years and older. Children younger than 1 year are the most likely to be hospitalized. Influenza-associated deaths are uncommon among children but represent a substantial proportion of vaccine-preventable deaths. An estimated annual average of 92 influenza-related deaths occurred among children age 5 years or younger during the 1990s, compared with 32,651 deaths among adults aged 65 years or older.

The cost of a severe epidemic has been estimated at $12 billion. Occasionally, major epidemics occur on an international scale. This is known as a pandemic. The first recording of such an event was in 1580, and at least seven international epidemics have occurred in the nineteenth and twentieth centuries. The “Spanish flu” epidemic of 1918 – 1919 caused an estimated 21 million deaths worldwide, including more than 500,000 Americans.

How many people in the United States are hospitalized with influenza in a typical year?
A study conducted by CDC and published in the Journal of American Medical Association (JAMA) on September 15, 2004, provided new information on the number of people in the United States who are hospitalized from influenza-related complication each year. The study was based on records from 1979 to 2001 from about 500 hospitals across the United States. The study concluded that, on average, more than 200,000 people in the United States are hospitalized each year for respiratory and heart-related illnesses associated with influenza virus infections.

How long is a person with influenza contagious?
A person is most likely to pass on the virus during the period beginning 1 – 2 days before the onset of symptoms and ending 4 – 5 days after the onset. Children may be able to transmit the virus for longer than 7 days. Anyone infected with influenza can spread the disease, even if they are not showing symptoms yet.

Is there a vaccine to prevent influenza?
Influenza vaccine can prevent this disease. While it may not prevent all infections, it can reduce the severity of disease and its complications. The vaccine should be received annually and is recommended for certain groups such as people over 50, healthcare workers, people with chronic underlying illnesses, and infants and toddlers 6 – 23 months of age. However, anyone who wants to reduce their chances of getting the flu can get vaccinated.

Is there an alternative to vaccination in preventing influenza? (Kathy has this instead of “Is there a treatment for influenza” –above)
Vaccination is the principal means of preventing influenza and its complications. Here are some additional steps that may help prevent the spread of respiratory illnesses like influenza:

1. Cover your nose and mouth with your sleeve or a tissue when you cough or sneeze—throw the tissue away after you use it.
2. Wash your hands often with soap and water, especially after you cough or sneeze. If you are not near water, use an alcohol-based hand cleaner.
3. Stay away as much as you can from people who are sick.
4. If you get influenza, stay home from work or school. If you are sick, don't go near other people to avoid infecting them.
5. Try not to touch your eyes, nose, or mouth. Germs often spread this way.

There are four antiviral agents approved for preventing or treating influenza in selected patients. Only two, oseltamivir and zanamavir, will offer protection against both A and B viruses; the other two, amantadine and rimantadine, protect only against the A viruses. Their use is generally limited to situations where an outbreak is underway and immediate protection of vulnerable, unvaccinated persons is critical (e.g., nursing home residents) or in persons who are expected to have an inadequate antibody response to the vaccine (e.g., persons infected with HIV) or who could not otherwise be vaccinated (e.g., persons with severe egg allergies). Antiviral agents are not a substitute for vaccination. (Note: Recent evidence indicates that a high proportion of currently circulating influenza A viruses in the United States have developed resistance to amantadine and rimantadine so that these two antivirals cannot be used during the 2007-08 influenza season.)

How common is influenza in the United States?
In the United States, 5% – 20% of the population is infected with the flu each year. Of these, more than 200,000 are admitted to the hospital, and about 36,000 die from the influenza virus.

If I contract influenza, what should I do?
Call your healthcare provider to discuss your particular situation. You will need to get plenty of rest and to drink a lot of liquids. You can take medications to relieve the symptoms of influenza (but never give aspirin to children or teenagers who have influenza-like symptoms, particularly fever). If you are at high risk from complications of influenza, you should consult your healthcare provider immediately if you develop influenza-like symptoms. Those at high risk for complications include people 65 years or older, people with chronic medical conditions, pregnant women, and young children. Your doctor may recommend use of an antiviral medication to help treat influenza.

Why can't we eradicate influenza as we are doing with some other vaccine-preventable diseases (e.g., polio)?
It is difficult to completely eliminate influenza for several reasons:
1. Influenza viruses mutate frequently, making it very difficult to provide one influenza vaccination that will protect an individual for life.
2. Each year's influenza vaccine is made up of three strains of the virus, based on an educated guess of which viruses will be most active during the upcoming influenza season. Occasionally, this projection may be wrong, and that year's vaccine will be less effective.
3. Influenza vaccine is not completely effective at preventing infection, especially with older individuals (although it does protect them from serious complications and death).

4. No attempt is made to vaccinate the entire population. Instead, influenza vaccine is mainly recommended for certain groups such as people over 50, healthcare workers, people with chronic underlying illnesses, and others. Most recently the vaccine was recommended for use in infants and children age 6 months through 18 years of age.

Can you get influenza more than once?
Yes. Influenza viruses change frequently and infection from one strain does not provide protection against all strains.

Technical content reviewed by the Centers for Disease Control and Prevention, October 2007.

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Fact Sheet: Vaccine Information

When did influenza vaccine first become available?
The first influenza vaccine in the United States became available in 1945.

What kind of vaccine is it?
There are 2 types of influenza vaccine. The most common influenza vaccine is made from inactivated (killed) viruses. In June 2003, a live influenza vaccine was licensed. It contains live viruses that have been weakened (attenuated).

How are the vaccines made?
Every year, researchers and manufacturers develop a vaccine that contains virus strains they believe will be circulating in the upcoming influenza season. Influenza vaccine contains 3 viruses: 2 type A and 1 type B. The viruses selected for the vaccine are grown in chicken eggs.

For inactivated vaccine, the viruses are killed with formaldehyde, purified, and packaged in vials or syringes. The live vaccine is packaged in a special sprayer. About 6months are required to produce influenza vaccine each year.

How is the vaccine given?
The inactivated vaccine is given as an intramuscular injection. The live attenuate vaccine is sprayed into the nose.

Who should get influenza vaccine?
Many groups of people can benefit from being protected from influenza. Annual vaccination with inactivated vaccine is recommended for the following groups:

- All persons, including school-age children, who want to reduce the risk of becoming ill with influenza or of transmitting influenza to others
- Everyone age 50 years or older
- All children age 6 months through 18 years of age
- Residents of long-term care facilities, nursing homes, and other chronic-care facilities
- Adults and children who have chronic pulmonary (including asthma), cardiovascular (except hypertension), renal, hepatic, hematological or metabolic disorders (including diabetes mellitus)
- Anyone who has a condition (e.g., spinal cord injury or seizure disorder) that can affect their ability to cough out their respiratory secretions or that can increase the risk for aspiration
- Anyone whose immune system is weakened because of the following: HIV/AIDS or other diseases that affect the immune system, long-term treatment with drugs such as steroids, or cancer treatment with x-rays or drugs
- Children and adolescents age 6 months-18 years on long-term aspirin treatment (who could develop Reye's syndrome if they catch influenza)
- Women who will be pregnant during the influenza season
- Healthcare personnel
- Healthy household contacts (including children) and caregivers of children younger than age 5 years and/or adults age 50 years and older

- Healthy household contacts (including children) and caregivers of persons with medical conditions that put them at higher risk for severe complications from influenza

The live nasal spray vaccine may only be used in healthy, nonpregnant persons age 2 through 49 years. Children younger than age two years, persons age 50 and older, and anyone with a chronic medical condition (listed above) should receive inactivated influenza vaccine (injectable), NOT live influenza vaccine.

What are the unique features of giving influenza vaccine to children compared with adults?
Children age 6 months through 8 years should receive 2 doses of influenza vaccine the first time they receive this vaccine, separated by at least 4 weeks. If a child age 6 months through 8 years only received 1 dose in their first year of vaccination, he/she should receive two doses the subsequent vaccination season.

Who recommends the influenza vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), the American College of Physicians (ACP), and the American College of Obstetricians and Gynecologists (ACOG) all recommend this vaccine.

How often should this vaccine be given?
Influenza vaccine is given once a year because immunity decreases after a year and because each year's vaccine is formulated to prevent only that year's anticipated influenza viruses.

When should persons be vaccinated?
The time to get influenza vaccine is whenever influenza vaccine becomes available for use. Vaccination should continue into the winter and spring, even until April or May. Travelers should be aware that the influenza season typically occurs from April to September in the Southern Hemisphere and throughout the year in the tropics. If they missed vaccination in the previous season, they should still be vaccinated before they travel, even if it's in the following spring or summer.

Are there recommendations for the prevention of influenza outbreaks in institutions?
The most important factor in preventing outbreaks is annual vaccination of all occupants of the facility and all persons working or volunteering in the facility who share the same air as the high-risk occupants. Groups that should be targeted include physicians, nurses, and all other personnel in hospitals, long-term care facilities, other care facilities, and outpatient settings who have contact with high-risk patients in all age groups.

Should siblings of a person with a chronic illness receive influenza vaccine even though the chronically ill person has been vaccinated?
Yes. All household contacts (who are age six months or older) of persons with "high-risk" conditions, of people age 50 years and older, or of children from birth through age 59 months, should receive annual influenza vaccination. Either inactivated or live vaccine may be used, except for household contacts and caregivers of people with severe

Immunosuppression in the care of a protective environment, who should receive only inactivated vaccine.

Should siblings of a healthy child who is younger than age 6 months be vaccinated?
Yes, all household contacts of children too young to be protected against influenza with vaccination should receive annual influenza vaccination to protect the younger child from serious infection. This is very important because these infants are too young to be vaccinated and are most vulnerable to complications from influenza.

Is it safe for pregnant women to get influenza vaccine?
Yes. In fact, vaccination with the inactivated vaccine is recommended for women who will be pregnant during the influenza season. Pregnant women are at increased risk for serious medical complications from influenza. One recent study found that the risk of influenza-related hospitalization was four times higher in healthy pregnant women in the fourteenth week of pregnancy or later than in nonpregnant women. In addition, vaccination of the mother will provide some protection for her newborn infant.

The live intranasal vaccine is not licensed for use in pregnant women. However, pregnant women do not need to avoid contact with persons recently vaccinated with this vaccine.

Vaccination is recommended for all persons, including breastfeeding mothers, who are contacts of infants or children from birth through age 59 months because infants and young children are at higher risk for influenza complications and are more likely to require medical care or hospitalization if infected. Women who are breastfeeding may receive either type of influenza vaccine unless the vaccine is not appropriate because of other medical conditions.

How safe is this vaccine?
Influenza vaccine is very safe. The most common side effects of the injectable (inactivated) influenza vaccine include soreness, redness, or swelling at the site of the injection. These reactions are temporary and occur in 15% – 20% of recipients. Less than 1% of vaccine recipients develop such symptoms as fever, chills, and muscle aches. These symptoms are more likely to occur in a person who has never been exposed to the influenza virus or vaccine. Experiencing these non-specific side effects does not mean that you are getting influenza. These symptoms can persist for 1 – 2 days.

In clinical trials, the most common side effects of the intranasal influenza vaccine among adults were runny nose or nasal congestion (28% – 78%), headache (16% – 44%), and sore throat (15% – 25%). Among children, side effects included runny nose or nasal congestion (20% – 75%), headache (2% – 46%), and fever (0% – 26%).

Serious adverse reactions to either vaccine are very rare. Such reactions are most likely the result of an allergy to a vaccine component, such as the egg protein left in the vaccine after growing the virus. A vaccine, like any medicine, is capable of causing serious allergic reactions.

The risk of an influenza vaccine causing serious harm, or even death, is very rare. In 1976, the swine flu (injectable) vaccine was associated with an illness called Guillain-Barré syndrome (GBS), a nerve condition that can result in temporary paralysis. Injectable influenza vaccines since then have not been clearly linked with GBS, because the disease is so rare it is difficult to obtain a precise estimate of any increase in risk. However, if there is a risk of GBS from current influenza vaccines, it is estimated at one or two cases per million persons vaccinated–much less than the risk of severe influenza, which can be prevented by vaccination.

What can you tell me about the preservative thimerosal that is in injectable influenza vaccine and the claim that it might be associated with the development of autism?

Thimerosal is a very effective preservative that has been used to prevent bacterial contamination in vaccines for more than 50 years. It is comprised of a type of mercury known as ethylmercury. It is different from methylmercury, which is the form that is in fish and seafood. At very high levels, methylmercury can be toxic to people, especially to the neurological development of infants.

In recent years, several very large scientific studies have determined that thimerosal in vaccines does not lead to serious neurologic problems, including autism. Nonetheless, because we generally try to reduce people's exposure to mercury if at all possible, the vaccine manufacturers have voluntarily changed their production methods to produce vaccines that are now free of thimerosal or have only trace amounts. They have done this because it is possible to do, not because there was any evidence that the thimerosal was harmful.

How effective is influenza vaccine?

Protection from influenza vaccine varies by the similarity of the vaccine strain(s) to the circulating strains, and the age and health of the recipient. Healthy persons younger than age 65 years are more likely to have protection from their influenza vaccination than are older, frail individuals. It is important to understand that although the vaccine is not as effective in preventing influenza disease among the elderly, it is effective in preventing complications and death. In general, the immunity following influenza vaccination rarely lasts longer than a year.

When the "match" between vaccine and circulating strains is close, the injectable (inactivated) vaccine prevents influenza in about 70% – 90% of healthy persons younger than age 65 years. Among elderly persons living outside chronic-care facilities (such as nursing homes) and those persons with long-term (chronic) medical conditions, the influenza shot is 30% – 70% effective in preventing hospitalization for pneumonia and influenza. Among elderly nursing home residents, the shot is most effective in preventing severe illness, secondary complications, and deaths related to influenza. In this population, the shot can be 50% – 60% effective in preventing hospitalization or pneumonia and 80% effective in preventing death from influenza.

In one large study among children aged 15 – 85 months, the nasal-spray influenza vaccine (FluMist®) reduced the chance of influenza illness by 92% compared with placebo. In a study among adults, the participants were not specifically tested for influenza. However, the study found 19% fewer severe febrile respiratory tract illnesses, 24% fewer respiratory tract illnesses with fever, 23% – 27% fewer days of illness, 13% –

28% fewer lost work days, 15% – 41% fewer health care provider visits, and 43% – 47% less use of antibiotics compared with placebo.

Can the vaccine cause influenza?
No! This common misconception keeps many people from getting the influenza vaccine. Neither the injectable vaccine nor the intranasal vaccine can cause influenza. The injectable influenza vaccine contains only killed viruses and cannot cause influenza disease. Less than 1% of people who are vaccinated develop influenza-like symptoms, such as mild fever and muscle aches, after vaccination. These side effects are not the same as having the actual disease.

The intranasal influenza vaccine does not cause influenza either. The intranasal influenza vaccine contains live attenuated viruses that can produce mild symptoms similar to a cold. While the viruses are able to replicate in the nose and throat tissue and produce protective immunity, they are attenuated and do not replicate effectively in the lung. Consequently, they cannot produce influenza disease.

Protective immunity develops 1 – 2 weeks after vaccination. Some people who get vaccinated later in the season (December or later) may get influenza shortly afterward, but the disease they develop is the result of being exposed to someone with the virus before the vaccine produced immunity, not the result of the vaccination.

Also, to many people “the flu” is any illness with fever and cold symptoms. If they get any viral illness, they may blame it on the influenza shot or think they got “the flu” despite being vaccinated. Influenza vaccine only protects against certain influenza viruses, not all viruses.

Who should NOT receive influenza vaccine?
In general, the inactivated (injectable) influenza vaccine can be given to most everyone except children younger than 6 months, persons with a history of a serious allergic reaction to eggs or to a previous dose of influenza vaccine (see additional contraindications below). The live, attenuated (intranasal) influenza vaccine is licensed for use only in healthy, nonpregnant individuals 2 – 49 years.

The following persons should not be vaccinated with live virus intranasal influenza vaccine:

- Persons younger than age two years
- Persons age 50 years or older
- Persons with asthma, reactive airway disease or other chronic disorders of the pulmonary or cardiovascular systems; persons with other underlying medical conditions, including metabolic diseases such as diabetes, renal dysfunction, and hemoglobinopathy; or persons with known or suspected immune deficiency diseases or who are receiving immunosuppressive therapies
- Children ages 2 through 4 years with a history of recurrent wheezing
- Children or adolescents receiving long-term aspirin therapy
- Pregnant women
- Healthcare workers, household members, and others who have close contact with severely immunocompromised individuals during the periods in which the immunosuppressed person requires care in a protective environment

Persons having had serious allergic reaction to eggs or to a previous dose of influenza vaccine should not receive either type of influenza vaccine (inactivated or live). Persons with a history of serious egg allergies who are at increased risk for influenza or its complications should consult with their healthcare provider regarding referral to an allergist to determine if the vaccine can be given following treatment for desensitization.

Persons with a history of Guillain-Barré syndrome should also consult with their physician before receiving this vaccine, so that the potential risks and benefits of influenza immunization can be weighed.

Persons who are moderately or severely ill at the time of their influenza vaccine appointment should usually wait until their symptoms are improved before getting the vaccine.

Some people believe they are allergic to thimerosal, the preservative used in some brands of influenza vaccine, because in the past they developed eye irritation after using eye drops containing thimerosal. Past eye irritation is no reason to avoid getting influenza vaccine. Only serious, life-threatening allergies to thimerosal are a reason not to be vaccinated. Most brands of influenza vaccine are packaged in vials or syringes that contain natural rubber or latex. Persons with a severe allergy to latex generally should not receive vaccine packaged in these vials or syringes.

Technical content reviewed by the Centers for Disease Control and Prevention, October 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Measles virus is an RNA virus, classified as a member of the genus *Morbillivirus* in the Paramyxovirus family.

B. Description of Illness

- ***General facts:*** Measles is a vaccine-preventable disease. The current measles vaccine is incorporated with mumps and rubella vaccine as a combined vaccine called MMR. It is a live attenuated virus vaccine that confers lifelong immunity and is given in 2 doses separated by at least 4 weeks.
- ***Occurrence:*** Measles occurs throughout the world. However, interruption of indigenous transmission of measles has been achieved in the United States and other parts of the Western hemisphere. In temperate areas, measles disease occurs primarily in the late winter and spring.
- ***Incubation period:*** Time from exposure to prodrome (first symptoms) averages 10 – 12 days. Time from exposure to rash onset averages 14 days (range 7 – 18 days).
- ***Common symptoms*:** Measles is an acute, highly communicable viral disease with prodromal fever, conjunctivitis, runny nose, cough, and small spots with white or bluish centers on an erythematous base on the buccal (cheek of mouth) mucosa (Koplik spots). The rash appears as a maculopapular eruption with a characteristic red blotchy rash appearing on the third to seventh day. The rash begins on the face, then becomes generalized, lasts 4 – 7 days, and sometimes ends in brawny (hardening) desquamation (shedding of the epidermis). An abnormal decrease in white blood cells is common. The disease is most severe in infants and adults rather than in children.
- ***Treatment:*** There is no specific treatment for measles. People with measles need bed rest, fluids, and control of fever. Patients with complications may need treatment specific to their problem.

C. Reservoirs

Humans are the only source of infection.

D. Modes of Transmission

Measles is a highly infectious disease, with >90% secondary attack rates among susceptible persons. Transmission is primarily person-to-person via large respiratory droplets; occurs by airborne, droplet spread, or direct contact with nasal or throat secretions of an infected person when one coughs or sneezes. Measles is less commonly transmitted by articles freshly soiled with nose and throat secretions.

E. Period of Communicability

The measles virus may be transmitted approximately 4 days before rash onset to 4 days after appearance of the rash; transmission is minimal after the second day of the rash.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Measles is physician reportable by telephone immediately on the day of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of measles to both the DPH and the LHD. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Definition

- **Clinical case definition:** An illness characterized by all of the following:
  - Generalized rash lasting ≥ 3 days, **and**
  - Temperature ≥ 101° F, **and**
  - Cough, coryza (head cold), **or** conjunctivitis

- **Laboratory criteria for diagnosis:**
  - Positive serologic test for measles immunoglobulin M antibody, **or**
  - Significant rise in measles antibody level by any standard serologic assay, **or**
  - Isolation of measles virus from a clinical specimen

- **Suspected:** Any febrile illness accompanied by rash.

- **Probable Case:** A case that meet the clinical case definition, has noncontributory or no serologic or virologic testing, and is not epidemiologically linked to a confirmed case.

- **Confirmed Case:** A case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to confirmed case. A laboratory-confirmed case does not need to meet the clinical case definition.

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program ensures that the appropriate diagnostic work has been completed and works in collaboration with LHD to ensure that contacts of each case-patient have been identified, and appropriate recommendations (e.g., vaccination, exclusion) have been made.

- **LHD Responsibility:** The LHD is involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunization Program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What is measles?
Measles is an acute disease that is caused by a virus.

How does measles spread?
Measles is highly contagious. The measles virus is in the mucus in the nose and throat of infected people. When they sneeze or cough, infectious droplets spray into the air.

What are the symptoms of measles?
Symptoms include fever, runny nose, cough, loss of appetite, "pink eye," and a rash. The rash usually lasts 5 – 6 days and begins at the hairline, moves to the face and upper neck, and proceeds down the body.

How long does it take to show signs of measles after being exposed?
It takes an average of 10 – 12 days from exposure to the first symptom, which is usually fever. The measles rash appears approximately 14 days after exposure, 2 – 3 days after the fever begins.

How serious is measles?
Measles can be a serious disease, with 30% of reported cases experiencing one or more complications. Death from measles occurs in approximately 1 – 2 per 1,000 cases reported in the United States. Complications from measles are more common among very young children (younger than 5 years of age) and adults (older than 20 years of age).

What are possible complications from measles?
Diarrhea is the most common complication of measles, especially in young children. Ear infections occur in 7% of reported cases. Pneumonia, occurring in 6% of reported cases, accounts for 60% of measles-related deaths. Approximately 1 out of 1,000 cases will develop acute encephalitis, an inflammation of the brain. This serious complication can lead to permanent brain damage.

Measles during pregnancy increases the risk of premature labor, miscarriage, and low-birth-weight infants. Birth defects have not been linked to measles exposure.

Measles can be especially severe in persons with compromised immune systems. Measles is more severe in malnourished children, particularly those with vitamin A deficiency. In developing countries, the case-fatality rate may be as high as 25%.

How do I know if someone has measles?
Measles is diagnosed by a combination of the patient's symptoms and laboratory tests.

Is there a treatment for measles?
There is no specific treatment for measles. People with measles need bed rest, fluids, and fever control. Patients with complications may need treatment specific to their problem.

How long is a person with measles contagious?
Measles is highly contagious and can be transmitted from 4 days before the rash becomes visible to 4 days after the rash appears.

Is there a vaccine to prevent measles?
The current measles vaccine is incorporated with the mumps and rubella vaccine as a combined vaccine called MMR.

If I think my child has been exposed to measles, what should I do?
You should contact your doctor immediately if you believe you or your child has been exposed to measles. If your child has not been vaccinated, measles vaccine may prevent disease if given within 72 hours of exposure. Immune globulin (a blood product containing antibodies to the measles virus) may prevent or lessen the severity of measles if given within 6 days of exposure.

How common is measles in the United States?
Before the vaccine was licensed in1963, there were an estimated 3 – 4 million cases each year. In the years following 1963, the number of measles cases dropped dramatically, with only 1,497 cases in 1983, the lowest annual total reported up to that time.

A measles epidemic occurred in the United States with large outbreaks in many cities from 1989 to 1991. There were 55,622 cases reported with 123 measles-associated deaths. Half of the cases and deaths were in children younger than 5 years old. The most important cause of this epidemic was low vaccination rates among preschool-age children.

Due to extensive vaccination efforts, the number of reported measles cases fell during the 1990s. Only 44 cases were reported in 2002. However, measles is still common in many other countries in the world and can easily be imported, so continued vaccination against the disease is still important.

Can you get measles more than once?
No.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccine Information

When did measles vaccine become available?
Measles vaccine became available in 1963. An improved measles vaccine became available in 1968. Combination measles-mumps-rubella (MMR) vaccine became available in 1971. Combination measles-mumps-rubella-varicella (MMRV) vaccine became available in 2005.

What kind of vaccine is it?
Measles vaccine is a live, attenuated (or weakened) strain of the measles virus grown in chick embryo tissue culture. In the United States, it is recommended that it be given as part of the MMR vaccine, which protects against measles, mumps, and rubella (German measles) or the MMRV vaccine (MMR plus varicella (chickenpox) vaccine) when age-appropriate (licensed for use only from age 12 months through 12 years).

How is this vaccine given?
This vaccine is a shot given subcutaneously (in the fatty layer of tissue under the skin).

Who should get this vaccine?
Two doses of measles vaccine (given as combination MMR or MMRV when age-appropriate) are recommended for all children and certain adolescents and adults.

At what age should the first MMR/MMRV shot be given?
The first dose of MMR or MMRV should be given on or after the first birthday; the recommended range is from 12 – 15 months. A dose given before 12 months of age may not be counted, so the child's medical appointment should be scheduled with this in mind.

When should children get the second MMR/MMRV shot?
The second dose is usually given when the child is 4 – 6 years old, or before he or she enters kindergarten or first grade. However, the second dose can be given anytime as long as it is at least four weeks after the first dose. MMRV can only be given through age 12 years.

How effective is this vaccine?
The first dose of MMR vaccine produces immunity to measles in 95% – 98% of children vaccinated. The reason for the second dose is to protect those persons who did not become immune after one dose. After 2 doses of measles vaccine, 99% of persons become immune to the disease.

Which adolescents and adults should receive the MMR vaccine?
In general, adults born before 1957 are likely to have had measles, mumps, and rubella during childhood and so are assumed to be immune. Exceptions to this guideline are women who want to become pregnant (see rubella section) and persons who work in medical facilities (see next question).

All persons born in or after 1957 should be immune to measles by having had one or more doses of MMR vaccine, a blood test that indicates immunity to measles, or written documentation of measles disease diagnosed by a doctor. Certain groups of people born in or after 1957 are at increased risk for exposure to measles and must be certain

to be immune to measles. These adults are those attending college or other post-high school educational institutions, persons who work in medical facilities, and international travelers. These adults should receive two doses of MMR or have other evidence of measles immunity (lab test or physician-diagnosed measles).

Why do healthcare workers need proof of immunity to measles?
Persons who work in medical facilities are at much higher risk for being exposed to measles than is the general population (most people with measles are quite ill and will visit a medical facility at some point during their illness). Making sure that all workers are immune to this disease protects both the employee and the patients with whom he or she may have contact. All persons working in a healthcare facility in any capacity should have evidence of immunity to measles, including full- or part-time employees, medical or non-medical, paid or volunteer, students, and those with or without direct patient responsibilities.

Healthcare workers should have one of the following: documentation of 2 doses of MMR vaccine (or 2 doses of a live measles-containing vaccine, 2 doses of a live mumps-containing vaccine, and at least 1 dose of a live rubella-containing vaccine), a laboratory test that indicates immunity, or written evidence of previous measles disease diagnosed by a physician.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP) have all recommended this vaccine.

How safe is this vaccine?
Hundreds of millions of doses of measles vaccine have been given in the United States, and its safety record is excellent. Because it is a live vaccine, side effects following vaccination can be similar to a very mild case of measles. More than 80% of children will have no side effects at all.

What side effects have been reported with this vaccine?
Fever is the most common side effect, occurring in 5% – 15% of vaccine recipients. About 5% of persons develop a mild rash. When they occur, fever and rash appear 7 – 10 days after vaccination. About 25% of adult women receiving MMR vaccine develop temporary joint pain, although this symptom is related to the rubella component of the combined vaccine. Joint pain only occurs in women who are not immune to rubella at the time of vaccination. MMR vaccine may cause thrombocytopenia (low platelet count) at the rate of about 1 case per 30,000 – 40,000 vaccinated people. Cases are almost always temporary and benign.

More severe reactions, including allergic reactions, are rare. About one person per million develops inflammation of the brain, which is probably caused by the measles vaccine virus.

If my child develops a rash after getting the MMR vaccine, is he contagious?
Transmission of the measles vaccine virus does not occur from a vaccinated person, including those who develop a rash. No special precautions (e.g., exclusion from school or work) need be taken.

Who should NOT receive measles vaccine?
Anyone who experiences a severe allergic reaction (e.g., generalized hives, swelling of the lips, tongue, or throat, difficulty breathing) following the first dose of MMR should not receive a second dose. Anyone knowing they are allergic to an MMR component (gelatin, neomycin) should not receive this vaccine.

As with all live virus vaccines, women known to be pregnant should not receive the MMR vaccine, and pregnancy should be avoided for 4 weeks following vaccination with MMR. However, women who are breast-feeding can be vaccinated. Children and other household contacts of pregnant women should be vaccinated according to the recommended schedule.

Severely immunocompromised persons should not be given MMR vaccine. This includes persons with conditions such as congenital immunodeficiency, AIDS, leukemia, lymphoma, generalized malignancy, and those receiving treatment for cancer with drugs, radiation, or large doses of corticosteroids. Household contacts of immunocompromised people should be vaccinated according to the recommended schedule. Although persons with AIDS or HIV infection with signs of serious immunosuppression should not be given MMR, persons with HIV infection without symptoms can and should be vaccinated against measles.

Can individuals with egg allergy receive MMR vaccine?
In the past it was believed that persons who were allergic to eggs would be at risk of an allergic reaction from the vaccine because the vaccine is grown in tissue from chick embryos. However, recent studies have shown that this is not the case. Therefore, MMR may be given to egg-allergic individuals without prior testing or use of special precautions.

Does the MMR vaccine cause autism?
There is no scientific evidence that measles, MMR, or any other vaccine causes autism. The question about a possible link between MMR vaccine and autism has been extensively reviewed by independent groups of experts in the U.S. including the National Academy of Sciences “Institute of Medicine”. These reviews have concluded that the available epidemiologic evidence does not support a causal link between MMR vaccine and autism.

The MMR-autism theory had its origins in research by Andrew Wakefield and colleagues in England. They suggested that inflammatory bowel disease (IBD) is linked to persistent viral infection. In 1993, Wakefield and colleagues reported isolating measles virus in the intestinal tissue of persons with IBD. The validity of this finding was later called into question when it could not be reproduced by other researchers.

The studies that suggest a cause-and-effect relationship exists between MMR vaccine and autism have received a lot of attention by the media. However, these studies have significant weaknesses and are far outweighed by many population studies that have consistently failed to show a causal relationship between MMR vaccine and autism. In addition, the findings were further discredited when an investigation found that Wakefield did not disclose he was being funded for his research by lawyers seeking evidence to use against vaccine manufacturers.

For a summary of the issues on this topic, please read "Vaccines and Autism," by Paul A. Offit, MD, Director, Vaccine Education Center, Children's Hospital of Philadelphia. This article can be accessed online at: www.immunize.org/catg.d/p2065.htm

"Does MMR vaccine cause autism? Weigh the evidence" lists all the major studies related to this issue with links to journal article abstracts: http://www.immunize.org/mmrautism

For more information, visit CDC's "Vaccines and Autism Theory" web page at www.cdc.gov/od/science/iso/mmr_autism.htm

Can the vaccine cause measles?
As mentioned above, because the measles vaccine is "live," it can cause mild measles-like symptoms in some recipients, but it does not cause measles disease.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Meningococcal Disease

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Meningococcal disease is an infection of the tissues that cover the brain and spinal cord. It is caused by a bacterium called *Neisseria meningitidis.* This bacterium has five subtypes: A, B, C, Y, and W-135.

B. Description of Illness

- ***General facts:*** Invasive infection caused by *N. meningitidis* usually results in meningococcemia, meningitis, or both. In the United States, serogroups B, C, and Y each account for approximately 30% of reported cases. With early diagnosis and treatment, the case fatality rate is 5% – 15%. Meningococcal disease occurs sporadically and in epidemics; in many parts of the world, it is the leading cause of bacterial meningitis. There are two vaccines against *N. meningitidis* available in the United States: meningococcal polysaccharide vaccine (MPSV4 or Menomune) and meningococcal conjugate vaccine (MCV4 or MenactraT). Both vaccines can prevent four types of meningococcal disease (A, C, Y, and W-135). In Connecticut, Public Act 01-93, Sec. 10a-155b states that each public or private college or university in this state shall require that each student who resides in on-campus housing be vaccinated against meningitis as a condition of such residence. The provisions of this subsection shall not apply to any such student who (1) presents a certificate from a physician stating that, in the opinion of such physician, such vaccination is medically contraindicated because of the physical condition of such student, or (2) presents a statement that such vaccination would be contrary to the religious beliefs of such student.
- ***Occurrence:*** The incidence of meningococcal disease is seasonal, usually peaking in late winter to early spring. Meningococcal disease, while primarily a disease of very small children, occurs commonly in children and young adults and is associated with crowded living conditions (e.g., dormitories, barracks). Recent community outbreaks have affected school and college-aged persons.
- ***Incubation period:*** From 2 – 10 days; usually about 3 – 4 days.
- ***Common symptoms*:** An acute bacterial disease, characterized by sudden onset of high fever, intense headache, nausea and often vomiting, stiff neck and frequently a petechial rash with pink macules or, very rarely, vesicles. Delirium, coma, and seizure may happen as the disease progresses. In newborns and small infants, the hallmarks may be difficult to detect – the infant may appear to be inactive, irritable, vomit, or feed poorly.
- ***Treatment:*** Meningococcal disease can be treated with antibiotics. It is critical to start treatment early. Even with treatment, approximately 5% – 15% of patients die.

C. Reservoirs

Humans are the only source of infection.

D. Modes of Transmission

Transmission occurs through direct contact with respiratory droplets from the nose and throat of infected people; infection usually only causes a subclinical mucosal infection. Up to 5% – 10% of people may be asymptomatic carriers with nasopharyngeal colonization by *N. meningitidis.* Less than 1% of those colonized will progress to invasive disease. Behaviors that facilitate transmission include coughing and kissing. Fomite transmission is not significant.

The communicability of *N. meningitidis* is generally limited. In studies of households in which a case of meningococcal disease has occurred, only 3% – 4% of households had secondary cases. Most households had only one secondary case. Estimates of the risk of secondary transmission are generally 2 – 4 cases per 1,000 household members at risk. However, this risk is 500–800 times that in the general population.

E. Period of Communicability

The bacteria may be transmitted as long as they are present in nasal and oral secretions. Usually, 24 hours of treatment with an antibiotic to which the bacteria are sensitive decreases their numbers in the nose and mouth. Penicillin will temporary suppress the organisms, but it does not usually eradicate them from the oronasopharynx.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Meningococcal disease is physician reportable immediately by telephone on the day of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of invasive meningococcal disease to both the DPH and LHD. **Additional requirements:** All isolates yielding *N. meningitidis* from invasive sterile sites must be submitted to the DPH State Laboratory for confirmation. See current list of Physician Reportable Diseases (Attachment A) and Laboratory Report of Significant Findings (Attachment C).

B. Case Definition

- **Clinical Description:** Meningococcal disease manifests most commonly as meningitis and/or meningococcemia that may progress rapidly to purpura fulminans, shock, and death. However, other manifestations might be observed.

- **Probable Case:** A clinically compatible case that has either:
  - Evidence of *N. meningitidis* DNA using a validated polymerase chain reaction (PCR), obtained from a normally sterile site, **or**
  - Evidence of *N. meningitidis* antigen by immunohistochemistry (IHC) on formalin-fixed tissue or latex agglutination of CSF.

- **Confirmed Case:** A clinically compatible case **and** isolation of *N. meningitidis* from a normally sterile site (e.g., blood or CSF or, less commonly, synovial, pleural, or pericardial fluid) or skin scrapings of purpuric lesions.

C. Case Investigation

- **DPH Responsibility:** The DPH Epidemiology and Emerging Infections Program will follow-up with the reporting laboratory and physician (or hospital infection control staff) to confirm the diagnosis. DPH will then notify the LHD of the above findings and provide additional recommendations for follow-up, if needed.

  The DPH is available to the LHD for assistance, consultation, guidance, and to ensure that appropriate investigative and control actions are being taken.

- **LHD Responsibility:** Contact case-patient to identify close contacts and ensure they are provided antibiotic prophylaxis (see Control Measures). Provide educational materials describing the nature of disease and preventive measures.

D. Control Measures

- **Close contacts:** Household contacts of all persons with meningococcal disease should receive antibiotic prophylaxis. Prophylaxis is also warranted for people who have been exposed directly to a patient's oral secretions through close social contact, kissing or sharing food or beverages, as well as childcare and nursery school contacts.

Antimicrobial prophylaxis should be administered as soon as possible (ideally < 24 hours after identification of the index patient). Prophylaxis administered > 14 days after onset of illness in the index patient is probably of limited or no value. Routine prophylaxis is not recommended for healthcare professionals unless they have had intimate exposure, such as occurs with unprotected mouth-to-mouth resuscitation, intubation, or suctioning, before antimicrobial therapy was initiated.

Meningococcal Disease

Fact Sheet

What causes meningococcal disease?
Meningococcal disease is caused by the bacterium *Neisseria meningitidis*. This bacterium has at least 13 different subtypes. Five of these subtypes, A, B, C, Y, and W-135, cause almost all invasive disease. The relative importance of these five subgroups depends on geographic location and other factors.

How does meningococcal disease spread?
The disease is spread person-to-person through the exchange of respiratory and throat secretions (e.g., coughing, kissing, or sharing eating utensils). Since meningococcal bacteria cannot live for more than a few minutes outside the body, the disease is not spread as easily as the common cold or influenza.

What are the symptoms of meningococcal disease?
The most common symptoms are high fever, chills, lethargy, and a rash. If meningitis is present, the symptoms will also include headache and neck stiffness (which may not be present in infants). Seizures may also occur. In overwhelming meningococcal infections, shock, coma, and death can follow within several hours, even with appropriate medical treatment.

How long does it take to show signs of meningococcal disease after being exposed?
Meningococcal bacteria can make a person extremely ill by infecting the blood (septicemia) or by infecting the fluid of the spinal cord and around the brain (meningitis). Symptoms of either can develop in just a few hours or they may take 1 – 2 days. Because this disease progresses quickly, it is important to be diagnosed and start treatment as soon as possible.

How serious is meningococcal disease?
Meningogoccal disease is serious. About 9% – 12% of persons with meningococcal disease die. Of those who recover, up to 20% suffer from permanent hearing loss, limb loss, brain damage, or other serious after-effects.

How do I know if someone has meningococcal disease?
The diagnosis is made by taking samples of blood and/or spinal fluid from a person who is possibly infected. Any bacteria found in the blood or spinal fluid is grown in a medical laboratory and identified.

Can't meningitis be caused by a virus too?
Yes, the word "meningitis" refers to inflammation of the tissues covering the brain and spinal cord. This inflammation can be caused by viruses and fungi, as well as bacteria. Viral meningitis is the most common type: it has not specific treatments but is usually not as serious as meningitis caused by bacteria.

Is there a treatment for meningococcal disease?
Bacterial meningitis can be treated with antibiotics. It is critical to start treatment early.

Meningococcal Disease

Is there a vaccine to prevent meningoccal disease?
There are two vaccines against *N. meningitidis* available in the United States. Meningococcal polysaccharide vaccine (MPSV4 or Menomune) has been available since 1981. Meningococcal conjugate vaccine (MCV4 or MenactraT) was licensed in 2005. Both vaccines can prevent four types of meningococcal disease, including two of the three types most common in the United States (serogroup C, Y, and W-135) and a type that causes epidemics in Africa (serogroup A). MCV4 differs from the polysaccharide meningococcal vaccine in that the duration of protection is expected to be much longer than the approximately 3 years that the polysaccharide vaccine provides, allowing it to be considered for long-term instead of situational protection.

How common is meningococcal disease?
There are approximately 2,000 – 3,000 cases of meningococcal disease each year in the United States. An estimated 125 deaths from meningococcal disease occurred in the United States in 2004.

An estimated 125 deaths from meningococcal disease occurred in the United States in 2004. The proportion of cases in adolescents and young adults has increased in recent years; the rate of invasive disease among persons aged 17 – 20 years is about twice that of the general US population.

What persons are at special risk for meningococcal disease?
Persons at risk include infants, travelers to places where meningococcal disease is common (e.g., certain countries in Africa and Saudi Arabia), people with damaged or missing spleens, and people with certain blood diseases.

Other factors make it more likely an individual will develop meningococcal disease, including having a previous viral infection, living in a crowded household, having an underlying chronic illness, and being exposed to cigarette smoke (either directly or second-hand).

Studies have also shown that college freshmen that live in dormitories are at an increased risk of meningococcal disease compared with others their age.

How common is meningococcal disease in the world?
Meningococcal disease is common in certain parts of the world, especially the area of Africa which is known as the “meningitis belt.” An estimated 700,000 cases of meningococcal disease occurred in this area over a recent 10-year period; about 10% of these cases died. Subtype A is responsible for most of the meningococcal disease in sub-Saharan Africa, but this subtype is uncommon in the United States.

Can you get meningitis more than once?
Yes, meningitis can be caused by different subtypes of the meningococcal bacterium, by other bacteria, such as Streptococcus and Haemophilus, as well as by viruses and fungi. Even being vaccinated against *N. meningitides* or having had the disease will not protect you against other sources of infection.

Meningococcal Disease

If a child is diagnosed with meningococcal disease, can anything be done to protect the other children with whom he has had contact?

Individuals who have been exposed to a person with bacterial meningitis can be protected by being started on a course of antibiotics immediately (ideally within 24 hours of the patient being diagnosed). This is usually recommended for household contacts and children attending the same daycare or nursery school. Older children, (e.g., who are attending the same school or church) aren't usually considered exposed unless they have had very close contact with the infected person (e.g., kissing or sharing a glass).

In addition to antibiotic treatment, vaccination may be recommended for people 2 years of age and older if the person's infection is caused by meningococcus type A, C, Y, or W-135, all of which are contained in the meningococcal vaccine.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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Fact Sheet: Vaccine Information

When did the meningococcal vaccine become available?
The first meningococcal vaccine in the United States was licensed in 1974 and was effective against only 1 of the 5 major subtypes of meningococcus.

A meningococcal polysaccharide vaccine or "MPSV" (Menomune by sanofi pasteur) was licensed in 1981 for persons aged 2 years and older. It protects against for subtypes of meningoccus: A, C, Y, and W-135.

A meningococcal conjugate vaccine or "MCV" (Menactra by sanofi pasteur) was licensed in 2005. It also protects against the A, C, Y, and W-135 subtypes. MCV is expected to give better, longer-lasting protection than the polysaccharide vaccine. It is licensed for persons 11 – 55 years of age.

Unfortunately, no vaccine protects against subtype B which causes about one third of all the meningococcus cases in the United States. In 2001, 65% of cases in infants 1 year or younger were caused by subtype B.

What kind of vaccines are they?
The MPSV vaccine is made from the outer polysaccharide capsule (sugar coat) of the meningococcal bacteria. The vaccine does not contain live bacteria. The MCV vaccine contains *N. meningitidis* serogroup A, C, Y, and W-135 capsular polysaccharide antigens individually conjugated to diphtheria toxoid protein, The vaccine does not contain live bacteria.

How is this vaccine given?
The MPSV vaccine is given as an injection into the fat of the arm. The MCV vaccine is given in the muscle.

Who should get the meningococcal vaccine?
MCV is recommended for all children at their routine preadolescent check-up at 11 – 12 years of age. For those who never got a dose previously, a dose is recommended at high school entry or at about 15 years of age.

Any other adolescent or teen who wants to decrease their risk of meningococcal disease can also get the vaccine.

Vaccination is recommended for other people at increased risk of meningococcal disease; this includes:

- College freshmen living in dormitories.
- Individuals who have a damaged or missing spleen.
- Persons with terminal compliment component deficiency (an immune system disorder).
- Persons working with meningococcus bacteria in laboratories.
- Travelers to certain countries in sub-Saharan Africa as well as to other countries for which meningococcal vaccine is recommended.

- US military recruits.
- Anyone who might have been exposed to meningitis during an outbreak.

MCV is the preferred vaccine for persons aged 11 – 55 years in these risk groups, but MPSV can be used if MCV is not available. MPSV should be used for children 2 – 10 years old and adults over 55, who have increased risk factors for disease.

Should college students be vaccinated against meningococcal disease?
College freshmen, especially those living in dormitories, are at an increased risk of meningococcal disease relative to other persons their age. The MCV vaccine is recommended for college freshmen who plan to live in dormitories. Some schools now require incoming freshmen and others to be vaccinated. The vaccine may be available through the college health service.

Although the risk for meningococcal disease among non-freshmen college students is similar to that of the general population of the same age, there is no medical reason that other students who wish to decrease their risk of meningococcal disease cannot receive the vaccine.

How many doses of meningococcal disease are needed?
Persons with risk factors who are either aged 2 – 9 years or older than 55 years should get 1 dose of MPSV. An additional dose is recommended if they remain at risk, such as people without a spleen or those who travel repeatedly to parts of Africa. If MCV is given, no additional doses are recommended at this time, even for people that remain at high risk.

Under special circumstances, MPSV may be recommended for children aged 3 months – 2 years. These children should get 2 doses, 3 months apart.

Should individuals who received MPSV vaccine in the past get a dose of MCV?
The current recommendation is only to revaccinate with MCV if it has been at least 5 years since the MPSV dose and if the person is in a high-risk category.

How safe is this vaccine?
Both meningococcal vaccines are very safe. Polysaccharide (sugar) meningococcal vaccines have been used extensively in mass vaccination programs, such as those conducted by the military.

What are the side effects of this vaccine?
Up to about half of people who get meningococcal vaccines have mild side effects, such as redness or pain where the shot was given. These symptoms usually last for 1 or 2 days and are more common after MCV than after MPSV.

A small percentage of people who receive the vaccine develop a fever. Severe reactions, such as a serious allergic reaction, are very rare.

How effective is this vaccine?
The MPSV vaccine is 85% – 100% effective at preventing infection from the subtypes of meningococcus found in the vaccine (A, C, Y, and W-135). However, the vaccine does

not protect against subtype B meningococcus. The vaccine is not licensed and not effective in children younger than 2 years of age.

Based on results of laboratory studies, MCV is believed to be as effective as MPSV, and to have a longer duration of immunity.

Who should not receive meningococcal vaccine?

- Persons who have had a serious allergic reaction to a previous dose of either meningococcal vaccine or to one of the vaccine components.
- Persons who are moderately or severely ill.

Can pregnant women get meningococcal vaccine?

Studies of vaccination with MPSV during pregnancy have not documents adverse effects among either pregnant women or newborns. No data are available on the safety of MCV during pregnancy. Pregnancy is not considered to be a contraindication to either MPSV or MCV.

Can the vaccine cause meningococcal disease?

No. Only the *N. meningitidis* bacterium can cause meningococcal disease. The vaccine is fractional and contains only part of the microbe.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Mumps is a viral illness caused by a paramyxovirus of the genus *Rubulavirus*.

B. Description of Illness

- ***General facts:*** Mumps is a vaccine-preventable disease. The current mumps vaccine is incorporated with measles and rubella vaccine as a combined vaccine called MMR. Currently, two doses of MMR are necessary to confer lifelong immunity. Mumps vaccine is routinely used in only 38% of countries or areas in the world, and importation of mumps into the United States is now increasingly recognized.
- ***Occurrence:*** The incidence of mumps in the United States has declined since introduction of the live attenuated vaccine in 1967 from 152,209 cases in 1968 to 258 cases in 2004. In 2006 a multistate mumps outbreak resulted in more than 6,000 reported cases. Eight states in the Midwest reported the majority of cases. The outbreak peaked in mid-April. The median age of persons reported with mumps was 22 years. Many cases occurred among college students, many of who had received 1 or 2 doses of MMR vaccine. The incidence of mumps peaks in the winter through spring.
- ***Incubation period:*** The average incubation period is about 14 – 18 days (range 14 – 25 days).
- ***Common symptoms*:** A systemic disease characterized by swelling of one or more of the salivary glands, usually the parotid glands. Additional symptoms include fever, muscle aches, loss of appetite, and headache. Complications include aseptic meningitis, inflammation of the testicles or ovaries, inflammation of the pancreas, and deafness (usually permanent).
- ***Treatment:*** There is no specific treatment for mumps. People with mumps need bed rest, fluids, and control of fever.

C. Reservoirs

Humans are the only source of infection.

D. Modes of Transmission

Mumps is about as contagious as influenza and rubella, but less so than measles or chickenpox. It is spread primarily by airborne transmission or by droplet spread and by direct contact with the saliva of an infected person.

E. Period of Communicability

The virus has been isolated from saliva from 6 – 7 days prior to swelling of the glands to 9 days after the swelling. Maximum infectiousness occurs about 48 hours before onset of illness. Approximately one third of cases do not have clinically apparent salivary gland swelling.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Mumps is physician reportable by mail within 12 hours of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). The director of any clinical laboratory must also report laboratory evidence of mumps to both the DPH and the LHD. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Definition

- **Clinical case definition:** An illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid and/or other salivary gland(s), lasting at least 2 days, and without other apparent cause.

- **Clinically compatible illness:** Infection with mumps virus may present as aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, parotitis, or other salivary gland swelling, mastitis, or pancreatitis.

- **Laboratory criteria:**
  - Isolation of mumps virus from clinical specimen, **or**
  - Detection of mumps nucleic acid (e.g., standard or real time RT-PCR assays), **or**
  - Detection of mumps IgM antibody, **or**
  - Demonstration of specific mumps antibody response in absence of recent vaccination, either a four-fold increase in IgG titer as measured by quantitative assays, or a seroconversion from negative to positive using a standard serologic assay of paired acute and convalescent serum specimens.

- **Probable Case:** A case that meets the clinical case definition without laboratory confirmation and is epidemiologically linked to a clinically compatible case.

- **Confirmed Case:** A case that: 1) meets the clinical case definition or has clinically compatible illness and 2) is either laboratory confirmed or is epidemiologically linked to a confirmed case.

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program ensures that the appropriate diagnostic work has been completed and works in collaboration with LHD to ensure that contacts of each case-patient have been identified, and appropriate recommendations (e.g., vaccination, exclusion) have been made.

- **LHD Responsibility:** The LHD is involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunization Program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What is mumps?
Mumps is an acute infection caused by a virus.

How does mumps spread?
Mumps spreads from person to person through the air. It is less contagious than measles or chickenpox.

What are the symptoms of mumps?
Individuals with mumps usually first feel sick with such nonspecific symptoms such as headache, loss of appetite, and low-grade fever.

The most well-known sign of mumps is "parotitis," the swelling of the salivary glands, or parotid glands, below the ear. Parotitis occurs only in 30% – 40% of individuals infected with mumps.

Up to 20% of persons with mumps have no symptoms of disease, and another 40% – 50% have only nonspecific or respiratory symptoms.

How long does it take to show signs of mumps after being exposed?
Symptoms may appear 14 – 18 days after exposure, but can range from 14 – 25 days after exposure.

How serious is mumps?
In children, mumps is usually a mild disease. Adults may have more serious disease and more complications.

What are possible complications from mumps?
Central nervous system involvement (meningitis) is common, but is usually not serious. Meningitis (with headache, stiff neck) occurs in up to 15% of people with mumps, but usually resolves without any permanent damage.

Up to 50% of post pubertal males experience "orchitis," or testicular inflammation, as a complication of mumps. This may involve pain, swelling, nausea, vomiting, and fever, with tenderness of the area possibly lasting for weeks. Sterility is a rare complication.

An increase in spontaneous abortion (miscarriage) has been found among women who developed mumps during the first trimester of pregnancy; however, there is no evidence that mumps causes birth defects.

Deafness, in one or both ears, can occur in approximately 1 per 20,000 reported cases of mumps**.**

Is there a treatment for mumps?
There is no specific treatment for mumps. People with mumps need bed rest, fluids, and control of fever.

How do I know if my child has mumps?
Mumps is diagnosed by a combination of symptoms and physical signs and laboratory confirmation of the virus, as not all cases develop characteristic parotitis and not all cases of parotitis are caused by mumps.

How long is a person with mumps contagious?
Mumps virus has been found in respiratory secretions 3 days before the start of symptoms until 9 days after onset. Although mumps virus has been detected on rare occasions for up to 9 days after symptom onset, the patient is most infectious within the first 5 days. Therefore, the Centers for Disease Control and Prevention (CDC) now recommends isolating mumps patients for 5 days following onset of symptoms (parotitis).

Is there a vaccine to prevent mumps?
The current mumps vaccine is incorporated with measles and rubella vaccine as a combined vaccine called MMR.

If I think my child has been exposed to mumps, what should I do?
If your child has not been vaccinated against mumps, receiving the vaccine after exposure to the virus will not help prevent disease if the child has already been infected. However, if the child did not become infected after this particular exposure, the vaccine will help protect him or her against future exposure to mumps.

How common is mumps in the United States?
Due to good immunization coverage, mumps is now rare in the United States. An estimated 212,000 cases occurred in 1964, while only 258 cases were reported in 2004. In 2006, outbreaks of mumps occurred in 45 states and the District of Columbia, primarily on college campuses. During January 1 – October 7, 2006, 5,783 confirmed or probable cases of mumps were reported to CDC.

Can you get mumps more than once?
No.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccine Information

When did mumps vaccine become available in the U.S.?
The currently used mumps vaccine was licensed in 1967.

What kind of vaccine is it?
The mumps vaccine is made from a live attenuated (weakened) virus. In the United States, it is recommended that it be given as part of the MMR vaccine, which protects against measles, mumps, and rubella (German measles) or the MMRV vaccine (MMR plus varicella (chickenpox) vaccine) when age-appropriate (licensed for use only from age 12 months through 12 years).

How is this vaccine given?
This vaccine is given by subcutaneous injection, meaning that the vaccine is deposited just under the skin and not deep into the muscle.

Who should get this vaccine?
At least one dose of mumps-containing vaccine is routinely recommended for all children and for all persons born during or after 1957. In the United States, mumps vaccine is given as part of the combination vaccines MMR or MMRV (when age-appropriate). Two doses of MMR/MMRV are recommended for all children and certain adults at risk of measles or mumps exposure.

At what age should my baby get his first mumps shot?
The first dose of MMR or MMRV should be given on or after the first birthday; the recommended range is from age 12 – 15 months. A dose given before 12 months of age may not be counted, so the child's medical appointment should be scheduled with this in mind.

When should my child get his second MMR/MMRV shot?
The second dose of MMR is usually given when the child is 4 – 6 years old, or before he or she enters kindergarten or first grade. However, the second dose of MMR can be given anytime as long as it is at least four weeks after the first dose. MMRV can only be given through age 12 years and should be separated from a previous dose of varicella-containing vaccine by 12 weeks.

Who recommends this vaccine?
The CDC, the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) have all recommended this vaccine.

How safe is this vaccine?
Mumps is a very safe vaccine. Most side effects are mild and related to the measles or rubella components of the MMR vaccine (fever, rash, temporary joint symptoms).

What side effects have been reported with MMR vaccine?
Fever is the most common side effect, occurring in 5% – 15% of vaccine recipients. About 5% of persons develop a mild rash. When they occur, fever and rash appear 7 – 10 days after vaccination. About 25% of adult women receiving MMR vaccine develop

temporary joint pain, although this symptom is related to the rubella component of the combined vaccine. Joint pain only occurs in women who are not immune to rubella at the time of vaccination. MMR vaccine may cause thrombocytopenia (low platelet count) at the rate of about 1 case per 30,000 – 40,000 vaccinated people. Cases are almost always temporary and benign.

More severe reactions, including allergic reactions, are rare. About one person per million develops inflammation of the brain, which is probably caused by the measles vaccine virus.

How effective is this vaccine?
Approximately 95% of individuals become immune to mumps after a single dose of vaccine. The second dose of MMR vaccine is intended to produce immunity in the 5% of persons who did not respond to the first dose. This also ensures that the individual gets another chance to become immune to measles and rubella.

Who should NOT receive mumps vaccine?
Anyone who experiences a severe allergic reaction (e.g., hives, swelling of the mouth or throat, difficulty breathing) following the first dose of MMR should not receive a second dose. Anyone knowing they are allergic to an MMR component (gelatin, neomycin) should not receive this vaccine.

Pregnant women should not receive the MMR vaccine, and pregnancy should be avoided for four weeks following vaccination with MMR. While there is no evidence that the mumps vaccine causes fetal damage, women are advised not to receive the MMR vaccine during pregnancy as a safety precaution based on the theoretical possibility of a live vaccine causing disease.

Severely immunocompromised persons should not be given MMR vaccine. This includes persons with a variety of conditions, including congenital immunodeficiency, AIDS, leukemia, lymphoma, generalized malignancy, or those undergoing immunosuppressive therapy.

Can individuals with egg allergy receive MMR vaccine?
In the past it was believed that persons who were allergic to eggs would be at risk of an allergic reaction from the vaccine because the vaccine is grown in tissue from chick embryos. However, recent studies have shown that this is not the case. Therefore, MMR may be given to egg-allergic individuals without prior testing or use of special precautions.

How do I know if I'm immune to mumps?
Persons are generally considered to be immune to mumps if they were born before 1957, have laboratory evidence of mumps immunity, have documentation from their health professional of previous mumps disease, or have received appropriate mumps vaccination.

Can the vaccine cause mumps?
No.

Does the MMR vaccine cause autism?
There is no scientific evidence that measles, MMR, or any other vaccine causes autism. The question about a possible link between MMR vaccine and autism has been extensively reviewed by independent groups of experts in the U.S. including the National Academy of Sciences, "Institute of Medicine". These reviews have concluded that the available epidemiologic evidence does not support a causal link between MMR vaccine and autism.

The MMR-autism theory had its origins in research by Andrew Wakefield and colleagues in England. They suggested that inflammatory bowel disease (IBD) is linked to persistent viral infection. In 1993, Wakefield and colleagues reported isolating measles virus in the intestinal tissue of persons with IBD. The validity of this finding was later called into question when it could not be reproduced by other researchers. In addition, the findings were further discredited when an investigation found that Wakefield did not disclose he was being funded for his research by lawyers seeking evidence to use against vaccine manufacturers.

The studies that suggest a cause-and-effect relationship exists between MMR vaccine and autism have received a lot of attention by the media. However, these studies have significant weaknesses and are far outweighed by many population studies that have consistently failed to show a causal relationship between MMR vaccine and autism.

For a summary of the issues on this topic, please read "Vaccines and Autism," by Paul A. Offit, MD, Director, Vaccine Education Center, Children's Hospital of Philadelphia. This article can be accessed online at: www.immunize.org/catg.d/p2065.htm

"Does MMR vaccine cause autism? Weigh the evidence" lists all the major studies related to this issue with links to journal article abstracts: http://www.immunize.org/mmrautism

For more information, visit CDC's "Vaccines and Autism Theory" web page at www.cdc.gov/od/science/iso/mmr_autism.htm

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Pertussis, or whooping cough, is an acute bacterial disease of the respiratory tract and is caused by the gram-negative bacillus *Bordetella pertussis.*

B. Description of Illness

- ***General facts:*** Infants under the age of 12 months have more serious illness from pertussis and they are more likely to have complications and be hospitalized than persons in other age groups. Older patients (adolescents and adults) and those partially protected by the vaccine may get infected with *B. pertussis,* but generally have milder disease.
- ***Occurrence:*** Since the introduction of the pertussis vaccine in the 1940s, the average incidence of pertussis decreased from 150 per 100,000 persons between 1922 and 1940 to 0.5 per 100,000 in 1976. However, since the 1980s, the incidence of reported pertussis cases has increased. The increase has been primarily among infants less than 4 months and among adolescents and adults. Reasons for the increase in pertussis are not completely clear. Improvements in diagnosis and reporting of pertussis in adolescents and adults appear to be important factors contributing to the overall increase. Outbreaks are being recognized in high schools and middle schools more frequently.
- ***Incubation period:*** Usually from 7 – 10 days (range 6 – 21 days).
- ***Common symptoms*:** Pertussis begins with mild upper respiratory tract symptoms. The cough gradually (within 1 – 2 weeks) becomes severe, characterized by bursts of numerous, rapid coughs where one cough follows the next without a break for breath. The cough may be accompanied by a characteristic high-pitched whoop. During such an attack, the patient may become cyanotic (turn blue). Vomiting and exhaustion commonly follow the episode. Fever is absent or gradual. Symptoms wane gradually over weeks to months. Disease in infants younger than 6 months of age is unusual; apnea (cessation of breathing) is a common manifestation, and whoop is absent.
- ***Treatment:*** Antibiotics are somewhat helpful in treating pertussis. The drug of choice is usually erythromycin. This antibiotic should be given for 14 days to all household and other close contacts of the patient to minimize transmission, regardless of age and vaccination status. Patients also need supportive therapy such as bed rest, fluids, and control of fever.

C. Reservoirs

Humans are the only known source of infection. Older siblings, including adolescents, and adults may be an important source of *B. pertussis* for infants and young children.

D. Modes of Transmission

Transmission occurs primarily by direct contact with discharges from respiratory mucous membranes of infected persons by the airborne route, probably by droplets. Up to 80% of non-immune household contacts may acquire the disease.

E. Period of Communicability

Pertussis is highly communicable in the early stage of illness. For control purposes, the period of communicability extends from the initial mild respiratory symptoms to 3 weeks after onset of severe cough in patients not treated with antibiotics. When treated with erythromycin, the period of infectiousness is usually 5 days or less after onset of therapy.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Pertussis is physician reportable by telephone immediately on the day of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of pertussis to both the DPH and the LHD. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Definition

- **Clinical case definition:** A cough illness lasting at least 2 weeks with one of the following:
  - Paroxyms of coughing, **or**
  - Inspiratory "whoop", **or**
  - Post-tussive vomiting, without other apparent cause (as reported by a health professional).

- **Laboratory criteria for diagnosis:**
  - Isolation of *B. pertussis* from clinical specimen
  - Positive polymerase chain reaction (PCR) for *B. pertussis*.

- **Probable Case:** A case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a confirmed case.

- **Confirmed Case:**
  - A case that is culture positive and in which an acute cough illness of any duration is present, **or**
  - A case that meets the clinical case definition and is confirmed by PCR, **or**
  - A case that meets the clinical case definition and is epidemiologically linked directly to a case confirmed by either culture or PCR.

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program ensures that the appropriate diagnostic work has been completed and works in collaboration with LHD to ensure that contacts of each case-patient have been identified, and appropriate recommendations (e.g., vaccination, exclusion) have been made.

- **LHD Responsibility:** The LHD is involved with case investigation and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunizations Program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What is pertussis?
Pertussis is an acute bacterial infection of the respiratory infection caused by *Bordetella pertussis*.

How does pertussis spread?
Pertussis is spread through the air by infectious droplets from respiratory mucous membranes and is highly contagious.

What are the symptoms of pertussis?
Pertussis infection can be divided into three stages:

Catarrhal stage: can last 1 – 2 weeks and includes a runny nose, sneezing, low-grade fever, and a mild cough (all similar symptoms to the common cold).

Paroxysmal stage: usually lasts 1 – 6 weeks, but can persist for up to 10 weeks. The characteristic symptom is a burst, or paroxysm, of numerous, rapid coughs. At the end of the paroxysm, the patient suffers from a long inhaling effort that is characterized by a high-pitched whoop (hence the name, "whooping cough"). Infants and young children often appear very ill and distressed, and may turn blue and vomit.

Convalescent stage: may last for months. Although the cough usually disappears after 2 – 3 weeks, paroxysms may recur whenever the patient suffers any subsequent respiratory infection.

The disease is usually milder in adolescents and adults, consisting of a persistent cough similar to that found in other upper respiratory infections. However, these individuals are still able to transmit the disease to others, including unimmunized or incompletely immunized infants.

How long does it take to show signs of pertussis after being exposed?
Symptoms may appear 5 – 10 days (with an upper limit of 21 days) after exposure.

How serious is pertussis?
Pertussis can be a very serious disease, especially for infants. Rates of hospitalization and complications increase with decreasing age. Of the 100 deaths from pertussis during 2000 – 2004, 76 occurred in infants age one month or younger. Infants younger than age one year accounted for 19% of pertussis cases and 92% of pertussis deaths in the United States during 2000 – 2004. The breathing difficulties associated with this disease can be very distressing and scary for the patient and family.

Although adults are less likely than infants to become seriously ill with pertussis, most make repeated visits for medical care and miss work, especially when pertussis is not initially considered as a reason for their long-term cough. In addition, adults with pertussis infection have been shown to be an important source of infection to infants with whom they have close contact.

What are possible complications from pertussis?
Younger patients have a greater chance of complications from pertussis than older patients. The most common complication is secondary bacterial infection, which is the cause of most pertussis-related deaths. Pneumonia occurs in one out of 20 cases.

Infants are also more likely to suffer from such neurologic complications as seizures and encephalopathy, probably due to the reduction of oxygen supply to the brain. In 1997 – 2000, 0.8% of all cases, and 1.4% of cases under 6 months of age, involved seizures.

Other less serious complications include ear infection, loss of appetite, and dehydration.

Adults with pertussis can have complications such as pneumonia (up to 5% of cases) and rib fracture from coughing (up to 4% of cases). Other reported side effects include (among others), loss of consciousness, female urinary incontinence, hernias, angina, and weight loss.

How do I know if someone has pertussis?
The diagnosis of pertussis is usually made based on its characteristic history and physical examination. A laboratory test may be done, which involves taking a specimen from the back of the patient's throat (through the nose).

Is there a treatment for pertussis?
Antibiotics are somewhat helpful in treating pertussis. The drug of choice is usually erythromycin. This antibiotic should also be given for 14 days to all household and other close contacts of the patient to minimize transmission, regardless of age and vaccination status.

All close contacts younger than 7 years of age should complete their DTaP vaccine series if they have not already done so. If they have completed their primary four dose series, but have not had a dose within the last 3 years, they should be given a booster dose.

Patients also need supportive therapy such as bed rest, fluids, and control of fever.

How long is a person with pertussis contagious?
Persons with pertussis are most infectious during the catarrhal period and during the first 2 weeks after onset of the cough (approximately 21 days), or in most cases until 5 days after the start of appropriate antimicrobial treatment.

Is there a vaccine to prevent pertussis?
Pertussis vaccine (contained in Tdap, DTP, DT, and DTaP vaccines) can prevent this disease.

How common is pertussis in the United States?
Before a vaccine against pertussis was available, whooping cough was a major cause of childhood sickness and death in the United States. From 1940 – 1945, over one million cases of pertussis were reported.

With the introduction of the vaccine in the 1940s, the number of pertussis cases reported nationally fell from approximately 200,000 a year in the pre-vaccine era to a low of 1,010 cases in 1976.

Unfortunately, since then, a steady increase in reported pertussis cases has occurred, with proportionately more cases in adults and adolescents. In 2004, 25,827 cases of pertussis were reported to CDC, the highest number since 1959. Adults (age 19 – 64 years) accounted for 27% of these cases. The increase in reported cases of pertussis might be due to a real increase in the disease rate or to increasing availability and use of testing technology to confirm cases and increasing healthcare provider awareness and reporting of pertussis.

Can you get pertussis more than once?
Reinfection appears to be uncommon but does occur. With natural infection, immunity to pertussis will likely wane as soon as seven years following disease; reinfection may present as a persistent cough, rather than typical pertussis. Unfortunately, it is difficult to verify pertussis infection with existing laboratory methods.

If someone has a recent culture-documented case of pertussis, he or she may not need immediate immunization against pertussis; however, a vaccine containing pertussis antigen will not be harmful, and they should continue on the routine immunization schedule for future protection against tetanus, diphtheria, and pertussis. If culture is lacking, even with a history of pertussis, do NOT withhold a dose of pertussis vaccine, if it is recommended per the routine schedule.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccine Information

When did pertussis vaccine become available?
The first whole-cell pertussis vaccine was developed in the 1930s and was in widespread use by the mid-1940s, when pertussis vaccine was combined with diphtheria toxoid and tetanus toxoid to make the combination DTP vaccine. In 1991, DTaP vaccine was licensed in the United States. The pertussis component of this vaccine is a more purified "acellular" version, which produces fewer side effects. In 2005, two new tetanus toxoid diphtheria-acellular pertussis (Tdap) vaccines were licensed. These vaccines are the first acellular pertussis-containing vaccines that make it possible to vaccinate adolescents and adults against pertussis. Pertussis is not available as a single vaccine.

What kind of vaccine is it?
DTaP and Tdap vaccines are "inactivated" vaccines. Inactivated vaccines do not contain live bacteria or virus and cannot reproduce, which is why multiple doses are needed to produce immunity. For the pertussis component of DTaP and Tdap vaccines, purified components of the bacterium are grown and then inactivated. DTaP is for children younger than 7 years and has a higher concentration of pertussis than Tdap, which is intended for persons 10 years and older.

How is this vaccine given?
The DTaP and Tdap vaccines are given as a shot in the muscle.

Is there more than one brand of pertussis vaccine?
At the present time, there are 3 different brands of DTaP (pediatric) vaccine available in the U.S. All 3 vaccines are equally effective and safe, and are given on the same schedule (2, 4, 6, 15 – 18 months, 4 – 6 years). DTaP is also part of 2 combination vaccines. Two companies produce the Tdap vaccines. The vaccines are approved for use in different age groups (10 – 18 years and 11 – 64 years). It is preferable but not mandatory to use the same DTaP product for all doses.

Who should get this vaccine?
All infants should receive DTaP vaccine as part of their routine immunization unless they have a medical reason not to. Persons 10 years and older can receive Tdap vaccine in place of a routine booster dose of adult Td vaccine.

How many doses of DTaP vaccine are required?
The usual schedule for infants is a series of 4 doses given at 2, 4, 6, and 15 – 18 months of age. A fifth shot, or booster dose, is recommended at 4 – 6 years of age, unless the fourth dose was given late (after the fourth birthday). Both Tdap vaccines are approved for a single booster dose in their respective age groups, generally as a substitute for 1 dose of adult formulation tetanus and diphtheria toxoid.

My father never received immunization against pertussis as a child. Should he get immunized as an adult?
Adults or children ages 7 years and older without documentation of tetanus and diphtheria vaccination should receive a primary series of 3 doses of tetanus-diphtheria toxoid (Td). The first 2 doses should be separated by 4 – 8 weeks, and the third dose given 6 – 12 months after the second dose. Td will protect you from diphtheria infection as well as tetanus. Tdap vaccine can be substituted for 1 of these 3 doses, preferably the first dose for persons 10 years and older to provide protection against pertussis.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) all recommend this vaccine.

How safe is this vaccine?
Most children have no serious reactions from this combined vaccine. The most common reactions are local reactions at the injection site, such as soreness, redness, and swelling, especially after the fourth or fifth dose. Other possible reactions may include fussiness, mild fever, loss of appetite, tiredness, and vomiting. The use of the more purified DTaP instead of the whole cell DTP has decreased these mild reactions substantially. Tdap is a new vaccine but trials have shown it to be safe.

What side effects have been reported with this vaccine?
Side effects such as crying for 3 or more hours (up to about 1 child out of 1,000 vaccinated) and high fever (about 1 child in 16,000) were known to have occurred following the whole cell pertussis vaccine in DTP. Now that the acellular pertussis vaccine (DTaP) is used exclusively in the U.S., these types of side effects are seen more rarely (estimated at about 1 in 10,000 doses). More serious reactions, such as seizures, are so rare that it is hard to tell if they are caused by the vaccine. If a child has a medical reason not to receive the pertussis vaccine, they can and should still be vaccinated against just diphtheria and tetanus with DT-pediatric vaccine. The most frequently reported side effects following vaccination with Tdap were headache, generalized body aches, and tiredness.

How effective is this vaccine?
In general, inactivated vaccines are not as effective in producing immunity as are live vaccines. In studies of acellular pertussis vaccine, children who received 3 or 4 doses were 80% – 85% less likely to develop pertussis than unvaccinated children. Immunity appears to last for 5 – 10 years. Tdap vaccine is believed to be similar in effectiveness and duration of immunity as pediatric DTaP vaccines.

Who should NOT receive pertussis vaccine?
People who had a serious allergic reaction to a previous dose of DTaP or Tdap vaccine, or who developed encephalopathy (brain injury) not due to another identifiable cause, should not receive another dose. Certain rare adverse events following pertussis vaccination usually serve as a precaution against receiving further doses. Such events include a temperature of 105°F or higher, collapse or shock-like state, persistent crying for more than three hours, or convulsions within three days. Even if one of these precautions exists, there may be occasions when the benefit of immunization outweighs

the risk (for example, during a community-wide outbreak of pertussis). A person who developed one of these adverse events after pediatric DTaP vaccine may receive Tdap as an adolescent or adult. A person with a recognized, possible, or potential neurologic condition should delay receiving DTaP or Tdap vaccine until the condition is evaluated, treated, and/or stabilized. Although DTaP vaccine does not cause neurological disorders, receiving the vaccine can cause an already-present underlying condition to show itself. Persons with a moderate or severe illness should postpone receiving the vaccine until they are well.

Can the vaccine cause pertussis?
No.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Pneumococcal Disease

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Pneumococcal disease is caused by the bacterium *Streptococcus pneumoniae.* There are more than 90 serotypes. While most types can cause disease, the 11 most common serotypes cause at least 75% of invasive disease.

B. Description of Illness

- ***General facts:*** Pneumococcal disease is a vaccine-preventable disease. The pneumococcal conjugate vaccine that was introduced in 2000 protects against the 7 most common serotypes that account for 80% of disease in young children.
- ***Occurrence:*** Until 2000, *S. pneumoniae* infections caused 100,000 – 135,000 hospitalizations for pneumonia, 6 million cases of otitis media, and 60,000 cases of invasive disease, including 3,300 cases of meningitis. Incidence from sterile-site infections showed geographic variation from 21 – 33 cases per 100,000 population. These figures decreased substantially following the introduction of the conjugate vaccine in children in 2000. Pneumococcal infections are most prevalent during winter months; most common in infants, young children, and the elderly; and more common in black individuals and some American Indian populations than in other racial and ethnic groups.
- ***Incubation period:*** The incubation period can vary by type of infection and can be as short as 1 – 3 days.
- ***Common symptoms*:** There are three major conditions caused by invasive pneumococcal disease: pneumonia, bacteremia, and meningitis. They are all caused by infection with the same bacteria, but have different symptoms.
- ***Treatment:*** Penicillin is the drug of choice for treatment of pneumococcal disease; however, resistance to penicillin and other antibiotics has been on the rise. Studies indicate that in some areas of the United States up to 40% of pneumococci are resistant to common antibiotics. Treating patients infected with resistant organisms requires expensive alternative antimicrobial agents and may result in prolonged hospital stays. The increased difficulty of treating serious bacterial infection makes prevention through vaccination even more important.

C. Reservoirs

S. pneumoniae is a human pathogen. The reservoir for pneumococci is presumably the nasopharynx of asymptomatic human carriers. There is no animal or insect vector.

D. Modes of Transmission

Transmission of *S. pneumoniae* occurs as the result of direct person-to-person contact via respiratory droplets and b autoinoculation in persons carrying the bacteria in their upper respiratory tract. The pneumococcal serotypes most often responsible for causing infection are those most frequently found in carriers. The spread of the organism within a family or household is influenced by such factors as crowding, season, and the presence of upper respiratory infections or pneumococcal disease such as pneumonia or otitis media. The spread of pneumococcal disease is usually associated with increased carriage rates.

However, high carriage rates do not appear to increase the risk of disease transmission in households.

E. Period of Communicability

The exact period of communicability is unknown. It appears transmission can occur as long as the organism remains in respiratory secretions. Treatment with an appropriate antibiotic renders an individual non-infectious within 24 – 48 hours.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Invasive pneumococcal disease is physician reportable by mail within 12 hours of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). The director of any clinical laboratory must also report laboratory evidence of invasive pneumococcal disease to both the DPH and LHD.

Additional requirements: All isolates yielding *S. pneumoniae* from invasive sterile sites must be submitted to the DPH State Laboratory for confirmation. See current list of Physician Reportable Diseases (Attachment A) and Laboratory Report of Significant Findings (Attachment C).

B. Case Definition

- **Clinical Description:** Invasive pneumococcal disease may produce any of several clinical syndromes, including meningitis, bacteremia, and pneumonia.

- **Laboratory criteria for diagnosis:** Isolation of *S. pneumoniae* from a normally sterile site (e.g., blood, cerebrospinal fluid, joint fluid, pleural fluid, peritoneal fluid, etc…).

- **Confirmed Case:** A clinically compatible case that is laboratory confirmed.

C. Case Investigation

- **DPH Responsibility:** The DPH Epidemiology Program obtains additional case data by completing a detailed report form through medical chart review. Information is forwarded to the Centers for Disease Control and Prevention.

- **LHD Responsibility:** No action required.

D. Control Measures

No specific control measures are recommended.

Fact Sheet

What causes pneumococcal disease?

Pneumococcal disease is caused by *Streptococcus pneumoniae*, a bacterium. There are more than 90 subtypes. Most types can cause disease, but only a few produce the majority of invasive pneumococcal infections: the 10 most common types cause 62% of invasive disease worldwide.

How does pneumococcal disease spread?

The disease is spread person to person by droplets in the air. Many people carry the bacteria in their nose and throat without ever developing invasive disease. The bacteria may be found in the nasopharnyx of 5% – 70% of normal, healthy adults.

What are the symptoms of pneumococcal disease?

There are three major conditions caused by pneumococcal disease: pneumonia, bacteremia, and meningitis. They are all caused by infection with the same bacteria, but have different symptoms. Pneumococcal pneumonia (lung disease) is the most common disease caused by pneumococcal bacteria. Symptoms include fever, cough, shortness of breath, and chest pain. Pneumococcal meningitis has symptoms that may include headache, stiff neck, and fever. Pneumococcal bacteremia (blood infection) occurs in about 25% – 30% of patients with pneumococcal pneumonia. Symptoms may be similar to those with pneumonia and meningitis, and may also include joint pain and chills.

How long does it take to show signs of pneumococcal disease after being exposed?

The incubation period for pneumococcal disease is not well determined but is probably 1 – 3 days.

How serious is pneumococcal disease?

Pneumococcal disease is a serious disease that causes much sickness and death. In fact, pneumococcal disease kills more people in the United States each year than all other vaccine-preventable diseases combined. More than 50,000 cases and more than 10,000 deaths from invasive pneumococcal diseases (bacteremia and meningitis) are estimated to have occurred in the United States in 2002. More than half of these cases occurred in adults for whom pneumococcal polysaccharide vaccine was recommended. Young children and the elderly (less than 5 years and older than 65 years) have the highest incidence of serious disease.

Case-fatality rates are highest for meningitis and bacteremia, and the highest mortality occurs among the elderly and patients who have underlying medical conditions. Despite appropriate antimicrobial therapy and intensive medical care, the overall case-fatality rate for pneumococcal bacteremia is about 20% among adults. Among elderly patients, this rate may be as high as 60%. Before a vaccine was available in the United States, pneumococcal disease caused serious disease in children younger than age five years. Each year it was responsible for causing 700 cases of meningitis, 17,000 blood infections, five million ear infections, and 200 deaths. Children younger than age two years are at the highest risk for serious pneumococcal disease.

Is there a treatment for pneumococcal disease?

Penicillin is the drug of choice for treatment of pneumococcal disease; however, resistance to penicillin and other antibiotics has been on the rise. Studies indicate that in

some areas of the United States up to 40% of invasive pneumococci are resistant to common antibiotics. Treating patients infected with resistant organisms requires expensive alternative antimicrobial agents and may result in prolonged hospital stays. The increased difficultly of treating this serious bacterial infection makes prevention through vaccination even more important.

How long is a person with pneumococcal disease contagious?
The exact period of communicability is not known. It appears that transmission can occur as long as the organism is present in respiratory secretions.

Is there a vaccine to prevent pneumococcal disease?
There are two vaccines available. The polysaccharide vaccine ("pneumonia vaccine") is recommended for anyone over 65 years of age and for younger people with certain chronic medical conditions. The conjugate vaccine is recommended for all children less than 2 years of age.

How common is pneumococcal disease in the United States?
Healthcare providers are not required by law to report pneumococcal disease to health authorities, so exact numbers are not known. Estimates have been made from a variety of population studies, however, and it is believed that 45,000 cases of invasive pneumococcal disease (meningitis and blood infections) occur each year in the United States.

The incidence of the disease varies greatly by age group. The highest rate of invasive pneumococcal disease occurs in young children, especially those younger than 2 years of age. Children with certain chronic diseases (such as sickle cell disease or HIV infection) are at very high risk of invasive disease.

Can you get pneumococcal disease more than once?
Yes. There are more than 90 known types of pneumococcus bacteria, with 23 subtypes included in the current pneumococcal polysaccharide (adult) vaccine and 7 subtypes included in the current conjugate (child) vaccine. Having been infected with one type does not always make the patient immune to other types. Even if an individual has had one or more episodes of invasive pneumococcal disease, he or she needs to be vaccinated.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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Fact Sheet: Vaccine Information

When did pneumococcal vaccine become available?
There are 2 types of pneumococcal vaccine, pneumococcal polysaccharide vaccine and pneumococcal conjugate vaccine.

The first pneumococcal polysaccharide vaccine was licensed in the United States in 1977. In 1983, an improved pneumococcal polysaccharide vaccine was licensed, containing purified protein from 23 types of pneumococcal bacteria (the old formulation contained 14 types). This pneumococcal polysaccharide vaccine is commonly known as PPV23 or PPV. The PPV vaccine is licensed for use in adults and persons with certain risk factors who are aged 2 years and older.

The pneumococcal conjugate vaccine was licensed in early 2000. It is recommended for use in preventing pneumococcal disease in infants and young children (from 6 weeks to the 5th birthday). It is commonly known as PCV7 or PCV.

What kind of vaccines are they?
Both pneumococcal vaccines are made from inactivated (killed) bacteria. The pneumococcal polysaccharide vaccine (PPV) contains long chains of polysaccharide (sugar) molecules that make up the surface capsule of the bacteria. The 23 types of pneumococci that are included cause 88% of invasive pneumococcal disease.

The pneumococcal conjugate vaccine (PCV) includes purified capsular polysaccharide of seven types of the bacteria “conjugated” (or joined) to a harmless variety of diphtheria toxin. The 7 types of purified bacteria included account for 86% of bacteremia, 83% of meningitis, and 65% of acute otitis media (ear infection) among children younger than 6 years old in the United States.

How is this vaccine given?
The polysaccharide vaccine (PPV) can be given as a shot in either the muscle or the fatty tissue of the arm or leg. The conjugate vaccine (PCV) is given as a shot in the muscle.

Who should get the pneumococcal polysaccharide vaccine (PPV)?

- All adults age 65 years or older
- Anyone age 2 years or older who has a long-term health problem such as cardiovascular disease, sickle cell anemia, alcoholism, lung disease, diabetes, cirrhosis, or leaks of cerebrospinal fluid
- Anyone who has or is getting a cochlear implant
- Anyone age two years or older who has a disease or condition that lowers the body’s resistance to infection, such as Hodgkin’s disease, kidney failure, nephritic syndrome, lymphoma, leukemia, multiple myeloma, HIV infection or AIDS, damaged spleen or no spleen, or organ transplant
- Anyone age 2 years or older who is taking any drug or treatment that lowers the body’s resistance to infection, such as long-term steroids, certain cancer drugs, or radiation therapy
- Alaska Natives and certain Native American populations

Who should get the pneumococcal conjugate vaccine (PCV)?
All infants beginning at 2 months of age should receive a 4-dose series of vaccine; catch-up vaccination is recommended for children younger than age 5 years who did not receive PCV vaccine on schedule.

What is the schedule for the routine doses of PCV for children?
All infants and toddlers should get 4 doses of PCV vaccine, usually given at 2, 4, 6, and 12 – 15 months.

What if my three-year-old child never got his PCV shots?
The number of doses a child needs to complete the series depends on his or her current age. Older children need fewer doses. For example, you should consider giving a healthy unvaccinated child age 24 – 59 months a single dose of PCV. Your healthcare provider can tell you how many doses are needed to complete the series at a certain age. PCV is not routinely recommended for individuals who are age 5 years or older.

Do some children need to get both PCV and PPV?
Yes, children at high risk of invasive pneumococcal disease should receive PCV and then also receive PPV when age 2 years or older. PPV is not given routinely to healthy children (or adults younger than age 65 years).

If influenza is recommended for healthcare workers to protect high-risk patients from getting influenza, why isn't pneumococcal vaccine also recommended?
Influenza virus is easily spread from healthcare workers to their patients, and infection usually leads to clinical illness. Pneumococcus is probably not spread from healthcare workers to their patients as easily as is influenza, and infection with pneumococcus does not necessarily lead to clinical illness. Host factors (such as age, underlying illness) are more important in the development of invasive pneumococcal disease than just having the bacteria in one's nose or throat.

My elderly neighbor got a second pneumococcal shot. I thought just one was required.
Revaccination is not done routinely, but a single revaccination dose is recommended for groups of people at highest risk of serious infection. No one should receive more than 2 doses of PPV.

For example, persons who received a first dose when they were younger than age 65 years should receive a second dose at age 65 years if at least 5 years have elapsed since the previous dose. Likewise, persons age 2 years or older who are at high risk for pneumococcal disease due to certain long-term health problems, in particular immunosuppression, HIV infection, and not having a functional spleen (or having no spleen) should get a second dose 5 or more years after the first dose.

High-risk children (e.g., who have sickle cell disease, HIV/AIDS, diabetes) who received the full PCV series as young children should receive one dose of PPV at age 2 years or older (at least 2 months following the last PCV dose).

Anyone interested in the full list of recommendations for revaccination with PPV can find a chart at http://www.immunize.org/catg.d/2015pne.pdf

Who recommends pneumococcal vaccines?
The Centers for Disease Control and Prevention, the American Academy of Pediatrics, and the American Academy of Family Physicians have all recommended routine vaccination for infants and young children with PCV vaccine. The Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, the American Academy of Family Physicians, and the American College of Physicians all recommend the PPV vaccine.

Should all nursing home patients ages 65 years and older be vaccinated against pneumococcal disease?
Yes.

Can pregnant women get this vaccine?
The safety of PPV vaccine for pregnant women has not been studied, although no adverse consequences have been reported among newborns whose mothers were vaccinated with PPV during pregnancy. Women who are at high risk of pneumococcal disease should be vaccinated before becoming pregnant, if possible. Unvaccinated pregnant women who are in a high-risk group should consult with a healthcare professional about getting the vaccination during pregnancy.

How safe is this vaccine?
PPV and PCV are both very safe vaccines. For PPV, about 30% – 50% of the people who get the vaccine have very mild side effects, such as redness or pain where the shot was given. Fewer than 1% of recipients develop a fever, muscle aches, or more severe local reactions. Serious allergic reactions have been reported very rarely. For PCV, about 10% – 20% of children develop redness, tenderness, or swelling where the shot was given. About 11% may have a mild fever.

How effective is pneumococcal polysaccharide vaccine (PPV)?
Overall, PPV is 60% – 70% effective in preventing invasive disease. Older adults (e.g., older than age 65 years) and persons with significant underlying illnesses do not respond as well, but vaccination with PPV is still recommended because such persons are at high risk of developing severe pneumococcal disease.

How effective is pneumococcal conjugate vaccine (PCV)?
In a large clinical trial, PCV was shown to be 97% effective in preventing invasive disease caused by the pneumococci contained in the vaccine and 89% effective against all types of *S. pneumoniae*, including those not found in the vaccine. Children with chronic diseases such as sickle cell disease and HIV infection also seem to respond well to PCV.

Who should NOT receive pneumococcal vaccine?
- For both PPV and PCV, persons who had a severe allergic reaction to one dose should not receive another (such reactions are rare).
- Persons who are moderately or severely ill should wait until their condition improves to be vaccinated.

Pneumococcal Disease

Can the vaccine cause pneumococcal disease?
No. Both PPV and PCV are inactivated vaccines containing only a portion of the microbe; therefore the vaccines cannot possibly cause pneumococcal disease.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Poliomyelitis is a highly contagious disease caused by three serotypes of poliovirus that can cause paralysis: types 1, 2, and 3. Type 1 is isolated from paralytic cases most often, type 3 less so, and circulation of wild poliovirus type 2 has been interrupted since 1999. Type 1 most frequently causes epidemics. Most vaccine-associated cases are due to type 2 or 3.

B. Description of Illness

- ***General facts:*** Poliomyelitis is a vaccine-preventable disease nearing worldwide eradication. The last case of indigenously acquired poliomyelitis occurred in the United States in 1979 and in the Western Hemisphere in 1991.
- ***Occurrence:*** In the United States, all cases since 1979 have been vaccine-associated paralytic poliomyelitis (VAPP), which is attributable to the oral poliovirus (OPV) vaccine. An average of 8 VAPP cases occurred in the United States between 1980 and 1996. In 2000, the United States instituted an all-inactivated poliovirus (IPV) vaccine schedule, ending the occurrence of VAPP in this country.
- ***Incubation period:*** Commonly 6 – 20 days (range of 3 to possibly 35 days).
- ***Common symptoms*:** Approximately 95% of poliovirus infections are asymptomatic; 4% – 8% of infected individuals have symptoms of a minor, non-specific nature, such as sore throat and fever, nausea, vomiting, malaise and headache. About 1% – 2% of infected individuals develop nonparalytic aseptic meningitis, with temporary stiffness of the neck, back, and/or legs. Less than 2% of all polio infections result in the classic "flaccid paralysis," where the patient is left with permanent weakness or paralysis of the legs, arms, or both. Adults who contracted paralytic poliomyelitis during childhood may develop postpolio syndrome 30 – 40 years later. Postpolio syndrome is characterized by slow onset of muscle pain and exacerbation of weakness.
- ***Treatment:*** There is no treatment for polio. Persons infected with polio need supportive therapy, such as bed rest and fluids. Standard precautions should be taken to avoid passing on the virus through any contamination from the patient's stool.

C. Reservoirs

Humans are the only source of infection.

D. Modes of Transmission

Poliovirus is spread person to person, primarily through the fecal-oral route. However, it may also spread through oral and nasal secretions. In rare instances, milk, foodstuffs, and other materials contaminated with feces have been incriminated as vehicles.

E. Period of Communicability

Communicability of poliovirus is greatest shortly before and after onset of clinical illness when the virus is present in the throat and excreted in high concentration in feces. The virus persists in the throat for approximately 1 week after the onset of illness and is excreted in

feces for several weeks. Patients are potentially contagious for as long as fecal excretion persists.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Poliomyelitis is physician reportable by telephone immediately on the day of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). A mailed report is also required within 12 hours. The director of any clinical laboratory must also report laboratory evidence of poliomyelitis to both the DPH and the LHD. See current lists of physician Reportable Diseases (Attachment A) and Laboratory Reportable Significant Findings (Attachment C).

B. Case Definition

Poliomyelitis, Paralytic:

- **Clinical Case Definition:** Acute onset of flaccid paralysis of one or more limbs with decreased or absent tendon reflexes in the affected limbs, without other apparent cause, and without sensory or cognitive loss.

- **Probable Case:** A case that meets the clinical case definition.

- **Confirmed Case**: A case that meets the clinical case definition and in which the patient has a neurologic deficit 60 days after onset of initial symptoms, has died, or has unknown follow-up status.

Poliovirus infection, non-paralytic:

- **Confirmed Case**: A poliovirus isolate identified in an appropriate clinical specimen with confirmatory typing and sequencing performed by the Centers for Disease Control and Prevention (CDC) poliovirus laboratory. (NOTE: If a case is confirmed, active acute flaccid paralysis (AFP) surveillance should be initiated.)

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program ensures that the appropriate diagnostic work has been completed and works in collaboration with LHD to ensure that contacts of each case-patient have been identified, and appropriate recommendations (e.g., vaccination, exclusion) have been made.

- **LHD Responsibility:** The LHD is involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunizations program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What is polio?
Polio is an infection caused by a virus.

How does polio spread?
Polio is usually spread from person to person primarily through the fecal-oral route. The virus is transmitted from the stool of an infected person to the mouth of another person from contaminated hands or such objects as eating utensils. Some cases may be spread directly through the oral-oral route.

What are the symptoms of polio?
Surprisingly, 95% of all individuals infected with polio have no apparent symptoms.

Another 4% – 8% of infected individuals have symptoms of a minor, non-specific nature, such as sore throat and fever, nausea, vomiting, and other common symptoms of any viral illness.

About 1% – 2% of infected individuals develop nonparalytic aseptic meningitis, with temporary stiffness of the neck, back, and/or legs.

Less than 2% of all polio infections result in the classic "flaccid paralysis," where the patient is left with permanent weakness or paralysis of legs, arms, or both.

How long does it take to show signs of polio after being exposed?
The incubation period of polio is commonly 6 – 20 days, with a range of 3 – 35 days.

How serious is polio?
Although most cases of polio are extremely mild, the 2% of cases resulting in flaccid paralysis have made polio a feared disease for hundreds of years.

Of persons with paralytic polio, about 2% – 5% of children die and up to 15% – 30% of adults die.

How is polio diagnosed?
If a person is suspected of being infected, a sample from their stool or throat should be tested for the poliovirus.

How long is a person with polio contagious?
Patients infected with the poliovirus can pass the virus on 7 – 10 days before the onset of disease. In addition, they can continue to shed the virus in their stool for 3 – 6 weeks.

Is there a treatment for polio?
There is no specific treatment for polio. Persons infected with polio need supportive therapy, such as bed rest and fluids.

Is there a vaccine to prevent polio?
There are two types of vaccine that can prevent polio: inactivated polio vaccine (IPV) and oral polio vaccine (OPV). IPV has been used in the United States since 2000; however OPV is still used throughout much of the world.

How common is polio in the United States?
Before a polio vaccine was developed, polio epidemics were common in the United States. For example, in the immediate pre-vaccine era (early 1950s), there were 13,000 – 20,000 paralytic cases and 1,000 polio-related deaths each year in the United States.

After the development of the inactivated (Salk) vaccine in 1955 and the live (Sabin) vaccine in 1961, the number of polio cases dropped dramatically. In 1960, there were 2,525 paralytic cases reported, but by 1965 this number had fallen to 61.

Due to a concentrated effort to eradicate polio from the world, there have been no cases of "wild" (natural) polio acquired in the United States since 1979 and no cases of wild polio acquired in the entire Western Hemisphere since 1991.

How common is polio in the world?
In 1988, the World Health Organization (WHO) adopted the goal of global polio eradication. Although the initial target date of 2000 was not met, substantial progress has been made. In 1988, there were estimated to be 350,000 reported cases of polio in the world; in 2001, just 480 cases were reported in only 10 countries. Unfortunately, rumors about the safety of polio vaccine in 2003, and subsequent refusal of vaccine by many parents in Nigeria, led to an increase in cases and spread of the virus to nearby countries that had previously been polio free. In 2003, there were 784 reported cases; in 2004, there were 1,258 reported cases.

Polio currently exists only in Asia (Afghanistan, India, and Pakistan) and Africa (primarily Nigeria). In 2006, there were 1,906 cases of polio in 16 countries, according to the Global Polio Eradication Initiative. Many organizations have been working hard toward eradicating polio including WHO, the United Nations Children's Fund (UNICEF), the CDC, Rotary International, and many other international and national groups. Strategies include house-to-house vaccination and National Immunization Days, where even warring factions have called temporary cease fires to allow children to be vaccinated.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

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Fact Sheet: Vaccine Information

When did the polio vaccine first become available?
The first polio vaccine was an inactivated, or killed, vaccine (IPV) developed by Dr. Jonas Salk and licensed in 1955.

What are the polio vaccines that have followed the first Salk vaccine?
In 1961, a live attenuated (e.g., weakened) vaccine was developed by Dr. Albert Sabin. This vaccine was given as an oral preparation instead of as a shot. By 1963, this oral vaccine had been improved to include protection against three strains of polio and was licensed as "trivalent oral poliovirus vaccine" (OPV). OPV was the vaccine of choice for the United States and most other countries of the world from 1963 until changes in U.S. policy in the 1990s. In 1988, an enhanced-potency IPV formulation became available and by 1997 had become part of the routine schedule for infants and children, given in a sequential combination with OPV. In 2000, an all-IPV vaccine schedule was adopted in the United States. IPV is also available in combination with other vaccines (e.g., DTaP-HepB-IPV).

How is the vaccine administered?
- IPV is given as a shot in the arm or leg.
- OPV is given as an oral liquid. OPV is no longer used in the United States, but is still given in other parts of the world where polio is common.

Why was the U.S. polio immunization recommendation changed from OPV to IPV?
The change to an all-IPV schedule in the United States occurred because the few cases of polio that were occurring (8 – 10 per year) were caused by the OPV vaccine itself and not the wild virus. The change to IPV protects individuals against paralytic polio, while eliminating the small chance (about once in every 2.4 million doses) of actually contracting polio from the live oral vaccine. OPV is better at stopping the spread of the virus to others, but now that wild (natural) polio has been eliminated from the Western Hemisphere, this advantage is no longer a consideration in the United States. IPV has been used exclusively in the United States since 2000. However, in other countries where wild polio is still a threat, OPV is still used.

Who should get this vaccine?
All infants should get this vaccine unless they have a medical reason not to. A primary series of IPV consists of 3 properly spaced doses, usually given at 2 months, 4 months, and 6-18 months. A booster dose is given at 4 – 6 years (before or at school entry), unless the primary series was given so late that the third dose was given on or after the fourth birthday.

Does my child need additional doses of polio vaccine if he received a combination of OPV and IPV?
No, four doses of any combination of IPV or OPV, properly spaced, is considered a complete poliovirus vaccination series.

Why should I vaccinate my child against polio if this disease has been eliminated from the Western Hemisphere since 1991?
Polio still exists in parts of Africa and Asia and can easily be imported. When the effort to eliminate polio from the world is successful, polio vaccine will become part of history. But we are not to that point yet.

Should adults get vaccinated against polio?
In the United States, routine vaccination of persons 18 years of age and older against polio is not recommended because most adults are already immune and also have little risk of being exposed to wild polio virus. Vaccination is recommended, however, for certain adults who are at increased risk of infection, including travelers to areas were polio is common, laboratory workers who handle specimens that might contain polioviruses, and healthcare workers in close contact with patients who might be excreting wild polioviruses in their stool (e.g., those caring for recent immigrants from central Africa or parts of Asia).

If an adult is at increased risk of exposure and has never been vaccinated against polio, he or she should receive 3 doses of IPV, the first 2 doses given 1 – 2 months apart, and the third 6 – 12 months after the second. If time will not allow the completion of this schedule, a more accelerated schedule is possible (e.g., each dose separated 4 weeks from the previous dose).

If an adult at risk previously received only 1 or 2 doses of polio vaccine (either OPV or IPV), he or she should receive the remaining dose(s) of IPV, regardless of the interval since the last dose. If an adult at increased risk previously completed a primary course of polio vaccine (three or more doses of either OPV or IPV), he or she may be given another dose of IPV to ensure protection. Only 1 “booster” dose of polio vaccine in a person’s lifetime is recommended. It is not necessary to receive a booster dose each time a person travels to an area where polio may still occur.

Who recommends this vaccine?
The CDC, the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) have all recommended that children receive this vaccine.

How safe is this vaccine?
The IPV vaccine is very safe; no serious adverse reactions to IPV have been documented.

What side effects have been reported with this vaccine?
Possible side effects include minor local reactions at the site of injection (e.g., pain, redness).

How effective is this vaccine?
IPV is very effective in preventing polio, but only when all recommended doses are completed. A single dose of IPV produces little or no immunity, but 99% of recipients are immune after 3 doses.

Who should not receive the polio vaccine?

- Anyone who has ever had a life-threatening allergic reaction to neomycin, streptomycin, or polymyxin B should not get the IPV shot because it contains trace amounts of these antibiotics.
- Anyone who has had a severe allergic reaction to a dose of polio vaccine should not get another one.
- Anyone who is moderately or severely ill at the time the shot is scheduled should usually wait until they recover to get vaccination.

Can the IPV vaccine cause polio?

No, the IPV cannot cause paralytic polio because it contains killed virus only.

Technically reviewed by the Centers for Disease Control and Prevention, April 2007.

This fact sheet is for information only and is not meant to be used for self-diagnosis or as a substitute for consultation with a health care provider. If you have any questions about the disease described above or think that you may have this infection, consult a health care provider.

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Tetanus is an acute, often fatal, disease caused by an exotoxin produced by *Clostridium tetani. C. tetani* is an anaerobic, spore forming bacterium. The spores enter the body through breaks in the skin and germinate under low oxygen conditions; the exotoxin is produced as the bacteria multiply.

B. Description of Illness

- ***General facts:*** Tetanus is characterized by generalized rigidity and convulsive spasms of skeletal muscles. The muscle stiffness usually involves the jaw (lockjaw) and neck and then becomes generalized. *C. tetani* spores are widely distributed in soil and in the intestine and feces of horses, sheep, cattle, dogs, cats, rats, guinea pigs, and chickens. Manure-treated soil may contain large numbers of spores. In agricultural areas, a significant number of human adults may harbor the organism. The spores can also be found on skin surfaces and in contaminated heroin. Laboratory confirmation for tetanus is of little help as the organisms are rarely recovered from the site of infection, and usually there is no detectable antibody response.
- ***Occurrence:*** Tetanus occurs worldwide and is more frequently seen in warmer climates and months, partly because of the frequency of contaminated wounds. In the United States, the reported morbidity and mortality due to tetanus have declined dramatically since the mid-to late 1940s, when tetanus toxoid became available. Tetanus is sporadic and relatively uncommon in the United States and most industrial countries, mostly because of widespread use of tetanus toxoid as part of routine immunizations and improved wound management. During the period 1996 – 2000, a total of 202 cases were reported in the United States: 72 (36%) were aged ≥ 60 years, 116 (57%) were aged 20-59 years, and 14 (7%) were aged < 20 years, including 2 cases of neonatal tetanus.
- ***Incubation period:*** The incubation period ranges from 3 – 21 days (average 8 days). In neonates the incubation period is usually 5 – 14 days. Shorter incubation periods are associated with more heavily contaminated wounds, more severe disease, and a worse prognosis.
- ***Common symptoms*:** The most common type (about 80%) of reported tetanus is generalized tetanus. The disease usually presents with a descending pattern. The first sign is trismus or lockjaw, followed by stiffness of the neck, difficulty in swallowing, and rigidity of abdominal muscles. Other symptoms include elevated temperature, sweating, elevated blood pressure, and episodic rapid heart rate. Spasms may occur frequently and last for several minutes. Spasms continue for 3 – 4 weeks. Complete recovery may take months.
- ***Treatment:*** Human tetanus immune globulin (TIG) is recommended for treatment in a single dose of 3000 to 6000 U for children and adults. The optimum therapeutic dose has not been established, and doses as small as 500 U have been effective and cause less discomfort to the patient. TIG can only help remove unbound tetanus toxin. It cannot affect toxin bound to nerve endings.

C. Reservoirs

C. tetani are found in the intestines of horses and other animals, including humans, in which the organism is a harmless normal inhabitant. Soil or fomites contaminated with animal and

human feces can act as a reservoir. Tetanus spores are a normal inhabitant of the environment and can contaminate wounds of all types.

D. Modes of Transmission

Transmission is primarily by contaminated wounds. The wound may be major or minor. In recent years, however, a higher proportion of cases had minor wounds, probably because severe wounds are more likely to be properly managed. Tetanus may follow elective surgery, burns, deep puncture wounds, crush wounds, otitis media (ear infections), dental infection, animal bites, abortion, and pregnancy.

E. Period of Communicability

Tetanus is not contagious from person to person. It is the only vaccine-preventable disease that is infectious but not contagious.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Tetanus is physician reportable by mail within 12 hours of recognition or strong suspicion to both the Connecticut Department of Public Health (DPH) and the local health department (LHD). See current list of physician Reportable Diseases (Attachment A).

B. Case Definition

- **Confirmed Case:** Acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw or neck) and generalized muscle spasms without any other apparent cause.

  NOTE: The diagnosis of tetanus is based entirely on clinical symptoms and does not depend on laboratory confirmation.

C. Case Investigation

- **DPH Responsibility:** The DPH Immunization Program is responsible for obtaining additional case data for tetanus, which is reportable to the Centers for Disease Control and Prevention (CDC). The additional information is usually obtained by either calling the reporting source or mailing a more detailed report form.

- **LHD Responsibility:** The assistance of the LHD is usually not required, unless there is an urgent need to simultaneously initiate control measures. The Immunization Program will contact the LHD if there is a need for the LHD to become involved.

D. Control Measures

The DPH Immunizations program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Fact Sheet

What is tetanus?
Tetanus is a disease of the nervous system caused by a toxin (poison). This toxin is produced by a bacterium, *Clostridium tetani*. The *C. tetani* bacteria cannot survive in the presence of oxygen. They produce spores that are very difficult to kill as they are resistant to heat and many chemical agents.

How does tetanus spread?
C. tetani spores can be found in the soil and in the intestines and feces of many household and farm animals. The bacteria usually enter the human body through a puncture (in the presence of anerobic [low oxygen] conditions, the spores will germinate). Tetanus is not spread from person to person.

What are the symptoms of tetanus?
The symptoms of tetanus are caused by the tetanus toxin acting on the central nervous system. In the most common form of tetanus, the first sign is a locked jaw, followed by stiffness of the neck, difficulty in swallowing, and stiffness of the abdominal muscles.

Other signs include fever, sweating, elevated blood pressure, and rapid heart rate. Spasms often occur, which may last for several minutes and continue for 3 – 4 weeks. Complete recovery, if it occurs, may take months.

How long does it take to show signs of tetanus after being exposed?
The incubation period varies from 3 – 21 days, with an average of 8 days. The further the injury site from the central nervous system, the longer the incubation period. The shorter the incubation period, the higher the risk of death.

How serious is tetanus?
Tetanus has a high fatality rate; during 1998 – 2000, the case-fatality rate for reported tetanus in the United States was 18%.

What are possible complications from tetanus?
Laryngospasm (spasm of the vocal cords) is a complication that can lead to interference with breathing. Patients can also break their spine or long bones from convulsions. Other possible complications include hypertension, abnormal heart rhythm, and secondary infections, which are common because of prolonged hospital stays. The high possibility of death is a major complication.

How is tetanus diagnosed?
The diagnosis of tetanus is based on the clinical signs and symptoms only. Laboratory diagnosis is not useful as the *C. tetani* bacteria often cannot be recovered from the wound of an individual who has tetanus, and conversely, can be isolated from the skin of an individual who does not have tetanus.

What kind of injuries might allow tetanus to enter the body?
Tetanus bacilli live in the soil, so the most dangerous kind of injury involves possible contamination with dirt, animal feces, and manure.

Although we have traditionally worried about deep puncture wounds, in reality many types of injuries can allow tetanus bacilli to enter the body. In recent years, a higher proportion of cases had minor wounds than had major ones, probably because severe wounds were more likely to be properly managed. People have become infected with tetanus following surgery, burns, lacerations, abrasions, crush wounds, ear infections, dental infections, animal bites, abortion, pregnancy, body piercing and tattooing, and injection drug use. People can also get tetanus from splinters.

Is there a treatment for tetanus?
There is no "cure" for tetanus once a person develops symptoms, just supportive treatment and management of complications. The best "treatment" is prevention through immunization.

Is there a vaccine to prevent tetanus?
Tetanus toxoid (contained in Td, Tdap, DTP, DT, and DTaP vaccines) can prevent this disease.

I stepped on a nail in our yard. What should I do?
Any wound that may involve contamination with tetanus bacilli should be attended to as soon as possible. Treatment depends on your vaccination status and the nature of the wound. In all cases, the wound should be cleaned. Seek treatment immediately and bring your immunization record with you.

With wounds that involve the possibility of tetanus contamination, a patient with an unknown or incomplete history of tetanus vaccination needs a tetanus- and diphtheria-containing shot (Td or Tdap) and a dose of tetanus immune globulin (TIG) as soon as possible. A person with a documented series of 3 tetanus and diphtheria-containing shots (Td or Tdap) who has received a booster dose within the last 10 years should be protected. However, to ensure adequate protection, a booster dose of vaccine may still be given if it has been more than 5 years since the last dose and the wound is other than clean and minor.

Is there a treatment for tetanus?
There is no cure for tetanus once a person develops symptoms, just supportive treatment and management of complications. The best treatment is prevention through immunization.

How common is tetanus in the United States?
Tetanus first became a notifiable disease in the late 1940s. At that time, there were 500 – 600 cases reported per year. After the introduction of the tetanus vaccine in the mid-1940s, reported cases of tetanus dropped steadily.

During 1990 – 2001, a total of 534 cases of tetanus were reported. Most (56%) of these cases occurred among adults age 19 – 64 years and 38% were among persons age 65 years or older.

Almost all cases of tetanus are in persons who have never been vaccinated, or who completed their childhood series, but did not have a booster dose in the preceding 10 years.

Tetanus

What is neonatal tetanus?
Neonatal tetanus is a form of tetanus that occurs in newborn infants, most often through the use of an unsterile cutting instrument on the unhealed umbilical stump. These babies usually have no temporary immunity passed on from their mother because their mother has not been vaccinated, and therefore has no immunity.

Neonatal tetanus is very rare in the United States (3 cases reported during 1990 – 2004), but is common in some developing countries. It causes more than 215,000 deaths worldwide per year.

Can you get tetanus more than once?
Yes. Tetanus disease does not cause immunity because so little of the potent toxin is required to cause the disease. Persons recovering from tetanus should begin or complete the vaccination series.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccine Information

When did tetanus vaccine become available?
The first tetanus toxoid (inactivated toxin) was produced in 1924 and was used successfully to prevent tetanus in the armed services during World War II. In the mid-1940s, tetanus vaccine was combined with diphtheria toxoid and inactivated pertussis bacteria to make the combination DTP vaccine for routine childhood immunization. In 1991, DTaP vaccine was licensed in the United States. The pertussis component of this vaccine is a more purified "acellular" version, which produces fewer side effects.

In 2005, 2 new tetanus toxoid-diphtheria-acellular pertussis (Tdap) vaccines were licensed. These vaccines are the first pertussis-containing vaccines that can be given to persons older than 7 years.

What kind of vaccine is the tetanus toxoid?
The tetanus vaccine is an inactivated toxin (poison) called a toxoid. It is made by growing the bacteria in a liquid medium and purifying and inactivating the toxin. Because it is not a live vaccine, a person's immunity tends to decline with time, which is why booster doses are recommended.

What's the difference between all the vaccines containing tetanus toxoid?
Tetanus toxoid is available as a single shot (TT) but it rarely is given that way as it's best to also provide needed protection against other diseases at the same time.

Children younger than age 7 years receive DTaP (tetanus, diphtheria, and acellular pertussis). If they cannot receive the pertussis component of the combined vaccine, they can receive DT (diphtheria and tetanus toxoids for pediatric use). DTaP also can be given as part of 2 different combination vaccines; one includes DTaP, inactivated polio vaccine, and hepatitis B vaccine, and another contains DTaP and Hib vaccine.

Children ages 7 years and older and adults should be given a different formulation (i.e., Td or Tdap).

How is this vaccine given?
The DTaP, DT, Td, and Tdap preparations are all given as an injection in the muscle.

Who should get this vaccine?
Infants should receive DTaP vaccine (or DT-pediatric if they cannot receive the pertussis component) as part of their routine immunization. Adults should be given a routine booster dose of Td every 10 years.

Adults without documentation of ever receiving the basic series of tetanus and diphtheria toxoids should first receive a primary series of 3 doses, properly spaced. A single dose of Tdap is recommended for persons age 11 years and older in place of one of the Td doses, preferably the first one.

How many doses of DTaP vaccine are needed?
The usual schedule for infants is a series of four doses given at 2, 4, 6, and 15 – 18 months of age. A fifth shot, or booster dose, is recommended at 4 – 6 years of age, unless the fourth dose was given late (after the fourth birthday).

When should adolescents and adults get vaccinated against tetanus? Should they get vaccinated with Td or Tdap?
Immunization experts recommend that the first dose of Tdap be given at age 11 – 12 as a booster during the routine adolescent immunization visit if the adolescent has finished the childhood DTaP schedule and has not already received a dose of Td or Tdap. Adults should continue to receive a booster dose of Td every 10 years. Adults age 19 – 64 years who have never received Tdap should receive a single dose of Tdap to replace a single dose of Td so they can boost their resistance to pertussis as well.

If someone experiences a deep or puncture wound, or a wound contaminated with dirt, an additional booster dose may be given if the last dose was more than 5 years ago. It is important to keep an up-to-date record of all immunizations so that repeat doses don't become necessary. Although it is vital to be adequately protected against tetanus, receiving more doses than recommended can lead to increased local reactions, such as painful swelling of the arm.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP) all recommend this vaccine.

How safe is this vaccine?
Most children have no serious reactions from the combined DTaP vaccine. The most common reactions are local reactions at the injection site, such as soreness, redness, and swelling, especially after the fifth dose. Other possible reactions may include fussiness, fever, loss of appetite, tiredness, and vomiting. The use of the more purified DTaP instead of DTP has decreased these reactions substantially.

For adults receiving Td vaccine, localized non-serious side effects are common (redness, soreness, etc.) but are generally self-limiting and require no treatment.

What side effects have been reported with this vaccine?
Moderate to serious reactions are uncommon with DTaP vaccine. Such reactions include crying for 3 hours or more (up to about 1 child out of 1,000) and high fever (about 1 child out of16,000). Most of these side effects are believed to be due to the pertussis component of the vaccine, and a child experiencing such a reaction may still be able to be protected against tetanus and diphtheria with the DT vaccine. More serious reactions, such as seizures, are so rare that it is hard to tell if they are caused by the vaccine.

As mentioned above, adults who received more than the recommended doses of Td vaccine can experience increased local reactions, such as painful swelling of the arm. This is due to the high levels of tetanus antibody in their blood. The most frequently reported side effects following vaccination with Tdap were headache, generalized body aches, and tiredness.

Some of my patients describe having had a severe reaction to something they were given for tetanus many years ago. What could this be?
The allergic reactions these people experienced may have actually been serum sickness, a reaction to equine antitoxin. Equine antitoxin was the only product available for the prevention of tetanus prior to the mid 1940s. It was used for postexposure prophylaxis until the late 1950s, when tetanus immune globulin was introduced. Tetanus toxoid has never contained any horse protein.

How effective is tetanus-diphtheria toxoid (Td)?
Td is close to 100% effective for persons receiving the correct primary series (as a child or adult) and a routine booster dose every 10 years. It is felt that Tdap vaccine will provide the same level of protection.

Who should NOT receive tetanus toxoid?
People who had a serious allergic reaction to 1 dose of tetanus toxoid should not receive another. Persons with a moderate or severe acute illness should postpone receiving the vaccine until they are improved. Most reactions to the combined DTaP vaccine are due to the pertussis component.

Can the vaccine cause tetanus?
No.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Varicella (Chickenpox)

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Varicella (chickenpox) is an acute, infectious disease caused by the varicella zoster virus (VZV). The recurrent infection (herpes zoster, also known as shingles) has been recognized since ancient times.

B. Description of Illness

- ***General facts:*** Varicella (chickenpox) is a febrile rash illness resulting from primary infection with the varicella zoster virus (VZV). Humans are the only source of infection for this virus. Varicella is highly infectious with secondary infection rates in susceptible household contacts from 65% – 86%.
- ***Occurrence:*** Occurrence is worldwide. In temperate climates, like the United States, 90% of the population has had chickenpox by age 15 and 95% by young adulthood. Chickenpox is more common in children, whereas shingles is more common in adults.
- ***Incubation period:*** From 10 – 21 days; usually about 14 – 16 days.
- ***Common symptoms*:** The most common symptoms of chickenpox are rash, fever, cough, headache, and loss of appetite. Generally, the rash develops on the scalp and body, and then spreads to the face, arms, and legs. The rash usually forms 200 – 500 itchy blisters in several successive crops with several stages of maturity present at the same time. Symptoms last about 5 – 10 days. Varicella severity and complications are increased among immunocompromised persons, neonates, children less than 1 year of age, and adults. However, healthy children and adults may also develop serious complications and even die from varicella. Serious complications include secondary bacterial infections (most notably caused by group A streptococcus including cellulitis, necrotizing fasciitis, septicemia, and toxic shock syndrome), pneumonia, encephalitis, cerebellar ataxia, Reye's syndrome, and death. In vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is almost always mild with fewer than 50 skin lesions and a shorter duration of illness. The rash may also be atypical in appearance (maculopapular with a few or no vesicles).
- ***Treatment:*** Most cases of chickenpox in otherwise healthy children are treated with bed rest, fluids, and control of fever. Children with chickenpox should ***not*** receive aspirin because of possible subsequent risk of Reye's syndrome. Acetaminophen may be given for fever control. Chickenpox may be treated with an antiviral drug in serious cases, depending on the patient's age and health, the extent of the infection, and the timing of treatment.

C. Reservoirs

Humans are the only source of infection.

D. Modes of Transmission

Chickenpox is highly contagious and spreads from person to person by direct contact or through the air from an infected person's coughing or sneezing or from aerosolization of virus from skin lesions. The virus can also be spread indirectly through articles freshly soiled

by discharges from vesicles and mucous membranes of infected people. Scabs from varicella lesions are not infectious.

E. Period of Communicability.

As long as 5 days but usually 1 – 2 days before rash onset and continuing until lesions are crusted over (usually about 6 – 8 days). Susceptible individuals should be considered infectious 10 – 21 days following exposure.

2) ACTIONS REQUIRED/CONTROL MEASURES

A. Reporting Requirements

Chickenpox in adults ≥ 18 years and all hospitalized cases are physician reportable immediately by telephone to the Connecticut Department of Public Health (DPH) and the local health department (LHD). Chickenpox in children <18 years old is physician reportable by mail within 12 hours of recognition or strong suspicion to both the DPH and the LHD. The director of any clinical laboratory must also report laboratory evidence of acute chickenpox infection to both the DPH and LHD. See current list of Physician Reportable Diseases (Attachment A) and Laboratory Report of Significant Findings (Attachment C).

In addition to healthcare providers, school and daycare center administrators are requested to report demographics and vaccination status of all cases they hear about using the DPH "Varicella Case Report Form" (Attachment K). A copy of the completed form can be mailed or faxed back to the Immunization Program at 860-509-7945.

B. Case Definition

- **Clinical case definition:** An illness with acute onset of diffuse (generalized) maculopapulovesicular rash without other apparent cause.

- **Laboratory criteria for diagnosis:**
  - Isolation of varicella virus from a clinical specimen, **or**
  - Direct fluorescent antibody (DFA), **or**
  - Polymerase chain reaction (PCR), **or**
  - Significant rise in serum varicella immunoglobulin G (IgG) antibody level by any standard serologic assay.

- **Probable Case:** A case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a probable or confirmed case.

- **Confirmed Case:** A case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or a probable case.

  NOTE: Two probable cases that are epidemiologically linked are considered confirmed, even in the absence of laboratory confirmation. Laboratory confirmation of cases of varicella is not routinely recommended; laboratory confirmation is recommended for fatal cases and in other special circumstances.

C. Case Investigation

- **DPH Responsibility:** The DPH Epidemiology Program will follow up on all adult and hospitalized cases of chickenpox. The DPH Immunization Program will follow up on all other cases.

- **LHD Responsibility:** LHD will be involved with case investigations and control measures under DPH guidance as necessary.

D. Control Measures

The DPH Immunization Program (860-509-7929) should be contacted for guidance on control measures and further action, if necessary.

Varicella (Chickenpox)

Fact Sheet

What is chickenpox?
Chickenpox is an infectious disease caused by the varicella zoster virus.

How does chickenpox spread?
Chickenpox spreads from person to person by direct contact or through the air from an infected person's coughing or sneezing. It is highly contagious. It can also spread through direct contact with the fluid from a blister of a person infected with chickenpox or from direct contact with a sore from a person with shingles.

What are the symptoms of chickenpox?
The most common symptoms of chickenpox are rash, fever, cough, headache, and loss of appetite. The rash usually develops on the scalp and body, and then spreads to the face, arms, and legs. The rash usually forms 200 – 500 itchy blisters in several successive crops. The illness lasts about 5 – 10 days.

How soon do symptoms appear?
Symptoms may begin 10 – 21 days after being exposed to a person infected with chickenpox. The average time period is 14 – 16 days.

How serious is chickenpox?
Many cases of chickenpox are mild, but death from this disease can occur. Before the development of a vaccine, about 100 people died every year in the United States from chickenpox. Most of these people were previously healthy. Chickenpox also accounted for about 11,000 hospitalizations each year.

Even children with average cases of chickenpox are uncomfortable and need to be kept out of daycare or school for a week or more.

What are possible complications from chickenpox?
The most common complication is bacterial infection of the skin or other parts of the body including the bones, lungs, joints, and blood. The virus can also lead to pneumonia or infection of the brain. These complications are rare but serious. Complications are more common in infants, adults, and persons with weakened immune systems.

How do I know if my child has chickenpox?
Usually chickenpox can be diagnosed by disease history and appearance alone. Adults who need to know if they have had chickenpox in the past can have this determined by a laboratory test.

How long is a person with chickenpox contagious?
Patients with chickenpox are contagious for 1 - 2 days before the rash appears and continue to be contagious until all the blisters are crusted over (usually 6 – 8 days).

Is there a treatment for chickenpox?
Most cases of chickenpox in otherwise healthy children are treated with bed rest, fluids, and control of fever. Children with chickenpox should ***not*** receive aspirin because of the

possible subsequent risk of Reye's syndrome. Acetaminophen may be given for fever control.

Chickenpox may be treated with an antiviral drug in serious cases, depending on the patient's age and health, the extent of the infection, and the timing of the treatment.

Is there a vaccine to prevent chickenpox?
Vaccination with the recommended 2 doses of varicella vaccine prevents chickenpox in most people.

If I think my child has been exposed to chickenpox, what should I do?
If the child has had chickenpox or has been vaccinated, nothing needs to be done. It is recommended that a susceptible person (one who has never had chickenpox) receive the chickenpox vaccine as soon as possible after being exposed to the virus (within 3 days and possibly up to 5 days). There is evidence that the vaccine may prevent illness or reduce the seriousness of the disease, if given within this time frame. Even if the person was not infected with the chickenpox virus from the exposure, receiving the vaccination will prevent future disease.

How common is chickenpox in the United States?
Because it is so easy to catch chickenpox, almost every adult in the United States has been infected. Until a vaccine became available, there were an estimated four million cases/year. Since the vaccine was licensed in 1995, the number of cases of chickenpox had fallen 83% – 93% by 2004.

Can you get chickenpox if you have been vaccinated?
Yes. About 15% - 20% of people who have received 1 dose of chickenpox vaccine still get chickenpox if they are exposed, but their disease is usually mild. In one study, children who received two doses of the chickenpox vaccine were 3 times less likely to get chickenpox than individuals who have had only one dose.

Can you get chickenpox more than once?
Most people are immune to chickenpox after having the disease. However, second cases of chickenpox do occur. The frequency of second cases is not known with certainty, but this appears to be an uncommon event.

If I think my child has been exposed to chickenpox, what should I do?
If the child has had chickenpox or has been vaccinated, nothing needs to be done. It is recommended that a susceptible person (one who has never had chickenpox) receive the chickenpox vaccine as soon as possible after being exposed to the virus. There is evidence that the vaccine may prevent illness or reduce the seriousness of the disease, if given within 3 to 5 days following exposure. Even if the person was not infected with the chickenpox virus from the exposure, receiving the vaccination will prevent future disease.

How are chickenpox and shingles related?
Both chickenpox and shingles are caused by the same virus. After a person has had chickenpox, the virus stays in the body permanently. About 10% - 20% of all people who have been infected with chickenpox later develop the disease known as herpes zoster or

shingles. Symptoms of shingles are pain, itching, blisters, and loss of feeling along a nerve. Most cases occur in persons older than 50, and the risk of developing shingles increases with age.

Technically reviewed by the Centers for Disease Control and Prevention, February 2007.

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Fact Sheet: Vaccination Information

When did the chickenpox vaccine become available?
The chickenpox (varicella) vaccine was licensed for use in Japan and Korea in 1988 and in the United States in 1995. In 2005, a combination vaccine containing live attenuated measles-mumps-rubella and varicella (MMRV) vaccine was licensed for use in persons aged 12 months through 12 years.

What kind of vaccine is it?
The chickenpox vaccine is a live attenuated vaccine. This means the live, disease-producing virus was modified, or weakened, in the laboratory to produce an organism that can grow and produce immunity in the body without causing illness.

How is this vaccine administered?
The chickenpox vaccine is a shot, given in the fatty tissue.

Who should get this vaccine?
Chickenpox vaccine is recommended for the following:

- All children younger than age 13 years (one dose at 12 – 15 months and a second dose at age 4 – 6 years);
- Everyone age 13 years and older who has never had chickenpox (two doses, given 4 – 8 weeks apart);

Anyone missing a dose at the recommended times should get the shot at their next visit to their doctor or clinic.

Should adults be tested before vaccination to see if they are already immune to chickenpox?
Currently, 90% of adults are immune to chickenpox because of having had the disease as children. If you have a history of chickenpox disease, you don't need testing or vaccination, unless you are working in an environment where your immune status must be documented (such as a hospital). If you are uncertain of your medical history, blood testing can be done to see if immunization is appropriate.

Who recommends this vaccine?
The Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP) have all recommended that children receive this vaccine.

How safe is this vaccine?
Tens of millions of doses of varicella vaccine have been given in the United States, and studies continue to show that the vaccine is safe. Serious side effects are very rare.

What side effects have been reported with this vaccine?
Possible side effects are generally mild and include redness, stiffness, and soreness at the injection site; such localized reactions occur in about 20% of children immunized. A small percentage of persons develop a mild rash, usually around the spot where the shot was given.

How effective is this vaccine?
Ninety-seven percent of children between age 12 months and 12 years develop immunity to the disease after one dose of vaccine. For older children and adults, an average of 78% develop immunity after one dose and 99% develop immunity after the recommended two doses.

Although some vaccinated children (about 2%) will still get chickenpox, they generally will have a much milder form of the disease, with fewer blisters (typically fewer than 50), lower fever, and a more rapid recovery.

The vaccine almost always prevents against severe disease. Getting chickenpox vaccine is much safer than getting chickenpox disease.

Isn't it better for a child to get chickenpox naturally?
Some parents purposely seek to get their children infected with varicella virus, even promoting "chickenpox parties" for this purpose. The belief is that it's better to be infected when young, a time when the infection is ordinarily less severe. Some parents also believe that something "natural" (the disease) is better than something "artificial" (the vaccine), or that immunity derived from the disease will be more permanent than that from the vaccine.

However, when a safe vaccine is available, parents need to weigh the supposed benefits of infection against its potential risks, including severe disease with complications such as infection with flesh-eating bacteria. No one can predict which child will develop a life-threatening case of chickenpox; in fact, most serious cases occur in previously healthy children.

In addition, in a recent study, 7 out of 10 children said given the choice, they'd rather have the shot than have the natural disease.

Can the vaccine protect you if you've already been exposed to chickenpox?
Yes, it is 70% – 100% effective if given within 72 hours of exposure.

Who should NOT receive the chickenpox vaccine?
Persons with weakened immune systems and those with life-threatening allergies to gelatin or the antibiotic neomycin should not receive this vaccine.

Pregnant women should not receive this vaccine, as the possible effects on fetal development are unknown. However, non-pregnant women of childbearing age who have never had the disease may be immunized against chickenpox to avoid contracting the disease while pregnant.

Can the vaccine cause chickenpox?
Because this vaccine is made from a live, but weakened, virus, about 1% of recipients develop a mild form of the disease, consisting of a limited rash, most often with only 5 – 6 blisters. Usually there is no fever. These persons are then safe from the more serious, naturally occurring form of the virus.

Can the varicella vaccine virus be transmitted (caught) from a person who was vaccinated?
Yes; however, transmission of the varicella vaccine virus is extremely rare. It has only been documented in healthy persons on three occasions out of the 21 million doses of vaccine distributed. All three cases resulted in mild disease without complications.

Can the vaccine cause herpes zoster (shingles)?
Yes, this is possible. The risk of zoster following vaccination appears to be less than that following infection with the varicella virus. The majority of cases of shingles following vaccine have been mild and have not been associated with serious complications.

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