Examples of Diseases Prevented by Childhood Vaccines*

Data comes from the Centers for Disease Control and Prevention and refers to U.S. statistics unless specified.

Diphtheria

Description of disease: Diphtheria is a severe disease primarily of the upper respiratory tract caused by a bacterium that produces a toxin. This toxin can spread to the heart and to the motor nerves causing severe damage.

Effect of vaccine: In the 1920's, 100,000 – 200,000 cases and 13,000-15,000 deaths from diphtheria were reported each year. Subsequent to the introduction of a vaccine in the 1940's, incidence of diphtheria disease has plummeted to an average of 2-3 cases per year.

Tetanus

Description of disease: Tetanus is an acute paralytic disease caused by a bacterial toxin, usually the result of an infected wound. Typically the paralysis commences in the jaw (lockjaw) and moves downward through the body. Contractions and convulsions are so severe that broken bones can result. Roughly 11% of cases today are fatal. Tetanus thrives in soil; therefore it can never be eradicated.

Effect of vaccine: Prior to the introduction of vaccine in the 1940's, there were 500-600 cases of tetanus or 0.4 cases per 100,000 people reported each year. Today there are 0.05 cases per 100,000 people reported each year and almost all cases are in those who are not vaccinated or inadequately vaccinated.

Pertussis†

Description of disease: Pertussis, commonly called whooping cough, is a highly contagious upper respiratory disease. Prior to vaccine introduction in the 1940's, pertussis was a major cause of childhood death. Coughing can be so severe that children turn blue from lack of oxygen. Roughly 60% of infected infants six months or less require hospitalization.

Effect of vaccine: Incidence of pertussis disease has decreased by 80% since the introduction of vaccine. However, there are still periodic outbreaks in the U.S., particularly in recent years among adolescents and adults whose immunity may have waned. Adults are commonly the transmitters of the disease to infants.

Influenza

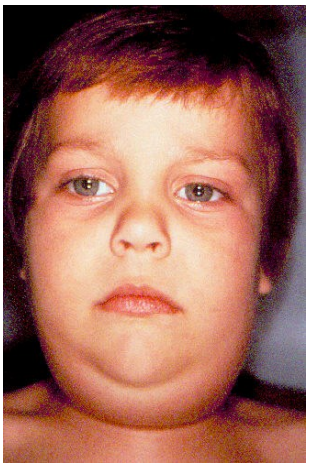
Description of disease: Influenza is a viral respiratory disease whose incidence peaks during the winter months. The disease can range from mild to severe in nature depending in part on the host's previous exposure to the particular circulating virus and in part depending on the disease-causing propensity of the virus strain itself. The influenza virus undergoes constant genetic changes and thus the vaccine each year is based on a prediction of what the genetic composition of the virus circulating in the upcoming winter is likely to be. In the U.S., there are roughly 200,000 hospitalizations annually from influenza complication such as pneumonia or myocarditis. Those most at risk for complications are very young children and adults over 65 years of age. During pandemic periods, particularly virulent strains of virus can cause massive fatalities. For example, the 1918-1919 epidemic killed 500,000 Americans.

Effect of vaccine: The effectiveness of influenza vaccine varies from year to year depending on the accuracy of predictions as to which virus varieties will cause disease in the upcoming influenza season. When the viral match is good, the vaccine is 90% effective in preventing disease in children.

Measles

Description of disease: Measles is a highly contagious disease caused by a virus that enters the body through the upper respiratory tract and then goes on to cause a rash that appears as eruptions starting on the face and moving downward. Roughly 30% of measles cases overall, with higher numbers in young children, develop complications such as pneumonia or encephalitis.

Effect of vaccine: Between 3-4 million cases of measles occurred annually prior to the introduction of vaccine and roughly 90% of the population had the disease by their 15th birthday. Upon introduction of a vaccine in 1963, the incidence of measles declined by 98%. A resurgence of measles occurred from 1989-1991 when 55,622 cases and 123 deaths were reported. A recent outbreak of measles has caused concern across the country. As of April 25, 64 cases had been reported as opposed to 30 cases of measles in all of 2007. Ninety percent of the fatal cases were in individuals with no history of being vaccinated.



Mumps

Description of disease: Mumps is caused by a virus that enters the body via the upper respiratory tract and then frequently locates to the salivary glands causing the characteristic swelling of the face and neck. Complications include meningitis, testicular inflammation, and deafness.

Effect of vaccine: Roughly 200,000 cases per year were reported in the 1960's. Post introduction of vaccine, the incidence fell to 3,000 cases per year in the 1980's and today only 200-300 cases occur per year.

Rotavirus

Description of disease: Rotavirus is a severe diarrheal disease primarily of young children. Roughly 95% of children suffer this affliction by the age of 5 years and there are 2.7 million cases per year in the U.S. This viral disease is responsible annually for more than 400,000 doctor visits, 200,000 emergency room visits, 55,000-70,000 hospital admissions, 20-60 deaths. The annual direct and indirect costs in the U.S. is nearly $1 billion.

Effect of vaccine: Rotavirus vaccine was approved for use in 2006 so it is too early to have data on the overall impact of vaccine. However, in clinical trials, the vaccine resulted in a 74% reduction in all rotavirus disease and a 98% reduction in severe disease.

***Haemophilus influenzae* type b**[‡]

Description of disease: *Haemophilus influenzae* type b is a bacteria that causes meningitis and epiglottitis (which can create life-threatening airway blockage) and other invasive diseases. Roughly half of the children who contract this infection develop meningitis and 15-30% of those who survive Haemophilus infection suffer sequelae such as hearing impairment and neurologic damage.

Effect of vaccine: Prior to the introduction of the vaccine, it is estimated that about 20,000 cases of *Haemophilus influenzae* type b infection occurred each year, mostly in children less than 5 years old. By 2004 that number had dropped to less than 100 with most cases occurring in children who were unvaccinated or too young to have completed the vaccine series.

Streptococcus pneumoniae

Description of disease: Streptococcus pneumoniae is a bacteria spread via the respiratory system that can result in serious invasive diseases such as meningitis, bacteremia (infection of the blood), and pneumonia. There are 90 different known serotypes, and of these the seven that are in the vaccine account for 80% of infections in young children. Prior to the introduction of a vaccine, the disease burden from pneumococcus in children was considerable with 13,000 cases of bacteremia, 700 cases of meningitis, 5 million cases of ear infection, and 200 deaths annually. In adults pneumonia caused by Streptococcus pneumoniae is the most common clinical presentation and more than 32,000 adults die from this affliction each year.

Effect of vaccine: Pneumococcal conjugate vaccine has had a significant effect not only on the young children who receive it but also on adults to whom children had previously spread disease. Since the introduction of vaccines, invasive pneumococcal disease from the vaccine serotypes declined by 94% in children under 5 years of age. Invasive pneumococcal disease in adults declined by 50% at the same time. Further, the rate of infection from penicillin resistant vaccine serotype strains fell by 87%.

Varicella (Chickenpox)[§]

Description of disease: Varicella, commonly referred to as chickenpox, is caused by a virus that enters the body through the upper respiratory tract and then spreads via the blood stream to various organs. The disease is characterized by a rash that can become oozing vesicles. Chickenpox is a mild disease in most children but can result in complications such as bacterial infections of the lesions, meningitis, and encephalitis. Roughly 3 children out of 1,000 infected require hospitalization. Additionally children with leukemia and those with a suppressed immune system can develop a severe, prolonged form of the disease.

Effect of vaccine: Prior to vaccine use, around 4 million cases of chickenpox occurred each year. One out of every 10,000 children infected died. Varicella cases have declined 83-93% since the introduction of vaccine.

Hepatitis A

Description of disease: Hepatitis is an infection of the liver, in this case caused by the Hepatitis A virus. The virus enters the body through the mouth. This form of hepatitis can be associated with food-borne outbreaks. Although the majority of those afflicted demonstrate no symptoms (but can still transmit disease), the illness can include fever, abdominal pain, and jaundice and can last up to two months. Roughly 1,000 deaths a year occur from acute hepatitis A infection.

Effect of vaccine: The highest annual number of cases of Hepatitis A in the U.S. occurred in 1971 with 59,606. In 1996 a vaccine was introduced and by 2004 the annual number of cases had declined to 5,970.

Hepatitis B**

Description of disease: Hepatitis is an infection of the liver in this case caused by the Hepatitis B virus. Infections can be acute or chronic in nature. Not all infections result in symptoms but non-symptomatic individuals can still spread the virus. The virus can enter the body through blood transfusion, mother to infant transmission at birth, sexual contact, and through mucosal surfaces such as eyes or mouths. Between 200-300 deaths occurred each year from complications of acute illness prior to vaccine introduction. Roughly 10% of acute infections go on to become chronic infections resulting in more than a million Americans who are chronically infected. Among this group, 3000-4000 die each year from cirrhosis caused by the virus and another 1000-1500 die from liver cancer caused by the virus.

Effect of vaccine: Since the introduction of Hepatitis B vaccine in the late 1980's, incidence of acute infection has dropped 75% in the population at large and 94% in children and adolescents.

Human Papillomavirus (HPV)

Description of disease: HPV is spread through sexual contact and is a cause of cervical cancer, the second leading cause of death in women worldwide. About 6.2 million Americans develop a genital HPV infection each year and roughly 20 million are currently living with this infection. Every year in the U.S., roughly 10,000 new cases of cervical cancer are diagnosed and about 3,700 women die.

Effect of vaccine: This vaccine was licensed for use in 2006 so it is too early to have data on the effect on public health as a whole. However, during clinical trials, the incidence of HPV infection was reduced by 90%.

Meningococcal (Neisseria meningitides)

Description of disease: Meningococcus is spread by respiratory means and results in meningitis and/or bacteremia (blood infection). Roughly 75% of meningitis cases also have bacteremia. Meningococcal infection can go from being a slight respiratory discomfort to being a fatal infection very quickly. 40% of patients with bacteremia die from the infection and among survivors, 20% have permanent damage such as loss of limbs, hearing or neurologic damage. Age groups at particular risk are children one year or younger and adolescents and young adults, particularly those living in close quarters like college students and military troops.

Effect of vaccine: Thirteen different strains of meningococcus are known to exist. Almost all disease is caused by 5 of these strains (different strains predominate in different countries) and 4 of those 5 are in a vaccine newly licensed in 2005. Because this vaccine has been available for such a short period of time, it is too early to have data on disease reduction. However, in clinical trials, the vaccine was 98% effective in reducing disease.

Polio

Description of disease: Polio is caused by a virus that enters the body orally and replicates in the gastrointestinal tract. The virus can cause paralysis that can be so severe that the child cannot breathe unassisted and hence the dramatic photographs from the 1950's of wards full of children in iron-lung machines. Between 2 – 75% of those with paralysis die, depending on the body systems affected by the paralysis.

Effect of vaccine: More than 21,000 people, primarily children, were paralyzed in 1952. The introduction of vaccine in the 1950's led to such a rapid decline in disease that by 1979 there was no more wild polio in the US.

Rubella

Description of disease: Rubella is caused by a virus that spreads via respiratory transmission and results in a rash that covers that body and lasts for roughly 3 days. While the disease can be mild in some, in others encephalitis and arthritis can result. Approximately 70% of adult women who contract rubella develop arthritis. Rubella's biggest threat is to pregnant women where the virus can cause a variety of serious birth defects and even fetal death.

Effect of vaccine: At its peak in 1964, this viral disease caused 20,000 cases of congenital rubella syndrome resulting in just one year in 11,600 children born deaf, 3,580 born blind, and 1,800 born mentally retarded. Additionally there were 2,100 neonatal deaths attributed to rubella. Subsequent to the introduction of vaccine, there are today 5-6 cases of congenital rubella syndrome reported each year, predominantly among immigrant women who were born in countries that do not provide rubella immunization.

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* Unless otherwise noted, all pictures can be found at: http://www.vaccineinformation.org/photos/

† Photo courtesy of Thomas Schlenker, MD, MPH

‡ Image provided by: Visual Red Book on CD-ROM (2000 Red Book: 25th Edition, Report of the Committee on Infectious Diseases)

§ Ibid

** Photo courtesy of Patricia Walker, MD