Parents' Guide *to* CHILDHOOD IMMUNIZATIONS

2007

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In 1736 I lost one of my Sons a fine Boy of 4 Years old, by the Small Pox...I long regretted bitterly and I still regret that I had not given it to him by Inoculation; This I mention for the Sake of Parents, who omit that Operation on the Supposition that they should never forgive themselves if a Child died under it; my example showing that the Regret may be the same either way, and that therefore the safer should be chosen.

Benjamin Franklin

Autobiography

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PART ONE

Introduction

Why Immunizations?

Immunization has been called the most important public health intervention in history, after safe drinking water. It has saved millions of lives over the years and prevented hundreds of millions of cases of disease.

We all know that getting our children immunized can protect them from some very serious diseases.

But did you know that it can also...

- Protect their friends, schoolmates, and others from those same diseases? *Some children can't get certain vaccines for medical reasons, or some children are not able to respond to certain vaccines. For these children, the immunity of people around them is their only protection.*
- Protect your grandchildren, their grandchildren, and future generations from diseases? *If we stopped vaccinating, diseases that are under control would eventually come back to cause epidemics. This has happened in several countries.*
- Even help rid the world of diseases that have been crippling and killing children for centuries? *Immunization allowed us to eradicate smallpox. Today polio is nearly gone, and in the future measles and other diseases will follow.*

Vaccines have a remarkable track record. For example...

- Diphtheria used to be one of the most dreaded of childhood diseases, killing over 10,000 people a year in the United States. After we started vaccinating children in the 1930s and 1940s the disease began to disappear. Today most doctors will never see a single case of diphtheria, much less have a patient die from it.
- In 1962, the year before measles vaccine was introduced, almost 500,000 cases of measles were reported in the United States, and many more cases went unreported. Ten years later there were about 32,000 cases and 10 years after that fewer than 2,000. As of the end of 2005, there have been only 405 cases in this century.

- Parents in the 1950s were terrified as polio paralyzed children by the thousands. Then we learned how to prevent polio using the Salk and Sabin vaccines. There has not been a case of wild virus polio in the United States since 1979.
- Smallpox was one of the most devastating diseases the world has ever known. It killed millions of people every year. In 1967 the World Health Organization undertook an intensive, worldwide vaccination campaign. Twelve years later the disease had been wiped out, and there hasn't been a single case since. Smallpox is the first, and so far the only, disease we have ever eradicated from the Earth; and it was thanks to vaccination.

How Vaccines Work

What is Immunity?

When disease germs enter your body, they start to reproduce. Your immune system recognizes these germs as foreign invaders and responds by making proteins called **antibodies**. These antibodies' first job is to help destroy the germs that are making you sick. They can't act fast enough to prevent you from becoming sick, but by eliminating the attacking germs, antibodies help you to get well.

The antibodies' **second** job is to protect you from future infections. They remain in your bloodstream, and if the same germs ever try to infect you again — even after many years — they will come to your defense. Only now that they are experienced at fighting these particular germs, they can destroy them **before** they have a chance to make you sick. **This is immunity**. It is why most people get diseases like measles or chickenpox only once, even though they might be exposed many times during their lifetime.

This is a good system for preventing disease. The only drawback is obvious — you have to get sick before you become immune.

Immunity From Vaccines

Vaccines solve this problem. They help you develop immunity without getting sick first.

Vaccines are made from the same germs (or parts of them) that cause disease — measles vaccine is made from measles virus, for instance, and *Haemophilus influenzae* type B (Hib) vaccine is made from parts of the Hib bacteria. But the germs in vaccines are either killed or weakened so they won't make you sick.

Vaccines containing these weakened or killed germs are introduced into your body, usually by injection. Your immune system reacts to the vaccine the same as it would if it were being invaded by the disease — by making antibodies. The antibodies destroy the vaccine germs just as they would the disease germs — like a training exercise. Then they stay in your body, giving you immunity. If you are ever exposed to the real disease, the antibodies are there to protect you.

Immunizations help your child's immune system do its work. The child develops protection against future infections, the same as if he or she had been exposed to the natural disease. Except with vaccines your child doesn't have to get sick first to get that protection.

PART TWO Fourteen Diseases

Why We Vaccinate Against Them

The purpose of immunizations is to prevent disease. Today, children in the United States routinely get vaccines that protect them from 14 diseases. All of these diseases have, at one time or another, been a serious threat to children in this country. Most of them are now at their lowest levels in history, thanks to years of immunization.

Selected Vaccine-Preventable Diseases, United States

	Cases per Year (Average) Before Vaccines	Cases in 2005	Decrease in Cases per Year
Diphtheria	175,885	0	100%
Hib (<5 yrs old)	20,000 (est.)	226	99%
Measles	503,282	66	99.9%
Mumps	152,209	314	>99%
Pertussis	147,271	25,616	83%
Polio (paralytic)	16,316	0	100%
Rubella	47,745	11	99.9%
Smallpox	48,164	0	100%
Tetanus	1,314	27	98%

Sources
CDC. Impact of vaccines universally recommended for children — United States, 1900-1998. *MMWR* 1999;48(12):243-8
CDC. Summary of Notifiable Diseases–2005. *MMWR* 2007;54(53).

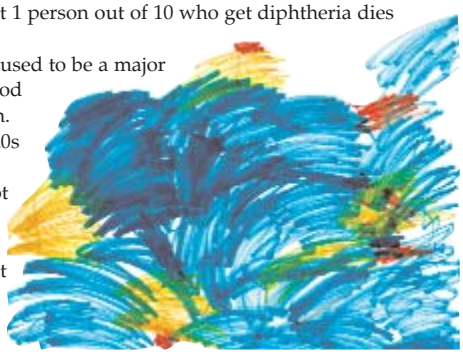
Because we don't see these diseases every day they might not seem as scary as they used to. Some of them might not even be familiar to many parents. Fifty years ago, measles was one of the most common diseases in the country — virtually every child got it. But today, most parents will never know a child with measles; in fact, most doctors will never see a case.

But measles still infects about 23 million people around the world every year and kills about 480,000 of them. An infected person can travel to the United States, and we can travel anywhere in the world. A single case of disease will remain a single case if everyone around the infected person is immune. If they are not, a single case can turn into an epidemic. By vaccinating we will make sure these 14 diseases will not become everyday events for our children ever again.

1. Diphtheria

Diphtheria caused by a bacterium called *Corynebacterium diphtheriae.* It lives in the mouth, throat and nose of an infected person and can be spread to others by coughing or sneezing. A child with diphtheria can infect others for 2 to 4 weeks.

Diphtheria can initially cause a sore throat, fever and chills. But if it is not properly diagnosed and treated it produces a **toxin** (poison) that can cause serious complications such as heart failure or paralysis. About 1 person out of 10 who get diphtheria dies from it.



Diphtheria used to be a major cause of childhood illness and death. Through the 1920s about 150,000 people a year got diphtheria in the United States, and about 15,000 of them died.

2. Hepatitis A

Hepatitis A is a liver disease caused by the hepatitis A virus. Until 2004 it was the most frequently reported type of hepatitis in the United States. Disease rates have been dropping since 1995, when a vaccine was licensed. There are now estimated to be about 20,000 cases a year in the United States. The virus is found mainly in bowel movements and is spread through personal contact or by eating contaminated food or drinking contaminated water.

Children under 6 often don't show any signs of illness, but for older children signs include fever, loss of appetite, tiredness, stomach pain, vomiting, dark urine, and yellow skin or eyes (jaundice). Hepatitis A does not cause long-term illness or permanent liver damage, but about 100 people die each year from liver failure caused by severe hepatitis A.

3. Hepatitis B

Hepatitis B is also a liver disease (the word "hepatitis" comes from the Greek words for "liver" and "inflammation"). It is caused by the hepatitis B virus. It is spread through contact with the blood, or other body fluids, of an infected person. Adolescents and adults can be infected through sharing drug needles or through unprotected sex, and health-care and public safety workers are often exposed to blood in the course of their jobs. Pregnant women can infect their newborn babies. People infected with hepatitis B might not feel sick, or might suffer loss of appetite or tiredness, muscle or stomach pains, diarrhea or vomiting, or yellow skin or eyes (jaundice).

People usually recover from hepatitis B after several weeks, but others become "chronically infected." They might not feel sick themselves, but they continue to carry the virus and can infect other people. A baby who is born to a chronically infected mother has a 70%–90% chance of being infected at birth. Many people who are chronically infected will suffer from serious problems such as cirrhosis (scarring of the liver) or liver cancer.

More than a million people in the United States are chronically infected with hepatitis B. In 1996 an estimated 200,000 people became infected, and 4,000 to 5,000 people die each year from hepatitis B.

4. Hib disease (*Haemophilus influenzae* type b)

Not long ago Hib disease (*Haemophilus influenzae* type b) was the leading cause of bacterial meningitis in children less than 5 years old. As recently as the mid-1980s it struck one child out of every 200 in that age group. About 1 in 4 of these children suffered permanent brain damage, and about 1 in 20 died.

Hib disease is spread through the air by coughing, sneezing, and even breathing. If the bacteria stay in a child's nose and throat, the child will probably not get sick. But if they spread to the lungs or bloodstream, the child can get meningitis (inflammation of the covering of the brain), pneumonia, epiglottitis (inflammation in the throat), arthritis, or other problems. A child who is infected can spread the disease to others for as long as the bacteria remain in the body. Antibiotics can stop spread in 2 to 4 days.

5. Influenza (Flu)

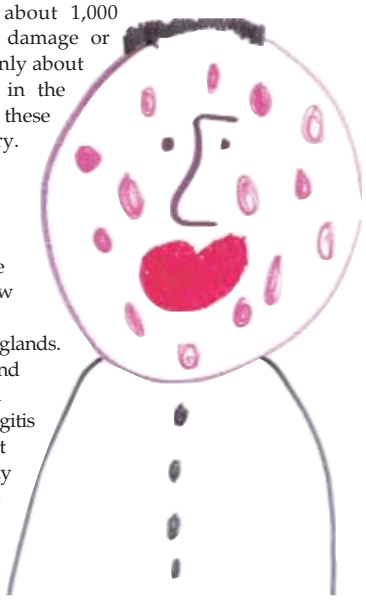
Influenza (Flu) is a seasonal illness, occurring mainly during the winter. It is caused by influenza virus. Influenza viruses are continually changing, meaning that immunity you acquire one year will not necessarily protect you in future years. This makes influenza different from most diseases, in that you can get it more than once. It also means that it is important to be re-immunized every year.

Influenza is spread from person to person through sneezing, coughing or breathing. Signs and symptoms include fever, sore throat, cough, headache, chills and muscle aches. Young children might also have vomiting and diarrhea. Complications can include ear and sinus infections, pneumonia, myocarditis (inflammation of the heart), and death. Influenza causes more deaths (about 36,000 per year) than any other vaccine-preventable disease. Most of these are among the elderly, but some children also die. Hospitalization rates are high among children, particularly those less than 1 year old.

6. Measles

Measles is a viral illness that causes a rash all over the body. It also causes fever, runny nose and cough. About 1 out of 10 children with measles also get an ear infection, and up to 1 out of 20 get pneumonia. About 1 out of 1,000 get encephalitis, and 1 or 2 out of 1,000 die. While measles is almost gone from the United States, it still kills about half a million people a year around the world. Measles can also make a pregnant woman have a miscarriage or give birth prematurely.

Measles spreads through the air by breathing, coughing or sneezing. It is so contagious that any child who is exposed to it and is not immune will probably get the disease. Before measles vaccine, nearly all children got measles by the time they were 15. Each year about 450 people died because of measles, 48,000 were hospitalized, 7,000 had seizures, and about 1,000 suffered permanent brain damage or deafness. Today there are only about 50 cases a year reported in the United States, and most of these originate outside the country.



7. Mumps

Mumps is best known for the swelling of the cheeks and jaw that it causes, a result of inflammation of the salivary glands. Mumps also causes a fever and headache. It is usually a mild disease, but it leads to meningitis in about 1 child in 10 who get the disease. It can occasionally cause encephalitis, deafness (about 1 in 20,000 cases), or even death (about 1 in 10,000 cases).

Mumps is caused by the mumps virus, which is spread from person to person through the air. Before a vaccine was available mumps was a very common childhood illness. About 152,000 cases were reported each year. Now mumps is very uncommon, with only 314 cases reported in 2005.

8. Pertussis (Whooping Cough)

Pertussis (Whooping Cough) is caused by a bacterium called *Bordetella pertussis*. If you have ever seen a child with pertussis you won't forget it. The child coughs violently and rapidly, over and over, until the air is gone from her lungs and she is forced to inhale with the loud "whooping" sound that gives the disease its nickname, whooping cough.

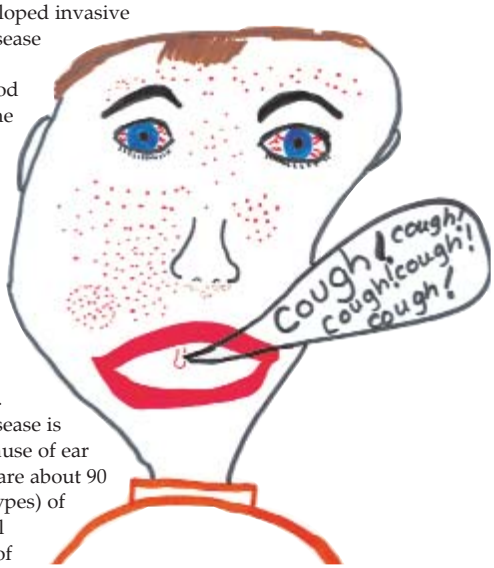
Pertussis is a very contagious disease, and one that is fairly common in the United States, even today. In 2005, over 25,000 cases were reported. While this is down considerably from the approximately 150,000 cases a year before the vaccine, it still makes it one of the most common vaccine-preventable childhood diseases in the country. It is spread from person to person through personal contact, coughing and sneezing.

At first pertussis resembles a common cold, with sneezing, runny nose, fever and a mild cough. But after 1 or 2 weeks the severe coughing spells begin. Pertussis is most severe in infants less than 1 year old. More than half of these infants who get the disease must be hospitalized. Older children and adults can get pertussis too, but it is usually not as serious. Many infants who get pertussis catch it from their older brothers and sisters, or from their parents — who might not even know they have the disease.

About 1 child in 10 who get pertussis also gets pneumonia, and about 1 in 50 will have convulsions. The brain is affected in about 1 person out of 250 (this is called encephalopathy). Pertussis causes about 10–20 deaths each year in the United States.

9. Pneumococcal Disease

Pneumococcal disease caused by *Streptococcus pneumoniae* bacteria. It is usually thought of as a disease of the elderly, but it also takes its toll among our children. In 1998, before a vaccine for children was licensed, about 188 of every 100,000 children younger than 2 years of age developed invasive pneumococcal disease (for instance, meningitis or blood infections). It is the leading cause of bacterial meningitis in the country, hitting children under 1 year old the hardest. About 200 children died from invasive pneumococcal disease each year. Pneumococcal disease is also a common cause of ear infections. There are about 90 subgroups (serotypes) of the pneumococcal bacterium, but 7 of these have accounted for about 80% of infections among children younger than 6 years of age.



Pneumococcal disease is spread through the air. It can be spread by anyone who is infected, even if they don't have symptoms. It is most common during the winter and early spring. All children are susceptible to pneumococcal disease, but some are more susceptible than others, including African Americans, American Indians, Alaska Natives, and children with certain medical conditions such as sickle cell disease or HIV infection, or those who don't have a functioning spleen.

10. Polio

Polio is a disease that has caused paralysis in millions of children worldwide over the years. In the United States, 6,000 people died and another 27,000 were paralyzed during a major epidemic in 1916. Polio reached a peak in the United States in the 1950s, when parents were terrified that the disease would leave their children unable to walk or force them to spend the rest of their life in an iron lung. With the appearance of the Salk and Sabin polio vaccines, the disease began to disappear, and there is no longer any wild polio in the country.

Polio is caused by a virus that lives in the throat and intestinal tract. It is spread mainly through contact with the feces of an infected person (for instance, by changing diapers). Some children who get polio don't feel ill at all. Others, have the symptoms of a common cold, sometimes accompanied by pain and stiffness in the neck, back and legs. But some children get severe muscle pain, and within a week can be paralyzed — in other words, lose the use of their muscles. Usually paralysis affects a child's legs, but it can also affect other muscles, including those that control breathing. There is no treatment for polio, and some children die from it.

Even though there is no polio in the United States, it is still common in some parts of the world. We are working towards eliminating it from the rest of the world within the next few years.

11. Rotavirus

Rotavirus is the most common cause of severe gastroenteritis (diarrhea and vomiting) in the world among young children. It kills about 500,000 children a year worldwide.

Every year in the United States, rotavirus is responsible for:

- 2½ million cases of gastroenteritis
- 400,000 doctor visits
- 200,000 emergency room visits
- 55,000 - 70,000 hospitalizations
- 20-60 deaths

Most children will have been infected at least once by the time they reach 5 years of age. There are several strains of rotavirus and children can be infected more than once, but the first case is usually the most serious.

In addition to diarrhea and vomiting, rotavirus infections cause a fever of 102°F or higher in about one-third of cases. Severe dehydration can be a serious complication associated with rotavirus infection.

Rotavirus is shed in the stool. It can be spread by direct contact with an infected person, or by contact with contaminated objects such as toys, or even food. The disease is spread within families, hospitals, and child-care facilities. Caregivers and parents can also be infected, but infections in young children are much more serious. People with weakened immune systems are at higher risk.

Rates of rotavirus illness are similar in industrialized and less developed countries. This suggests that we can't eliminate the disease through clean water and good hygiene alone.

12. Rubella (German Measles)

Rubella is sometime called German Measles or 3-day Measles. It is a generally mild disease caused by the rubella virus. It usually strikes in the winter and spring, and causes a slight fever, a rash on the face and neck, and (when teenagers or adults get the disease) swollen glands in the back of the neck and arthritis-like symptoms in the joints. It is spread from person to person through the air, by coughing, sneezing or breathing.

The greatest danger from rubella is to unborn babies. If a woman gets rubella in the early months of her pregnancy, there is an 80% chance that her baby will be born deaf or blind, with a damaged heart or small brain, or mentally retarded. This is called Congenital Rubella Syndrome, or CRS. Miscarriages are also common among women who get rubella while they are pregnant.

The last major rubella epidemic in the United States was in 1964–1965, when about 12.5 million people got the disease and 20,000 babies were born with CRS. Several years later a vaccine was licensed, and the disease has been disappearing ever since. Today there are fewer than 20 cases reported each year.

13. Tetanus (Lockjaw)

Tetanus (lockjaw) differs from other vaccine-preventable diseases in that it is not contagious. It does not spread from person to person. *Clostridium tetani* bacteria are usually found in soil, dust, and manure, and they enter the body through breaks in the skin. Children usually become infected through deep puncture wounds or cuts, like those made by nails or knives. But the bacteria can enter through even a tiny pinprick or scratch. Children can also get tetanus following severe burns, ear infections, tooth infections, or animal bites.

When tetanus gets into the body it can take up to 3 weeks for the first symptoms to appear. These are usually a headache, crankiness, and spasms of the jaw muscles. The bacteria produce a toxin (poison), which spreads throughout the body, causing painful muscle spasms in the neck, arms, legs, and stomach. These can be strong enough to break a child's bones. Children with tetanus might have to spend several weeks in the hospital under intensive care.

The number of tetanus cases in the United States has fallen from about 500 a year in the 1940s to only about 50 cases a year today. But 2 out of every 10 people who get tetanus die from it.

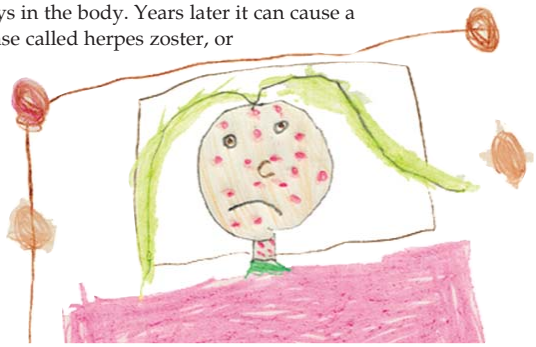
14. Varicella (Chickenpox)

Varicella (Chickenpox) was, until recently, one of the most common of childhood diseases. Before there was a vaccine, almost everyone got it — there were about 4 million cases a year in the United States.

Chickenpox is caused by the varicella zoster virus. Its most recognizable feature is an itchy rash all over the body. It also causes fever and drowsiness. It is spread from person to person through the air, by coughing, sneezing or breathing, and can also be spread by contact with fluid from the blisters.

It usually takes 2–3 weeks from the time of exposure for a person to become ill, and an infected person is contagious from 1 or 2 days before the rash appears until all the blisters are dried up, usually 4 to 5 days after.

Chickenpox is usually mild, but it occasionally causes serious problems. The blisters can become infected, and some children get encephalitis. Among infants less than 1 year old who get the disease, about 1 in 250,000 die. For older children, about 1 in 100,000 die. If a woman gets chickenpox just before or after giving birth, her baby can get very sick, and about 1 in 3 of these babies will die if not treated quickly. About 1 child in 500 who gets chickenpox is hospitalized (about 1 in 50 adults). After a person has chickenpox the virus stays in the body. Years later it can cause a painful disease called herpes zoster, or shingles.



PART THREE Ten Vaccines *for* Fourteen Diseases

Some childhood vaccines have been used since the 1940s, others have been around for only a short time. Currently there are 10 routinely used vaccines that protect children against the 14 diseases described in Part Two of this booklet. All of them have done an excellent job of reducing the burden of those diseases to their lowest point in history (see the table on page 15).

Because the diseases they prevent affect children, these vaccines are given during childhood. We will describe each vaccine, and then show the routine schedule for receiving all these vaccines on page 49. Contrary to a fairly common misperception, children have very robust immune systems, and can easily cope with multiple vaccines given on the same day.

Vaccine Side Effects

While vaccines are very safe, like any medicine they do sometimes cause reactions. Mostly, these are mild "local" reactions (soreness or redness where the shot is given) or a low-grade fever. They last a day or two and then go away. Sometimes more serious reactions are associated with vaccines. These are much less common. Some of them are clearly caused by the vaccine; some have been reported after vaccination but are so rare that it is impossible to tell if they were caused by the vaccine or would have happened anyway. We will mention side effects specifically associated with each vaccine in the descriptions below.

Some children also have allergies, and occasionally a child will have a severe allergy to a substance that is component of a vaccine. There is a very small risk (estimated at around one in a million) that a vaccine could trigger a severe reaction in a child who has such an allergy. Should one of these allergic reactions occur, it would usually happen within several minutes to several hours after the vaccination, and would be characterized by hives, difficulty breathing, paleness, weakness, hoarseness or wheezing, a rapid heart beat, and dizziness. Doctors' offices are equipped to deal with these reactions. Always tell your provider if your child has any allergies that you know of.

Vaccine Precautions

A child who has had a severe (life-threatening) **allergic reaction** to a previous dose of any vaccine should not get another dose of that vaccine. A child with a known severe (life-threatening) **allergy** to any vaccine component should not get a vaccine containing that component.

If a child has any **moderate or severe illness** on the day any vaccine is scheduled, it should probably be delayed until the child has recovered. A mild illness or fever is usually not a reason to delay an immunization.

We will mention any additional precautions for each vaccine in the following descriptions.

1. DTaP Vaccine

DTaP combines vaccines against three diseases, Diphtheria, Tetanus and Pertussis into one shot. (The small "a" in the name stands for "acellular," which means that the pertussis component of the vaccine contains only parts of the pertussis bacterium rather than the whole cell.) The diphtheria and tetanus components of the vaccine are not technically vaccines, but "toxoids." In other words, they help the immune system develop protection against the toxins produced by the diseases rather than against the disease bacteria

themselves. All three components of DTaP are "inactivated" (killed). Tetanus, diphtheria and pertussis (DTP) vaccines have been in common use since the 1940s. DTaP vaccine (with the acellular pertussis component) was first licensed in 1991.

Children need five DTaP shots for maximum protection. The first three shots are given at 2, 4, and 6 months of age. The fourth (booster) shot is given between 15 and 18 months, and a fifth shot — another booster — is given when a child enters school, at 4–6 years. When it is given according to this schedule, DTaP protects most children from all three diseases (80%–85% from pertussis, 95% from diphtheria, nearly 100% from tetanus). Protection can fade with time, so booster doses (using Td or Tdap vaccine, see below) are recommended every 10 years. These vaccines are also sometimes given when a person gets a serious wound that could contain tetanus bacteria.

DTaP Vaccine Side Effects

Up to one third of children who get DTaP have local reactions (tenderness, pain, redness, swelling). These are most common after the 4th or 5th doses. When they occur it is usually within 2 days after the shot. Some children also experience swelling of the entire arm or leg after the 4th or 5th DTaP dose. This happens within 3 days of the shot and usually lasts around 4 days, with no after-effects. Up to about 1 child in 20 will get a fever of over 101°F — also more often after the fourth or fifth dose. And up to about 1 child in 5 may become fussy or lose their appetite for a day or two; nearly half may become drowsy after the shot.

More serious side effects include a fever of 104°F or higher (1 in 3,000), continuous crying for 3 hours or more (separate studies have found this in 1 in 900 to 1 in 8,000), and convulsions (1 in 14,000). Convulsions that occur after DTaP are usually not caused directly by the vaccine, but by a fever, which in turn was triggered by the vaccine. These are called "febrile seizures" and, while they might be alarming, children recover from them quickly and they do not cause permanent harm. Some experts recommend giving a non-aspirin pain reliever, such as acetaminophen, to reduce the chances of a fever.

Over the years several cases of permanent brain damage were reported following DTP vaccine (an earlier version of DTaP).

Whether these were true vaccine reactions or merely coincidence is impossible to say, because they occurred so infrequently. Some people used to believe that DTP vaccine could cause Sudden Infant Death Syndrome (SIDS), but studies have discredited that theory.

DTaP Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, a child who developed **encephalopathy** (brain illness) within 7 days after a dose of DTaP should not get another dose of pertussis-containing vaccine (see DT vaccine, below).

There are several other conditions that might cause a doctor to recommend not getting DTaP. These are: a **temperature of 105°F**, a **collapse or "shock-like" state**, or **continuous crying** for 3 or more hours, occurring within 48 hours of a previous dose; or **convulsions** occurring within 3 days after a previous dose. If your child had any of these conditions after a previous dose of DTaP, be sure to talk with your doctor before getting another dose of the vaccine. He or she might recommend getting a non-pertussis-containing vaccine.

Other Related Vaccines

- **DT** is a tetanus/diphtheria vaccine, which does not contain pertussis. It is used for children younger than 7 years old who should not get pertussis vaccine (for example, because they have had a reaction to pertussis vaccine in the past).
- **Td** is similar to of DT, but is for children 7 years old and older and for adults. It has a lower concentration of diphtheria toxoid than DT. It is used for routine 10-year boosters.
- **Tdap** was licensed in 2005. It contains a full concentration of tetanus and lower concentrations of both diphtheria and pertussis. It is the first pertussis-containing vaccine licensed in the United States for older children, adolescents, and adults. It is currently recommended as a once-only booster for adolescents.

2. Hepatitis A Vaccine

Hepatitis A vaccine is made from inactivated (killed) hepatitis A virus. It is 94%–100% effective in preventing hepatitis A. Because it has been available only since 1995, we don't know yet how long immunity will last, but mathematical modeling suggests that it should protect for 20 years or more. The vaccine is not licensed for children younger than 1 year of age.

Until late 2005 hepatitis A vaccine was recommended only for certain children: those who live in states where risk of hepatitis A is highest and those who live in communities with high levels of hepatitis A, including Alaska Native villages, American Indian reservations, some Hispanic communities, and some religious communities. Travelers to countries where the disease is common should also get the vaccine.

As of 2005 hepatitis A vaccine has been routinely recommended for all children from 12 through 23 months of age.

Two doses of hepatitis A vaccine are recommended, the second dose given at least 6 months after the first. For travelers who don't have time to get the second dose before their departure, one dose provides good short-term protection.

Hepatitis A Vaccine Side Effects

Mild local reactions, like **pain or swelling** where the shot is given, are reported in up to half of people who get the vaccine. Fatigue or mild fever are report less often—fewer than 1 person in 10. No serious reactions have been associated with the vaccine.

Hepatitis A Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, children who are known to have a **severe allergy to alum** should not get hepatitis A vaccine.

3. Hepatitis B Vaccine

Hepatitis B vaccine is an inactivated (killed) vaccine that is made from a small, non-infectious part of the hepatitis B virus, called hepatitis B surface antigen. The vaccine was licensed in 1986, and 98%–100% of children who get the vaccine develop immunity.

Some parents question why infants and young children should be vaccinated against hepatitis B when they don't have the risk factors (drug use, sexual activity, professional risk) that lead to many infections. There are two reasons. One is that babies and children can become infected too. If a mother infects her baby during birth, for example, and the baby is not immunized immediately, it will probably become chronically infected too. One out of 4 of these children will eventually die from cirrhosis or liver cancer. The other reason is that vaccinating only high-risk adolescents and adults has proved not to be a very effective way to control the disease. It was only after we began routine childhood vaccination that rates of disease began to drop significantly.

Three doses of hepatitis B vaccine are needed for full protection. The first dose is recommended at birth. This is particularly important for children whose mothers are chronically infected. The second dose is recommended at 1–4 months and the third at 6–18 months. These three doses should protect children for life. No additional booster doses are needed.

Hepatitis B Vaccine Side Effects

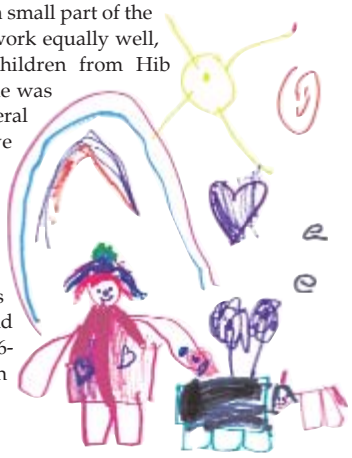
About 3–9 children out of 100 have some soreness where the shot is given, and up to 6 in 100 develop a mild fever. Up to 2 out of 10 might become tired or irritable. More serious reactions are extremely rare.

Hepatitis B Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, children who are known to have a **severe allergy to yeast** should not get hepatitis B vaccine.

4. Hib Vaccine

There are several brands of *Haemophilus influenzae* type b (Hib) vaccine used in the United States. They are all inactivated (killed) vaccines, made from a only a small part of the Hib bacterium. All brands work equally well, protecting 95%–100% of children from Hib disease. The first Hib vaccine was licensed in 1985, and several improved versions have become available since then.



Children should get either 3 or 4 doses of Hib vaccine, depending on which brand your doctor uses. The vaccine is recommended at 2, 4, 6, and 12–15 months of age. The 6-month dose is not given with one brand of vaccine.

Hib Vaccine Side Effects

Hib is a very safe vaccine. It cannot cause Hib disease or meningitis, and is not known to cause any other serious reactions. About 2 children in every 100 who get Hib vaccine have redness, swelling or warmth where the shot was given, or a fever over 101°F. These reactions usually begin within 24 hours after the shot and last 2 or 3 days.

Hib Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, Hib vaccine should not be given to children **younger than 6 weeks of age**. This is not because it is unsafe but because it might not protect as well if given too early.

5. Influenza Vaccine

There are two types of influenza vaccine. The first is an inactivated (killed) vaccine given as a shot, which has been used for many years. It can be given to anyone 6 months of age and older. The second is a live, attenuated (weakened) vaccine, which is sprayed into the nose and was licensed in 2003. It is not licensed for children younger than 2 years old.

Because influenza viruses change from year to year, new vaccines must also be formulated each year, and annual vaccination is recommended. The inactivated influenza vaccine is 70%–90% effective in healthy children, and the live, intranasal vaccine is about 87% effective in healthy children 5–7 years of age.

Many other infections have the same symptoms as influenza and are often mistakenly called "flu." Neither vaccine is effective against infections that are not actually caused by influenza viruses.

One dose of vaccine (either type, depending on age) is recommended annually, beginning around October or November. For children younger than 9 who are getting influenza vaccine for the first time, 2 doses are recommended, and should be given at least a month apart.

Influenza Vaccine Side Effects

Inactivated Vaccine

About 15%–20% of those who get inactivated influenza vaccine have a mild local reaction, such as **soreness or redness** where the shot was given. These generally last 1 or 2 days. A very small number, less than 1%, may get a **fever**, **chills** or **muscle aches**. Because the virus in this vaccine has been killed, it cannot cause influenza.

Some inactivated influenza vaccine contains a preservative called thimerosal, which contains mercury. Some people believe that thimerosal in vaccines has been associated with developmental problems, including autism. In 2004 the Institute of Medicine reviewed scientific studies looking for a connection between thimerosal and these problems, but concluded that there is no evidence of such a connection. Parents can ask their providers about the availability of thimerosal-free vaccine.

Live, intranasal vaccine

Some children have gotten a **runny nose** or **nasal congestion**, **fever**, **headaches** or **muscle aches**, **abdominal pain** or **vomiting**. Since these symptoms are fairly common among all children, it is difficult to tell whether their occurrence after vaccination is due to the vaccine or not. Although the vaccine contains live influenza virus, it has been weakened and altered in other ways so it does not cause influenza.

Influenza Vaccine Precautions

Inactivated vaccine

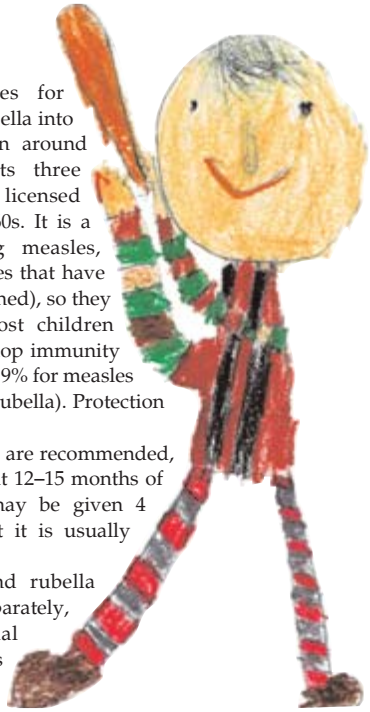
In addition to the normal precautions for all vaccines, shown on page 30, children who are known to have a **severe allergy to eggs** should not get inactivated influenza vaccine.

Live, Intranasal Vaccine

In addition to the normal precautions for all vaccines, shown on page 30, children who have a **severe allergy to eggs** should not get

live influenza vaccine. Children who have a **weakened immune system**, who have **chronic medical conditions** such as asthma, reactive airways disease, diabetes, renal disease, or sickle cell disease, or who are receiving **long-term therapy with aspirin or other salicylates** should also not get this vaccine. The vaccine is not known to be harmful to these people, but it has not yet been thoroughly tested in them.

6. MMR Vaccine



MMR combines vaccines for **M**easles, **M**umps and **R**ubella into one shot. MMR has been around since 1971, although its three components were licensed separately during the 1960s. It is a live vaccine, containing measles, mumps and rubella viruses that have been "attenuated" (weakened), so they won't cause disease. Most children who get the vaccine develop immunity to all three diseases (over 99% for measles and 95% for mumps and rubella). Protection is believed to be life-long.

Two doses of vaccine are recommended, with the first dose given at 12–15 months of age. The second dose may be given 4 weeks after the first, but it is usually given at 4–6 years.

Measles, mumps and rubella vaccines may be given separately, although these individual vaccines are not always readily available. Doctors usually prefer not to give the vaccines this way because it means giving a child 3 shots instead of one.

MMR Vaccine Side Effects

Some children (about 1 in 5) get a mild rash or fever after MMR vaccine. These reactions begin a week or two after the vaccination and usually last for 1–3 days. About 1 child in 7 may get swollen lymph glands, and 1 child in 100 may have pain or stiffness in the joints that can last from a few days to a few weeks. There is a smaller risk of painful **swelling of the joints** (arthritis). These joint symptoms occur more often in adults, especially women.

Febrile seizures (seizures caused by a fever) have occasionally been reported after MMR vaccination. These usually happen 1 or 2 weeks after the shot and are caused by the fever than can accompany the vaccination rather than by the vaccine itself. Children recover from febrile seizures quickly and they do not cause permanent harm.

There have been reports of children getting **encephalitis** (inflammation of the brain) after an MMR shot. This happens so rarely — less than once in a million shots — that experts can't be sure whether the vaccine is the cause or not. Remember, though, that if the same million children were infected with measles, about 1,000 of them would get encephalitis.

MMR Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, children who are known to have a **severe allergy to gelatin** or the antibiotic **neomycin** should not get MMR. A child who has a **suppressed immune system**, either because of a disease such as cancer or HIV infection or a medication such as steroids, should be evaluated by a doctor before getting MMR. A child who has recently gotten a **transfusion or other blood product** might have to wait up to several months before getting MMR.

Two live vaccines (for example, MMR and varicella) may be given on the same day or separated by at least 4 weeks. But they should not be given less than 4 weeks apart, because they might interfere with each other. MMR and inactivated (killed) vaccines may be given together, or at any time in relation to each other.
Children who have gotten MMR vaccine cannot infect people they come in contact with.

7. Pneumococcal Vaccine

Pneumococcal conjugate vaccine was licensed in 2000. It is an inactivated (killed) vaccine, which gives immunity against the 7 strains of the pneumococcal bacterium that have caused most of the serious infections in children. It is more than 90% effective against invasive disease (for example, blood infections and meningitis). Some ear infections are prevented by pneumococcal vaccine, but many are caused by other organisms, and the vaccine will not prevent these.

Four doses of pneumococcal vaccine are recommended, at 2, 4, 6, and 12–15 months of age. Children who are late starting the series may need fewer doses. Check with your doctor or clinic for the recommended schedule if your child starts late. This vaccine is usually not given to children 5 years old and older. But some older children (those with certain chronic diseases or damaged immune systems) still need pneumococcal vaccine. There is a different vaccine — called pneumococcal polysaccharide vaccine — that can be given to these children and to adults. Pneumococcal vaccine may be given at the same time as other childhood vaccines.

Pneumococcal Vaccine Side Effects

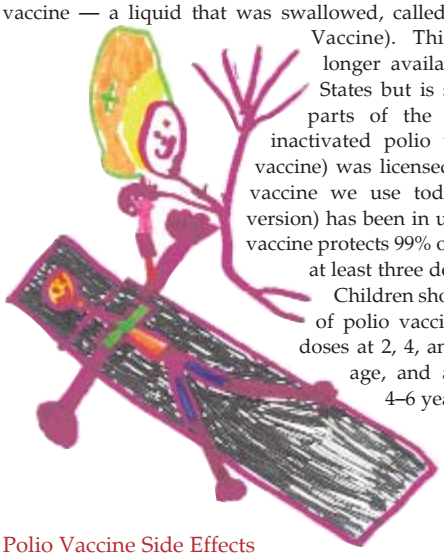
Local reactions have been reported in 10%–20% of children getting the vaccine. Of these, only about 3% were considered severe (for example, tenderness that interferes with arm or leg movement). These local reactions occur most frequently after the 4th dose. Some children also report a mild fever. More severe reactions are extremely uncommon.

Pneumococcal Vaccine Precautions

Other than the normal precautions for all vaccines, shown on page 30, there are no precautions for pneumococcal vaccine.

8. Polio Vaccine

The polio vaccine used in the United States contains 3 types of inactivated (killed) polio virus. It is sometimes called IPV (Inactivated Polio Vaccine). We once used another type of polio vaccine — a liquid that was swallowed, called OPV (Oral Polio Vaccine). This vaccine is no longer available in the United States but is still used in other parts of the world. The first inactivated polio vaccine (the Salk vaccine) was licensed in 1955, and the vaccine we use today (an improved version) has been in use since 1987. The vaccine protects 99% of children who get at least three doses.



Children should get four doses of polio vaccine, the first three doses at 2, 4, and 6–18 months of age, and a booster dose at 4–6 years.

Polio Vaccine Side Effects

Inactivated polio vaccine is a very safe vaccine. It is not known to produce any side effects other than a little soreness and redness where the shot is given. The old oral vaccine, OPV, could actually cause polio, although rarely. This cannot happen with IPV.

Polio Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, a child who is known to have a **severe allergy** to the antibiotics **neomycin**, **streptomycin**, or **polymyxin B** should not get polio vaccine.

9. Rotavirus Vaccine

Rotavirus vaccine is a live vaccine, which is given orally rather than by injection. Children should get a total of three doses, one dose at 2, 4, and 6 months of age. The vaccine protects against five different strains of rotavirus, so even a child who has had a case of rotavirus disease should get the vaccine. The vaccine has been very effective in preventing rotavirus gastroenteritis (about 74%) and even more effective in preventing *severe* rotavirus gastroenteritis (about 98%).

Rotavirus Vaccine Side Effects

Children who get rotavirus vaccine have a slight risk of mild side effects, including mild, temporary vomiting, diarrhea, and earaches. No serious side effects have been associated with the vaccine.

> In the late 1990s a different type of rotavirus vaccine was briefly available, but it was removed from the market because it was found to be associated with an uncommon type of bowel obstruction, called *intussusception*. The new vaccine was tested with more than 70,000 children before it was licensed, and millions of doses have been distributed since it was licensed. There is no sign that intussusception is a problem with this vaccine.

Rotavirus Vaccine Precautions

In addition to the routine precautions for all vaccines, shown on page 30, a child who has a weakened immune system should be evaluated by a doctor before getting rotavirus vaccine. Suppression of the immune system can be caused by certain diseases such as cancer or HIV infection, or by medications such as steroids or chemotherapy. A child who has recently gotten a transfusion or other blood product might have to wait before getting rotavirus vaccine. Talk to your doctor if your child has any ongoing digestive problems or has ever had intussusception. Even though this vaccine hasn't been associated with intussusception, children who had this condition in the past may be at higher risk of getting it again.

10. Varicella Vaccine

Varicella vaccine is made with live, attenuated (weakened) varicella virus. It was licensed in the United States in 1995. It prevents chickenpox in 70%–90% of people who get it, and it prevents severe chickenpox in more than 95%. It is expected to provide life-long immunity. People who were vaccinated during testing, before the vaccine was licensed, are still immune.

Two doses of varicella vaccine are recommended for children. The first dose is recommended at 12–15 months of age. It is usually given at the same time as MMR vaccine. The second dose is recommended at 4-6 years, before entering kindergarten or first grade. It may be given sooner, as long as it is seprated from the first dose by at least 3 months. Anyone who has had chickenpox does not need the vaccine.

Each year, about 1% of people who have gotten varicella vaccine develop chickenpox in spite of having responded to the vaccine. This is called "breakthrough" infection. Breakthrough infections are much milder than normal chickenpox. Patients generally have fewer than 50 lesions, which do not form blisters. They also do not get a fever and have no complications. We don't know why breakthrough infections occur.

Varicella Vaccine Side Effects

About 1 child in 5 gets some **redness or soreness** where the shot was given. Some children also get a **mild rash** (about 5 spots) 1 to 3 weeks after the shot. About 15% of children get a fever, but most of these fevers have been shown to have causes other than the vaccine. Febrile seizures (seizures caused by fever) have occurred in less than 1 out of 1,000 children. Other serious problems, such as inflammation of the brain (**encephalitis**) or **loss of muscle coordination**, have been reported very rarely — so rarely that it is not certain that the vaccine is the cause.

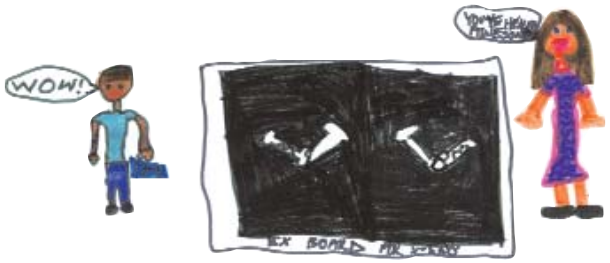
Varicella Vaccine Precautions

In addition to the normal precautions for all vaccines, shown on page 30, children who are known to have a **severe allergy to gelatin** or the antibiotic **neomycin** should not get varicella vaccine. A child who has a **suppressed immune system**, either because of a disease such as cancer or HIV infection, or a medication such as steroids, should be evaluated by a doctor before getting varicella vaccine. A child who has recently gotten a **transfusion or other blood product** might have to wait up to several months before getting varicella vaccine.

The manufacturer recommends not using aspirin or other salicylates for 6 weeks after varicella vaccine. This is because Reye syndrome has been associated with use of salicylates after chickenpox disease. Any similar risk associated with the vaccine is merely theoretical.

Two live vaccines (for example, varicella and MMR) may be given on the same day or separated by at least 4 weeks. But they should not be given less than 4 weeks apart, because they might interfere with each other. Varicella and inactivated (killed) vaccines may be given together, or at any time in relation to each other.

There is a very small risk that a child who has gotten varicella vaccine could infect a susceptible family member — particularly one with a suppressed immune system. This appears to happen very rarely, and only when the vaccinated child develops a rash. To be safe, anyone with a suppressed immune system should consider avoiding contact with a child who develops a varicella vaccine-related rash.



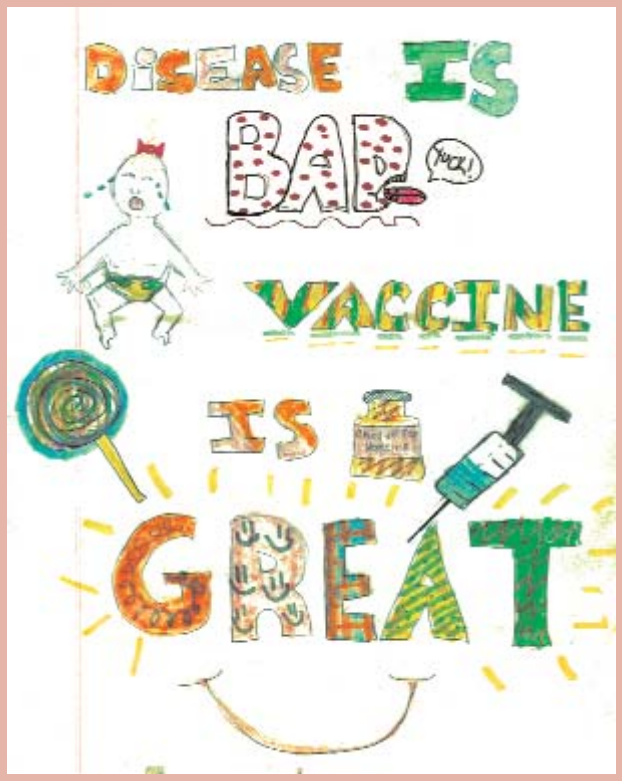
Combination Vaccines

Several vaccines are sometimes combined into a single shot. These are called combination vaccines. Some combination vaccines are used routinely — DTaP is a combination; so is MMR. There are currently four other combination vaccines available for children. One combines DTaP and Hib vaccines; the second Hib and hepatitis B; the third combines DTaP, hepatitis B, and polio, and the fourth combines measles, mumps, rubella and varicella. The advantage of combination vaccines is, of course, that your children get the protection of all the component vaccines while getting fewer injections.

Each of these vaccines has certain restrictions, and not all providers carry them. But ask your provider about them if you are interested in reducing the number of shots your child needs.

PART FOUR

Appendix



Childhood Immunization Schedule

Vaccines work best when they are given at certain ages. For example, measles vaccine is not usually given to children until they are at least a year old. If it is given earlier it might not work as well. For vaccines requiring multiple doses, the doses should not be given too close together.

This chart shows the routine childhood immunization schedule for the United States. It shows what vaccines are recommended and the ages at which they should be given. A bar spanning several ages means the dose may be given at any time during that age range. For example, the 3rd dose of polio vaccine may be given any time between 6 and 18 months.

These are the recommended ages for vaccine doses, but the schedule is flexible. If a child doesn't get a dose of vaccine at the recommended age, he can catch up later. Sometimes a child needs to get a dose earlier than the recommended age. Within limits, this can be done too. Your provider can give you more information.

This schedule is updated yearly. A more detailed version is available online at **www.cdc.gov/vaccines/recs/schedules/child-schedule.htm**.

Childhood Immunization Schedule, United States

	Birth	1 Mo	2 Mos	4 Mos	6 Mos	12 Mos	15 Mos	18 Mos	23 Mos	4-6 Yrs
Hepatitis B	1st Dose	2nd Dose			3rd Dose					
Rotavirus			1st Dose	2nd Dose	3rd Dose					
Hib			1st Dose	2nd Dose	3rd Dose	4th Dose				
DTaP			1st Dose	2nd Dose	3rd Dose		4th Dose			5th Dose
Polio			1st Dose	2nd Dose	3rd Dose					4th Dose
Pneumococcal			1st Dose	2nd Dose	3rd Dose	4th Dose				
MMR						1st Dose				2nd Dose
Varicella						1st Dose				2nd Dose
Influenza					1 Dose Anually					
Hepatitis A						2 Doses 6 Months Apart				

Diseases Summary

	Caused by	Spread by	Signs and Symptoms	Complications
Diphtheria	Bacterium — *Corynebacterium diphtheriae*	Air, direct contact	Sore throat, mild fever, membrane in throat, swollen neck	Heart failure, paralysis, pneumonia, death
Hepatitis A	Virus — Hepatitis A	Personal contact; contaminated food or water	Fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice, dark urine	Liver failure, death
Hepatitis B	Virus — Hepatitis B	Contact with blood or body fluids	Fever, headache, malaise, vomiting, arthritis	Chronic infection, cirrhosis, liver failure, liver cancer, death
Hib disease	Bacterium — *Haemophilus influenzae* type b	Air, direct contact	May be no symptoms unless bacteria enter blood	Meningitis, epiglotittis, pneumonia, arthritis, death
Influenza	Virus — Influenza	Air, direct contact	Fever, muscle pain, sore throat, cough	Pneumonia, Reye syndrome, myocarditis, death
Measles	Virus — Measles	Air, direct contact	Rash, fever, cough, runny nose, pinkeye	Pneumonia, ear infections, encephalitis, seizures, death
Mumps	Virus — Mumps	Air, direct contact	Swollen salivary glands, fever, headache, malaise, muscle pain	Meningitis, encephalitis, inflammation of testicles or ovaries, deafness
Pertussis	Bacterium — *Bordetella pertussis*	Air, direct contact	Severe cough, runny nose, fever	Pneumonia, seizures, brain disorders, ear infection, death
Pneumo-coccal	Bacterium — *Streptococcus pneumoniae*	Air, direct contact	Pneumonia (fever, chills, cough, chest pain)	Bacteremia (blood infection), meningitis, death
Polio	Virus — Poliomyelitis	Person to person	May be no symptoms, sore throat, fever, nausea	Paralysis, death
Rotavirus	Virus — Rotavirus	Person to person, contaminated food or water	Diarrhea, vomiting, fever	Dehydration electrolyte imbalance
Rubella	Virus — Rubella	Air, direct contact	Rash, fever, lymphadeno-pathy, malaise	Encephalitis, arthritis/arthralgia, hemorrhage, orchitis
Tetanus	Bacterium — *Clostridium tetani*	Exposure through breaks in skin	Stiffness in neck, difficulty swallowing, rigid abdominal muscles, muscle spasms, fever, sweating, elevated blood pressure	Broken bones, breathing difficulty, death
Varicella	Virus — Varicella Zoster	Air, direct contact	Rash, fever	Bacterial infections, meningitis, encephalitis, pneumonia, death

Questions and Answers

Why do children need so many shots?

Some of us may have gotten only 3 vaccines as children: DTP, polio, and smallpox. There were no vaccines for measles, chickenpox, mumps, and other diseases — which meant that many of us also got those diseases! Over the years scientists have developed vaccines against more diseases, and we give them to our children to protect them from those diseases. Children don't get smallpox vaccine any more because we have eradicated the disease. Within our lifetimes, we may also eradicate polio, and then that vaccine too will no longer be needed. More combination vaccines may also reduce the number of shots children will need. At the same time, vaccines may be developed to protect us against even more diseases.

Why are vaccines given at such an early age?

Vaccines are given at an early age because the diseases they prevent can strike at an early age. Some diseases are far more serious or common among infants or young children. For example, up to 60% of severe disease caused by *Haemophilus influenzae* type b occurs in children under 12 months of age. Of children under 6 months of age who get pertussis, 72% must be hospitalized, and 84% of all deaths from pertussis are among children less than 6 months of age. The ages at which vaccines are recommended are not arbitrary. They are chosen to give children the earliest and best protection against disease.

What if my child misses a dose of vaccine?

They can continue the series where they left off. Vaccinations do not have to be repeated when there is a longer-than-recommended interval between doses.

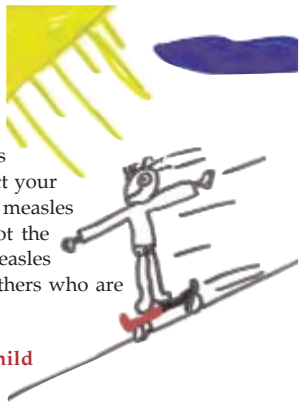
How safe are vaccines?

They are very safe. But like any medicine, they are not perfect. They can cause reactions. Usually these are mild, like a sore arm or slight fever. Serious reactions are very uncommon. Your health-care

provider will discuss the risks with you before your child gets each vaccine, and will give you a form called a Vaccine Information Statement, which describes the vaccine's benefits and risks. The important thing to remember is that getting vaccines is much safer than getting the diseases they prevent.

Do vaccines always work?

Vaccines work most of the time, but not always. Most childhood vaccinations work between 90% and 100% of the time. Sometimes, though, a child may not respond to certain vaccines, for reasons that aren't entirely understood. This is one reason why it is important for all children to be immunized. A child who does not respond to a vaccine has to depend on the immunity of others around her for protection. If my child is immune to measles, he can't infect your child who failed to respond to measles vaccine. But if my child never got the vaccine, he can not only get measles himself, he can pass it along to others who are not immune.



What will happen if my child doesn't get his vaccinations?

One of two things could happen:

1. If your child goes through life without ever being exposed to any of these diseases, nothing will happen.
2. If your child is exposed to one of these diseases, there is a good chance he will get it. What happens then depends on the child and the disease. Most likely he would get ill and have to stay in bed for a few days up to 1–2 weeks. But he could also get very sick and have to go to the hospital. At the very worst, he could die. In addition, he could also spread the disease to other children or adults who are not immune.

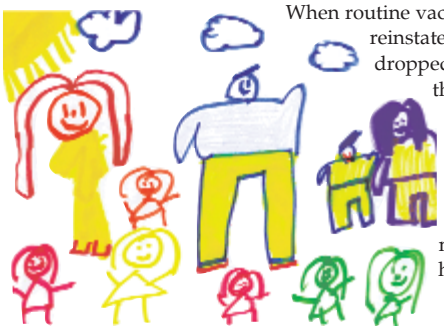
What are my child's chances of being exposed to one of these diseases?

Overall, quite low. Some of these diseases have become very rare in the United States (thanks to immunizations), so the chances of exposure are small. Others, such as varicella and pertussis, are still relatively common. Some are rare in the U.S. but common elsewhere in the world, so there is risk not only to travelers, but also to anyone exposed to travelers from other countries visiting here.

If my child's risk of exposure to disease is so low, why should I bother getting him immunized?

This is a good question. One answer, of course, is that even if the risk of getting these diseases is low, it is not zero. If only one child in the whole country gets diphtheria this year, that child has a 1 in 10 chance of dying. Vaccination would have protected him.

But there is also another answer. Even if disease rates are low now, if we stopped vaccinating they wouldn't remain low for very long. We know this because it has already happened in several countries, including Great Britain and Japan. For instance, in 1974, about 80% of Japanese children were being vaccinated against pertussis. That year Japan had only 393 pertussis cases and no deaths. But then there was a national scare about the safety of pertussis vaccine, and over the next few years the vaccination rate dropped to about 10%. In 1979 the country suffered a major pertussis epidemic with more than 13,000 cases and 41 deaths.



When routine vaccination was reinstated, disease rates dropped again. Without the protection afforded by a highly-immunized population, diseases could make a comeback here too.

What ingredients go into vaccines, and why?

The major ingredient of any vaccine is a killed or weakened form of the disease organism the vaccine is designed to prevent. Therefore, measles vaccine is mostly measles virus. Pneumococcal vaccine is mostly the surface coating from pneumococcal bacteria.

In addition, vaccines can contain:

- **Diluents** A diluent is a liquid used to dilute a vaccine to the proper concentration. It is usually saline or sterile water.
- **Adjuvants** Adjuvants are chemicals added to vaccines to make them provide stronger immunity. Various forms of aluminum salts are the most commonly used adjuvants in vaccines.
- **Preservatives** Preservatives are included in some vaccines (mainly ones that come in multi-dose vials that are used more than once) to prevent bacterial growth that could contaminate the vaccine.
- **Stabilizers** Some vaccines contain stabilizers (for example, gelatin or lactose-sorbitol), to keep them safe and effective under different conditions or different temperatures.
- **Remnants from manufacturing** Chemicals are often used during the vaccine manufacturing process, and then removed from the final product. For example, formalin might be used to kill a vaccine virus, or antibiotics might be used to prevent bacterial contamination. When these chemicals are removed, a tiny trace may remain. While some of these chemicals might be harmful in large doses, the trace amounts left in vaccines are too small to have a toxic effect.

The "package insert" that comes with each vial of vaccine lists all the contents of the vaccine and explains why each substance is there.

What to Do if Your Child Has a Reaction

Most children do not have any reactions to vaccines. Among those who do, the large majority are minor local reactions (pain, swelling or redness at the injection site) or a mild fever. These go away within a day or two and don't normally require any special treatment.

But what if your child has a more serious reaction, such as a severe allergic reaction?

Signs of a severe allergic reaction can include difficulty breathing, hoarseness or wheezing, hives, paleness, weakness, a fast heart beat or dizziness. If your child shows these symptoms after getting vaccinations — or if she shows other unusual symptoms, such as a high fever or behavior changes — don't hesitate:

- Call a doctor or get the child to a doctor right away.
- Tell your doctor what happened, the date and time it happened, and when the vaccination was given.

Reporting Adverse Reactions

In the event your child has a vaccine-associated injury — or even if you think a medical problem your child has might have been caused by a vaccine — you should report the problem.

VAERS (the **V**accine **A**dverse **E**vent **R**eporting **S**ystem) collects reports of suspected vaccine injuries. Generally, the doctor fills out a VAERS report and sends it to the program. But a parent or individual can also file a VAERS report. You can get more information about VAERS from their toll-free information line at **800-822-7967**, or visit their website at **www.vaers.hhs.gov**

Not all reactions reported to VAERS are caused by the vaccine, but may have been unrelated events that just happened to occur after an immunization. VAERS expects this, and you shouldn't let doubt about whether a reaction was really caused by a vaccine stop you from filing a report. One of the purposes of VAERS is to collect enough data to reveal patterns that might help researchers identify previously unknown side effects, or to show that some reactions are not caused by vaccines. All VAERS reports contribute to this useful database.

If your child were to suffer a serious injury that proves to have been caused by a vaccination, a program called the **National Vaccine Injury Compensation** Program will provide compensation to help with their care. You can learn more about the National Vaccine Injury Compensation Program from their website at **www.hrsa.gov/vaccinecompensation**, or by calling the program tool-free at **800-338-2382**.

Other Vaccines

In addition to the routine childhood vaccinations covered in this booklet, there are other vaccines that are recommended for older children or adolescents, or which younger children might need under certain circumstances.

Rabies vaccine might be recommended for children bitten by animals, or otherwise thought to have been exposed to rabies, or for children living in a country where rabies is common.

Children traveling abroad may need other vaccines, depending on what diseases are present in the countries they are visiting. These vaccines can include **Japanese encephalitis**, **typhoid**, **meningococcal**, and **yellow fever**.

Meningococcal vaccine is also recommended for all adolescents between 11 and 18 years of age. **Tdap** (see page 32) is recommended at their 11-12 year doctor's visit. **Human papillomavirus (HPV) vaccine** is recommended for girls at 11-12 years of age as well.

Your health-care provider can advise you about use of these vaccines.

Immunization Trivia

- The first Nobel Prize in medicine was awarded in 1901 to the scientist who developed the first antitoxin for diphtheria.
- The "March of Dimes" began in 1938 as a fund-raising campaign for polio. People were asked to mail one dime directly to the White House to help fight the disease. In the first 3 days, the White House received 230,000 dimes. President Franklin D. Roosevelt, whose profile is now on the dime, was himself paralyzed by polio.
- The word "measles" probably comes from a Latin word meaning "miserable."
- The reason varicella is called chickenpox has nothing to do with chickens. It got its name because its blisters look like chick peas.
- The last person in the world to get a natural case of smallpox was a 23-year-old cook in Somalia, in 1977. In recent years he has made public appearances to help with Somalia's polio eradication campaign.
- Although it is called *Haemophilus influenzae*, Hib is not related to influenza (flu). Hib was first discovered in people who died from influenza during the 1889 pandemic, and was mistakenly believed to be the cause of that disease.
- Mumps is considered mainly a childhood disease. But it used to be known as a disease afflicting armies. Mumps was one of the leading causes of hospitalization during World War I.
- In 1970, astronaut Ken Mattingly was scrubbed from the Apollo XIII moon mission because he was exposed to measles.
- During World War I, German measles (rubella) was referred to as "Liberty Measles."
- The famous dog-sled race, the Iditarod, commemorates a dog-sled run in 1925 to rush serum to Nome, Alaska to treat an epidemic of diphtheria.
- There is a patron saint of tetanus — Saint Osmund.
- About one-fourth of the U.S. population, including President Woodrow Wilson, got influenza during the 1918 pandemic.

Glossary

Acetominophen — A non-aspirin drug that reduces pain and lowers fever. It goes by several brand names, including Tylenol®.

Antibody — A protein produced by the immune system that helps identify and destroy foreign germs (viruses or bacteria) that attack the body.

Bacteremia — Presence of bacteria in the blood.

Convulsion — See *seizure*.

Encephalitis — Inflammation of the brain.

Encephalopathy — Any illness that affects the brain.

Epidemic — A large outbreak of disease (see *outbreak*). An epidemic could include many people from the same city or community, or even from an entire country. A world-wide epidemic is called a *pandemic.*

Exposure — Contact with the germs that cause disease. A person must be both exposed to a disease and susceptible to it (see *susceptible*) to get sick from the disease.

Febrile Seizure — A seizure caused by a high fever (see *seizure*).

Immune — Protected from a disease, even when exposed to it. People can become immune after getting a disease or by getting vaccinated against the disease. Opposite of **susceptible**.

Immunity — Protection from disease. Having **antibodies** to a disease organism generally makes a person immune.

Local Reaction — a reaction that is restricted to a small area. With vaccines, a local reaction is usually redness, soreness, or swelling where the injection was given. A reaction that affects the whole body, such as a fever or **bacteremia**, is called a **systemic reaction**.

Meningitis — Inflammation of the covering of the brain or spinal cord.

Outbreak — An unusually large number of cases of a disease occurring around the same time and place, involving people who all got the disease from the same source or from each other.

Paralysis — Inability to move the muscles. Paralysis usually occurs in the arms or legs, but any muscles can become paralyzed, including those that control breathing.

Schedule — (Or vaccination schedule.) The ages and/or intervals at which children should get the various childhood vaccinations.

Seizure — A spell in which the muscles may jerk uncontrollably, or in which the patient simply stares at nothing. Usually, a seizure lasts only a brief time and doesn't cause permanent harm. A seizure can have many causes, including epilepsy or other brain disorders, or a high fever (see *febrile seizure*). Also called convulsion or fit.

Susceptible — Vulnerable to disease. Someone who has never had a disease or been vaccinated against it is susceptible to that disease. Opposite of **immune**. A person who is immune is no longer susceptible.

Toxin — Poison.

For More Information

With the ***Parents' Guide*** we have tried to give you the important facts about immunization in a relatively small package. Naturally we have not been able to include everything. The short section about immunity on page 10 is a simplified explanation of a much more complex process. Whole books have been written on topics we try to cover in a page or two. If you would like to learn more about childhood diseases and immunization, here are some places to look:

Books

- ***What Every Parent Should Know About Vaccines*** by Paul A. Offit, MD and Louis M. Bell, MD. This is a good introduction to immunization, which covers essentially the same topics as this booklet, but in much more detail. It also has chapters about vaccines needed for foreign travel, how vaccines work, how they are made, vaccine safety, and vaccines of the future.
- ***Vaccinating Your Child: Questions & Answers for the Concerned Parent*** by Sharon G. Humiston, MD and Cynthia Good. Another good introduction to immunization for parents, containing sections on vaccine use, routine childhood vaccinations, and other vaccines. It answers many of the questions parents have about childhood vaccinations.
- ***Epidemiology & Prevention of Vaccine-Preventable Diseases*** (The "Pink Book") by William L. Atkinson, MD et al. CDC Publication. A comprehensive introduction to the principles of vaccination and routine childhood vaccines and vaccine-preventable diseases. This book is intended for doctors, nurses, and others who give vaccinations. It also contains information of interest to parents. Available online or through the Public Health Foundation — see

  www.cdc.gov/vaccines/pubs/pinkbook/default.htm.
- ***The Immune System — How it Works*** by Lydia Woods Schindler. National Institutes of Health (NIH Publication #96-3229). This is a colorful, 25-page booklet written for a general audience, but still somewhat technical, describing the workings of the human immune system.

- ***Vaccines 4th Edition***, edited by Stanley A. Plotkin, MD, and Walter A. Orenstein, MD. This is a very important and comprehensive source of immunization information. It is written for health professionals, and can be very technical, but it contains a wealth of information about vaccines and vaccine-preventable diseases.

Telephone

Your State Health Department's Immunization Program. To find the phone number for your state go to this internet address: **www.immunize.org/nslt.d/n18/coord18.htm** and look for the state immunization coordinator for your state. (Thanks to the Immunization Action Coalition for maintaining this list.)

CDC-INFO. Talk with a trained operator who can answer individual questions about vaccines and vaccine-preventable diseases. Call **(800) 232-4636 (CDC-INFO)** 24 hours a day.

Internet

- CDC Websites

  General vaccine information **www.cdc.gov/vaccines**
  Information about Hepatitis **www.cdc.gov/ncidod/disease/hepatitis**
  Information about Influenza **www.cdc.gov/flu**
  International Travel Information: **wwwn.cdc.gov/travel**

- American Academy of Pediatrics **www.aap.org/new/immpublic.htm**
- World Health Organization's Pages on Vaccines and Immunization **www.who.int/vaccines**
- "A Miracle of Medicine" Vaccine Education Center at the Children's Hospital of Philadelphia **www.vaccine.chop.edu**
- National Network for Immunization Information **www.immunizationinfo.org**
- Dr. Reddy's Pediatric Office on the Web **www.drreddy.com/shots**

- National Vaccine Injury Compensation Program **www.hrsa.gov/vaccinecompensation**
- Vaccine Adverse Event Reporting System **www.vaers.hhs.gov**

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