

Seventh Edition
2023

VACCINES
and your **Baby**



Children's Hospital
of Philadelphia®

Vaccine Education Center



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and your **Baby**



**Children's Hospital
of Philadelphia[®]**

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In 1987, Susumu Tonegawa won the Nobel Prize in Medicine. He was taken to Stockholm, treated like visiting royalty and, in a lavish and spectacular ceremony, awarded mankind's greatest scientific prize. When Dr. Tonegawa returned to his home in Boston, he was asked by a local reporter to describe his experience. "It paled in comparison to the birth of my son," he said.

Children are our greatest prize. And we, as parents, want to do what is best — to nurture them and protect them from harm.

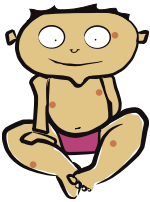
Very soon after our babies come into this world, we are asked to give them vaccines. We are told that vaccines will protect them from pneumonia, bloodstream infections, meningitis and other serious infections. Within hours of birth, children will get a shot of the hepatitis B vaccine. At around 2 months of age, children could get as many as five separate shots containing seven vaccines.

For some parents, all of these shots can seem overwhelming. Parents ask: "What are vaccines?" "How do vaccines work?" "What is my child's risk of getting one of the diseases that vaccines prevent?" and, most importantly, "Are vaccines safe for my baby?"

In this booklet, we will describe how vaccines are made and how vaccines work to protect our children from harm. With a better understanding of vaccines and the diseases they prevent, you will see why your doctor feels so strongly about recommending them.



How Do Vaccines Work?



What is immunity?

Let's use chickenpox to explain what we mean by "immunity." Before we had a chickenpox vaccine, almost all children got chickenpox. A few children who got chickenpox had very *mild* symptoms.

Most children experienced a *moderate* chickenpox infection, consisting of about 300-500 blisters, fever and intense itching that lasted for several days.



Occasionally children with chickenpox would get a *severe* infection of the skin, brain or lungs. Indeed, before the chickenpox vaccine, every year about 10,000 people were hospitalized with complications from chickenpox infection and about 100 died from the disease. Most of these were previously healthy children.

However, regardless of whether children got mild, moderate or severe infection with chickenpox, they all had one thing in common: They were not likely to ever get chickenpox again. They were now "immune" to chickenpox.

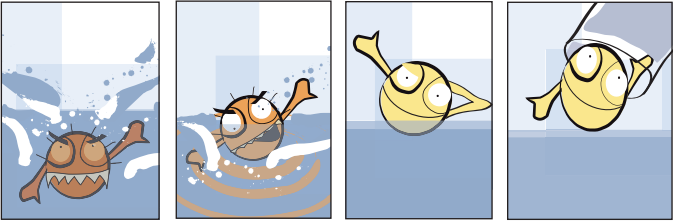


Vaccines give immunity without making children suffer the high price of natural infection.

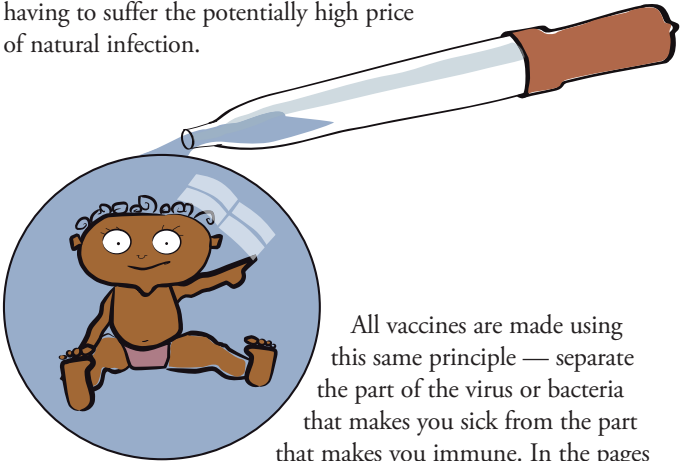
Because chickenpox caused occasional hospitalizations and deaths in children, a vaccine was made to prevent it.

The chickenpox (or varicella) vaccine, like all vaccines, separated the part of the chickenpox virus that made children sick (the pathogenic or virulent part) from the part that made them immune (the immunogenic part).

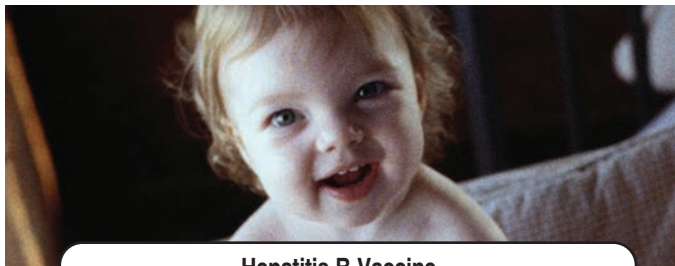
The chickenpox vaccine was made by taking natural chickenpox virus and growing it in specialized cells in the laboratory. As the chickenpox virus got better and better at growing in these laboratory cells, it got worse and worse at growing in children.



The chickenpox vaccine represents the best of two worlds. On the one hand, the vaccine grows well enough to cause immunity. On the other hand, it doesn't grow well enough to cause disease. Therefore, children can get immunity to chickenpox without having to suffer the potentially high price of natural infection.



All vaccines are made using this same principle — separate the part of the virus or bacteria that makes you sick from the part that makes you immune. In the pages that follow, we will talk about how this is done for each vaccine.



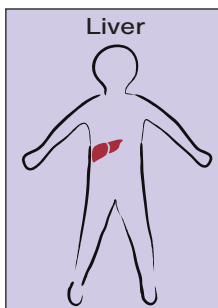
Hepatitis B Vaccine

What is hepatitis B?

Hepatitis B is a virus that infects the liver. Every year in the United States several thousand new cases of hepatitis B are diagnosed.

Most people who catch hepatitis B virus don't have any symptoms. Some have loss of appetite, vomiting, nausea, fatigue and jaundice (yellowing of the eyes and skin).

Hepatitis B virus can also cause a *rapid, overwhelming infection of the liver*, a long-term liver disease, called *cirrhosis*, and *liver cancer*. Indeed, young infants infected with hepatitis B virus are more likely to develop cirrhosis than older children or adults. Every year in the United States thousands of people die from the complications of hepatitis B virus infections.



What is my child's risk of getting hepatitis B infection?

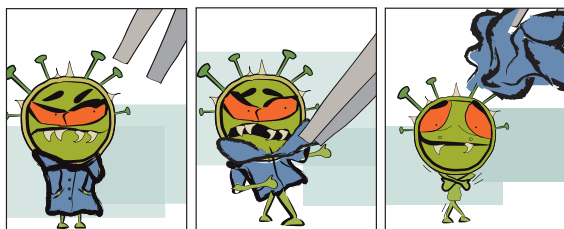
A common misconception is that hepatitis B virus is spread only by sexual contact among adults. The reality is that children can also catch hepatitis B virus in other ways:

- Mothers who are infected with hepatitis B virus can pass the infection on to their babies at birth.
- Infants and young children living in the home with someone who is infected can catch hepatitis B. The virus can be spread by toothbrushes, washcloths or hand towels that contain minute, even invisible, quantities of blood from someone who is infected.
- Infants and young children exposed to someone outside the home who is infected (for example, a playmate, relative or family friend) can catch hepatitis B. Because most people infected with hepatitis B virus don't have any symptoms, they often don't know that they are infected.

Two features of hepatitis B infection make it particularly dangerous. First, some people who are infected, particularly young children, do not experience symptoms, so they do not know they have the virus until they experience diseases associated with long-term liver infection. Second, people with long-term hepatitis B infections have such high quantities of virus in their blood that they can unwittingly pass it to others who are exposed to very small quantities of their blood. Up to 2 million people in the United States are infected with hepatitis B virus and can spread the infection to others, including young children. For these reasons, all newborns should receive the first dose of hepatitis B vaccine within 24 hours after birth.

What is the hepatitis B vaccine?

The hepatitis B vaccine is made by isolating the protein coat that surrounds the virus (called the hepatitis B surface protein). Immunity to this one protein protects children from infection with the virus.



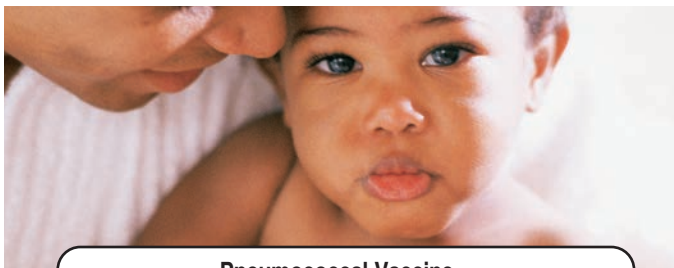
Does the hepatitis B vaccine cause any reactions?

The hepatitis B vaccine can cause pain, redness and tenderness at the site of the shot. Rarely, the hepatitis B vaccine causes fever.

The hepatitis B vaccine can also rarely cause a severe hypersensitivity (allergic) reaction. This reaction occurs in about 1 of every 600,000 people given the vaccine. Symptoms include hives, rash or low blood pressure and usually occur within 30 minutes of receiving the vaccine.

Do the benefits of the hepatitis B vaccine outweigh the risks for my child?

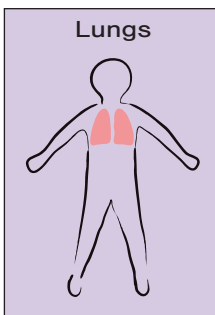
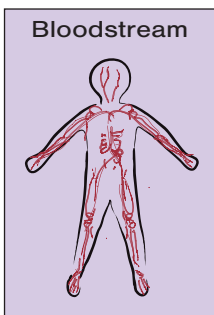
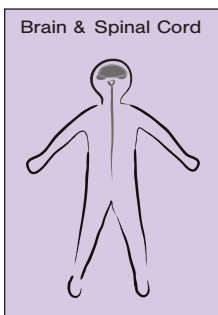
Every year thousands of people are permanently harmed or killed by hepatitis B virus. Many of these people (including infants and young children) catch the infection from a friend, family member or relative who didn't know that they were infected. On the other hand, severe reactions to the hepatitis B vaccine are extraordinarily rare and never fatal. Therefore, the benefits of the hepatitis B vaccine clearly outweigh its risks.



Pneumococcal Vaccine

What is pneumococcus?

Pneumococcus is a bacterium that is one of the most common causes of severe bacterial infections of infants and young children throughout the world. Severe infections include *meningitis* (an infection of the lining of the brain and spinal cord), bloodstream infections (also known as *sepsis*) and *pneumonia* (an infection of the lungs). Pneumococcus is also a common cause of ear and sinus infections.



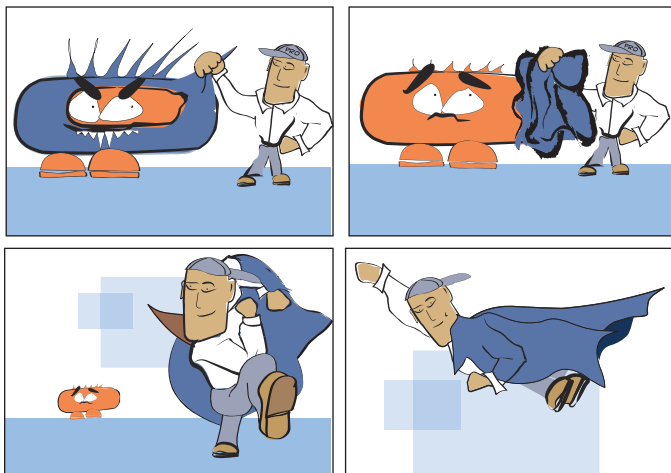
What is my child's risk of getting infected with pneumococcus?

The pneumococcal vaccine was first used in the United States in the year 2000. Before the vaccine, every year pneumococcus caused about 1,400 cases of meningitis, 17,000 cases of bloodstream infections, 70,000 cases of pneumonia, and about 5 million ear infections in young children. Because of the pneumococcal vaccine, these numbers have declined.

What is the pneumococcal vaccine?

The pneumococcal vaccine is made by taking the sugar coat (called a polysaccharide) from the bacteria and linking it to a helpful protein. Immunity to the polysaccharide protects children from infection with the bacteria.

Several different types of pneumococcus are contained in the vaccine. Although there are about 90 different types of pneumococcus, the types contained in the vaccine are the ones that most commonly infect infants and young children.



Does the pneumococcal vaccine cause any reactions?

The pneumococcal vaccine can cause mild pain, redness and tenderness at the site of the injection, as well as mild fever.

Do the benefits of the pneumococcal vaccine outweigh the risks for my child?

Before the pneumococcal vaccine, every year thousands of children were permanently harmed or killed by pneumococcus when they suffered meningitis, pneumonia or bloodstream infections. The pneumococcal vaccine has decreased, but not eliminated, the risk of pneumococcal infections. On the other hand, the pneumococcal vaccine does not cause any severe reactions. Therefore, the benefits of the pneumococcal vaccine clearly outweigh its risks.



Diphtheria-Tetanus-acellular Pertussis (DTaP) Vaccine

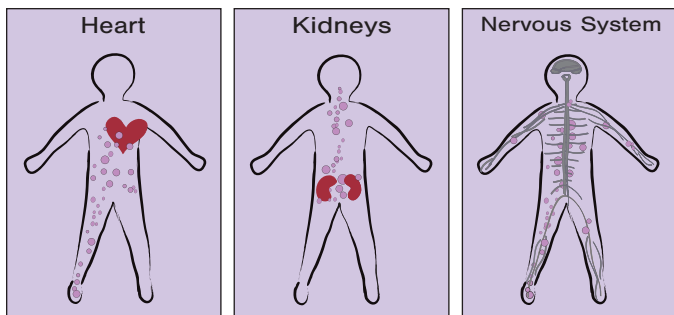
Diphtheria

What is diphtheria?

The “D” in DTaP stands for diphtheria. Diphtheria is caused by a bacterium that typically infects children and adolescents.

The bacterium causes a thick coating on the back of the throat that makes it difficult to swallow and breathe. Also, the bacterium makes a harmful protein (toxin) that can invade the heart, kidneys and nervous system. About 1 of every 20 children infected with diphtheria dies from *suffocation, heart failure* or *paralysis*.

Diphtheria is very contagious and is spread by coughing and sneezing.



What is my child’s risk of getting diphtheria?

Although few children in the United States get diphtheria each year, the disease is not controlled in other parts of the world, so it could easily re-emerge if immunization rates drop.

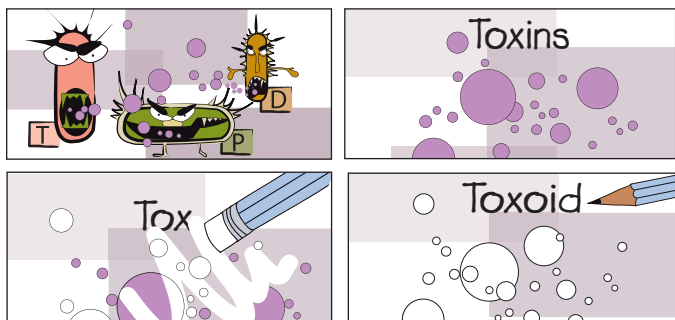
What is the diphtheria vaccine?

The diphtheria vaccine is made by taking the diphtheria toxin and inactivating it with a chemical. The chemical is then washed away leaving the purified inactivated toxin (called *toxoid*). The toxoid is very effective at protecting children against diphtheria.

Because immunity to diphtheria fades, the diphtheria vaccine should be given every 10 years (in combination with the tetanus [Td] or tetanus and pertussis [Tdap] vaccines) for life.

Does the diphtheria vaccine cause any reactions?

Some children given the diphtheria vaccine will develop local reactions like pain, redness or tenderness at the site of injection.



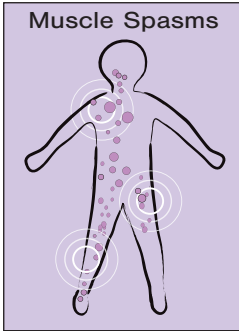
Do the benefits of the diphtheria vaccine outweigh the risks for my child?

Although diphtheria is extremely rare in the United States, the disease occurs in other countries, and is, therefore, only a plane ride away from coming back into this country. Because the diphtheria vaccine does not cause serious reactions, the benefits of the vaccine clearly outweigh the risks.

Tetanus (Lockjaw)

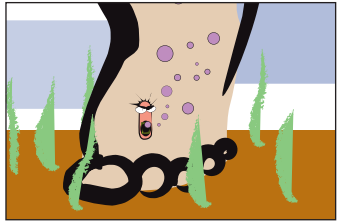
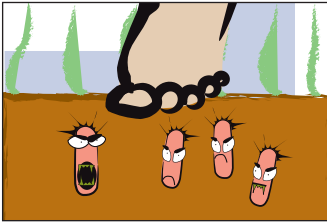
What is tetanus?

The “T” in DTaP stands for tetanus. Tetanus is a bacterium that typically infects older adults.



The tetanus bacterium makes a toxin that causes *severe and painful spasms of the muscles*, including the muscles of the jaw (tetanus is referred to as “lockjaw”).

Sometimes tetanus can be fatal. Muscle spasms of the throat can block the windpipe and cause instant death from *suffocation*. Also, the tetanus toxin can cause *severe and permanent damage to the heart*. About 3 of every 10 people who get tetanus die from the disease.



The tetanus bacterium is present in soil and can enter the skin after a cut or puncture wound. Because tetanus bacteria will always be present in soil, a child’s risk does not change regardless of how many people around them have been vaccinated.

What is my child’s risk of getting tetanus?

Every year in the United States about 30-40 cases of tetanus are reported. A few of them are fatal. Although most of these infections occur in older adults, some occur in children.

What is the tetanus vaccine?

The tetanus vaccine is made in the same manner as the diphtheria vaccine.

Because immunity to tetanus fades, it is recommended that children and adults receive the tetanus vaccine every 10 years. However, if your child gets a deep puncture wound and has not received a tetanus shot within five years, a booster dose is recommended.

Does the tetanus vaccine cause any reactions?

Some children will develop local reactions like pain, redness or tenderness at the site of injection.

The tetanus vaccine can also rarely cause a severe hypersensitivity (allergic) reaction. This reaction occurs in about 1 in every 1 million people given the vaccine. Symptoms include hives, rash or low blood pressure and usually occur within 30 minutes of receiving the vaccine.

The tetanus vaccine is also a very rare cause of painful swelling of the arm beginning several hours after injection — this reaction occurs primarily in adults who have received many doses of the tetanus vaccine.

Do the benefits of the tetanus vaccine outweigh the risks for my child?

Every year in the United States some people get tetanus and die from the disease. Because severe reactions to the tetanus vaccine are extraordinarily rare and never fatal, the benefits of the tetanus vaccine clearly outweigh its risks.

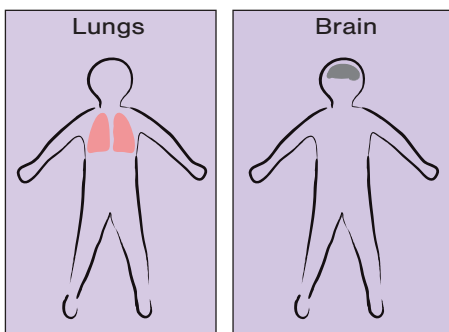
Pertussis (Whooping Cough)

What is pertussis?

The “P” in DTaP stands for pertussis. Pertussis is a bacterium that infects infants, children, adolescents and adults.

Pertussis bacteria make several toxins that cause children to develop thick, sticky mucus that clogs the windpipe and causes *painful spasms of coughing*. When the child breathes in against the narrowed windpipe, it causes a whooping sound — pertussis is also known as “whooping cough.” Coughing spasms make it difficult for children to breathe, eat or drink.

Pertussis bacteria can also cause *pneumonia, seizures and permanent brain damage*.



What is my child’s risk of getting pertussis?

Every year in the United States tens of thousands of cases of pertussis are reported and 15 to 20 people die from the disease. Most of these deaths occur in young infants who are unable to breathe during the severe coughing spasms.

Unfortunately, most cases of pertussis are not reported. It is estimated that about 5% of adults with a cough lasting longer than five days are infected with pertussis. This means that hundreds of thousands of teenagers and adults get pertussis every year! Young children usually catch pertussis from adults who are coughing. Therefore, children who are not immunized against pertussis are at high risk of getting infected.

What is the pertussis vaccine?

The pertussis vaccine is made in the same manner as the diphtheria vaccine.

Because immunity to pertussis fades, a vaccine called Tdap is recommended for adolescents 11 to 12 years of age and for adults who didn't receive it during adolescence. This vaccine is also recommended during *every* pregnancy (between 27 and 36 weeks of gestation), so maternal antibodies can protect newborns from pertussis until they can develop immunity from their own vaccinations.

Does the pertussis vaccine cause any reactions?

Some children will develop local reactions like pain, redness, tenderness or swelling at the site of injection. Mild reactions such as fever, drowsiness and fretfulness can also occur.

The pertussis vaccine can also cause more serious reactions, such as high fever, inconsolable crying lasting for more than three hours, and severe listlessness and lethargy. All of these severe reactions are very rare (occurring in only about 1 child for every 10,000 doses administered), and although scary, they do not cause permanent harm.

Do the benefits of the pertussis vaccine outweigh the risks for my child?

Every year in the United States many children are infected with pertussis and some die from the disease. Although severe reactions are a very rare consequence of the pertussis vaccine, these reactions do not result in permanent harm or death. Therefore, the benefits of the pertussis vaccine clearly outweigh its risks.

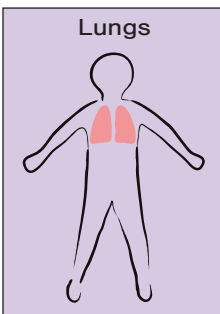
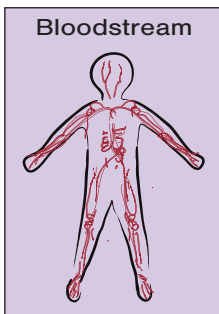
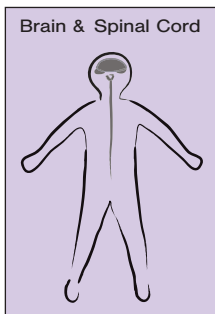


***Haemophilus influenzae* type b (Hib) Vaccine**

What is Hib?

Haemophilus influenzae type b (Hib) is a bacterium that typically infects infants and young children. Hib causes *meningitis*, *bloodstream infections* and *pneumonia*.

About 1 of every 5 children who survive Hib meningitis are left with *mental delays*, *deafness*, *blindness* or *learning disabilities*.



What is my child's risk of getting infected with Hib?

Although fewer than 25 children in the United States are infected with Hib every year, the disease is devastating and can be deadly.

What is the Hib vaccine?

The Hib vaccine is made in the same manner as the pneumococcal vaccine.

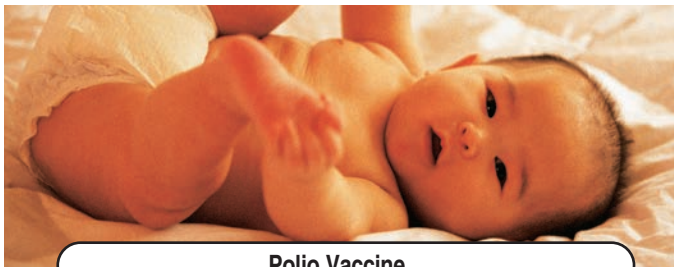
Whereas the pneumococcal vaccine is made using several different types of pneumococcal bacteria, the Hib vaccine is made using only one type of bacteria (type b). That is because type b causes the majority of severe infections in children.

Does the Hib vaccine cause any reactions?

Some children will develop pain, redness or tenderness at the site of injection, or fever after the Hib vaccine.

Do the benefits of the Hib vaccine outweigh the risks for my child?

Because of the Hib vaccine, infections with Hib are now rare in the United States. But they still happen. Therefore, a choice not to get the Hib vaccine is a choice to take a risk that your child will be infected and harmed by Hib. Because the Hib vaccine does not cause serious reactions, the benefits of the Hib vaccine clearly outweigh its risks.



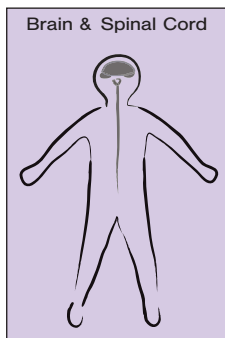
Polio Vaccine

What is polio?

Polio is caused by a virus that typically infects children.

Polio usually causes a mild intestinal infection. However, about 1 out of every 100 people infected with polio will be permanently paralyzed when the virus infects the brain or spinal cord. Usually, polio causes *paralysis of the arms and legs*. But, sometimes, polio causes *paralysis of the muscles needed for breathing*.

Polio is spread from hand to mouth and is very contagious.

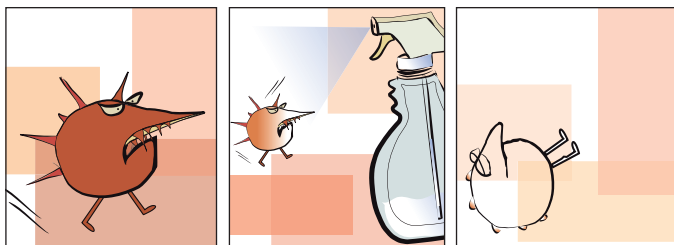


What is my child's risk of getting polio?

Polio has been eliminated from the United States. However, polio still occurs in a few other parts of the world. People from the United States might inadvertently bring polio virus back into the U.S. when returning from a trip. Although we are close to eradicating (completely ridding the world of) polio, a few strongholds remain. Therefore, current immunization programs must remain in place.

What is the polio vaccine?

Three different types of poliovirus infect people. The polio vaccine is made by taking each of these three different types of poliovirus, purifying them, and completely inactivating them with a chemical (formaldehyde). The inactivated polio vaccine is often referred to as IPV.

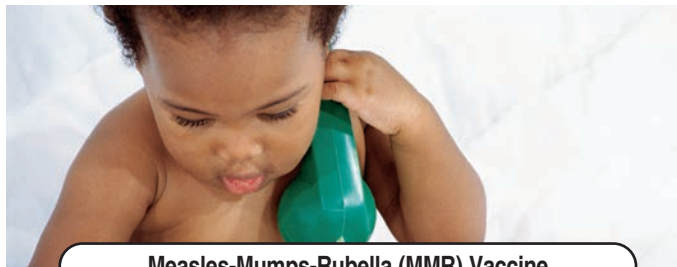


Does the polio vaccine cause any reactions?

Some children given the polio vaccine will develop pain, redness or tenderness at the site of injection.

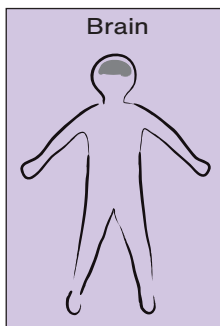
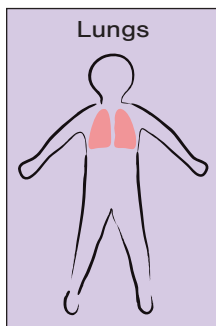
Do the benefits of the polio vaccine outweigh the risks for my child?

Although it has been effectively eliminated from the United States, polio still occurs in several other countries, so entrance of the virus back into the U.S. is always a possibility. Because the polio vaccine does not cause serious reactions, the benefits of the vaccine outweigh its risks.



Measles-Mumps-Rubella (MMR) Vaccine

Measles



What is measles?

Measles is a virus that typically infects young children.

Children with measles have cough, runny nose, fever, “pink eye,” and a rash that starts on the face and spreads to the rest of the body.

Measles virus can also infect the lungs, causing *pneumonia*, and the brain, causing *permanent brain damage* or *death*. Measles is very contagious and is spread by coughing and sneezing.

What is my child’s risk of getting measles?

While few children get measles every year in the United States, recent outbreaks have increased the frequency with which this happens.

What is the measles vaccine?

The measles vaccine is made in the same manner as the chickenpox vaccine (see “How do vaccines work?” pages 5 and 6).

Does the measles vaccine cause any reactions?

Some children given measles vaccine will develop pain, redness or tenderness at the site of injection. In addition, the measles vaccine can cause fever or a rash in about 5% to 10% of recipients. The fever and rash typically occur eight to 10 days after the vaccine is given.

The measles vaccine can also cause a temporary decrease in the number of cells in the bloodstream that are used to help the blood clot (platelets). This reaction is extremely rare (occurring in about 1 in 24,000 children) and is not a cause of death or prolonged hospitalization.

Do the benefits of the measles vaccine outweigh the risks for my child?

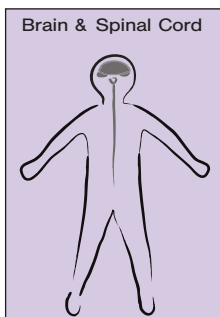
Measles infections are relatively uncommon in the United States. But, measles is a highly contagious infection that can cause severe and occasionally fatal disease. For example, during the late 1980s and early 1990s in the United States, only about 70% of all children were immunized against measles, causing the disease to sweep across the country. More than 11,000 children were hospitalized and 120 died from measles infections during that outbreak. Now, about 90% of children are immunized against measles. But the lesson learned was that measles immunization rates don't have to drop very far for measles to come back. Recent outbreaks in Europe have also shown this to be true.

Of interest, by 2000 measles had been eliminated from the United States. Then in 2014, because enough parents had again chosen not to vaccinate their children, measles came back. Centered on an Amish community in Ohio, about 680 people, mostly children, developed measles. The following year, starting at a Disney theme park in southern California, about 190 more people in 25 states developed measles. In 2019, almost 1,300 cases occurred in the United States. Although about 75% of cases were associated with unvaccinated, close-knit communities in New York, people from more than 30 states were infected. Because severe reactions to the measles vaccine are extraordinarily rare and never fatal, the benefits of the measles vaccine clearly outweigh its risks.

Mumps

What is mumps?

Mumps is a virus that typically infects children and causes a painful swelling of the glands located just below the ear (parotid glands).



Mumps also infects the lining of the brain and spinal cord (*meningitis*) and can cause *permanent hearing loss*.

Mumps can also infect the unborn child in the first trimester of pregnancy and cause *fetal death*.

What is my child's risk of getting mumps?

Several hundred to a few thousand cases of mumps are reported every year in the United States.

What is the mumps vaccine?

The mumps vaccine is made in the same manner as the chickenpox vaccine (see "How do vaccines work?" pages 5 and 6).

Does the mumps vaccine cause any reactions?

Some children will develop pain, redness or tenderness at the site of injection.

Do the benefits of the mumps vaccine outweigh the risks for my child?

Although the risk of getting mumps is fairly low, a few hundred to a few thousand cases are diagnosed each year. So, we need to keep immunization rates high. And, although mumps is usually a mild infection, it can cause meningitis, deafness and fetal death. Because the mumps vaccine does not cause any serious reactions, the benefits of the mumps vaccine clearly outweigh its risks.

Rubella (German Measles)

What is rubella?

Rubella is a virus that typically infects children and causes swelling of the glands behind the ear, mild rash and fever.

Rubella infections are usually mild in young children. However, when a woman is infected with rubella virus during pregnancy, the virus can cause *permanent and severe birth defects* or *miscarriage*.



What is my child's risk of getting rubella?

In 2005, the Centers for Disease Control and Prevention (CDC) declared that rubella had been eliminated from the United States. However, because rubella is still common in many other countries, we need to keep our guard up.

What is the rubella vaccine?

The rubella vaccine is made in the same manner as the chickenpox vaccine (see “How do vaccines work?” pages 5 and 6).

Does the rubella vaccine cause any reactions?

Some children given the rubella vaccine will develop pain, redness or tenderness at the site of injection. The vaccine can also cause a short-lived swelling of the small joints (arthritis). The arthritis caused by the rubella vaccine is temporary and occurs primarily in adolescent girls and women given the vaccine — this reaction is very rare in children.

Do the benefits of the rubella vaccine outweigh the risks for my child?

Rubella has been eliminated from the United States. However, because rubella infections are still common in the world, a drop in immunization rates would increase the likelihood of outbreaks of rubella infections in the U.S.

The rubella vaccine does not cause serious reactions. Therefore, the benefits of the rubella vaccine clearly outweigh its risks.



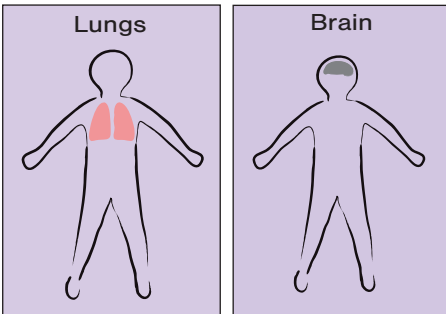
Varicella (Chickenpox) Vaccine

What is varicella?

Varicella (chickenpox) is a virus that typically infects young children, but it can also infect older children and adults who are not immune.

People infected with varicella virus usually develop fever and about 300 to 500 blisters over their entire body. The virus is very contagious and is spread by coughing and sneezing.

Varicella also infects the lungs (*pneumonia*) and the brain (*encephalitis*) and sets the stage for *severe skin infections* (caused by “flesh-eating” bacteria).



Varicella can also infect unborn babies during pregnancy, causing *birth defects* or *fetal death*.

What is my child's risk of getting varicella?

Before the varicella vaccine, almost all children got varicella. The varicella vaccine first became available in 1995. Since that time, the incidence of varicella infections has decreased tenfold. However, varicella infections are still fairly common in the United States.

What is the varicella vaccine?

The varicella vaccine is described in the section, "How do vaccines work?" pages 5 and 6.

Does the varicella vaccine cause any reactions?

Some children will develop reactions like pain, redness or tenderness at the site of injection. Fewer than 5% of children will develop a few blisters after receiving the vaccine.

Do the benefits of the varicella vaccine outweigh the risks for my child?

Before the varicella vaccine became available, every year thousands of children were hospitalized and some were killed by varicella. The varicella vaccine has decreased, but not eliminated, chickenpox infections in the United States.

Because varicella infections are still fairly common, and because the disease is highly contagious, a choice not to get the varicella vaccine is a choice to risk getting varicella. Because the vaccine does not cause any serious reactions, the benefits of the varicella vaccine clearly outweigh its risks.

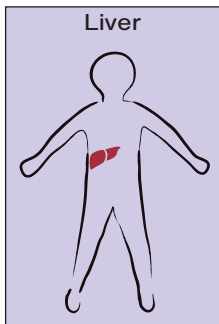


Hepatitis A Vaccine

What is hepatitis A?

Hepatitis A is a virus that infects the liver. People who catch hepatitis A virus often don't have any symptoms. Those who do have symptoms can experience loss of appetite, vomiting, nausea, fatigue and jaundice (yellowing of the eyes and skin). Hepatitis A virus infections are usually much less severe than hepatitis B virus infections.

However, hepatitis A virus can cause a *rapid overwhelming infection of the liver and death.*



What is my child's risk of getting hepatitis A infection?

Hepatitis A virus is usually spread in contaminated food or water. Every year before the vaccine, tens of thousands of people in the United States were infected with hepatitis A, and about 100 died from the disease.

The hepatitis A vaccine is now recommended for all children in the United States.

What is the hepatitis A vaccine?

The hepatitis A vaccine is made in a manner identical to the poliovirus vaccine (see page 20).

Does the hepatitis A vaccine cause any reactions?

About 5 to 10 of 100 children given the hepatitis A vaccine will have pain, warmth or swelling where the shot was given, and about 5 of 100 will have a headache.

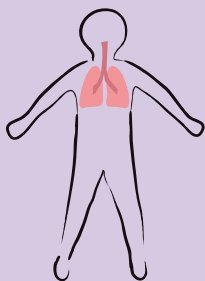
Do the benefits of the hepatitis A vaccine outweigh the risks for my child?

Every year, thousands of people in the United States are infected and some are killed by hepatitis A virus. The hepatitis A vaccine does not cause any severe reactions. Therefore, the benefits of the hepatitis A vaccine clearly outweigh its risks.



Influenza Vaccine

Respiratory System



What is influenza?

Influenza (flu) is a virus that infects the respiratory system (attacking the lining of the nose, windpipe, large breathing tubes, small breathing tubes and lungs).

Every year in the United States, about 200,000 people are hospitalized and thousands to tens of thousands die. Most of the deaths caused by influenza occur in people 65 or older. However, young children are more likely than adults to be hospitalized with infections caused by influenza, and young children commonly transmit influenza virus to parents and grandparents. In addition, children with diseases such as asthma are, like the elderly, at higher risk of developing *severe pneumonia* and *dying* from influenza. Most years about 50 to 150 children in the United States die from influenza. Many of these were previously healthy children.

What is my child's risk of getting influenza infection?

Every year in the United States tens of thousands of children are hospitalized with fever, croup (infection of the voice box), pneumonia, bronchitis (infection of the large breathing tubes) or bronchiolitis (infection of small breathing tubes) caused by influenza virus, and some die. The influenza vaccine is recommended for all people 6 months of age and older.

What is the influenza vaccine?

The influenza vaccine can be composed of live or “inactivated” influenza viruses. The version with live viruses is given as a nasal spray to healthy people between 2 and 49 years of age. Most influenza vaccines are given as a shot, including those given to infants between 6 months and 2 years of age. These are typically made by growing the viruses in eggs, purifying and completely inactivating them with the chemical formaldehyde. Some newer versions are grown in mammalian cells instead of eggs, decreasing concerns related to egg allergies.

The vaccines contain four different strains of influenza viruses likely to cause disease that year.

Does the influenza vaccine cause any reactions?

The influenza vaccine causes fever, muscle aches and fatigue in less than 1 of 100 people given the vaccine. These reactions usually begin six to 12 hours after immunization and can persist for one to two days. Reactions are most likely to occur in children who were not immunized with influenza vaccine or not infected with influenza virus in the past (typically very young children).

Children and adults known to be allergic to eggs can safely receive the influenza vaccine. However, they should remain in the doctor’s office for about 15 minutes after receiving the vaccine.

Do the benefits of the influenza vaccine outweigh the risks for my child?

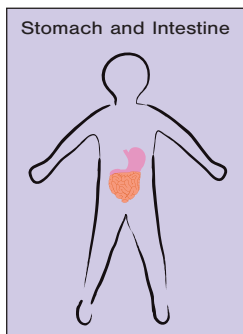
Influenza virus kills about 50 to 150 children every year. In addition, children are commonly hospitalized when influenza virus causes fever, croup, bronchitis, bronchiolitis or pneumonia. Because the vaccine does not cause serious reactions, the benefits of the vaccine clearly outweigh its risks.



Rotavirus Vaccine

What is rotavirus?

Rotavirus is a virus that infects the lining of the intestine. The virus typically infects children between 6 and 24 months of age. In temperate climates, such as the United States, rotavirus is a winter disease.



What is my child's risk of getting infected with rotavirus?

Before the rotavirus vaccine, every year in the United States, rotavirus infected 3 million children. Of those, 500,000 children with rotavirus infection visited the doctor or emergency department, 70,000 were hospitalized, and 40 to 60 died. In fact, 1 of every 50 children born in the United States was hospitalized with rotavirus.

In the world, rotavirus still kills more than 125,000 children each year. About 350 children in the world die *every day* from rotavirus.

What is the harm of infection with rotavirus?

Rotavirus causes three symptoms: *high fever*; *diarrhea*; and *persistent, severe and often unrelenting vomiting*. All three of these symptoms cause children to lose fluids. Also, because the vomiting caused by rotavirus is particularly severe, it is very difficult to get children to take in the fluids that they've lost. For this reason, no virus causes children to be dehydrated as quickly and as severely as rotavirus.

What is the rotavirus vaccine?

The rotavirus vaccine is given by mouth. Two versions are available in the United States. One version is made using a cow rotavirus that contains some proteins also found in human rotaviruses. Cow rotaviruses aren't very good at infecting people. As a consequence, the rotavirus vaccine induces protection against rotavirus without causing symptoms of rotavirus. The other version uses a weakened form of human rotavirus, made in the same manner as the chickenpox vaccine (see "How do vaccines work?" pages 5 and 6).

Does the rotavirus vaccine cause any reactions?

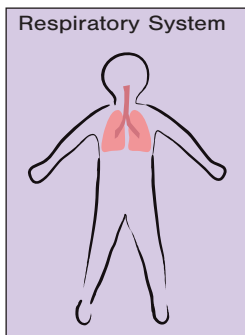
No. The rotavirus vaccine was tested in more than 130,000 children before licensure. Children given the vaccine were not more likely to develop fever, vomiting, diarrhea or other symptoms than those not given the vaccine.

Do the benefits of the rotavirus vaccine outweigh the risks for my child?

Every year, children are hospitalized from rotavirus in the United States. On the other hand, the rotavirus vaccine does not cause mild or severe reactions. Therefore, the benefits of the rotavirus vaccine clearly outweigh its risks.



COVID-19 Vaccine



What is COVID-19?

COVID-19 is a disease caused by a virus known as SARS-CoV-2. The virus infects the respiratory system, but it can also affect various other body systems and organs.

This new virus was first identified in late 2019, and because no one had immunity to it, by the end of 2022, it had killed almost 7 million people worldwide. Most of the deaths caused by SARS-CoV-2 occur in people 65 or older. However, anyone can suffer severe disease or death. In particular, children and younger adults with certain chronic diseases, like obesity or diabetes, and those with weakened immune systems resulting from disease or treatment are, like the elderly, at higher risk of developing *severe disease* and *dying* from COVID-19.

What is my child's risk of getting COVID-19?

The virus that causes COVID-19 spreads through droplets in the air, and because the virus has continued to change (or evolve) since its arrival on the planet in late 2019, virtually everyone is at risk of being infected. Even those who have been sick or vaccinated previously can be infected again. However, vaccination or previous infection has been shown to decrease the likelihood of hospitalization or death from this disease. Since young babies will lack previous exposure, vaccination is important as soon as they are old enough. The COVID-19 vaccine is recommended for all people 6 months of age and older.

What is the COVID-19 vaccine?

The COVID-19 vaccine delivers genetic material specific for the spike protein on SARS-CoV-2 virus, causing our cells to produce the spike protein and generate an immune response against it. The version available for young children uses messenger RNA, or mRNA (Pfizer and Moderna). Another version, available in limited situations for adults (J&J/Janssen), uses DNA delivered by a weakened virus that does not cause illness in people. This type is called a viral vector vaccine. A third type of COVID-19 vaccine (Novavax), available for older children and adults, delivers the spike protein directly. This version is made similarly to the hepatitis B and some influenza vaccines.

Does the COVID-19 vaccine cause any reactions?

The COVID-19 vaccine can cause pain at the injection site, fatigue, headache, fever, chills, muscle aches or joint pain. These reactions usually begin six to 12 hours after immunization and can persist for one to two days.

Although a small number of cases of heart inflammation (myocarditis) have been found to occur in teens and young adults in the first four days after vaccination, this side effect has not been found in younger children. This may be due to the lower doses used in young children.

Do the benefits of the COVID-19 vaccine outweigh the risks for my child?

COVID-19 can cause severe illness that results in hospitalization or death. It can also occasionally lead to a delayed onset condition, called multi-inflammatory syndrome in children, as well as lingering effects, commonly referred to as “long COVID,” including in children and adults who only experienced mild illness.

The COVID-19 vaccine does not typically cause serious reactions. Therefore, the benefits of the vaccine clearly outweigh its risks.



Common Questions and Concerns About Vaccines

Are vaccines safe?

To best answer this question, we must first define what we mean when we say “safe.” If by “safe” we mean completely risk-free, then vaccines aren’t 100% safe. Like all medicines, vaccines have mild side effects, such as pain, tenderness or redness at the site of injection. And some vaccines have very rare, but more serious, side effects.

But nothing is harmless. Anything that we put into our bodies (like vitamins or antibiotics) can have side effects. Even the most routine activities can be associated with hidden dangers.

So a more reasonable definition of “safe” would be that *the benefits of a vaccine must clearly outweigh the risks*. You can think of a vaccine as being like a seat belt. It’s possible that in an accident your child’s seat belt could cause a minor injury, like a bruise. That’s a side effect of wearing one. But if you measure the risk of wearing a seat belt against the risk of not wearing one, the decision to wear a seat belt is an easy one.



For each of the vaccines recommended for children, the benefits far outweigh the risks.

Do we still need vaccines?

Vaccines are still given for three reasons:

1. For common diseases (like chickenpox, pertussis or pneumococcus), a choice not to get a vaccine is a choice to risk natural infection. For example, every year thousands of children are infected with pertussis and some die from the disease. Therefore, it's important to get the vaccine.
2. Some diseases (like measles, mumps or Hib) still occur in the United States at low levels. If immunization rates drop, even by as little as 10% to 15%, these diseases will come back.
3. While some diseases (like polio, rubella or diphtheria) have been either completely or virtually eliminated from the United States, they still occur in other parts of the world. Polio still commonly paralyzes children in Africa, diphtheria still kills children in Russia, and rubella still causes birth defects and miscarriages in many parts of the world. Because international travel is common, these diseases are only a plane ride away from coming back into the United States.

Are children too young to get vaccines?

If infants aren't too young to be permanently harmed or killed by viruses or bacteria, then they aren't too young to be vaccinated to prevent those diseases.

The diseases that vaccines prevent often occur in very young infants. For example, before vaccines, thousands of young infants were hospitalized or killed by diseases like whooping cough, bloodstream infections (sepsis), meningitis and pneumonia — diseases that can now largely be prevented by vaccines. The only way to keep young infants from getting these diseases is to give them vaccines soon after they are born. Fortunately, infants given vaccines in the first few months of life are quite capable of making a protective immune response.

Can children manage so many different vaccines at the same time?

The mother's womb is essentially a sterile environment. The fluid surrounding the baby is free from bacteria. However, within minutes of leaving the womb, the child must confront thousands of bacteria. By the end of the first week of life, the child's skin, nose, throat and intestines are covered with tens of thousands of different bacteria.



Fortunately, from the moment of birth, infants begin to develop an active immune response to these bacteria — an immune response that prevents these bacteria from entering the bloodstream and causing harm.

The vaccines that children receive in the first two years of life are just a drop in the ocean when compared to the tens of thousands of environmental challenges that babies successfully manage every day.

Do vaccines weaken the immune system?

Sometimes infections with natural viruses can weaken the immune system. For example, children infected with influenza virus are at risk of developing severe bacterial pneumonia. Also, children infected with chickenpox virus are at risk of developing severe infections of the skin caused by “flesh-eating” bacteria.

However, because the bacteria and viruses contained in vaccines are highly weakened versions of natural bacteria and viruses, they do not weaken the immune system. On the contrary, vaccines prevent infections that weaken the immune system.

Can't we give vaccines by a method other than shots?

Viruses and bacteria usually damage children by first entering the bloodstream. So, the best way to fight off these infections is to make antibodies that are present in the blood during an infection. By giving vaccines as shots, we ensure that the body has antibodies in the blood or can quickly make them.

For example, diseases like hepatitis B and chickenpox can be prevented by giving a vaccine even *after* a child is exposed to these viruses. This is because antibodies in the bloodstream are made more quickly after vaccination by shot than they are made after natural infection.

Can vaccines cause long-term diseases like multiple sclerosis, diabetes, hyperactivity, autism or asthma?

When one event precedes another, we often wonder whether they are related.

For example, some people who smoke a lot of cigarettes get lung cancer. But “Does cigarette smoking cause lung cancer?” To answer this question, a number of studies performed in the 1960s compared the incidence of lung cancer in people who smoked cigarettes with that in people who didn’t smoke. The best studies “matched” these two groups of people with regard to age, general health, medications and so on. By “matching” these groups, they made sure that the only difference between them was cigarette smoking. The result was clear: Cigarette smoking caused lung cancer.

Similarly, some people who use cell phones get brain cancer. But “Do cell phones cause brain cancer?” To answer this question, the incidence of brain cancer in people who used cell phones was compared with that in people who didn’t. Again, these groups were “matched” to make sure that the only difference between them was cell phone use. The result was also clear: Cell phones didn’t cause brain cancer.

Because vaccines are given to almost all children, many children with diseases like autism, asthma or hyperactivity will have received vaccines. And some of these children will have received vaccines recently. The question is: “Did the vaccine cause the disease?” The best way to answer this question is to do studies similar to those described for smoking and cell phones.

Although not all potential associations have been studied, many have. What we do know is that vaccines don’t cause autism, diabetes, multiple sclerosis, allergies, asthma or permanent brain damage.

Vaccine Schedule

Below is a likely schedule for all routinely recommended vaccines for infants and young children. Most vaccines are given as a series of shots (shown as #1, #2, etc.). Some of these vaccines may be given in combination (such as DTaP-Hib or Hib-Hep B). Also, as more combinations of vaccines become available, this schedule may change. Because the schedule of vaccines is somewhat flexible, the one used by your doctor may vary from the one below.

The following abbreviations will be used:

Hep B – Hepatitis B Vaccine

DTaP – Diphtheria-Tetanus-acellular Pertussis Vaccine

IPV – Inactivated Polio Vaccine

Pneum – Pneumococcal Vaccine

Hib – *Haemophilus influenzae* type b Vaccine

MMR – Measles-Mumps-Rubella Vaccine

Varicella – Varicella (Chickenpox) Vaccine

Rota – Rotavirus Vaccine

Hep A – Hepatitis A Vaccine

Influenza – Influenza Vaccine

COVID – COVID-19 Vaccine

BIRTH	2 MONTHS	4 MONTHS	6 MONTHS	6-18 MONTHS	4-6 YEARS
Hep B #1	Hep B #2	---	---	Hep B #3	---
---	DTaP #1	DTaP #2	DTaP #3	DTaP #4	DTaP #5
---	IPV #1	IPV #2	---	IPV #3	IPV #4
---	Hib #1	Hib #2	Hib #3*	Hib #3 or #4	---
---	Pneum #1	Pneum #2	Pneum #3	Pneum #4	---
---	---	---	---	MMR #1	MMR #2
---	---	---	---	Varicella #1	Varicella #2
---	Rota #1	Rota #2	Rota #3*	---	---
---	---	---	---	Hep A**	---
			Influenza – annually, beginning at 6 months of age [†]		
			COVID – 3 or 4 doses depending on brand and immune system status		

*Dose if it's needed, depending on version of vaccine administered.

**The hepatitis A vaccine is given as a series of two shots, the second of which is given six to 12 months after the first.

†The influenza vaccine is recommended for all children in the United States 6 months of age and older. The first time a child gets the influenza vaccine, it is given as a series of two shots. The second shot is given at least one month after the first. In subsequent years, the child only requires one dose.

Resources

We hope that the information provided in this booklet has answered your questions about vaccines. If you would like to know more about vaccines, vaccine safety, the science behind vaccines, or the process by which vaccines are tested and approved for use, here are some other sources of information that you may find useful.

Websites

The Vaccine Education Center at Children's Hospital of Philadelphia (VEC) is composed of physicians, scientists, mothers and fathers interested in explaining the science of vaccines in a clear and straightforward manner. The website is **vaccine.chop.edu**.

Parents PACK is a program administered by the VEC that parents can join to receive monthly e-newsletters and updates about vaccines. The website is **vaccine.chop.edu/parents**.

The American Academy of Pediatrics (AAP) is an organization of pediatricians interested in promoting the health and well-being of children. In addition to their interest in all aspects of healthcare for children, the AAP has information about vaccines on their website at **aap.org/immunization**.

Immunize.org is a nonprofit organization that works to boost immunization rates and prevent disease. The organization provides excellent and timely information, including practical tips about vaccine use and translations of vaccine information in many languages. The website is **immunize.org**.

Vaccine Information for the Public and Health Professionals is a site administered by Immunize.org and is designed for the public and healthcare professionals. The website is **vaccineinformation.org**.

Vaccinate Your Family is an immunization awareness campaign that aims to protect people from vaccine-preventable diseases. The website is **vaccinateyourfamily.org**.

Institute for Vaccine Safety is based at the Johns Hopkins Bloomberg School of Public Health and provides excellent, thorough and up-to-date information on vaccine safety. The website is **vaccinesafety.edu**.

The Sabin Vaccine Institute aims to make vaccines more accessible for citizens around the globe. The website is **sabin.org**.

Autism Science Foundation (ASF) is a nonprofit organization that funds autism research and supports individuals and families affected by autism. The website is **autismsciencefoundation.org**.

Voices for Vaccines is a parent-driven organization that provides parents clear, science-based information about vaccines and an opportunity to join the national discussion about the importance of on-time vaccination. The website is **voicesforvaccines.org**.

National Resource Center for Refugees, Immigrants, and Migrants (NRC-RIM) is a national center based at the University of Minnesota that focuses on providing resources to health departments and community groups working with populations affected by health inequities. They offer vaccine-related information in a variety of languages. The website is **nrcrim.org**.

Books

Baby 411: Clear Answers and Smart Advice for Your Baby's First Year, 10th Edition (Windsor Peak Press, 2022), co-written by Denise Fields and Ari Brown, MD.

Vaccines and Your Child: Separating Fact from Fiction (Columbia University Press, 2011), co-written by Paul A. Offit, MD, and Charlotte A. Moser.

The Complete Idiot's Guide to Vaccinations (Penguin Group USA, 2009), co-written by Michael J. Smith, MD, MSCE, and Laurie Bouck.

Do Vaccines Cause That?! A Guide for Evaluating Vaccine Safety Concerns (i4ph, 2008), co-written by Martin G. Meyers, MD, and Diego Pineda.

Vaccines: What Everyone Needs to Know (Oxford University Press, 2017), written by Kristen Feemster, MD.

Pamphlets and Informational Sheets

Vaccine Information Statements (VIS) on all childhood and adult vaccines are offered by the Centers for Disease Control and Prevention (CDC) and can be found at **[cdc.gov/vaccines/hcp/vis/index.html](https://www.cdc.gov/vaccines/hcp/vis/index.html)**.

Various informational tear sheets and booklets are available for download from the Vaccine Education Center at Children's Hospital of Philadelphia at **[vaccine.chop.edu/resources](https://www.vaccine.chop.edu/resources)**.

Videos

Videos are available from the Vaccine Education Center at Children's Hospital of Philadelphia at vaccine.chop.edu/videos.

Online Course

The Vaccine Quest is a free online course offered by Voices for Vaccines, a parent advocacy group. The course is designed for anyone who wants to learn more about vaccines at voicesforvaccines.org/course/the-vaccine-quest.

Hotlines

The Centers for Disease Control and Prevention Contact Center answers questions about vaccines in English or Spanish. The Center can be reached by calling 800-CDC-INFO [800-232-4636] or completing the form at cdc.gov/cdc-info.

Mobile Apps

Vaccines on the Go: What You Should Know was developed by the Vaccine Education Center at Children's Hospital of Philadelphia and is available on both iPhone and Android platforms. The app contains information about vaccines and the diseases they prevent, as well as interactive components, such as games, places to save or email questions, and links to other VEC resources. Learn more or download at vaccine.chop.edu/mobileapp.

Voices for Vaccines free mobile app offers help for debunking misinformation and starting vaccine conversations. Learn more or download at voicesforvaccines.org/resources.



Vaccine Record

Below is a list of the recommended childhood immunizations. Please have your child's physician or other healthcare professional fill in the date that your child receives a vaccine.

Number of Doses

Vaccine	#1	#2	#3	#4	#5	#6
Hep. B						
DTaP						
Hib						
Polio						
Pneumo						
MMR						
Varicella						
Influenza						
Hep. A						
Rota						
COVID						
Other						

Child's Name _____ Date of birth _____

Comments/Notes: _____





VACCINES
and your

Baby



**Children's Hospital
of Philadelphia®**

Vaccine Education Center

About the Vaccine Education Center:

The Center was formed in October 2000 to provide accurate, comprehensive and up-to-date information about childhood vaccines, and the diseases they prevent, to parents and healthcare professionals. “Vaccines and your Baby” was written and produced by the Vaccine Education Center at Children’s Hospital of Philadelphia.

The Vaccine Education Center is funded by endowed chairs from the Children’s Hospital of Philadelphia. The Center does not receive support from pharmaceutical companies.

For more information about vaccines,
visit the Vaccine Education Center websites at
vaccine.chop.edu
and
vaccine.chop.edu/parents



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