Vaccines Require More Than One Dose There are four reasons that babies—and even teens or adults—who receive a vaccine for the first time may need more than one dose: • For some vaccines (primarily inactivated vaccines), the first dose does not provide as much immunity as possible. So, more than one dose is needed to build more complete immunity. The vaccine that protects against the bacteria Hib, which causes meningitis, is a good example. • For some vaccines, after a while, immunity begins to wear off. At that point, a "booster" dose is needed to bring immunity levels back up. This booster dose usually occurs several years after the initial series of vaccine doses is given. For example, in the case of the DTaP vaccine, this protects against diphtheria, tetanus and pertussis, the initial series of four shots that children receive as part of their infant immunizations helps build immunity. But a booster dose is needed at 4 years through 6 years old. Another booster against these diseases is needed at 11 years or 12 years of age. This booster for older children—and teens and adults, too—is called Tdap. • For some vaccines (primarily live vaccines), studies have shown that more than one dose is needed for everyone to develop the best immune response. For example, after one dose of the MMR vaccine, some people may not develop enough antibodies to fight off infection. The second dose helps make sure that almost everyone is protected. • Finally, in the case of flu vaccines, adults and children (6 months and older) need to get a dose every year.

Why aren't all vaccines 100% effective?

Vaccines are designed to generate an immune response that will protect the vaccinated individual during future exposures to the disease. Individual immune systems, however, are different enough that in some cases, a person's immune system will not generate an adequate response. As a result, he or she will not be effectively protected after immunization.That said, the effectiveness of most vaccines is high. After receiving the second dose of the MMR vaccine (measles, mumps and rubella) or the standalone measles vaccine, 99.7% of vaccinated individuals are immune to measles. The inactivated polio vaccine offers 99% effectiveness after three doses. The varicella (chickenpox) vaccine is between 85% and 90% effective in preventing all varicella infections, but 100% effective in preventing moderate and severe chicken pox.

Is natural immunity better than vaccine-acquired immunity?

In some cases, natural immunity is longer-lasting than the immunity gained from vaccination. The risks of natural infection, however, outweigh the risks of immunization for every recommended vaccine. For example, wild measles infection causes encephalitis (inflammation of the brain) for one in 1,000 infected individuals. Overall, measles infection kills two of every 1,000 infected individuals. In contrast, the combination MMR (measles, mumps and rubella) vaccine results in a severe allergic reaction only once in every million vaccinated individuals, while preventing measles infection. The benefits of vaccine-acquired immunity extraordinarily outweigh the serious risks of natural infection.

Additionally, the Hib (Haemophilus influenzae type b) and tetanus vaccines actually provide more effective immunity than natural infection.

Why do some vaccines require boosters?

It's not completely understood why the length of acquired immunity varies with different vaccines. Some offer lifelong immunity with only one dose, while others require boosters in order to maintain immunity. Recent research has suggested that the persistence of immunity against a particular disease may depend on the speed with which that disease typically progresses through the body. If a disease progresses very rapidly, the immune system's memory response (that is, the "watchdog antibodies" generated after a previous infection or vaccination) may not be able to respond quickly enough to prevent infection—unless they've been "reminded" about the disease fairly recently and are already watching for it. Boosters serve as a "reminder" to your immune system.

Can you get a disease from the vaccine that's supposed to prevent it? And why do some vaccines have live pathogens but others have killed pathogens?

Vaccines that are made with killed versions of pathogens—or with only a part of the pathogen—are not able to cause illness. When a person receives these vaccines, it is impossible for him or her to become ill with the disease.Live, attenuated (or weakened) vaccines are theoretically capable of causing illness: because they can still replicate (though not well), mutation is possible, which can result in a virulent form of the pathogen. However, they are designed with this in mind, and attenuated to minimize this possibility. Reversion to virulent form is a problem with some forms of the oral polio vaccine (OPV.It is important to note that attenuated vaccines can cause serious problems for individuals with weakened immune systems, such as cancer patients. These individuals may receive a killed form of the vaccine if one is available. If not, their doctors may recommend against vaccination. In such cases, individuals rely on herd immunity for protection.As to why some vaccines contain live pathogens and others contain killed pathogens, the reasons vary by illness. However, generally speaking, live, attenuated vaccines generate longer-lasting immunity than killed vaccines. Thus, killed vaccines are more likely to require boosters to maintain immunity. Killed vaccines, however, also tend to be more stable for storage purposes, and can't cause illness.