Q&A

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Too Many Vaccines? What you should know

The Children's Hospital of Philadelphia®
VACCINE EDUCATION CENTER

Today, young children receive vaccines to protect them against 14 different diseases. Because some vaccines require more than one dose, children can receive as many as 27 inoculations by 2 years of age and up to five shots at one time. For this reason, some parents now ask their doctors to space out, separate or withhold vaccines. The concern that too many vaccines might overwhelm a baby's immune system is understandable, but the evidence that they don't is reassuring.

Q. What are the active components in vaccines?

A. Vaccines contain parts of viruses or bacteria that induce protective immune responses. These active ingredients are called immunological components.

Vaccines that protect against bacterial diseases are made from either inactivated bacterial proteins (e.g., diphtheria, tetanus and whooping cough [pertussis]) or bacterial sugars called polysaccharides (e.g., *Haemophilus influenzae* type b [Hib] and pneumococcus). Each of these bacterial proteins or polysaccharides is considered an immunological component, meaning that each evokes a distinct immune response.

Vaccines that protect against viral diseases (e.g., measles, mumps, rubella, polio, rotavirus, hepatitis A, hepatitis B, chickenpox and influenza) are made of viral proteins. Just like bacterial proteins, viral proteins induce an immune response.

Q. Do children encounter more immunological components from vaccines today than they did 30 years ago?

A. No. Although children receive more vaccines now than ever before, most people would probably be surprised to learn that the number of immunological components in vaccines has dramatically decreased.

Thirty years ago, children received vaccines that protected against eight diseases: measles, mumps, rubella, diphtheria, tetanus, pertussis, *Haemophilus influenzae* type b and polio. The total number of bacterial and viral proteins contained in these vaccines was a little more than 3,000.

Today, children receive vaccines that protect against 14 diseases, but the total number of immunological components in these vaccines is only about 150. This dramatic reduction is the result of scientific advances that have allowed for purer, safer vaccines.

Q. Can too many vaccines overwhelm an infant's immune system?

A. No. Compared to the immunological challenges that infants handle every day, the challenge from the immunological components in vaccines is minuscule. Babies begin dealing with immunological challenges at birth. The mother's womb is a sterile environment, free from viruses, bacteria, parasites and fungi. But after babies pass through the birth canal and enter the world, they are immediately colonized with trillions of bacteria, which means that they carry the bacteria on their bodies but aren't infected by them. These bacteria live on the skin, nose, throat and intestines. To make sure that colonizing bacteria don't invade the bloodstream and cause harm, babies constantly make antibodies against them.

Colonizing bacteria aren't the only issue. Because the food that we eat and the dust that we breathe contain bacteria, immunological challenges from the environment are unending. Viruses are also a problem. In the first few years of life, children are constantly exposed to a variety of different viruses that cause runny noses, cough, congestion, fever or diarrhea.

Given that infants are colonized with trillions of bacteria, that each bacterium contains between 2,000 and 6,000 immunological components, and that infants are infected with numerous viruses, the challenge from the 150 immunological components in vaccines is minuscule compared to what infants manage every day.

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Q. How many vaccines can children effectively handle at one time?

A. A lot more than they're getting now. The purpose of vaccines is to prompt a child's body to make antibodies, which work by preventing bacteria and viruses from reproducing themselves and causing disease. So, how many different antibodies can babies make? The best answer to this question came from a Nobel Prize-winning immunologist at the Massachusetts Institute of Technology named Susumu Tonegawa, who first figured out how people make antibodies.

Tonegawa discovered that antibodies are made by rearranging and recombining many different genes, and found that people can make about 10 billion different antibodies. Given the number of antibody-producing cells in a child's bloodstream, and the number of immunological components contained in vaccines, it is reasonable to conclude that babies could effectively make antibodies to about 100,000 vaccines at one time. Although this number sounds overwhelming, remember that every day children are defending themselves against a far greater number of immunological challenges in their environment.

Q. How do we know that multiple vaccines can be given safely?

A. The Food and Drug Administration (FDA) requires extensive safety testing before vaccines are licensed. Before a new vaccine can be licensed by the FDA, it must first be tested by something called "concomitant use studies." Concomitant use studies require new vaccines to be tested with existing vaccines.

These studies are performed to make sure the new vaccine doesn't affect the safety or effectiveness of existing vaccines given at the same time, and vice versa. Because concomitant use studies have been required for decades, many studies have been performed showing that children can be inoculated with multiple vaccines safely.

Q. What is the harm of separating, spacing out or withholding vaccines?

A. Delaying vaccines can be risky. The desire by some parents to separate, space out or withhold vaccines is understandable. This choice, however, is not necessarily without consequence.

First, delaying vaccines only increases the time during which children are susceptible to certain diseases, some of which are still fairly common. Chickenpox, whooping cough (pertussis), *Haemophilus influenzae* type b, influenza and pneumococcus still cause hospitalizations and deaths in previously healthy children every year. And, for example, before the chickenpox vaccine, every year about 70 children died from the disease.

Second, spacing out or separating vaccines will require children to visit the doctor more often for shots. Researchers have found that children experience similar amounts of stress, as measured by secretion of a hormone called cortisol, whether they are getting one or two shots at the same visit. This study suggests that although children are clearly stressed by receiving a shot, two shots aren't more stressful than one. For this reason, more visits to the doctor created by separating or spacing out vaccines will actually increase the trauma of getting shots.

References

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