



Vaccines 101: Too Much Too Soon?

By [Dr. Alison Shuman](#) September 7, 2016

Just yesterday I was sitting with expectant parents whose first baby is due next week. They both support vaccinating their daughter on the recommended CDC schedule, but mom comes from a family that is strongly opposed to vaccination. Understandably, she has many questions and concerns, so mom and dad were there to talk to me and get answers.

There is so much out there about vaccines coming at parents from all sides; new parents are bombarded with an endless supply of opinions, ideas and recommendations from the internet, doctors, friends, family, celebrities and politicians. It can be difficult to know what and whom to trust. Every parent's only goal is the same as this young family's: protect your child as best you can. When it comes to vaccination many parents ask *"What does my decision about vaccination mean for my child?"*

Before we answer that question, we should talk about what vaccines are made of and how they work. A vaccine is a way of training your body's immune system to defend itself against a foreign invader like a virus or bacteria, without launching a full-scale attack like it does when you get sick. In medicine we call these foreign invaders (that is, not made of us) antigens. An antigen is any substance that stimulates a response from your immune system. Once the immune system spots antigens, it creates antibodies that help fight off the antigen. If the immune system has never seen an antigen before, you get sick while the immune system tries to fight off the invader. If the immune system *has* seen it before, the antibodies released act like a roadblock. They shut the invader down and you don't get sick. If you want to read more about how the immune system works, [you can read Pediatric Allergist and Immunologist Dr. David Stukus' post about your child's immune system.](#)

Our environment and everything in it is made of up proteins and antigens, there's no way to escape them. Our babies are exposed to antigens when they breastfeed, lay on a blanket, crawl on the floor, chew on an apple slice, even just breathing and existing. Each of these activities exposes a baby to hundreds of antigens. [The labor and delivery process naturally exposes them to hundreds and hundreds of antigens.](#)

To be clear, not all antigens are infectious, but the amazing thing about our immune system is how many antigens it is built to manage every single day. Our immune system is pretty good at handling mildly infectious antigens like the common cold (10 antigens) and strep throat (25-50 antigens). On average children get an infection about 8-12 times a year in the first few years of life (you're not imagining it, parents, your kids actually are sick for about half the year) your child has been exposed to more antigens than in all doses of all recommended vaccines combined.

Like everything in the environment, vaccines contain antigens. The antigens in vaccines are either dead, weakened, or synthetic, depending on the specific vaccine. Because our immune system isn't exposed to the full virulence of the antigen (as it would be if we encountered the antigen in the wild) our immune system is able to learn how to defend itself against the virus or bacteria without the patient getting sick. Vaccines make it an easy fight for your immune system to win. And the great thing is that it doesn't matter to your immune system how you became immune (either by getting sick and then getting better or through a vaccine), immunity is immunity. The benefit from acquiring immunity through a vaccine is that your child never gets the illness, or has any of the associated risks from the illness, and they don't pass the illness along to anyone else.

The family I spoke with yesterday had one of the same concerns I've heard from many parents: "There are so many more vaccines than when I was a kid, and now they combined some of them into one shot...doesn't that increase the risk of bad reactions? Can't that overwhelm my baby's system? Isn't this too much too soon?"

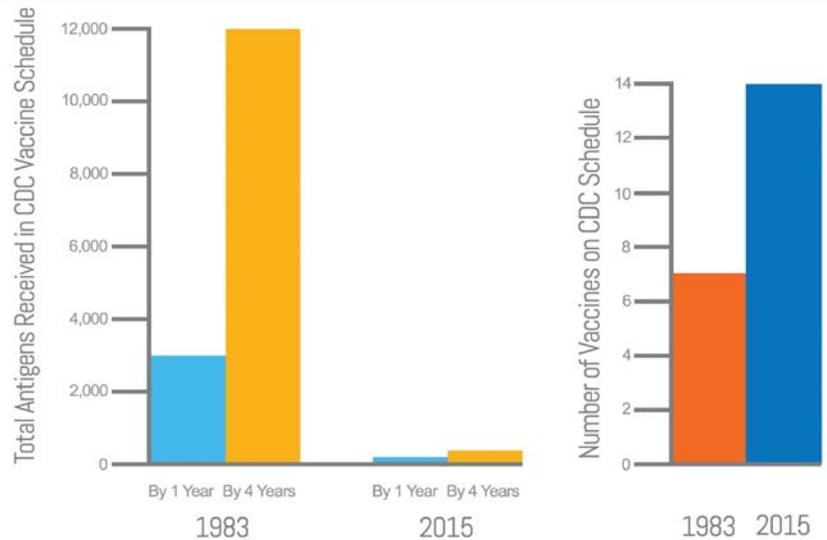
The simple answer is: though you and I had fewer vaccines as kids, your child is actually being exposed to fewer antigens and preservatives than we were.

When we were children (70s, 80s and early 90s) we were vaccinated against fewer things (which were nonetheless still deadly). Let's take the [CDC's vaccine schedule from 1983 for example](#). There were seven diseases we were protected against including measles, mumps, rubella, (MMR), Diphtheria, tetanus and pertussis (DTaP) and polio. Because of how vaccines were made at the time, we were exposed to [about 3,000 antigens by the time we were 12 months old and 12,000 by the time we were 4](#) if we got all of our vaccines.

Today's CDC schedule provides protection against 14 diseases before the age of two. If a child today receives all their vaccines on schedule and has received all doses by 12 months, they will have been exposed to 150-204 antigens, depending on the timing of their 12-month shots. If they have received all the recommended vaccines by age four, depending on the timing of their four-year shots, they will have been exposed to exactly 359 antigens for ALL vaccines from birth through age four.

When you compare 204 and 359 antigens to about 3,000 to 12,000, just 30-40 years ago, that's a huge reduction in exposure as well as additional protection against 6 more diseases! Additionally, as the antigen dose in each vaccine has decreased, there has been a corresponding drop in both the amount of preservatives in each vaccine, and the total amount of preservatives received (fewer antigens means fewer preservatives). We have refined and improved our vaccines so much that our children today are even safer than we were. So when you worry about exposing your children to so many "more" things, don't worry, you aren't! You are exposing them to fewer antigens than all of us got. If you are wondering how many antigens are in certain vaccines, the hepatitis B, diphtheria and tetanus vaccines each contain just one antigen.

Antigens in Early Childhood Vaccines



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Another question I hear from a number of parents is whether or not it's really necessary to protect children from so many viruses and bacteria. "I got the chicken pox as a kid, my mom even made me play with the neighbor who had it, so why does my kid need a vaccine for it?"

Before the chicken pox (varicella) vaccine was introduced, about 100 children died every year from chicken pox. This may not seem like a lot. But if it is your child, it is the only one that matters. Since the introduction of the vaccine, [varicella deaths have declined 99% during 2008 to 2011 as compared with 1990 to 1994 before the vaccine was introduced](#). The reason our parents wanted us to get chicken pox as a child was to prevent a much more severe infection as a teen or adult. The chicken pox is even more severe as you get older. So back when we were kids, catching it early was the safest possible choice. Today, we have an even safer choice: prevent the disease completely with a vaccine.

The family I saw yesterday also had one of the most common questions I hear about how vaccines are administered: "why are so many vaccines given in combination shots? Isn't it safer to give one vaccine at a time and space them out?"

The short answer, and again this is counterintuitive, is that it actually increases your child's risk of experiencing an adverse reaction to a vaccine if they are given one at a time.

In some vaccines, we're able to combine the antigens for multiple viruses or bacteria into one shot. This allows us to actually give not just fewer total antigens but smaller amounts of each antigen, as the multiple components of the vaccine work together to improve the body's immune response.

When vaccines are given one at a time, the antigen amount increases, as does the amount of preservatives, to produce the necessary immune system response. It seems strange that a combination vaccine has fewer antigens than a single vaccine, but it's true.

When you break up those vaccines you're exposing your child to more antigens and if you double or triple the number of shots they're getting because you've cut out the combination shots, you're increasing the risk of an adverse reaction. Multiple studies show that children who receive [individual or delayed vaccines instead of combination shots actually have increased side effects and adverse effects for this reason and others](#).

Besides that, we know that shots hurt, and combination vaccines means fewer "pokes" for your baby, which is always a good thing!

The final question this family had was about preservatives in vaccines, including aluminum and mercury, which was something the wife's family had brought up as a concern about vaccines. *"They want to know how it can be safe for their grandchild to be injected with metals like this into their bloodstream?"*

Aluminum is the most abundant metal on earth. It occurs naturally in rocks and soil. In fact we all have aluminum in our bodies right now just by [drinking water and eating plants and fish that naturally contain small amounts of it. Infants get more aluminum into their system in a year from breastmilk than they do from all the vaccines they get in that year combined](#). Breastfeeding for a year gives a child 7 milligrams of aluminum, formula feeding can give up to 117 milligrams in a year. All of the vaccines combined in the first year provide 4.4 milligrams.

Aluminum salt is used in vaccines as an adjuvant. An adjuvant boosts the immune system's response to the antigen. The amount of aluminum salt in each vaccine [is well below what would be considered toxic for an infant](#). Like we say all too frequently in medicine, the dose makes the poison.

Now, on to the mercury question. The mercury in vaccines is known commercially as thimerosal, which has about 50% mercury content and is used as a preservative. Why was this ever used in the first place? It acts to keep the vaccine fresh in storage. It is also important to know that there are different types of mercury. Thimerosal contains ethylmercury, which is the naturally occurring form of mercury, and *not* methylmercury which is an industrial byproduct that builds up in fish and in the human body.

In the mid-1990s thimerosal was removed from all single-dose pediatric vaccines in the U.S. in response to public outcry over its use. Some but not all brands of multi-dose influenza vaccines still contain thimerosal. Despite a lack of evidence that the preservative in its dose in vaccines posed a health risk, the CDC recommended the removal in hopes of calming public fears, [but the move had the opposite effect](#). Doctors and public health professionals like myself have been wringing our hands at the move ever since.

While many studies [have failed to show any harm from thimerosal in vaccines](#), regardless, you don't even need to ask the question anymore. Thimerosal is no longer in the vaccines your child is going to get.

Additionally I need to clarify one important misconception about vaccinations. It's important to know that when we vaccinate a child we are not injecting things into their bloodstream. Vaccines go into the skin or muscle and the body then responds to them there. They are not injected into a vein or artery.

Now, you may say, *"Well, yes, Dr. Ali, of course you say all this, you support vaccinating, you probably get paid by big pharma to push vaccines."* Well, the first part of that is true, I do support vaccinating for the very reasons listed in this article. I support vaccinating because my years of medical education, training and hands-on experience have shown me that the [science and extensive research accurately reflects how safe our vaccines are](#). I have had the misfortune of seeing how quickly these preventable diseases can injure or even kill a child. When you are the doctor of a child that dies from a vaccine preventable disease, it stays with you forever.

The second part of the statement is not true. As fellow pediatrician Dr. Jaime Friedman has explained on this blog, [your pediatrician is not allowed to be paid by a pharmaceutical company to promote a drug or product](#). We aren't allowed to

accept any form of compensation, including goods, services or even a free lunch from a pharmaceutical rep. Additionally, big pharma makes most of their money off drugs that are patented (meaning only one company can sell the product). The

patents on most early childhood vaccines expired decades ago, so pharmaceutical companies have no incentive to push them on doctors, even if they were allowed to. I am firmly not in the pocket of big pharma.

Like the young family in my office the other day, as a parent your only goal is to protect your child and that's what it means when you vaccinate your child. Just like the young family in my office yesterday, your decision to vaccinate your child

means you are protecting them as best you can from significant illnesses. I hope this information has helped answer questions about how vaccinating them lets you do just that.

About the Author:



Dr. Alison Shuman lives in Santa Paula, California with her husband. She is unable to have children of her own, but takes great joy in being the auntie and part of the village raising the children of many of her closest friends, many of whom she's helped raise since they were born. She is also the proud aunt to Lucy Luna, a feisty 6 month old whose parents face many of the questions she sees her own patients handle every day. Dr. Shuman graduated Valedictorian from her Rutgers Medical School and completed her Pediatric Residency and 18 months of Pediatric Critical Care Medicine Fellowship at New York Presbyterian Hospital Komansky Children's Hospital in New York City. She has been a Pediatric Hospitalist and General Pediatrician in Ventura County since 2008, where she has served as the Chair of Pediatrics and the Director of Pediatric Hospital Medicine for Community Memorial Hospital.

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