Vaccine Risks Are Outweighed by the Risks of Not Vaccinating

Should Vaccinations be Manditory?, 2010

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> Many people concerned about vaccines spread disinformation about the need for childhood vaccination. Vaccines work very well to prevent disease and are necessary, even though the diseases they prevent are not common—in fact, vaccines are part of the reason this is so. Vaccines are not entirely harmless, but the small risks are outweighed by the benefits of disease prevention. Despite claims by critics, babies can tolerate the a high number of vaccines, and these vaccines prevent diseases that can occur in infancy. Studies have disputed claims by critics that autism is caused by a particular vaccine.

It seems that almost every month newspaper articles and television programs depict the horrors of vaccines. The villains of these stories are greedy vaccine manufacturers, disinterested doctors, and burdensome regulatory agencies. The focus of the stories is that children are hurt unnecessarily by vaccines, and the tone is one of intrigue and cover-up.

Perhaps the most dangerous part of these stories (apart from the fact that they may cause many children to miss the vaccines they need) is that the explanations are presented in a manner that seems believable. Below we have listed the most commonly aired stories about vaccines and have tried to separate fact from myth.

The Myth That Vaccines Do Not Work

Probably the best example of the impact of vaccines is the vaccine that prevents meningitis caused by the bacterium *Haemophilus influenzae* type b (Hib).

> Vaccines not only work, but they work phenomenally well.

The current Hib vaccine was first introduced to this country in 1990. At that time Hib was the most common cause of bacterial meningitis, accounting for approximately 15,000 cases and 400 to 500 deaths every year. The incidence of cases and deaths per year had been steady for decades. After the current Hib vaccine was introduced, the incidence of Hib meningitis declined to fewer than fifty cases per year! The power of the Hib vaccine is that most pediatricians and family practitioners working today saw its impact.

The story of the Hib vaccine is typical of all widely used vaccines. A dramatic reduction in the incidence of diseases such as measles, mumps, German measles [rubella], polio, diphtheria, tetanus, and pertussis [whooping cough] occurred within several years of the introduction of vaccines against them.

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The Myth That Vaccines Are Not Necessary

In some ways, vaccines are victims of their own success. Most young parents today have never seen a case of measles, mumps, German measles, polio, diphtheria, tetanus, or whooping cough. As a result, some of these parents question the continued need for vaccines.

Vaccines should be given for three reasons:

- Some diseases are so prevalent in this country that a decision not to give a vaccine is a decision to risk that disease (for example, pertussis).
- Some diseases are still present in the environment. These diseases continue to occur, but at fairly low levels (for example, measles, mumps, and German measles). If immunization rates drop, outbreaks of these diseases will again occur and children will die from our lack of vigilance. This is exactly what happened in the late 1980s and early 1990s when immunization rates against measles dropped. The result was 11,000 hospitalizations and more than a hundred deaths caused by measles. Now, due to an increase in measles immunization rates, there are only about a hundred cases of measles and no deaths every year in the United States.
- Some diseases have been virtually eliminated from this country (such as polio and diphtheria). However, these diseases continue to cause outbreaks in other areas of the world. Given the high rate of international travel, these diseases could be easily imported by travelers or immigrants.

The Myth That Vaccines Are Not Safe

What does the word safe mean? The first definition of the word safe is "harmless." This definition would imply that any negative consequences of vaccines would make the vaccine unsafe. Using this definition, no vaccine is 100 percent safe. Almost all vaccines can cause pain, redness, or tenderness at the site of injection. And some vaccines cause more severe side effects. For example, the pertussis (or whooping cough) vaccine can be a very rare cause of persistent, inconsolable crying or high fever. Although none of these severe symptoms results in permanent damage, they can be quite frightening to parents.

But, in truth, few things meet the definition of "harmless." Even everyday activities contain hidden dangers. For example, each year in the United States, 350 people are killed in bath- or shower-related accidents, 200 people are killed when food lodges in their windpipe, and 100 people are struck and killed by lightning. However, few of us consider eating solid food, taking a bath, or walking outside on a rainy day as unsafe activities. We just figure that the benefits of the activity clearly outweigh its risks.

The second definition of the word *safe* is "having been preserved from a real danger." This definition implies that vaccines provide safety. Using this definition, the danger (the disease) must be significantly greater than the means of protecting against the danger (the vaccine). Or, said another way, a vaccine's benefits must clearly and definitively outweigh its risks....

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The Myth That Infants Are Too Young to Get Vaccinated

Children are immunized in the first few months of life because several vaccine-preventable diseases infect them when they are very young. For example:

- Pertussis infects about 8,000 children, causing five to ten deaths every year in the United States. Almost all of the cases are in children *less than one year of age*.
- Children *under two years old* are 500 times more likely to catch Hib meningitis if someone with a Hib infection is living in the home.
- About 90 percent of *newborns* whose mothers are infected with hepatitis B will contract hepatitis and go on to develop chronic liver disease, cirrhosis, and possibly liver cancer.

For these reasons, it is very important for infants to be fully immunized against certain diseases by the time they are six months old.

Fortunately, young infants are surprisingly good at building immunity to viruses and bacteria. About 95 percent of children given DTaP, Hib, and hepatitis B virus vaccines will be fully protected by two years of age.

The Myth That It Is Better to Be Naturally Infected

It is true that "natural" infection almost always causes better immunity than vaccination (only the Hib, pneumococcal, and tetanus vaccines are better at inducing immunity than natural infection). Whereas natural infection causes immunity after just one infection, vaccines usually create immunity only after several doses are given over a number of years. For example, DTaP [diphtheria, tetanus, and pertussis], hepatitis B, and IPV [inactivated polio vaccine] are each given at least three times.

However, the difference between vaccination and natural infection is the price paid for immunity. The price paid for vaccination is the inconvenience of several shots and the occasional sore arm. The price paid for a single natural infection is usually considerably greater: paralysis from natural polio infection, mental retardation from natural Hib infection, liver failure from natural hepatitis B virus infection, deafness from natural mumps infection, or pneumonia from natural varicella [chicken pox] infection are high prices to pay for immunity.

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The Myth That Children Get Too Many Shots

Infants and young children commonly encounter and manage many challenges to their immune systems at the same time. Twenty years ago, seven vaccines were routinely recommended, and children received five shots by two years of age and as many as two shots at one time. Now that we have eleven routinely recommended vaccines, children could receive as many as twenty shots by two years of age and five shots at a single visit. Many parents are concerned about whether children can handle all these vaccines.

But vaccines are just a small part of what babies encounter every day. Although the mother's womb is free from bacteria and viruses, newborns immediately face a host of different challenges to their immune system. For example, from the minute they are born, thousands of different bacteria start to live on the skin as well as the lining of the nose, throat, and intestines. By quickly making an immune response to these bacteria, babies keep the bacteria from invading their bloodstream and causing serious disease.

In fact, babies are capable of responding to millions of different viruses and bacteria because they have billions of immunologic cells circulating in their bodies. Therefore the vaccines given in the first two years of life are literally a raindrop in the ocean of what infants' immune systems successfully encounter in their environment every day.

It is interesting to note that although children receive more vaccines today than they did a hundred years ago, when only the smallpox vaccine was routinely recommended in infancy, the number of separate immunologic challenges contained in vaccines has actually decreased! The smallpox vaccine contained about 200 viral proteins. If you add up today's eleven routinely recommended vaccines, the number of vaccine proteins and polysaccharides (complex sugars) is less than 130: diphtheria (1), tetanus (1), pertussis (2-5), polio (15), measles (10), mumps (9), rubella (5), Hib (2), varicella (69), conjugate pneumococcus (8), and hepatitis B (1)....

The Myth That Vaccines Cause Autism

Recently, stories carried by the media have caused some parents to fear that the combination measles-mumps-rubella (MMR) vaccine causes autism. Summarized below are (1) studies used to support the notion that MMR causes autism, (2) studies that disprove the notion that MMR causes autism, and (3) other investigations into the causes of autism.

Two studies have been cited by those claiming that the MMR vaccine causes autism. Both studies are critically flawed.

In 1998, Andrew Wakefield and colleagues published a paper in the journal *Lancet*. Wakefield's hypothesis was that the MMR vaccine caused a series of events that include intestinal inflammation, entrance into the bloodstream of proteins harmful to the brain, and consequent development of autism. In support of his hypothesis, Dr. Wakefield described twelve children with developmental delay, of whom eight had autism. All of these children had intestinal complaints and developed autism within one month of receiving MMR.

The Wakefield paper published in 1998 is flawed for two reasons: (1) About 90 percent of children in England received MMR at the time this paper was written. Because MMR is administered at a time when many children are diagnosed with autism, it would be expected that most children with autism would have received an MMR vaccine, and that many would have received the vaccine recently. The observation that some children with autism recently received MMR is, therefore, expected. However, determination of whether MMR causes autism is best made by studying the incidence of autism in *both* vaccinated and unvaccinated children. This wasn't done. (2) Although the authors claim that autism is a consequence of intestinal inflammation, intestinal symptoms were observed *after*, not before, symptoms of autism in all

eight cases.

In 2002, Wakefield and coworkers published a second paper examining the relationship between measles virus and autism. The authors tested intestinal biopsy samples for the presence of measles virus from children with and without autism. Of children with autism, 75 of 91 were found to have measles virus in intestinal biopsy tissue as compared with only five of 70 patients who didn't have autism.

Four studies have been performed that disprove the notion that MMR causes autism.

On its surface, this is a concerning result. However, the second Wakefield paper is also critically flawed for the following reasons: (1) Measles vaccine virus is live and attenuated. After inoculation, the vaccine virus probably replicates (or reproduces itself) about fifteen to twenty times. It is likely that measles vaccine virus is taken up by specific cells responsible for virus uptake and presentation to the immune system (termed antigen-presenting cells, or APCs). Because all APCs are mobile, and can travel throughout the body (including the intestine), it is plausible that a child immunized with MMR would have measles virus detected in intestinal tissues using a very sensitive assay. To determine whether MMR is associated with autism, one must determine whether the finding is *specific* for children with autism. Therefore, children with or without autism must be identical in two ways. First, children with or without autism must be matched for immunization status (that is, receipt of the MMR vaccine). Second, children must be matched for the length of time between receipt of MMR vaccine and collection of biopsy specimens. Although this information was clearly available to the investigators and critical to their hypothesis, it was omitted from the paper. (2) Because natural measles virus is still circulating in England, it would have been important to determine whether the measles virus detected in these samples was natural measles virus or vaccine virus. Although methods are available to distinguish these two types of virus, the authors did not use them. (3) The method used to detect measles virus in these studies was very sensitive. Laboratories that work with natural measles virus (such as the lab where these studies were performed) are at high risk of getting results that are incorrectly positive. No mention is made in the paper as to how this problem was avoided. (4) As is true for all laboratory studies, the person who is performing the test should not know whether the sample is obtained from a case with autism or without autism (blinding). No statements were made in the methods section to assure that blinding occurred.

Studies Show the MMR Vaccine Does Not Cause Autism

Four studies have been performed that disprove the notion that MMR causes autism.

In 1999, Brent Taylor and coworkers examined the relationship between receipt of MMR and development of autism in a well-controlled study. Taylor examined the records of 498 children with autism or autism-like disorder. Cases were identified by registers from the North Thames region of England before and after the MMR vaccine was introduced into the United Kingdom in 1988. Taylor then examined the incidence and age at diagnosis of autism in vaccinated and unvaccinated children. He found that (1) the percentage of children vaccinated was the same in children with autism as in other children in the North Thames region; (2) no difference in the age of diagnosis of autism was found in vaccinated and unvaccinated children; and (3) the onset of symptoms of autism did not occur within two, four, or six months of receiving the MMR vaccine.

Subsequent studies by Natalie Smith published in the *Journal of the American Medical Association* and by Hershel Jick in the *British Medical Journal* found that the increase in the number of children reported to have autism was not associated with an increase in the use of the MMR vaccine.

The largest study to examine the relationship between the MMR vaccine and autism was reported in the *New England Journal of Medicine* in November 2002. About 537,000 children in Denmark who either did or did not receive the MMR vaccine were examined for about six years. The incidence of autism was the same in children who did or did not receive the MMR vaccine.

> Very subtle symptoms of autism are present in early infancy and argues strongly against vaccines as a cause of autism.

Studies on the Causes of Autism

One of the best ways to determine whether a particular disease or syndrome is genetic is to examine the incidence in identical and fraternal twins. Using a strict definition of autism, when one twin has autism, approximately 60 percent of identical and 0 percent of fraternal twins have autism. Using a broader definition of autism (that is, autistic spectrum disorder), approximately 92 percent of identical and 10 percent of fraternal twins have autism. Therefore, autism clearly has a genetic basis.

Clues to the causes of autism can be found in studies examining when the symptoms of autism are first evident. Perhaps the best data examining when symptoms of autism are first evident are the "home-movie studies." These studies took advantage of the fact that many parents take movies of their children during their first birthday (before they have received the MMR vaccine). Home movies of children who were eventually diagnosed with autism and those who were not diagnosed with autism were coded and shown to developmental specialists. Investigators were, with a very high degree of accuracy, able to separate autistic from nonautistic children at one year of age. These studies found that subtle symptoms of autism were present earlier than some parents had suspected, and that receipt of the MMR vaccine did not precede the first symptoms of autism.

Other investigators extended the home-movie studies of one-year-old children to include videotapes of children taken at two to three months of age. Using a sophisticated movement analysis, videos from children eventually diagnosed with autism or not diagnosed with autism were coded and evaluated for their capacity to predict autism. Children who were eventually diagnosed with autism were predicted from movies taken in early infancy. This study supported the hypothesis that very subtle symptoms of autism are present in early infancy and argues strongly against vaccines as a cause of autism.

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