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National Institute
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Autism Research at the NICHD



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Autism and the MMR Vaccine

What is autism?

Autism is a complex biological disorder of development that lasts throughout a person's life. People with autism have problems with social interaction and communication, so they may have trouble having a conversation with you, or they may not look you in the eye. They sometimes have behaviors that they *have* to do or that they do over and over, like not being able to listen until their pencils are lined up or saying the same sentence again and again. They may flap their arms to tell you they are happy, or they might hurt themselves to tell you they are not.

One person with autism may have different symptoms, show different behaviors, and come from different environments than others with autism. Because of these differences, doctors now think of autism as a "spectrum" disorder, or a group of disorders with a range of similar features. Doctors classify people with autism spectrum disorder (ASD) based on their autistic symptoms. A person with mild autistic symptoms is at one end of the spectrum. A person with more serious symptoms of autism is at the other end of the spectrum. But they both have a form of ASD.

The National Institute of Child Health and Human Development (NICHD), part of the National Institutes of Health (NIH), is one of the NIH Institutes doing research into various aspects of autism, including its causes, how many people have it, and its treatments.

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Why do people think that vaccines can cause autism?

Some parents and families of children with autism believe that the Measles/Mumps/Rubella (MMR) vaccine caused their children's autism. These parents report that their children were "normal" until they received the MMR vaccine. Then, after getting the vaccine, their children started showing symptoms of autism. Because the symptoms of autism begin to occur around the same time as the child's MMR vaccination, parents and families see the vaccine as the cause of the autism. However, just because the events happen around the same time does not mean that one caused the other. Although children receive many other vaccines in addition to the MMR vaccine, these other vaccines have not been identified as possible causes of autism.

These parents' beliefs and observations were reinforced by a small study of bowel disease and autism, published by Wakefield and his colleagues in 1998 (Wakefield et al 1998). The study's authors suggested that there was a link between the MMR vaccine and autism. This study did not include scientific testing to find out if there was a link. The authors relied on the reports of parents and families of the 12 children with autism involved in the study to make their suggestion. The study did not provide scientific proof that there was any link.

Since this study was published in 1998, a number of other studies have also been published that suggested a link between the MMR vaccine and autism (Singh et al 1998; Horvath et al 1999; O'Leary et al 2000;

Wakefield et al 2000; Kawashima et al 2000), but none of these provide scientific proof of such a link.

To date there is no definite, scientific proof that any vaccine or combination of vaccines can cause autism. It's important to know that vaccines actually *help* the immune system to defend the body.

How do vaccines help the immune system defend the body?

The immune system has cells, sometimes called memory cells, that remember diseases. If these cells meet a disease, they keep track of what it looks like so they can recognize it later. When the memory cells meet up with the disease again, they recognize it and know they need to get rid of it. They call in the other parts of the immune system to get rid of the disease. In some cases, memory cells can recognize a disease without ever having to meet up with it, which is called "natural" immunity. In other cases, the cells need some help to become familiar with a disease.

That help comes in the form of a vaccine. The vaccine takes a form of the disease that doesn't make you sick and introduces it to the memory cells so they know what to look for later. If the memory cells ever bump into the disease again, they know to call in other cells in the immune system to protect the body and get rid of the disease. The memory cells of a child keep track of diseases well into adulthood, preventing such diseases by getting rid of them quickly. In this way, vaccines help the immune system by making it easier to remember diseases.

Why do many doctors and scientists believe that the MMR vaccine does *not* cause autism?

In 2000, the Institute of Medicine (IOM) at the National Academy of Sciences, at the request of the Centers for Disease Control and Prevention (CDC) and the NIH, conducted a review of all the evidence related to the MMR vaccine and autism. This independent panel examined completed studies, on-going studies, published medical and scientific papers, and expert testimony to assess whether or not there was a link between autism and the MMR vaccine. The IOM concluded that the evidence reviewed did not support an association between autism and the MMR vaccine. This and other conclusions from the IOM review were released in April 2001 (Immunization Safety Review Committee 2001).

Also in 2000, the American Academy of Pediatrics (AAP), a professional organization for pediatricians with over 55,000 members, held a conference on the MMR vaccine and autism. Parents, scientists, and practitioners presented information on this topic to a multidisciplinary panel of experts. Based on its review, the AAP also found that the available evidence did not support the theory that the MMR vaccine caused autism or related disorders. The AAP policy statement appeared in the May issue of *Pediatrics* (Halsey et al 2001).

In 1999, Taylor and colleagues published a study (Taylor et al 1999) that argued against

the suggested link between autism and the MMR vaccine suggested in the Wakefield study. Taylor's study looked at all the known cases of ASD in children living in certain districts of London who were born in 1979, or later. Researchers then matched the ASD patients with an independent registry of vaccinations. The results of this study showed that:

- The number of ASD cases had increased steadily since 1979, but there was no sharp increase in the number of cases after doctors started using the MMR vaccine in 1988.
- Children showed symptoms of ASD and were diagnosed with ASD at the same ages, regardless of whether they were vaccinated before or after 18 months of age. This finding is important because if the MMR vaccine caused ASD, the children who were vaccinated earlier would show symptoms earlier.
- By age two, vaccination coverage (the number of children who received vaccines) among children with ASD was nearly the same as vaccination coverage for children the same age who did not have ASD throughout the region. If the MMR vaccine and ASD autism were linked, then a greater number of children who had been vaccinated throughout the region would have ASD.
- The first signs of autistic behavior or first diagnosis of ASD was not more likely to occur in time periods following the MMR vaccine than in other time periods.

Also in 1999, the United Kingdom's Committee on Safety of Medicine examined hundreds of reports collected by lawyers of patients with autism and similar disorders that families said they developed after receiving the MMR or MR vaccine. After a systematic, standardized review of the case information, the Committee found that the information did not support any link between vaccines and autism. Based on the evidence, the Committee concluded that there was no cause for concern about the safety of MMR or MR vaccines (Medicines Commission Agency 1999).

A study, done in Sweden in 1998, also showed no evidence of association between the MMR vaccine and autism. The study compared the number of autism cases in children from two Swedish towns before 1982, when local doctors first started using the MMR vaccine, and after 1982. The results showed no difference in the rate of autism between the two groups of children in either town (Gillberg & Heijbel 1998).

Another study, done in England in 1997, looked at any possible link between the measles-specific vaccine (one part of the MMR vaccine) and different problems that result from damage to the nervous system, such as learning disabilities and behavior problems. These researchers found no proof that the measles vaccine was in any way linked to long-term damage to the nervous system (Miller et al 1997).

Is there any research going on to find out if the MMR vaccine is linked to autism?

The NIH is doing a number of things to look into the claims about MMR vaccines and autism:

- The Network on the Neurobiology and Genetics of Autism: Collaborative Programs of Excellence in Autism (CPEA), funded by the NICHD and the National Institute on Deafness and Other Communication Disorders (NIDCD), with additional funding from the CDC, are working together to study autism and the MMR vaccine. This research will examine people diagnosed with autism who seemed to develop normally, but then started to show autistic symptoms. This type of situation is called "regression." To learn as much as possible about these patients, researchers will compare them to people who do not have autism, and to people who showed autistic symptoms since birth, called classic autism. CPEA researchers will compare vaccination records to see if the onset of autism was associated with receipt of MMR and other vaccines. Lab tests will then look for any evidence of persistent infections that could be related to the MMR vaccine.

- The NICHD is also working with other NIH Institutes, the CDC, the Environmental Protection Agency (EPA), and other federal agencies to conduct a large, long-term study of the effects of the environment on children's health. This study will follow 100,000 children from before birth to age 20, to track their growth and development, as well as their genetic blueprints and environmental factors that they encounter. Researchers hope to develop theories about whether environmental events, like environmental pollutants or vaccines, can cause abnormal development, such as autism, asthma, or other childhood disorders that have shown dramatic increase. The study is currently under design.
- Another NIH Institute, the National Institute of Neurological Disorders and Stroke (NINDS) is also conducting a retrospective case-control study to identify any molecular markers in neonatal blood of children with autism, with support from the California Department of Health Services and the Division of Bioengineering and Physical Science (DBEPS) at the NIH.
- In 1998, the NIH, led by the NICHD and the NINDS, sponsored a conference on ASDs. These and other NIH Institutes formed an expert panel, which also included 15 professional organizations and three parents' groups, and began a review of over

2,500 scientific articles to develop a system for diagnosing ASDs. The panel published its findings in the *Journal of Autism and Developmental Disorders* in 1999 (Filipek et al 1999). In 2000, the panel's report was adopted as a practice parameter by the American Academy of Neurology and the Child Neurology Society (Filipek et al 2000). *Practice parameter: screening and diagnosis of autism* gives doctors and other health professionals the first, standardized method for diagnosing autism and ASDs based on scientific evidence.

In addition, the NIH is in the process of implementing the autism aspects of the Children's Health Act of 2000. This Act, which was signed into law in October 2000, charges the NIH with the, "Expansion, intensification, and coordination of activities of the NIH with respect to research on autism." All of the NIH Institutes that fund autism research are working together to establish "Centers of Excellence" to focus on autism research. In addition, the NIH will form a committee with representatives from parents' groups and other federal agencies to coordinate autism research activities throughout the federal government and to enhance efforts to educate doctors and other health care professionals, and parents, and other child caretakers, about autism.

Aren't the diseases prevented by the MMR vaccine mild, when compared to the life-long symptoms of autism?

The diseases that the MMR vaccine prevents, measles, mumps, and rubella (also called German measles), are actually very serious. Many times, the symptoms and effects of these diseases are just as serious and life-long as the symptoms of autism. In some cases, these diseases result in death. If people stop getting vaccines, the number of cases of these diseases will increase, and with it, the number of deaths and serious health problems.

Measles is a life-threatening disease that spreads quickly and easily. Before the vaccine was available in the U.S., nearly everyone who was exposed to measles got the measles, with nearly three-to-four million cases each year. The symptoms of measles include a rash, high fever, cough, runny nose, and watery eyes. But, if not treated, these seemingly mild symptoms can lead to conditions such as pneumonia, seizures, and water and swelling around the brain. For one-in-500 to one-in-1,000 people, measles causes death. High levels of immunization in the U.S. have led to a 99 percent decrease in measles cases since doctors first started using the vaccine. But in poorer countries of the world, where vaccines aren't as common, nearly 900,000 people died from causes related to measles in 1998.

Mumps, which the MMR vaccine also protects against, was a major cause of deafness in children before doctors started using vaccines to prevent it. Even though it tends to be mild in children, mumps is dangerous for adults, with side effects that can include paralysis, seizures, and fluid in the brain. Before the vaccine for mumps was available, there were about 212,000 cases of mumps each year in the U.S. In 1998, there were only 606 cases of mumps in the U.S.

The last disease prevented by the MMR vaccine, rubella, is harmful to pregnant women and their growing babies. If a pregnant woman gets rubella, her baby may develop a life-long condition that includes heart defects, mental retardation, and deafness. In some cases, the baby's condition is so severe that the baby dies. In 1964-65, before the vaccine for rubella was available, 20,000 babies were born to mothers who had rubella. Of those 20,000 born, 11,600 were deaf, 3,580 were blind, and 1,800 were mentally retarded.

Note: Disease statistics cited in this document came from the National Institute of Allergy and Infectious Diseases at the NIH and the National Immunization Program at the CDC.

Should my child have the MMR vaccine?

Both the CDC and the AAP recommend that children receive two doses of the MMR vaccine, as long as they have no known health problems that prevent the vaccine from being effective. The CDC and AAP immunization schedules recommend that the first dose be given at age 12-to-15 months, while the second dose should be given at either four-to-six years of age or 11-to-12 years of age.

Allergies, immune system diseases like HIV, or other sicknesses can interact with a vaccine to make it less effective. These interactions can sometimes cause other health problems. If your child is sick, your doctor may delay the vaccination until your child is healthy. For example, a child with a fever should not have a vaccination until the fever is gone. Make sure you give a complete description of your child's current health and health history to your child's doctor at every visit, so he or she can help you make an informed choice about the timing of your child's vaccinations.

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For more information on autism and autism research, including studies involving vaccines and autism, contact the NICHD Clearinghouse, at:

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You can also comment on this or other *Autism Research at the NICHD* fact sheets through the Web site.

For more information on vaccines and vaccine safety, contact the National Immunization Program (NIP) at the CDC, at 1-800-232-2522 (English) or 1-800-232-0233 (Spanish), or visit the NIP web site at www.cdc.gov/nip.

