



Some parents are concerned that thimerosal, a mercury-containing preservative contained in the influenza vaccine, causes autism. However, during the past few years, a series of biological and epidemiological studies have shown this concern to be unfounded. Here is a summary of the evidence showing that, while some things do cause autism, mercury in vaccines isn't one of them.

All mercury isn't the same: methylmercury vs. ethylmercury

Mercury is a naturally occurring element found in the earth's crust, air, soil and water. Since the earth's formation, volcanic eruptions, weathering of rocks and burning of coal have caused mercury to be released into the environment. Once released, certain types of bacteria in the environment can change mercury to methylmercury. Methylmercury makes its way through the food chain in fish, animals and humans. At high levels, it can be toxic to people.

Thimerosal — a preservative still used in the influenza vaccine — contains a different form of mercury called ethylmercury. Studies comparing ethylmercury and methylmercury suggest that they are processed differently in the human body. Ethylmercury is broken down and excreted much more rapidly than methylmercury. Therefore, ethylmercury (the type of mercury in the influenza vaccine) is much less likely than methylmercury (the type of mercury in the environment) to accumulate in the body and cause harm.

Scientific evidence clearly indicates that mercury in vaccines doesn't cause autism.

Evidence that mercury doesn't cause autism

- In 1971, Iraq imported grain that had been fumigated with methylmercury. Farmers ate bread made from this grain. The result was one of the worst single-source mercury poisonings in history. Methylmercury in the grain caused the hospitalization of 6,500 Iraqis and killed 450. Pregnant women also ate the bread and delivered babies with epilepsy and mental retardation. But they didn't deliver babies with an increased risk of autism.
- Several large studies have now compared the risk of autism in children who received vaccines containing thimerosal to those who received vaccines without thimerosal. The studies were consistent, clear and reproducible — the incidence of autism was the same in both groups. Denmark, a country that abandoned thimerosal as a preservative in 1991, actually saw an increase in autism beginning several years later.
- Studies of the head size, speech patterns, vision, coordination and sensation of children poisoned by mercury show that the symptoms of mercury poisoning are clearly different from the symptoms of autism.
- Methylmercury is found in low levels in water, infant formula and breast milk. Although it is clear that large quantities of mercury can damage the nervous system, there is no evidence that the small quantities contained in water, infant formula and breast milk do. An infant who is exclusively breast-fed will ingest more than twice the quantity of mercury that was ever contained in vaccines and 15 times the quantity of mercury contained in the influenza vaccine.

Thimerosal: What you should know

What is known about the cause of autism?

- First, like cystic fibrosis or sickle cell disease, autism clearly has a genetic basis. Researchers found that when one identical twin had autism, the chance that the other twin had autism was about 90 percent; for fraternal twins, the chance was less than 10 percent.
- Second, although autism clearly has a genetic basis, environmental factors can also cause the disease. For example, children whose mothers took thalidomide during pregnancy had birth defects, including malformed ears and shortened limbs. But they also had a significantly greater incidence of autism than babies born to mothers who never took thalidomide. Thalidomide clearly caused autism, but only if mothers took it early in pregnancy. If mothers took thalidomide in the second or third trimester of pregnancy, their babies weren't at increased risk of autism.
- The thalidomide experience showed that there was a vulnerable time early in pregnancy when a drug could possibly cause autism. Echoes of the thalidomide story are found in babies infected with rubella virus. Babies born to mothers who suffered rubella early in their pregnancies develop birth defects involving the eyes, ears, brain and heart. They also are at greater risk of developing autism; but, as with thalidomide, only if the baby is exposed to rubella early during pregnancy. Babies don't develop autism if they are infected with the virus soon after birth. Taken together, these findings suggest that a virus or a drug can cause autism, and that there is a vulnerable time early during pregnancy when the baby is at risk. However, during the second or third trimester of pregnancy, or after the child is born, the window for environmental factors causing autism has apparently closed.
- Women in the United States also occasionally received mercury when they were pregnant. It happened when doctors found that the mother's blood type was not compatible with her baby's blood type. To prevent this blood mismatch from hurting the baby, mothers were given RhoGam, a product that contained thimerosal as a preservative. However, consistent with the observation in Iraq, babies exposed to thimerosal in RhoGam did not have a greater risk for autism than babies whose mothers never received RhoGam. Although thalidomide and rubella virus can cause autism in pregnancy, scientific evidence clearly indicates that mercury doesn't.

Selected References

- Andrews N, et al. Thimerosal exposure in infants and developmental disorders: a retrospective cohort study in the United Kingdom does not show a casual association, *Pediatrics*. 2004;114:584-591.
- Chess S, Fernandez P, Korn S. Behavioral consequences of congenital rubella, *J Pediatr*. 1978;93:699-703.
- Deysin EY, MacMahon B. Vital exposure and autism, *Am J Epidemiol*. 1979;109:628-638.
- Fombonne E, et. al. Pervasive Developmental Disorders in Montreal, Quebec, Canada: Prevalence and Links with Immunizations, *Pediatrics*. 2006; 118:139-150.
- Gundacker C, Pietschnig B, Wittmann KJ, et al. Lead and mercury in breast milk, *Pediatrics*. 2002;110:873-878.
- Heron J, Golding J, and ALSPAC Study Team. Thimerosal exposure in infants and developmental disorders: a prospective cohort study in the United Kingdom does not show a casual association, *Pediatrics*. 2004;114:577-583.
- Hviid A, et al. Association between thimerosal-containing vaccine and autism, *Journal of the American Medical Association*. 2003;290:1763-1766.
- Madsen K. Thimerosal and Occurrence of Autism: Negative Ecological Evidence from Danish Population-Based Data, *Pediatrics*. 2003; 112:604-606.
- Nelson KB, Bauman ML. Thimerosal and autism? *Pediatrics*. 2003;111:674-679.
- Pichichero ME, Cernichiari E, Lopreiato J, Treanor J. Mercury Concentrations and Metabolism in Infants Receiving Vaccines Containing Thimerosal: A Descriptive Study, *Lancet*. 2002; 360:1737-1741.
- Rodier PM. The early origins of autism, *Scientific American*. February 2000, pp.56-63.
- Schechter R, Grether J. Continuing Increases in Autism Reported to California's Developmental Services System: Mercury in Retrograde, *Arch Gen Psychiatry*. 2008; 65:19-24.
- Stehr-Green P. Autism and Thimerosal-Containing Vaccines: Lack of Consistent Evidence for an Association, *Am J Prev Med*. 2003; 25:101-106.
- Stomland K, Nordin V, Miller M, et. al. Autism is in thalidomide embryopathy: a population study, *Developmental Med Child Neurol*. 1994;36:351-356.
- Verstraeten T, et al. Safety of thimerosal-containing vaccines: a two-phased study of computerized health maintenance organization databases, *Pediatrics*. 2003;112L1039-1048.
- Thomson B, Price C, et. al. Early Thimerosal Exposure and Neuropsychological Outcomes at 7 to 10 Years, *New England J of Med*. 2007; 357:1281-1292.

This information is provided by the Vaccine Education Center at The Children's Hospital of Philadelphia. The Center is an educational resource for parents and healthcare professionals and is composed of scientists, physicians, mothers and fathers who are devoted to the study and prevention of infectious diseases. The Vaccine Education Center is funded by endowed chairs from The Children's Hospital of Philadelphia. The Center does not receive support from pharmaceutical companies.

Some of this material was excerpted from the book, *Vaccines: What You Should Know*, co-authored by Paul A. Offit, M.D., and Louis M. Bell, M.D.



Vaccine Education Center at
The Children's Hospital of Philadelphia

vaccine.chop.edu

 The Children's Hospital of Philadelphia®

Hope lives here.

The Children's Hospital of Philadelphia, the nation's first pediatric hospital, is a world leader in patient care, pioneering research, education and advocacy.

©2008 by The Children's Hospital of Philadelphia, All Rights Reserved.