

What is the issue?

Autism spectrum disorder is generally considered to be a neurodevelopmental disability. It is thought that the main causes are genetic, but because the exact cause is not yet known there are many theories about what might contribute to a child showing signs of autism. One theory that has gained attention in the media and on the internet since the 1990s, is that vaccines are somehow linked to autism. Concerns in some groups in the UK have particularly focussed on the Measles-Mumps-Rubella (MMR) immunisation, while US groups have generally been concerned about the role of mercury (thiomersal or thimerosal) in vaccinations¹, although there are indications that concerns about the MMR are also common in the US².

Because of the differences in the proposed theories, this factsheet will examine each of the issues separately.

What are the hypotheses?

1. MMR

The Measles-Mumps-Rubella (MMR) immunisation is given to children in Australia in 2 doses, at 12 months and again at 4 years. A possible link between autism and the MMR gained widespread publicity based on a small study of children with gastrointestinal symptoms and behaviour abnormalities by Andrew Wakefield³ and a number of other researchers⁴. In a press conference following the publication of the paper, Dr Wakefield further discussed a proposed link between the MMR and autism and suggested there was a case for splitting the vaccine into its component parts (that is, separate measles, mumps and rubella vaccinations)⁵. The main proposed idea was that MMR causes a persistent measles infection in the gut, leading to “leaky-gut” syndrome, which in turn allows inadequately processed peptides from gluten and casein to enter the bloodstream and brain producing an opioid effect⁶. An alternative pathway is that the measles virus itself invades the brain and triggers an immune response resulting in inflammation in the brain, causing autism⁷.

2. Mercury (Thiomersal/Thimerosal)

Thiomersal (also known as thimerosal) was added to vaccines in the 1940s as a preservative and contains ethylmercury. Mercury is known to cause neurological damage⁸, and while ethylmercury is considered less harmful than methylmercury, the suggestion is that small amounts in vaccines, combined with the increased number of compulsory vaccines since the early 1990s⁹ are causing autism and other developmental and neurological problems. There appears to be more than one causal mechanism proposed for the thiomersal-autism link, with some authors suggesting that the signs of autism are similar to symptoms of mercury poisoning¹⁰, while others have suggested that thiomersal weakens the immune system, allowing the live virus contained in the MMR to persist and damage the gut and brain¹¹.

What does the research say?

1. MMR

Wakefield's original research has been criticised on a number of grounds. Following publication, the paper was criticised for using adult, or other non-standard age ranges, rather than paediatric ranges on some laboratory tests, meaning that some of the gastrointestinal findings were in fact not abnormal^{12 13}. It was also found that there was a link between Dr Wakefield and a legal action by parents of some of the children in the study against the makers of the MMR. The journal that published the article, *The Lancet*, suggested that this link should have been known to help inform whether the paper should have been published in the first place^{14 15}. Ten of the thirteen original authors of the paper issued a partial retraction in 2004, suggesting there was no causal link established between the MMR and autism¹⁶. In 2010, The UK General Medical Council¹⁷ found Wakefield had displayed serious professional misconduct on numerous occasions in relation to his research. As a result of these findings Wakefield was removed from the medical register and the *Lancet* issued a full retraction of the paper in February 2010¹⁸. Since this time, a number of very large studies have found no evidence to support a causal association between MMR and autism:

- A study of more than 500,000 Danish children¹⁹ found no increased risk of autism among those who had received the MMR compared with those who had not been vaccinated, and even though autism rates increased during the study period, this increase occurred well after the introduction of the MMR vaccine.
- Similarly, Fombonne and colleagues²⁰ study in 2006 of more than 27,000 Canadian children noted that rates of Pervasive Developmental Disorders (PDDs) increased over time, while take-up of the MMR vaccination decreased, which ruled out a causal association between autism and the MMR. Another study²¹ also found that even when the MMR was discontinued in a region of Japan, autism rates continued to rise, suggesting that the MMR vaccine was unlikely to be the main cause of autism. Similarly, a more recent study of Japanese children²² did not find convincing evidence that MMR vaccination was associated with an increased risk of autism
- In an attempt to replicate part of Wakefield's findings, a study in 2008²³ compared bowel tissue of 25 children on the spectrum with gastrointestinal symptoms, with 13 children with gastrointestinal symptoms alone. The researchers found no differences between the two groups.
- In 2010, more research²⁴ found that autism risk was actually lower in children who were vaccinated with the MMR than in children who were unvaccinated.
- In 2014, Australian researchers completed a meta-analysis of case control and cohort studies (high level evidence) and found no evidence for increased risk of developing autism following MMR²⁵

2. Mercury (Thiomersal/Thimerosal)

Mercury, in the form of methylmercury, has well documented links to neurological disorders, but ethylmercury, the type of mercury previously used in vaccines, has less potential for harm²⁶. Studies of whole populations also provide information about the thiomersal-autism theory as follows:

- The Fombonne et al (2006) study mentioned previously examined links between autism rates and links with thiomersal. Because there were different immunisation schedules over time, the children received different amounts of exposure to thiomersal and could be looked at in three groups – children who had medium exposure, children with high exposure and children whose vaccinations contained no thiomersal at all. More cases of autism (referred to in the article as Pervasive Developmental Disorders or PDDs) were found in the group that had no exposure to thiomersal, leading them to rule out an association between PDDs and thiomersal.

- Another study²⁷ also looked at rates of autism before and after the removal of thiomersal from vaccines in California and found no decrease in diagnosis. A similar recent study²⁸ also looked at thiomersal exposure and found no evidence that higher thiomersal exposure was associated with increased risk of autism.
- The Australian meta-analysis mentioned above also found no relationship between autism and mercury or thimerosal across studies involving more than 1.2 million children.

In addition, it is important to note that thiomersal has been removed from all childhood vaccines, with the exception of one of the Hepatitis B vaccinations (Australia) and an influenza vaccine (US) in 2001²⁹.

In summary

While there have been concerns that vaccines cause autism, large scale studies have not found a link between autism and the MMR vaccine, or autism and the mercury-based preservative thiomersal.

Australian information about vaccinations and a decision making guide for parents regarding the MMR is provided by the National Centre for Immunisation Research & Surveillance (NCIRS), at www.ncirs.edu.au/immunisation/education/mmr-decision/index.php

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Reviewed February 2015