

## **Does the MMR vaccine cause autism?**

### **How uncritical acceptance of information can have disastrous consequences**

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**Alana Vowel**

#### **Abstract**

One of the most damaging medical controversies in several decades has been sparked by the publication of a fraudulent paper in 1998 claiming that a link between autism and the administration of the MMR vaccine had been found. The crisis is proving to be very difficult to remedy, as vaccination rates plummeted and have still not fully recovered. Fueled by media attention and ill-informed celebrity spokespeople, this poorly conducted study has received dangerous amounts of attention and support. Even with ever-increasing scientific evidence against the claim, the lack of skepticism and critical analysis of research has resulted in children being put in danger of preventable diseases by leaving them unvaccinated.

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Autism, or autism spectrum disorder (ASD), is an umbrella term for a group of complex disorders primarily characterized by impaired social interaction, problems communicating, and performing repetitive behaviors (Autism Center of Excellence 2014). Other problems can include issues with sleep, the gastrointestinal system, attention, motor coordination, and intellect. Symptoms are diverse and vary in degree of severity. The earliest signs of autism are usually a reduction in interactions such as eye contact, pointing at and showing objects, and following gaze (Autism Center of Excellence 2014). These social impairments become more obvious as the child matures because interaction with a wider array of people is expected. Research supports that the causes of autism spectrum disorders arise in early brain development, but symptoms do not become obvious until individuals reach two to three years of age (Autism Center of Excellence 2014). Recent studies suggest that genetic mutations are most likely the core cause of the disorder—identical twins have a rate of concordance between 70 and 90 percent (Autism Center of Excellence 2014). Although there is no concrete evidence thus far, coupling with environmental factors, such as an illness during pregnancy, may increase the risk of autism (Autism Center of Excellence 2014). It is important to recognize that because the symptoms of autism range from one extreme to the other, the disorder is most likely due to extremely complex brain irregularities with multiple interactions on the gene level combined with potential environmental influences (Autism Center of Excellence 2014).

Measles, mumps, and rubella (MMR) are viral diseases that can result in serious health problems, but can all be prevented using a combination vaccine (McLean et al. 2013). Measles is a very contagious illness that manifests as a skin rash, and can be transmitted via airborne particles or direct contact with respiratory fluids. Mumps results in fever and inflamed salivary glands. Rubella is transmitted through contact with nasopharyngeal fluids, and symptoms include skin rash and fever (McLean et al. 2013). While these illnesses alone do not appear to be extremely serious, severe complications with other ailments such as pneumonia, diarrhea, encephalitis, or arthritis can increase the likelihood of permanent medical issues, or death (McLean et al. 2013). Infants and children experience an increased risk of complications, which is why vaccination programs for these illnesses were so successful after their introduction in the 1960s (McLean et al. 2013).

A controversy began in 1998 when a paper was published stating that a relationship had been found between an autism variant and the administration of the measles, mumps, and rubella combination vaccine (Wakefield et al. 1998; Honda et al. 2005). The reported results were obtained from the testing of twelve children from a gastroenterology unit. Each was experiencing intestinal problems, but had also lost acquired skills (Wakefield et al. 1998). The children underwent gastroenterological and neurological testing and the development of each child was assessed. Out of the twelve subjects involved, neurological testing diagnosed nine with autism or ASD. The time between exposure to an environmental factor (for which eight of twelve subjects was the MMR vaccine) and the onset of behavioral symptoms was measured, with the majority of intervals ranging from 24 hours to one month (Wakefield et al. 1998). The findings of this study were based on this temporal link, regardless of the fact that there was no scientific evidence to back up the claim. However, it was suggested that data on autism prevalence should be looked into from before and after 1988—the year that the MMR vaccine was introduced in the UK (Taylor et al. 1999). Two years later, Wakefield published a second paper claiming that the MMR vaccine was introduced without adequate testing of its safety (Wakefield & Montgomery 2000). The widespread panic was not initiated until Wakefield spoke at a press conference televised by a charity supporting gastrointestinal research. He spoke about his papers, and the crisis began (Flaherty 2011). Although the first paper never outright said that the MMR vaccine causes autism in children, it was implied, and considerable media coverage allowed these ideas to spread quite quickly (Flaherty 2011). Unfortunately, when ignorant celebrities began supporting the faulty research and garnering media attention, the general public accepted what they were told uncritically (Pepys 2007). For example, Jenny McCarthy became a vocal supporter of the anti-vaccination movement. It is reasonable that parents would be concerned about these studies, which were performed by people they assumed were professionals and had been published in a major journal.

Although the vast majority of research on this topic supports no causal relationship, one examined the exposure to aluminum in vaccines and the rates of autism and suggested a link (Tomljenovic & Shaw 2011). Autism rates were retrieved from United States government reports for the period between 1991 and 2008, and this information was linked to Centers for Disease Control and Prevention data pertaining to exposure to aluminum from vaccines (Tomljenovic & Shaw 2011). Data from the United Kingdom, Canada, Australia, Sweden, Finland, and Iceland were also obtained. The researchers stated that aluminum is a neurotoxic metal and the most commonly used adjuvant—a substance used in a vaccine that increases the body's immune response (Centers for Disease Control and Prevention 2010). The study reported that the correlation between children diagnosed with autism and exposure to aluminum from vaccines was most significant when exposure occurred at three to four months of age (Tomljenovic & Shaw 2011). Furthermore, countries with the highest rate of autism had a higher exposure to aluminum in vaccines, especially when individuals were two months old (Tomljenovic & Shaw 2011). Arguably the most important thing in regard to the results of this study is that while some vaccines contain aluminum as an adjuvant, the MMR vaccine does not (Centers for Disease Control and Prevention 2010).

Countless studies have since been performed that strongly show that no causal relationship exists between receiving the MMR vaccine and being diagnosed with autism. A study reviewed the histories of 498 individuals with autism, looking at multiple factors including birth year, interval between vaccination and symptom onset, if developmental regression was clustered after vaccination, age of diagnosis, and if the incidence of the disorder was rising in accordance with autism rate (Taylor et al. 1999). The results showed that for each birth year, cases of autism increased at a steady rate, with no sudden jump in cases after MMR vaccinations were introduced. No temporal relationship between the two was found, and there was no clustering of developmental regression (Taylor et al. 1999). There was no difference found for age of diagnosis between individuals that were vaccinated and those who were not. The researchers concluded that no association was supported, and if one exists, it is so rare that it could not be detected in the sample (Taylor et al. 1999). A similar study involving the histories of 537,303 children born in Denmark between 1991 and 1998 came to the same conclusion, finding no links between the age of the child when vaccinated, time since the child was vaccinated, and development of autism (Madsen et al. 2002).

It is difficult to determine if rates of autism are truly rising, or if the disorder is just more easily diagnosed now, because the criteria for determining if the disability is present have changed and advanced over time (Wing & Potter 2002). There has been a noticeable increase in rates of autism over time; however, there are multiple explanations as to why this is occurring other than simply that the number of people with autism is increasing (Wing & Potter 2002). The

reasons include different criteria for diagnosis, increased awareness of the disorder and how much variety there is within it, or increase in the number of specialized professionals (Wing & Potter 2002). An interesting study, performed in Japan, involved comparing the rate of administration of the MMR vaccine with autism incidence. In the city of Yokohama, MMR vaccination rates were declining between 1988 and 1992, and none have been administered since 1993 (Honda et al. 2005). The researchers found that autism incidence increased in the period between 1988 and 1996, and actually experienced a dramatic rise beginning with children born in 1993. This information strongly suggests that the administration of the vaccine does not cause autism, and removing the MMR vaccination from health care programs is not the solution (Honda et al. 2005). Although the possibility that rates of autism are truly on the rise cannot be completely ruled out, better diagnostic techniques and a wider concept of what ASD comprises is most likely the main contributor to more diagnoses (Rutter 2005). In addition, awareness of autism is quite widespread, and services for individuals with the disorder are much more widely available than they were a few decades ago. Because of this, professionals, educators, and the general public are all more aware, so certain behaviors that lead to a diagnosis will be more likely to be noticed (Rutter 2005).

The biggest impact, caused by the papers Wakefield published, was that rates of vaccination dropped quite drastically, resulting in outbreaks of diseases such as measles. Between 1998 and 2003, the vaccination rates in England dropped from 91 percent to less than 80, with less than half of children in London receiving vaccinations (Flaherty 2011). Measles outbreaks reemerged and spread to Scotland and Ireland after having been completely eliminated from England, with 56 cases in 1998 and 1370 in 2008. Unfortunately, even with a vast amount of evidence supporting that the MMR vaccine is safe, and that the benefits outweigh the costs, rates of vaccinations in England have never risen back to the point needed for herd immunity (Flaherty 2011). Although England experienced arguably the biggest backlash, countries around the world began questioning the safety of vaccinating children.

Wakefield's original study has received tremendous criticism for its poor methods and clear limitations, obvious even when it was first published (Godlee et al. 2011). The paper featured a small sample size, lack of controls, relied on parental recall for data, and related common gastrointestinal ailments to arrive at the controversial claim (Godlee et al. 2011). There was no mechanism discussed concerning how the vaccines led to the development of autism, and Wakefield's assertions did not line up with any scientific evidence or epidemiological studies. The data were neither reproducible nor rigorous (Pepys 2007). Multiple organizations, including the World Health Organization, have done in depth reviews of all available evidence on the subject and concluded that the MMR vaccine is very safe and does not cause autism (Pepys 2007). In fact, studies have shown no links exist between the MMR vaccination and any other autoimmune

diseases, such as diabetes, multiple sclerosis, or inflammatory bowel disease (Schattner 2005). The British General Medical Council investigated Wakefield, and his original paper was retracted (Flaherty 2011). Wakefield was found guilty of scientific and medical misconduct, failing to disclose conflicts of interest, performing medical research that had not been approved by a bioethics committee, and disregarding the safety of the participants by performing certain medical procedures on the children (Flaherty 2011). Further analysis of his data revealed that Wakefield had altered significant portions of the children's medical histories so that his hypothesis would be supported. These findings culminated in the decision that his medical license was to be revoked (Flaherty 2011).

A small number of studies using questionable research methods and shaky claims have sparked one of the largest and most damaging medical controversies in a very long time, largely due to media attention and popular spokespeople joining the debate. Unfortunately, not everyone judges scientific claims critically. Even with massive amounts of evidence supporting no causal relationship, a vast amount of damage has been done in terms of how a significant portion of the general public views the MMR vaccination program. Hopefully, as the public becomes more aware of the vast amount of scientific evidence that discredits a relationship between the MMR vaccine and autism, parents will return to making the safe choice and vaccinating their children.

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