Vaccine Safety: Examine the Evidence

Vaccines are under constant study. For a vaccine to become part of the AAP Recommended Immunization Schedule (/English/safety-prevention/immunizations/Pages/Recommended-Immunization-Schedules.aspx), it must be tested in many steps, found safe and be closely monitored. Safety testing begins as soon as a new vaccine is made and clinical trials start. Evidence of safety continues to be gathered for as long as a vaccine is in use.

Getting answers about vaccines

Pediatricians get a lot of questions from parents about vaccines. They are ready to answer them all, no matter how big or small, common or unusual they are. A lot of questions come from things parents read online. There's so much information out there, and not all of it is accurate. It can be hard to know what's true. That's why it helps to talk with someone you can trust, someone trained to understand the science and discuss what it means for your child.

Pediatricians' knowledge and experience make them great partners to help you navigate the information out there, weigh risks and benefits and make the best decision for your child. Now more than ever, talking with your pediatrician can give you clarity and peace of mind.

The truth about vaccines & autism

The U.S. Centers for Disease Control and Prevention (CDC) recently added misleading claims to their **autism (/English/health-issues/conditions/Autism/Pages/Autism-Spectrum-Disorder.aspx)** webpage. We want to be clear: decades of high-quality, large-scale studies show that vaccines do not cause autism. "Parents deserve peace of mind. Decades of rigorous research have shown vaccines do not cause autism," said **Dr. Susan Kressly (https://www.aap.org/en/news-room/news-releases/aap/2025/statement-by-aap-president-susan-j.-kressly-md-faap-on-changes-to-cdcs-website-on-autism?_gl=1%2ansnfnk%2a_ga%2aMTA4MDkxODkzNi4xNzI5MTkxNjQy%2a_ga_FD9D3XZVQQ%2aczE3NzQ5NzE2NzkkbzM1OSRnMSR0MTc3NDk3MzY0OCRqMjckbDAkaDA.)**, past president of the American Academy of Pediatrics (AAP). "Vaccines are one of the safest and most effective ways to protect children's health and help them thrive."

What to know about vaccines

The AAP Recommended Child and Adolescent Immunization Schedule is based on expert review of all available evidence.

As a parent, you can be reassured to know that there have been hundreds of large-scale studies around the world on vaccine safety during the past several decades. They show that:

- Recommended vaccines are safe for children and teens.
- Vaccines don't cause autism or developmental delays.
- Vaccine ingredients are safe.
- Vaccines are not associated with conditions like allergies, diabetes or fertility problems.
- The vaccine against measles doesn't cause inflammatory bowel disease or autism.
- The risk of a febrile seizure after getting the combined vaccine against measles, mumps, rubella and varicella (MMRV) is extremely low.

Research continues to confirm that vaccines protect children and teens from serious diseases.

How we know that vaccines are safe for children & teens: a research round-up

a quick look at some of the studies published in trusted scientific journals. They show that there is no link between vaccines and mune, viral or neurodevelopmental health conditions.

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Note: *This is not a complete list. Vaccine safety studies are constantly being conducted and published. The studies below were published between the late 1990s and the early 2020s. Before any study is published, experts review it carefully. They check the methods and data to make sure the results are accurate and reliable.*

Recommended vaccines are safe

Safety of Vaccines Used for Routine Immunization in the United States: An Update

Agency for Healthcare Research and Quality (AHRQ) Publication No. 21-EHC024 (2021) (https://effectivehealthcare.ahrq.gov/products/safety-vaccines/research)

This 2021 report is an update to a 2014 report (https://publications.aap.org/pediatrics/article/134/2/325/33005/Safety-of-Vaccines-Used-for-Routine-Immunization) from the Agency for Healthcare Research and Quality (AHRQ). The 2021 update found no new evidence of increased risk of rare adverse events (severe allergy, seizures caused by fever and blood clotting issues) following administration of routine recommended childhood vaccinations.

Association Between Estimated Cumulative Vaccine Antigen Exposure Through the First 23 Months of Life and Non–Vaccine-Targeted Infections From 24 Through 47 Months of Age

Glanz JM, et al. *JAMA*. 2018; 319: 906-913 (https://jamanetwork.com/journals/jama/fullarticle/2673970)

This study looked at 994 children ages 24-47 months who had an emergency department (ED) or inpatient visit. 193 children were seen for an infectious disease for which there is no vaccine. Reserarchers counted how many antigens the children were exposed to through vaccines. They compared the group of 193 children with the remaining 801 children who were seen for a different reason. There was no significant difference in the two groups of children related to their exposure to multiple vaccines through the first 23 months of life and their risk for infections not targeted by vaccines.

Assessment of Efficacy and Safety of mRNA COVID-19 Vaccines in Children Aged 5 to 11 Years: A Systematic Review and Meta-Analysis

Watanabe A, et al. *JAMA Pediatr*. 2023; 177(4): 384-394 (https://jamanetwork.com/journals/jamapediatrics/fullarticle/2800743?resultClick=1)

Reviewers looked closely at data from 17 studies involving 10,935,541 vaccinated and 2,635,251 unvaccinated children between 5 and 11 years of age. They concluded that COVID-19 vaccination was associated with lower risks of SARS-CoV-2 infection, symptomatic COVID-19, hospitalization and multisystem inflammatory syndrome in children. The overall frequency of severe adverse events associated with vaccination, including myocarditis, was low.

Respiratory Syncytial Virus Maternal Vaccination in Infants Below 6 Months of Age: Meta-Analysis of Safety, Immunogenicity and Efficacy

Mapindra MP, et al. *Neonatology*. 2024; 121(3): 271-282 (https://karger.com/neo/article/121/3/271/894569/Respiratory-Syncytial-Virus-Maternal-Vaccination)

This meta-analysis evaluated six randomized clinical trial studies of the maternal RSV vaccine. It concluded that RSV vaccination is safe for mothers and provides effective antibody levels in infants. The vaccine reduces RSV-related severe disease in babies younger than 6 months. The overall reduction of RSV-related lower respiratory tract infections and hospitalizations in the first 6 months of life ranges between 48% and 52%.

Efficacy and Safety of Hepatitis B Vaccine: An Umbrella Review of Meta-Analyses

Qiu J, et al. *Expert Rev Vaccines*. 2024 Jan-Dec; 23(1): 69-81 (https://www.tandfonline.com/doi/full/10.1080/14760584.2023.2289566)

Researchers compiled and analyzed studies with evidence about strategies to prevent infection with the hepatitis B virus using the hepatitis B vaccine. They concluded that universal hepatitis B vaccination can effectively reduce infection with the virus. Researchers also concluded that adjuvants in vaccines and booster vaccination enhance immune protection without significant reactions. After they analyzed the evidence about safety of the hepatitis B vaccine in the studies, they concluded that most people don't experience side effects. They found that if side effects happen (injection-site pain, fatigue and myalgia), they are mild.

ıcy, Immunogenicity and Safety of Pneumococcal Conjugate Vaccine in Children: A Systematic Review and Meta-Analysis

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Dai Q, et al. *Front. Pediatr.* 2025; 13. doi: 10.3389/fped.2025.1652946 (https://www.frontiersin.org/journals/pediatrics/articles/10.3389/fped.2025.1652946/full)

Researchers analyzed 11 studies involving 147,274 two-year-old children. They found that, compared with placebo, the PCV vaccine lowered the incidence of pneumonia and increased the level of IgG antibodies.

Efficacy, Immunogenicity and Safety of Pertussis Vaccine During Pregnancy: A Meta-Analysis

Shi Q, et al. *Vaccines (Basel).* 2025 Jun 20; 13(7): 666. doi: 10.3390/vaccines13070666 (https://www.mdpi.com/2076-393X/13/7/666#)

Researchers reviewed 7 randomized controlled trials and 10 case-control studies published between 2014 and 2024. They concluded the trials and studies did not show a significant association between Tdap vaccination during pregnancy and serious adverse events in infants and pregnant women.

Universal Hepatitis B Vaccination at Birth—Safety, Effectiveness and Public Health Impact

Center for Infectious Disease Research and Policy. Vaccine Integrity Project. Hepatitis B (https://www.cidrap.umn.edu/vaccine-integrity-project/hepatitis-b)

This 2025 report looks at information and recommendations from the past 40 years related to universal hepatitis B vaccination at birth in the United States. Sources of information included epidemiological trends, vaccine coverage, clinical trials, clinical studies, federal vaccine committee reports, systematic reviews, meta-analyses and risk-of-bias analyses. The authors also reviewed studies from national safety monitoring programs which verify safety signals for hepatitis B vaccines licensed for the U.S. The report concludes there is no benefit related to vaccine safety or protection in a delayed first dose compared with getting it at birth. On the contrary, delaying the first dose increases the risk of getting hepatitis B in newborns.

Vaccines are not associated with conditions like infertility or diabetes

Evidence Refuting the Existence of Autoimmune/Autoinflammatory Syndrome Induced by Adjuvants (ASIA)

Ameratunga R, et al. *J Allergy Clin Immunol Pract.* 2017(5): 1551-1555 (https://www.sciencedirect.com/science/article/pii/S2213219817305172)

Authors reviewed the diagnostic criteria for ASIA and looked into data that explains the cause of that syndrome. They found that patients with treatment called allergen-specific immunotherapy (IT) get 100 to 500 times more injected aluminum over 3 to 5 years, than people getting he papillomavirus vaccines. The studies reviewed show that ASIA patients receiving IT had a lower incidence of autoimmune disease, which stro adjuvants do not cause or increase autoimmune disease in them. Further review of other study of patients with a different autoimmune cond received the hepatitis B and HPV vaccines did not see exacerbation of their condition.

No Association between HPV [human papillomavirus] Vaccination and Infertility in U.S. Females 18–33 Years Old

Schmuhl NB et al. *Vaccine*. 2020. 19; 38: 4038–4043 (https://www.sciencedirect.com/science/article/abs/pii/S0264410X2030414X?via%3Dihub

Authors found there is no link between getting the human papillomavirus (HPV) vaccine and infertility in women from the age group studied

The Childhood Vaccination Schedule and the Lack of Association With Type 1 Diabetes

Glanz JM, et al. *Pediatrics*. 2021; 148:e2021051910 (https://publications.aap.org/pediatrics/article/148/6/e2021051910/183391/?_gl=1%2a11qf6m4%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUxNTA5MTIkbzUyMSRnMSR0MTc3NTE1I

Researchers studied medical records from 584,171 children to learn if there was a link between receiving on-time vaccination (following the r immunization schedule) and children developing type 1 diabetes mellitus (/English/health-issues/conditions/chronic/Pages/Diabetes-Mellit They found vaccination did not increase the risk of children developing type 1 diabetes.

A Prospective Cohort Study of COVID-19 Vaccination, SARS-CoV-2 Infection and Fertility

Wesselink AK, et al. *Am J Epidemiol.* 2022; 191(8): 1383-1395 (https://academic.oup.com/aje/article/191/8/1383/6511811)

Study authors found COVID-19 vaccination did not affect odds of achieving pregnancy in females. They also found that being infected with th ...y lead to a brief decline in fertility for males. This means the vaccine is safe for females who want to get pregnant. It also means not gett ...ssibility of conceiving for males.

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Vaccines don't cause autism or developmental delays

Autism and Measles, Mumps and Rubella Vaccine: No Epidemiological Evidence for a Causal Association

Taylor B, et al. *The Lancet*. 1999; 353: 2026-2029 (https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2899%2901239-8/abstrac

Authors looked for any change in number or age of children diagnosed with autism associated with the MMR vaccine introduced in the Unite study identified 498 cases of autism (261 "core" autism; 166 "atypical" autism; 71 "Asperger syndrome") in children born in the UK since 1979. T autism cases by year of birth with no sudden change after the MMR vaccine was introduced. There was no difference in age at diagnosis betw before or after 18 months of age and those never vaccinated. There was no causal relationship found between onset of autism within 1 or 2 yea MMR. Developmental regression was not clustered in the months after vaccination.

Mumps, Measles and Rubella Vaccine and the Incidence of Autism Recorded by General Practitioners: A Time Trend Analysis

Kaye JA, et al. *BMJ*. 2001; 322: 460-463 (https://www.bmj.com/content/322/7284/460.full)

A United Kingdom study looked at links between MMR vaccination of children and rising prevalence of autism diagnoses in children. The stu with a pervasive developmental disorder born between 1992 and 1995 who received the MMR vaccine. They were compared with children wh vaccine. The study concluded the likelihood of autism was the same between children who received the MMR vaccine and those who didn't.

Neurologic Disorders After Measles-Mumps-Rubella Vaccination

Mäkelä A, et al. *Pediatrics*. 2002; 110: 957–963 (https://publications.aap.org/pediatrics/article/110/5/957/64506/Neurologic-Disorders-After-M _gl=1%2a11j4nz5%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMjQwNDQkbzUyMyRnMSR0MTc3NTIyN

This study looked at 535,544 children aged 1-7 years old who were vaccinated between November 1982 and June 1986 in Finland. Researchers connection between MMR vaccination and encephalitis, aseptic meningitis or autism.

A Population-Based Study of Measles, Mumps and Rubella Vaccination and Autism

Madsen KM, et al. *NEJM*. 2002; 347: 1477-1482 (https://www.nejm.org/doi/10.1056/NEJMoa021134)

In a population-based study in Denmark that included 537,303 children born between 1991 and 1998, Researchers found no link between auti MMR vaccination, time since MMR vaccination, or date of MMR vaccination.

Immunization Safety Review: Vaccines and Autism

Institute of Medicine, The National Academies Press: 2004 (https://nap.nationalacademies.org/catalog/10997/immunization-safety-review-v

An independent review committee found there is no causal relationship between the MMR vaccine and autism. The Institute of Medicine Im on Vaccines and Autism involved input from 15 committee members with expertise in pediatrics, internal medicine, immunology, neurology, epidemiology, biostatistics, public health, risk perception, decision analysis, nursing, genetics, ethics and health communications. The commi relevant studies. The group also rejected a causal relationship between thimerosal-containing vaccines and autism.

Age at First Measles-Mumps-Rubella Vaccination in Children with Autism and School-Matched Control Subjects: A Population-Base Atlanta

DeStefano F, et al. *Pediatrics*. 2004; 113: 259-266 (https://publications.aap.org/pediatrics/article/113/2/259/66877/Age-at-First-Measles-Mumps _gl=1%2a1cevmfy%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMjQwNDQkbzUyMyRnMSR0MTc3NTIy

In this large case-control study, researchers compared MMR vaccination timing in a group of children with autism and a school-matched cor did not have autism. They found no links between getting the MMR vaccine at the recommended age and an increased risk of conditions like the group of children with autism.

Relationship Between MMR Vaccine and Autism

Klein KC, Diehl EB. *Ann Pharmacother*. 2004; 38: 1297-1300 (https://journals.sagepub.com/doi/10.1345/aph.1D293)

rchers identified and evaluated 10 articles on autism and the MMR vaccine. They didn't find any causal relationship between the vaccin

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No Effect of MMR Withdrawal on the Incidence of Autism: A Total Population Study

Honda H, et al. J *Child Psychol Psychiatry*. 2005; 46: 572-579 (https://acamh.onlinelibrary.wiley.com/doi/10.1111/j.1469-7610.2005.01425.x)

In a study of all children born between 1988 and 1996 in Yokohama, Japan, the number of new cases of autism spectrum disorder (ASD) increa
though MMR vaccination decreased over the period. In addition, there was a steep increase in ASD that started with the 1993 birth cohort, the
administration of MMR to Japanese children was discontinued. Authors concluded that the withdrawal of MMR vaccine did not lead to a redu
ASD and the vaccine can't explain the rise over time in the incidence of ASD.

Immunizations and Autism: A Review of the Literature

Doja A, Roberts W. *Can J Neurol Sci*. 2006; 33: 341-346 (https://pubmed.ncbi.nlm.nih.gov/17168158/)

In a review of literature on immunizations and autism, an overwhelming majority of studies concluded the MMR vaccine does not cause auti
evidence was found to support a link between the vaccine preservative thimerosal and autism. In addition, no evidence was found to support
treatment of autism.

Is There A 'Regressive Phenotype' of Autism Spectrum Disorder Associated with the Measles-Mumps-Rubella Vaccine? A CPEA Study

Richler J, et al. J *Autism Dev Disord*. 2006; 36: 299-316 (https://link.springer.com/article/10.1007/s10803-005-0070-1)

Authors found no evidence of a link between observable loss of skills (regressive phenotype (https://www.genome.gov/genetics-glossary/Phe
disorder (ASD) and the MMR vaccine. This multi-site study used caregiver interviews to describe the loss of social-communication milestone
reported that the children with ASD had atypical development before the observable loss of skills.

MMR-Vaccine and Regression in Autism Spectrum Disorders: Negative Results Presented from Japan

Uchiyama T, et al. *J Autism Dev Disord*. 2007; 37:210-217 (https://link.springer.com/article/10.1007/s10803-006-0157-3)

MMR vaccine and regression in autism spectrum disorders (ASDs) were not linked in a study of 904 patients with ASD in Japan. No significan
incidence of regression between MMR-vaccinated children and non-vaccinated children.

Measles Vaccination and Antibody Response in Autism Spectrum Disorders

Baird G, et al. *Arch Dis Child*. 2008; 93: 832-837 (https://adc.bmj.com/content/93/10/832)

Researchers studied the cases of 98 vaccinated children aged 10-12 years in the UK with ASD and two control groups of similar age: 52 childre
needs but no ASD and 90 children in the "typically developing" group. There was no evidence of a different response to the measles virus or th
MMR vaccine in children with ASD, with or without regression, and children in the control groups who had either one or two doses of MMR.
connection between autism symptoms and the concentration of antibodies against the measles virus.

Lack of Association between Measles Virus Vaccine and Autism with Enteropathy: A Case-Control Study

Hornig M, et al. *PLoS One*. 2008; 3:e3140 (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0003140)

Autism was not associated with traces of measles virus in the gastrointestinal tract after recovery from infection or MMR vaccination. In this
for measles virus in the guts of 25 children with both autism and gastrointestinal disorders, and another 13 children with the same gastrointes
autism. The virus was detected in one child from each group. No evidence of a connection between the presence of the measles virus in the g
autism was found.

On-time Vaccine Receipt in the First Year Does Not Adversely Affect Neuropsychological Outcomes

Smith M and Woods C. *Pediatrics*. 2010; 125: 1134-1141 (https://publications.aap.org/pediatrics/article/125/6/1134/72509/?
_gl=1%2a13fr1w6%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzO

Researchers looked for any links between vaccines in the first year of a child's life and neuropsychological outcomes 7-10 years later. The stu
children born between 1993-1997. On-time vaccination in the first year was compared with delayed or incomplete vaccination in the first yea
negative effect on long-term neuropsychological outcomes in 42 different tests. The tests were related to speech and language, verbal memo
coordination, visuospatial ability, attention and executive-functioning tasks, behavior regulation, tics and general intellectual functioning. In
ociated with better performance on many outcomes.

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Increasing Exposure to Antibody-Stimulating Proteins and Polysaccharides in Vaccines is Not Associated with Risk of Autism

DeStefano F, et al. *J Peds*. 2013; 163: 561-567 (https://www.jpeds.com/article/S0022-3476%2813%2900144-3/fulltext)

Researchers studied 321 children with diagnosis of autism spectrum disorder (ASD), autistic disorder (AD) or ASD with regression and 752 chi these conditions. They compared the number of components used in vaccines that each group of children had received through vaccines. Re if children with a diagnosis of ASD, AD or ASD with regression had received more vaccine components. Having a diagnosis of ASD, AD or ASD associated with exposure to vaccine components at any of the studied time periods (birth to 3 months, birth to 7 months, birth to 2 years), or w vaccine components a child received in one day.

Vaccines Are Not Associated with Autism: An Evidence-Based Meta-Analysis of Case-Control and Cohort Studies

Taylor L, et al. *Vaccine*. 2014; 32: 3623-3629 (https://www.sciencedirect.com/science/article/abs/pii/S0264410X14006367?via%3Dihub)

Authors of a meta-analysis review of 10 studies (5 cohort and 5 case-control) involving over 1.25 million children looked at autism spectrum d ingredient thimerosal (mercury) and the measles-mumps-rubella (MMR) vaccine. No causal association was found between vaccinations an the MMR vaccine. In addition, no causal association was found between ASD and thimerosal (mercury).

Autism Occurrence by MMR Vaccine Status Among U.S. Children with Older Siblings with and Without Autism

Jain A, et al. *JAMA*. 2015; 313: 1534-1540 (https://jamanetwork.com/journals/jama/fullarticle/2275444)

The study looked at MMR vaccine status in children with and without autism spectrum disorder (ASD) with older siblings with and without A calculated for a child receiving an ASD diagnosis at ages 2 years, 3 years or 4 years based on 0 doses or 1 dose of MMR vaccine and whether th ASD or a sibling without ASD. Relative risk also was calculated any child who got an ASD diagnosis at age 5 years based on 1) whether they had doses of MMR vaccine, and 2) whether the child had a sibling with ASD or a sibling without ASD. No harmful association was found between M risk. In addition, no causal association was found between receipt of 1 or 2 doses of MMR vaccine and having a higher risk of ASD for children ASD.

In Utero Exposure to Maternal COVID-19 Vaccination and Offspring Neurodevelopment at 12 and 18 Months

Jaswa Eleni G, et al. *JAMA Pediatrics*. 2024; 178(3): 258-265 (https://jamanetwork.com/journals/jamapediatrics/fullarticle/2814106?resultClick

This cohort study included 2,261 and 1,940 infants aged 12 and 18 months, respectively, who were exposed to the COVID-19 vaccine in utero. Va with abnormal neurodevelopmental scores on the Ages and Stages Questionnaire, third edition.

Early Childhood Developmental Concerns Following SARS-CoV-2 Infection and COVID-19 Vaccination During Pregnancy: A Scottish R Retrospective cohort study

Hardie I, et al. *The Lancet*. 2025; 9(3): 162-171 (https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642%2825%2900008-2/fulltext)

Researchers looked for connections between SARS-CoV-2 infections during pregnancy, COVID-19 vaccination during pregnancy and early ch in kids aged 13–15 months in Scotland. Concerns included communication, problem solving and development of social, emotional, behavioral Researchers analyzed data from 24,919 child-mother pairs. They did not find any connection between SARS-CoV-2 infection during pregnanc concerns in children. Instead, they found that getting the COVID-19 vaccine during pregnancy might reduce chances of developmental conce and emotional or behavioral development in children.

Vaccine ingredients are safe

Association Between Thimerosal-Containing Vaccine and Autism

Hviid A, et al. *JAMA*. 2003; 290: 1763-1766 (https://jamanetwork.com/journals/jama/fullarticle/197365)

A study of 467,000 children born in Denmark between 1990 and 1996 compared children who were vaccinated with a thimerosal-containing received a thimerosal-free formulation of the same vaccine. The risk of autism spectrum disorders was the same for children vaccinated with vaccine and for children vaccinated with thimerosal-free vaccine. The results do not support a causal relationship between childhood vaccina containing vaccines and development of autism spectrum disorders.

m and Thimerosal-Containing Vaccines: Lack of Consistent Evidence for an Association

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Stehr-Green P, et al. *Am J Prevent Med*. 2003; 25: 101-106 (https://www.ajpmonline.org/article/S0749-3797%2803%2900113-2/fulltext)

A study compared the prevalence and incidence of autism in California, Sweden and Denmark from the mid-1980s to the late 1990s to the ave thimerosal-containing vaccines. In California, the average thimerosal dose from vaccines increased throughout the 1990s. However, in Swed to thimerosal from vaccines was low during the 1970s and 1980s, decreased in the late 1980s and was eliminated in the early 1990s. In all thre and prevalence of autism spectrum disorders began to rise in the 1985-1989 period, and the rate of increase accelerated in the early 1990s. Fi theory that increased exposure to thimerosal-containing vaccines is responsible for the apparent increase in the rates of autism in young chi worldwide.

Thimerosal and the Occurrence of Autism: Negative Ecological Evidence from Danish Population-Based Data

Madsen KM, et al. *Pediatrics*. 2003; 112: 604-606 (https://publications.aap.org/pediatrics/article/112/3/604/28678/Thimerosal-and-the-Occurr Negative?
_gl=1%2auvp3ns%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzO

Researchers analyzed data from the Danish Psychiatric Central Research Register. They looked at all psychiatric admissions since 1971 and al psychiatric departments in Denmark since 1995. There was no trend toward an increase in the incidence of autism during the period when th Denmark. From 1991 to 2000, after thimerosal was removed from vaccine in Denmark, the incidence of autism increased and continued to ris were also increases among children born after thimerosal was no longer used. Data do not support a correlation between thimerosal-contain incidence of autism.

Thimerosal Exposure in Infants and Developmental Disorders: A Retrospective Cohort Study in the United Kingdom Does Not Suppor

Heron J, et al. *Pediatrics*. 2004; 114: 577-583 (https://publications.aap.org/pediatrics/article/114/3/577/67138/Thimerosal-Exposure-in-Infants-a _gl=1%2auvp3ns%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzO

Researchers monitored the thimerosal exposure of more than 14,000 children born in the United Kingdom between 1991 and 1992. The age a thimerosal-containing vaccines were administered was recorded. Measures of ethylmercury from thimerosal by 3, 4 and 6 months of age we compared with numerous measures of childhood cognitive and behavioral development between 6 and 91 months of age. No evidence was fo thimerosal had a negative effect on neurologic or psychological outcomes.

Pervasive Developmental Disorders In Montreal, Quebec, Canada: Prevalence And Links With Immunizations

Fombonne E, et al. *Pediatrics*. 2006; 118: 139-150 (https://publications.aap.org/pediatrics/article/118/1/e139/69581/Pervasive-Developmental-D

This study looked at 28,000 children in Montreal, Quebec, Canada, born between 1987-1998, including 180 identified with pervasive developm older term for a group of conditions now diagnosed as Autism Spectrum Disorder. The study found that thimerosal and the MMR vaccine we prevalence of PDD. Data ruled out an association between PDD and either high levels of ethyl mercury exposure or 1 or 2 dose MMR vaccinati

Early Thimerosal Exposure and Neuropsychological Outcomes at 7-10 Years

Thompson WW, et al. *NEJM*. 2007; 357: 1281-1292 (https://www.nejm.org/doi/full/10.1056/NEJMoa071434)

Researchers compared the frequency of 42 neuropsychological outcomes in 1,047 children ranging in age from 7 to 10 years who had early ex thimerosal-containing vaccines and/or thimerosal-containing immune globulin. The study did not support a causal association between earl used in vaccines or immune globulin and deficits in neuropsychological functioning at the age of 7 to 10 years old.

Continuing Increases in Autism Reported to California's Developmental Services System: Mercury in Retrograde

Schechter R, et al. *Arch Gen Psychiatry*. 2008; 65: 19-24 (https://jamanetwork.com/journals/jamapsychiatry/fullarticle/482546)

Autism data from the California Department of Developmental Services were analyzed between 1995-2007. Thimerosal was removed from re vaccines after 2002. However, autism cases continued to increase each quarter after the removal of thimerosal. Data did not support the hypo thimerosal during childhood is a primary cause of autism.

Prenatal and Infant Exposure to Thimerosal from Vaccines and Immunoglobulins and Risk of Autism

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Price C, et al. *Pediatrics*. 2010; 126: 656-664 (https://publications.aap.org/pediatrics/article/126/4/656/65633/Prenatal-and-Infant-Exposure-to-
_gl=1%2a1l0f4rp%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzOT

Researchers reviewed managed care organization records and conducted interviews with the parents of 256 children with autism spectrum d
studied another 752 children without autism, matched to the ASD children by birth year, gender and managed care organization. Prenatal and
mercury from thimerosal-containing vaccines and immune globulin was not related to increased risk of ASDs.

Lack of Association Between Measles-Mumps-Rubella Vaccination and Autism in Children: A Case-Control Study

Budzyn D, et al. *Pediatr Infect Dis J*. 2010; 29: 397-400
(https://journals.lww.com/pidj/abstract/2010/05000/lack_of_association_between_measles_mumps_rubella.3.aspx)

Researchers in Poland compared the vaccination history of 96 children with autism, age 2 to 15 years, and 192 children without the disorder. N
found between receiving the measles-mumps-rubella (MMR) vaccine and the development of autism. In fact, children later diagnosed with a
vaccinated before the diagnosis was made had a lower autism risk than those who were not vaccinated. The result was similar for children wh
antigen (/English/safety-prevention/immunizations/Pages/Vaccine-Ingredients-Frequently-Asked-Questions.aspx) measles vaccine.

Updated Aluminum Pharmacokinetics Following Infant Exposures Through Diet and Vaccination

Mitkus RJ, et al. *Vaccine*. 2011; 29(51): 9538–9543 (https://www.sciencedirect.com/science/article/abs/pii/S0264410X11015799?via%3Dihub)

This study compares the amount of aluminum from vaccines and diet during an infant's first year of life with the safe amount of aluminum in
Risk Level (MRL) model. Researchers concluded that exposures to vaccines with aluminum adjuvants (/English/safety-prevention/immuniza
Ingredients-Frequently-Asked-Questions.aspx) are extremely low risk for infants. They also concluded that the benefits of getting those vacc
potential concerns.

Blood and Hair Aluminum Levels, Vaccine History and Early Infant Development: A Cross-Sectional Study

Karwowski MP, et al. *Acad Pediatr*. 2018; 18: 161-165 (https://www.sciencedirect.com/science/article/pii/S1876285917304837)

Researchers studied the potential connection between the amount of aluminum found in the body and infant development in a group of child
form an urban primary care center. They used the Bayley Scales of Infant and Toddler Development to measure development, and linear regr
(https://pmc.ncbi.nlm.nih.gov/articles/PMC11537238/) models to measure aluminum load. Researchers found there was no connection betwe
aluminum in children's bodies and their immunization history or their language and cognitive development (/English/ages-stages/baby/Pag
Development-8-to-12-Months.aspx).

Aluminum-Adsorbed Vaccines and Chronic Diseases in Childhood: A Nationwide Cohort Study

Andersson NW, et al. *Annals of Internal Medicine*. 2025; 178(10): 1369-1377 (https://www.acpjournals.org/doi/10.7326/ANNALS-25-00997)

Researchers analyzed information from over 1.2 million two-year-old children born in Denmark between 1997 and 2018. They compared natio
vaccinations, outcome diagnoses and potential confounding variables for those children. The amount of aluminum in childhood vaccines var
not find evidence supporting an increased risk for autoimmune, atopic or allergic or neurodevelopmental disorders associated with early chi
aluminum-containing vaccines (/English/safety-prevention/immunizations/Pages/Vaccine-Ingredients-Frequently-Asked-Questions.aspx).

The Role and Safety of Aluminum Adjuvants in Childhood Vaccines

Nirenberg E, et al. *Pediatrics*. 2025; doi:10.1542/peds. 2025-074874 (https://publications.aap.org/pediatrics/article/doi/10.1542/peds.2025-0748
Safety-of-Aluminum-Adjuvants-in?
_gl=1%2a1gnv9sa%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzO

Researchers break down how decades of research show that aluminum adjuvants (/English/safety-prevention/immunizations/Pages/Vaccin
Asked-Questions.aspx) are safe and are not linked to autism, asthma or autoimmune disorders in children. The report compares aluminum e
with everyday sources of aluminum. Authors note that the entire AAP recommended immunization schedule (/English/safety-
prevention/immunizations/Pages/Recommended-Immunization-Schedules.aspx) has significantly less aluminum than a single dose of antac
example. The report also answers safety concerns that parents have about vaccines. Evidence from the strongest studies with more than a mi
have consistently found there is no link between aluminum toxicity and vaccines.

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Measles-containing vaccines do not cause inflammatory bowel disease

No Evidence for Measles, Mumps and Rubella Vaccine-Associated Inflammatory Bowel Disease or Autism in a 14-Year Prospective Study

Peltola H, et al. *The Lancet*. 1998; 351:1327-1328 (https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2898%2924018-9/fulltext)

This 14-year prospective study tracked subjects who developed gastrointestinal symptoms or signs starting 1 hour or longer after MMR vaccination and lasting 24 hours or more. Researchers also checked hospital and health center records or interviewed local public health nurses. They found no evidence of MMR vaccine-associated inflammatory bowel disease or autism.

Measles-Mumps-Rubella and Other Measles-Containing Vaccines Do Not Increase the Risk for Inflammatory Bowel Disease: A Case-Control Study From the Vaccine Safety Datalink Project

Davis RL, et al. *Arch Pediatr Adolesc Med*. 2001; 155: 354-359 (https://jamanetwork.com/journals/jamapediatrics/fullarticle/190443)

The study looked at possible connections between measles-containing vaccines and risk of Crohn's disease, ulcerative colitis or irritable bowel disease (IBD). The study found no link between past vaccination, the age when someone received a measles-containing vaccine and increased risk of Crohn's disease, ulcerative colitis or IBD. Vaccination with MMR or other MCV, or the timing of vaccination early in life, did not increase the risk for IBD.

Measles, Mumps and Rubella Vaccination and Bowel Problems or Developmental Regression in Children with Autism: Population Study

Taylor B, et al. *BMJ*. 2002; 324:393 (https://www.bmj.com/content/324/7334/393.long)

This study looked at a population of children born between 1979 and 1998, including 473 with autism. Researchers found no evidence that the MMR vaccine, a "new variant form" of autism and bowel problems or developmental regression were connected.

The risk of febrile seizure after getting the MMRV vaccine is very low

Measles-Containing Vaccines and Febrile Seizures in Children Age 4-6 Years

Klein N, et al. *Pediatrics*. 2012; 129: 809-814 (https://publications.aap.org/pediatrics/article/129/5/809/73854/Measles-Containing-Vaccines-ar
_gl=1%2a1gnv9sa%2a_ga%2aMzk4NTc1NTg4LjE3NDg5NzU2ODg.%2a_ga_FD9D3XZVQQ%2aczE3NzUyMzQ0NTckbzUyNCRnMSR0MTc3NTIzO

This cohort study included 715,484 children aged 48-83 months to determine the risk of having a febrile seizure (/English/health-issues/conditions/fever/Pages/Febrile-Seizures.aspx) after vaccination. Organized in 4 groups, children received the MMR-V vaccine, separat vaccines on the same day, only the MMR vaccine or only the varicella vaccine. Authors concluded that the rate of febrile seizure after MMRV There was no increased risk of febrile seizures in any of the study groups within 6 weeks of vaccination.

How vaccine studies separate cause from coincidence

What do ice cream cone and air conditioner sales tell us about vaccine studies? They help explain an important idea: **association and causation are not the same**.

In a study, if two things happen at the same time or one after the other, researchers look closely for any connection between them. Two things can happen at the same time or one after the other, but one does not always cause the other.

For example, a store sells ice cream cones and air conditioners. The shopkeeper notices that when the store sells more ice cream cones, it also sells more air conditioners. There might be an association between the increasing sales of the two products (they are happening at the same time after all). But more ice cream sales do not cause or lead to more air conditioning sales and the other way around.

The same is true for vaccines. When someone develops a health problem after getting a vaccine, that does not necessarily mean the vaccine caused it. Researchers study these situations carefully. In fact, hundreds of studies over decades on the effects of vaccines on children show that they are safe.

Medical researchers keep reviewing new data to make sure safety information stays up to date and is available to the public. This includes ɔ into all kinds of reactions to vaccines—even the rare negative ones. Decades of research from many countries show the benefits far ɡh the risks.

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If an adverse event (https://historyofvaccines.org/getting-vaccinated/vaccine-faq/vaccine-side-effects-and-adverse-events/) happens after a child gets a vaccine, parents can report it to the U.S. Vaccine Adverse Events Reporting System (https://vaers.hhs.gov/) (VAERS), even if the health problem was not caused by the vaccine. VAERS tracks reports of health reactions possibly connected to a vaccine. Using the information collected with this system, medical researchers and public health authorities evaluate any potential harms related to vaccines, even if the chance is very small. Read more about how VAERS is used as part of a larger safety monitoring system here (https://vaers.hhs.gov/).

Where did the MMR vaccine and autism myth come from?

In 1998, a study claimed there was a link between the MMR (measles, mumps, rubella) vaccine and autism. The results of the study were later proven false. However, that claim caused fear and confusion for many parents.

In 2011, British journalist Brian Deer investigated Dr. Andrew Wakefield, the researcher behind the 1998 study. A 2011 *BMJ* feature article entitled "Secrets of the MMR Scare: How the Case Against the MMR Vaccine Was Fixed (http://www.bmj.com/content/342/bmj.c5347.full)" explored Wakefield's practices during the study. The investigation revealed serious problems with Wakefield's research. As a result, the study was retracted (https://www.thelancet.com/journals/lancet/article/PIIS0140673697110960/fulltext) in 2010, and Wakefield lost his medical license.

Before it was retracted, Wakefield's 1998 study had been cited more than (https://retractionwatch.com/the-retraction-watch-leaderboard/top-10-most-highly-cited-retracted-papers/) 600 times. **This serves as an example of how easily misinformation can spread, and how hard it can be to correct.**

More evidence on the Wakefield study is presented in a 2021 *PLoS One* study, Quantifying the effect of Wakefield et al. (1998) on skepticism about MMR vaccine safety in the U.S. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0256395), and 2019 *JAMA* original investigation, "Assessment of Citations of the Retracted Article by Wakefield et al With Fraudulent Claims of an Association Between Vaccination and Autism (https://jamanetwork.com/journals/jamanetworkopen/article-abstract/2755486)."

Finally, on Feb. 12, 2009, the U.S. Court of Federal Claims (also called the "vaccine court") ruled in three test cases. The court found overwhelming scientific evidence against any link between the MMR vaccine, thimerosal (/English/safety-prevention/immunizations/Pages/Vaccine-Ingredients-Frequently-Asked-Questions.aspx) (a preservative) and autism.

Remember

If you have any questions about vaccines and your child, don't hesitate to talk with your pediatrician.

More Information

- How Vaccines Are Developed, Safety Tested & Approved: Step by Step (/English/safety-prevention/immunizations/Pages/how-vaccines-are-developed-tested-for-safety-and-approved-step-by-step.aspx)
- All about the AAP Recommended Immunization Schedule (/English/safety-prevention/immunizations/Pages/Recommended-Immunization-Schedules.aspx)
- How Vaccine Schedules Changed Over Time & Why (/English/safety-prevention/immunizations/Pages/History-of-Immunizations.aspx)
- Medicine in the Media: Reliable Health Information v. Fake News (/English/family-life/Media/Pages/Medicine-Ads.aspx)
- WHO Expert Group's New Analysis Reaffirms There is no Link Between Vaccines and Autism (https://www.who.int/news/item/11-12-2025-who-expert-group-s-new-analysis-reaffirms-there-is-no-link-between-vaccines-and-autism)
- Retraction Watch: Top 10 Most Highly Cited Retracted Papers (https://retractionwatch.com/the-retraction-watch-leaderboard/top-10-most-highly-cited-retracted-papers/)

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