

The Real Science of Vaccines and Autism

***The science, the science and
nothing but the science***

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CSO, Autism Science Foundation

Disclosures

Alycia Halladay has no relevant financial relationships with ineligible companies to disclose.

Objectives

1. Provide a history of the vaccine/autism debate
2. Describe scientific evidence confirming or denying an association between vaccines and autism.
3. Identify commonly held myths around the relationship between vaccines and autism.

Huh?

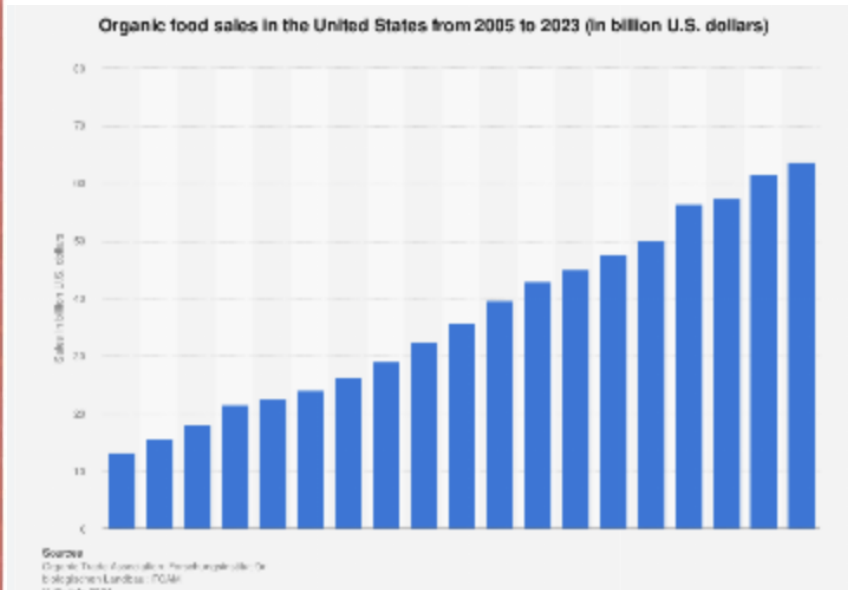
- Who came up with this association?
- Has it been tested scientifically?
- What does the science say?
- Why is it coming back up again, I thought it was resolved?
- How do we talk about this with concerned families?



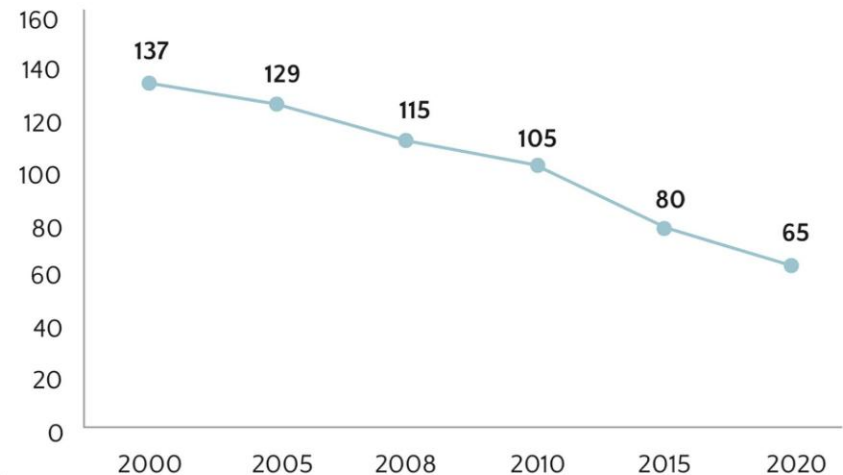
Heard in a pediatrician's office:
"Polio? Why does she need a polio vaccine? I haven't seen a case of polio since I was little"



Increase in prevalence = Correlation does not mean causation



Declining Median Worship Attendance among US Congregations

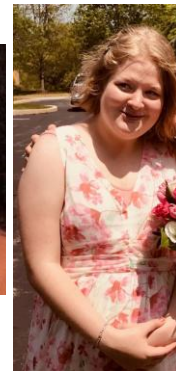


Source: 2020 Faith Communities Today survey, Hartford Institute for Religion Research

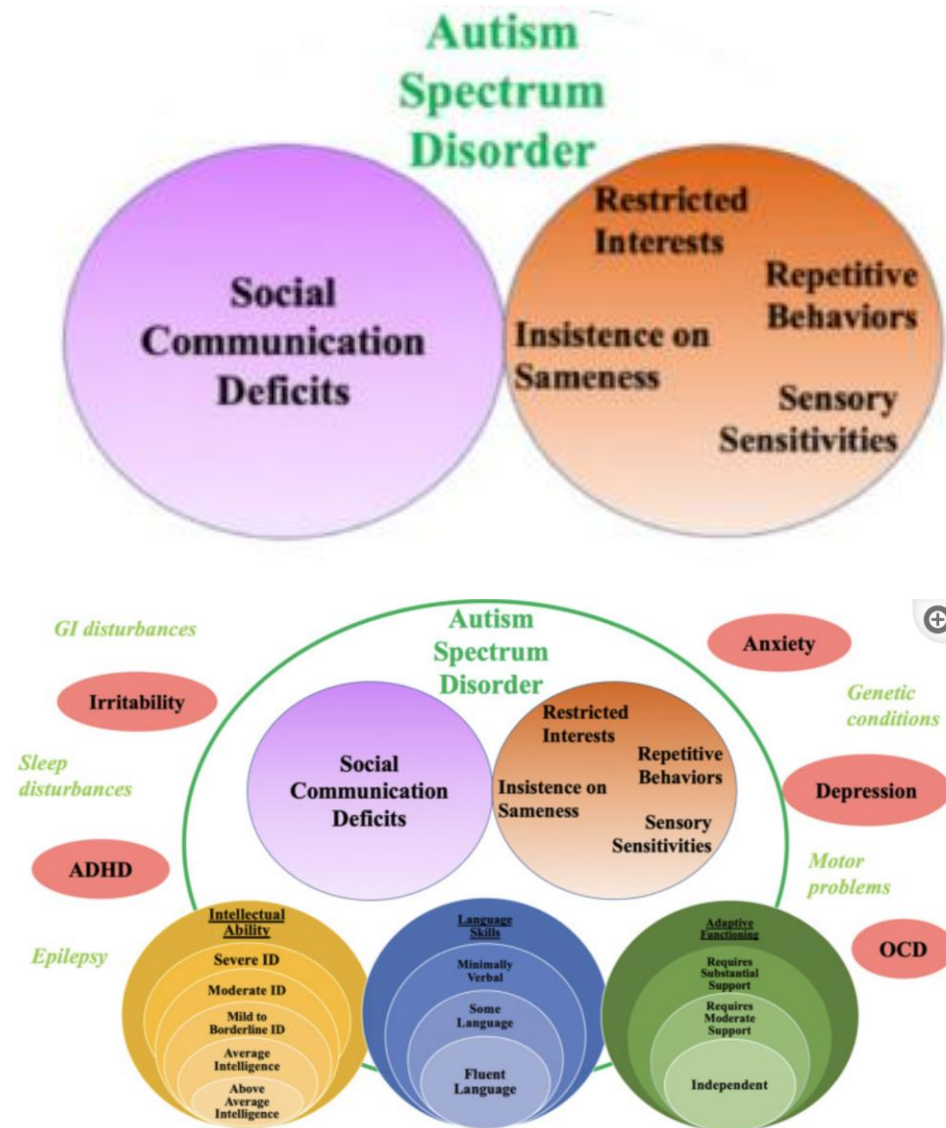
Figure 6

Do Vaccines Cause Autism?

Autism is Complex

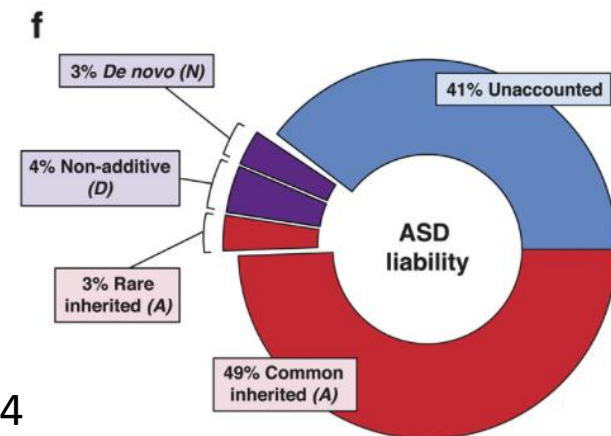


Core and Associated Features



Do vaccines cause autism? The evidence

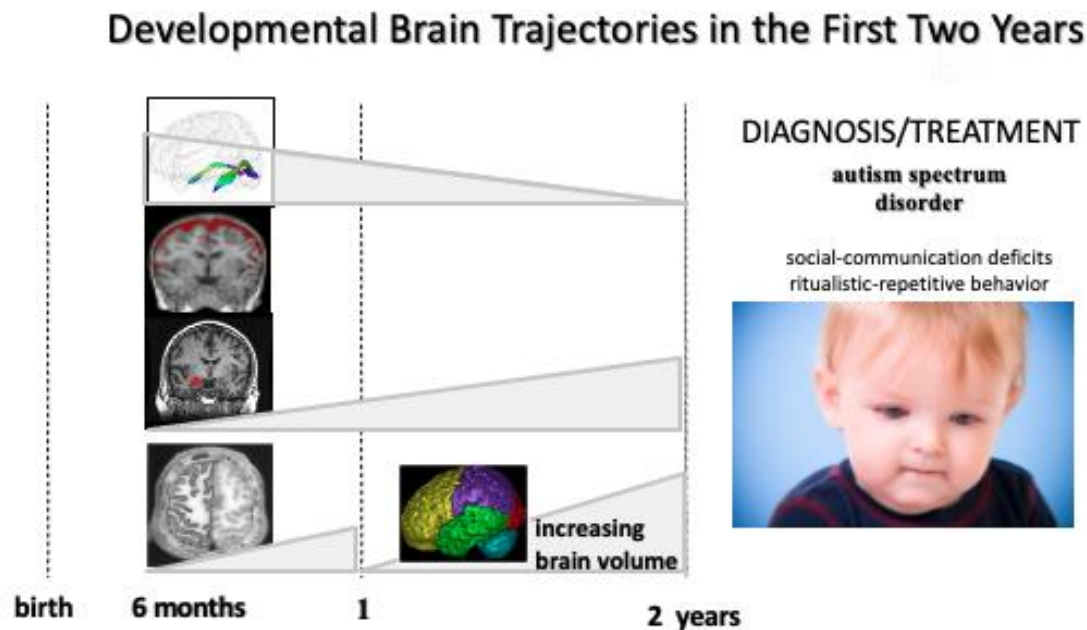
- VSD studies – negative or null association
- Autism runs in families
- Genetic links – common and rare variants
- Genetic means prior to birth
 - Brain cells and connectivity prenatal



Gaugler et al., 2014

Evidence that vaccines do not cause autism

- Autism symptoms seen before 6 months
- Brain changes can be observed by 6 months



Piven, 2025

What environmental factors have been studied – where is there a link??

Exposure	Relative Risk/Odds Ratio
Air Pollution during pregnancy	1.25 - 2x
Illness during pregnancy	2-3x
Prematurity /very low birth weight/traumatic birth	4-5x
Parental age	1.3 – 1.4x
“difficult pregnancy” – preeclampsia, false labor, maternal diabetes	1.5 – 1.7x
Pesticide use during pregnancy	1.2 – 2.5x
Valproic acid (anti – seizure)	5x

References at end



Table 2. Parental vaccine concerns identified in the literature (frequency of themes mentioned out of 115 articles reviewed).

Theme	Belief	General Vaccines <i>f</i> (%)	MMR [†] Specific <i>f</i> (%)
Danger/risk	Vaccine adverse reactions/hypersensitivity reactions	86 (75)	36 (31)
	General/other safety concerns	54 (47)	18 (16)
	Risk of autism	49 (43)	62 (54)
	Overwhelms immune system	37 (32)	1 (1)
	Concerns with vaccine components	33 (29)	13 (11)
	Pain on injection site	26 (23)	6 (5)
Personal concern	Too many vaccines/concerns with vaccine schedule	49 (43)	9 (8)
	Mistrust of government and health officials	45 (39)	9 (8)
	Preference for natural immunity	31 (27)	3 (3)
	Philosophical/moral objection	27 (23)	5 (4)
	Cost or access to vaccines	26 (23)	6 (5)
	Religious opposition	24 (21)	8 (7)
Perceived benefits	Low perceived benefit/susceptibility	45 (39)	14 (12)
	Vaccine efficacy concerns	26 (23)	8 (7)
	Not recommended by healthcare provider	7 (6)	0 (0)

[†] Measles, mumps, and rubella vaccine.

How it started: it's the MMR

1998:

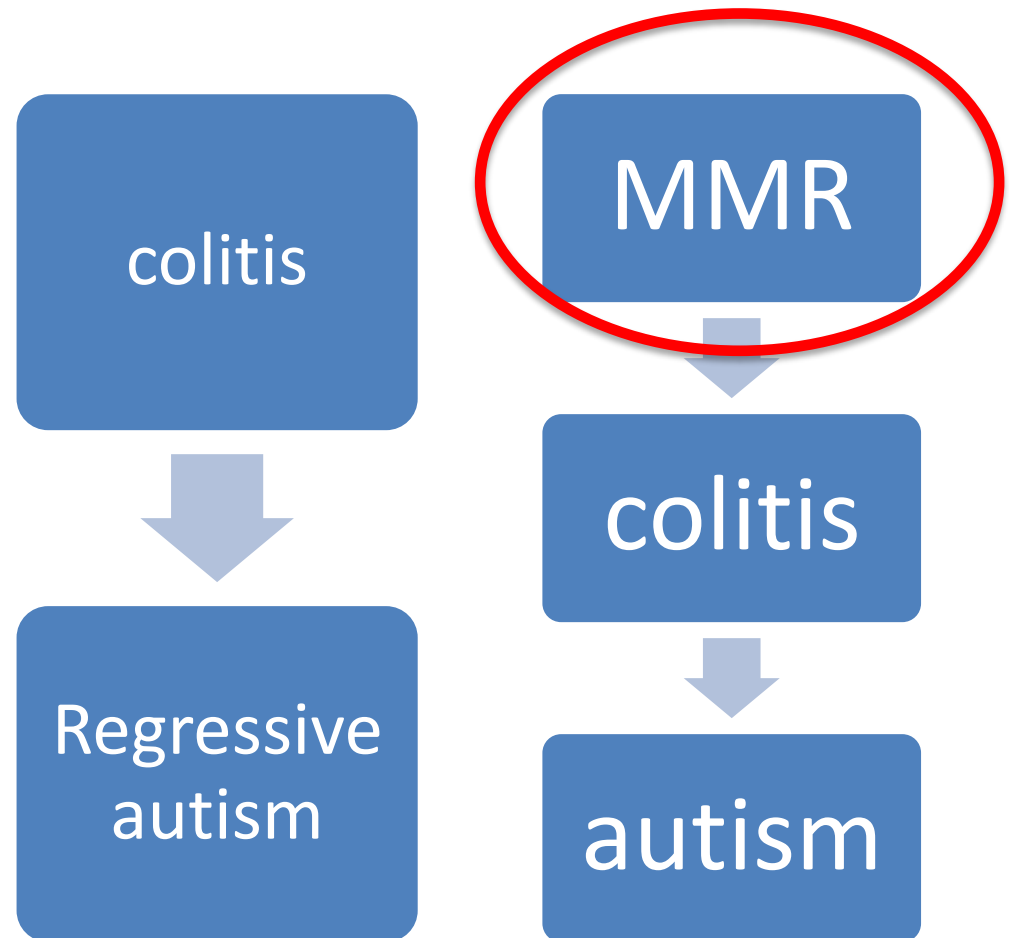


Retraction—Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children

The Editors of The Lancet,

The Lancet, Volume 375, Issue 9713, 445

Findings - n = 12



Reasons for retraction:

- Ethical concerns around need for invasive procedures in children
- Original study did not include kids with autism
- Collected some blood samples at a 10 year old's birthday party
- Financial conflict of interest by Wakefield – applying for a single disease vaccine patent
- Wakefield was retained by lawyers in 1996 for an MMR class action that paid him \$700k
- Data was manipulated
- Data was never replicated
- The article really should have never been published

Retraction response

2 stages:

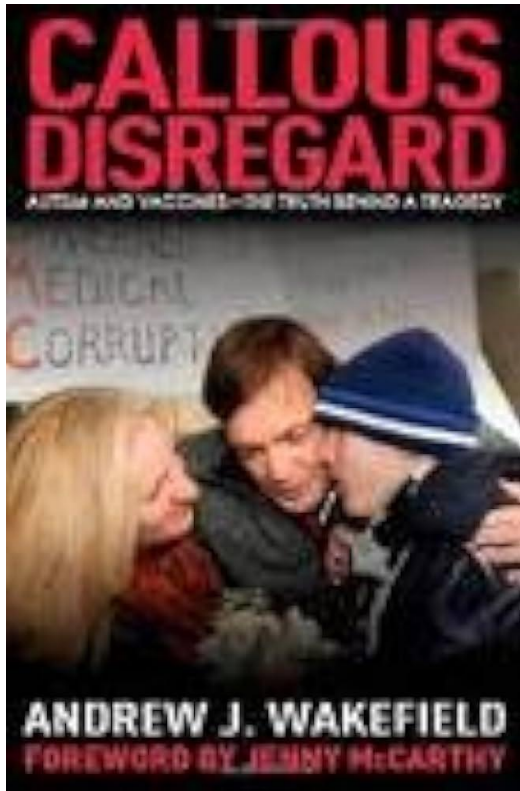
- 2004 – 10 of the original 12 authors issued partial retraction (not Wakefield)
- 2010: Lancet retracts the whole article.

“We wish to make it clear that in this paper **no causal link was established between MMR vaccine and autism as the data were insufficient.**”

-10 out of the 12 authors, 2004

“We are dismayed at the way in which events have been misrepresented”
- Wakefield, 2004

Since 1998



ISBN: 9781616081690

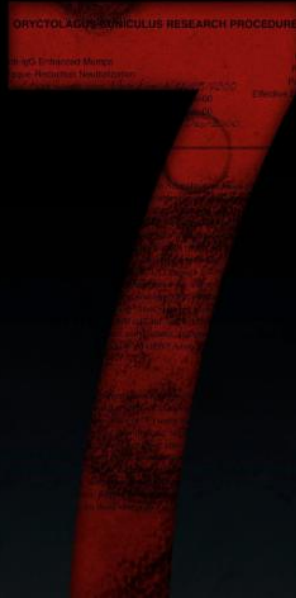


Since 1998

Sponsored ⓘ

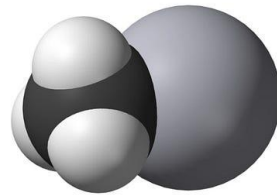
AN ANDY WAKEFIELD FILM

PROTOCOL

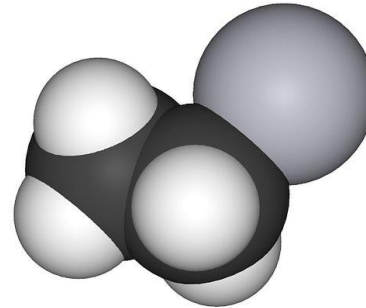


How it went: It's the thimerosal in vaccines

METHYLMERCURY



ETHYLMERCURY



2008 and 2015



NEW YORK TIMES BESTSELLING AUTHOR

ROBERT F. KENNEDY, JR., EDITOR

THIMEROSAL LET THE SCIENCE SPEAK

The Evidence Supporting the Immediate Removal
of Mercury—a Known Neurotoxin—from Vaccines



Preface by **MARK HYMAN, MD**
New York Times bestselling author of *The Blood Sugar Solution* and
founder and medical director of the UltraWellness Center

Introduction by **MARTHA R. HERBERT, PhD, MD**
assistant professor of neurology at Harvard Medical School
and pediatric neuroscientist at Massachusetts General Hospital

Foreword by **U.S. CONGRESSMAN BILL POSEY**

INCLUDES THE ORIGINAL OMITTED CHAPTERS ON THE AUTISM LINK

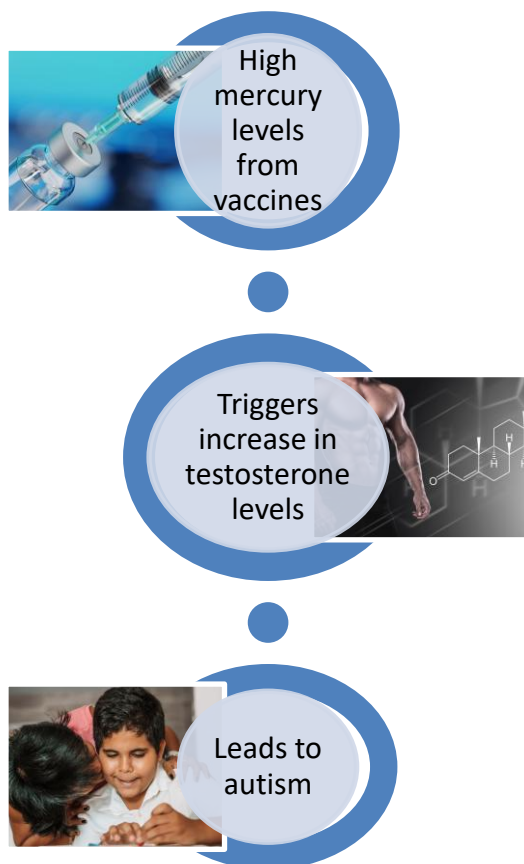
ISBN: 9781634504423



Data around thimerosal

- 2001 – except for flu, thimerosal is removed in all vaccines recommend for children 6 years and younger
- 2004 – IOM reviews studies and concludes no association b/w thimerosal and autism
- 2007 – another study published
- 2010 – another study published

Thimerosal and Leuprolide



IN THE MATTER OF
MARK R. GEIER, M.D.

Respondent

License Number: D24250

* * * * *

* BEFORE THE
* MARYLAND STATE
* BOARD OF PHYSICIANS

Case Numbers: 2007-0083,
2008-0454 & 2009-0308

ORDER FOR SUMMARY SUSPENSION
OF LICENSE TO PRACTICE MEDICINE

The Maryland State Board of Physicians (the "Board") hereby **SUMMARILY SUSPENDS** the license of Mark R. Geier, M.D., (the "Respondent") (D.O.B. 05/03/1948), license number D24250, to practice medicine in the State of Maryland. The Board takes such action pursuant to its authority under Md. State Govt Code Ann. § 10-226(c)(2009 Repl. Vol.) concluding that the public health, safety or welfare imperatively requires emergency action.

CDC to study vaccines and autism, despite several studies already finding no link

"The American people expect high quality research and transparency."

By [Anne Flaherty](#), [Jon Haworth](#), and [Sony Salzman](#)

March 8, 2025, 6:29 AM



CDC to study vaccines and autism, despite several studies already finding no link Vaccine expert Dr. Paul Offit criticizes the decision as something coming from a "science resistant" Health and Human Services Secretary Robert F. Kennedy Jr.

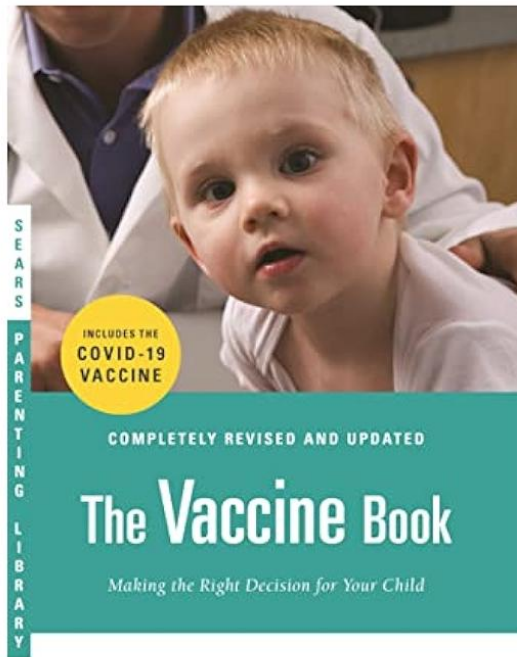
Knowledge check

True or false: Andrew Wakefield's 1998 study linking the MMR vaccine to autism was later retracted due to ethical and scientific concerns

How it's going, 2020:

There are too many vaccines given at once

Myth



Robert W. Sears, MD

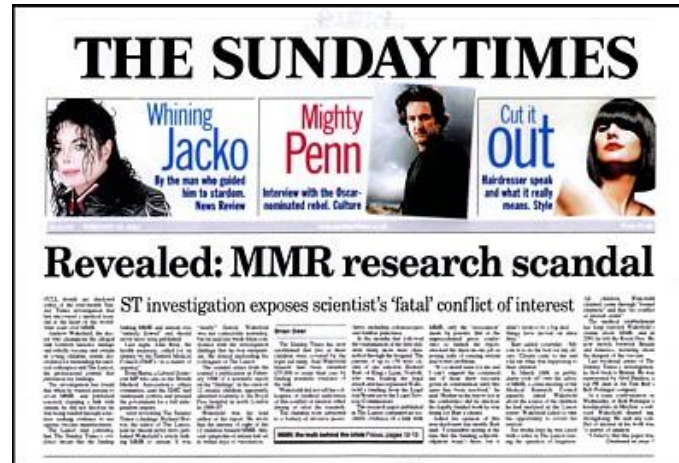
ISBN-139780316213639

Facts

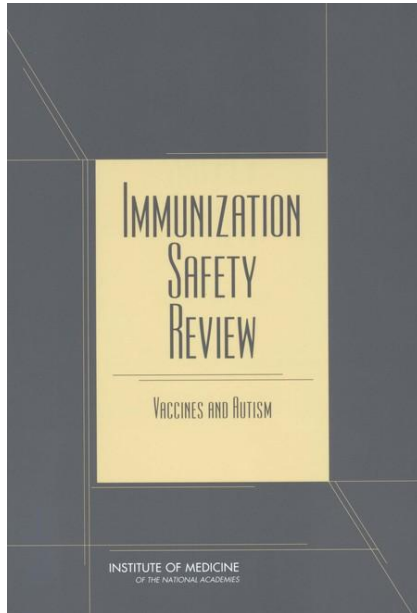
- Vaccines do not "overwhelm the immune system"
- Vaccines today have fewer antigens than 40 years ago
- Only 1% physicians agreed they should be spaced out, yet this is the only way to keep some families vaccinated at all



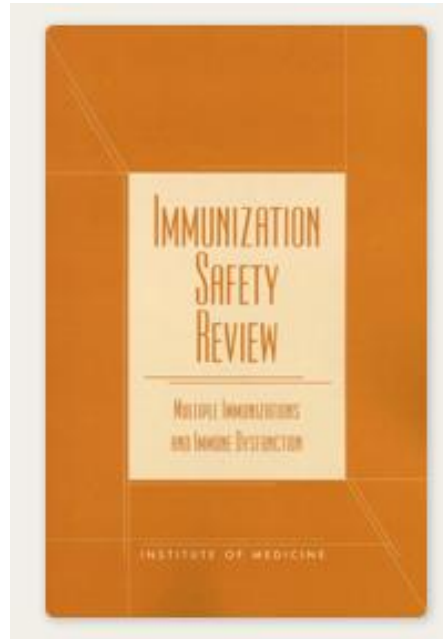
2011:



THE SCIENCE



<https://doi.org/10.17226/10997>



<https://doi.org/10.17226/10306>.

And dozens of others included in website, from groups from around the world

Comparative Study > *Pediatrics*. 2003 Nov;112(5):1039-48.

Safety of thimerosal-containing vaccines: a two-phased study of computerized health maintenance organization databases

Thomas Verstraeten [†], Robert L Davis, Frank DeStefano, Tracy A Lieu, Philip H Rhodes, Steven B Black, Henry Shinefield, Robert T Chen; Vaccine Safety Datalink Team

Affiliations + expand
PMID: 14595043



2012 - today:

eScholarship > UCLA > **UCLA Previously Published Works**

Download PDF

Safety of vaccines used for routine immunization in the United States: An updated systematic review meta-analysis

2021 | Gidengi, Courtney; Goetz, Matthew Bidwell; Newberry, Sydne; Maglione, Margaret; Hall, Owen; Larkin, Jody; Motala, Aneesa; Hempel, Susanne

Published Web Location

<https://doi.org/10.1016/j.vaccine.2021.03.079>

Views **407,345** | Citations **43** | Altmetric **3672**

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Original Investigation FREE

April 21, 2015

Autism Occurrence by MMR Vaccine Status Among US Children With Older Siblings With and Without Autism

Anjali Jain, MD¹; Jaclyn Marshall, MS¹; Ami Buikema, MPH²; et al

> Author Affiliations | Article Information

JAMA. 2015;313(15):1534-1540. doi:10.1001/jama.2015.3077



Cochrane Library

Cochrane Database of Systematic Reviews

Vaccines for measles, mumps, rubella, and varicella in children (Review)

Di Pietrantonj C, Rivetti A, Marchione P, Debalini MG, Demicheli V



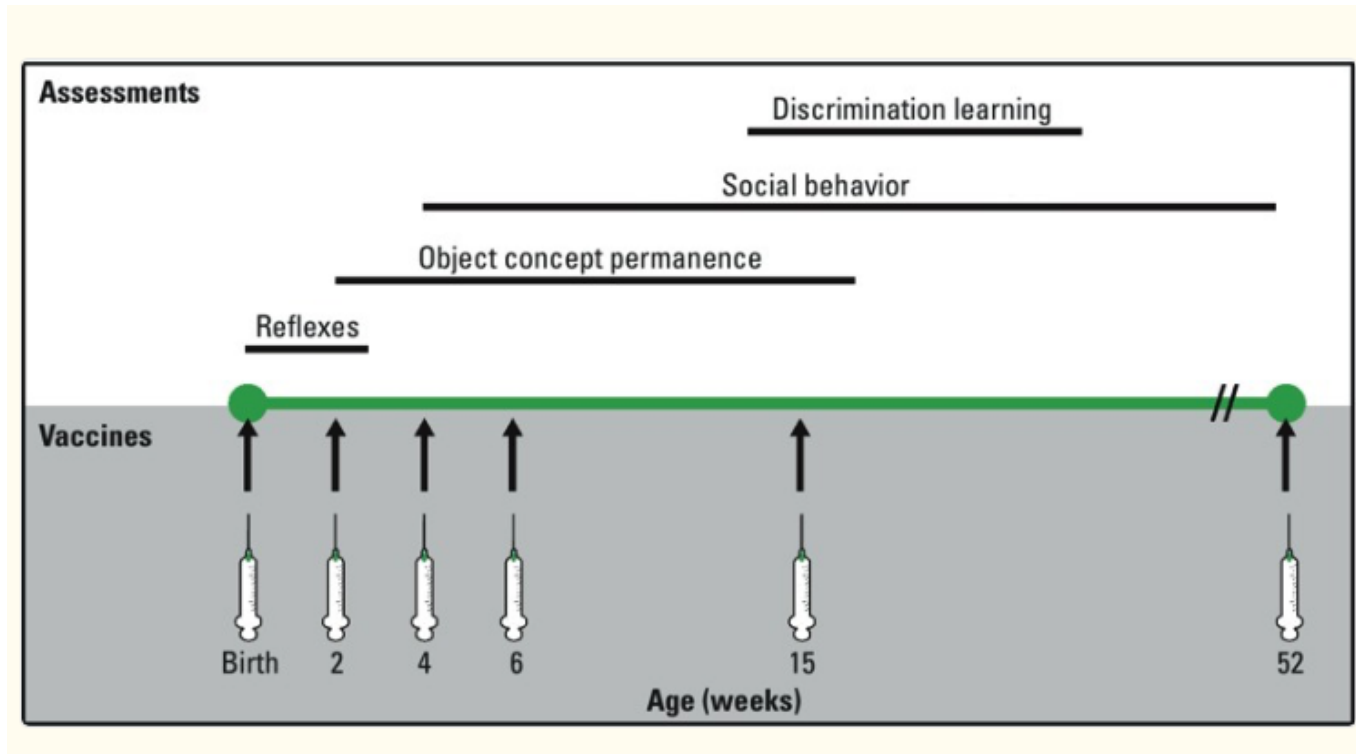
How do we know?

- Post licensure safety in US
 - CDC monitoring system
 - VAERS – adverse events only – might be biased
 - Vaccine Safety Datalink (VSD) – HMO data
 - ACIP (cancelled)
- Monitoring for :
 - Immunogenicity
 - Disease protection
 - Adverse events

Different types of studies investigating vaccine/autism link

- Basic science
- Animal research – behavioral outcomes
- Large scale epidemiological research – millions

Major findings so far - monkeys



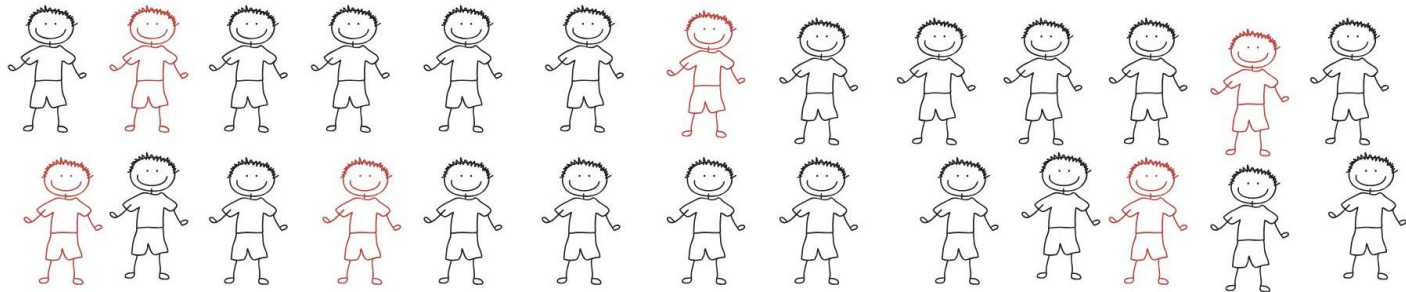
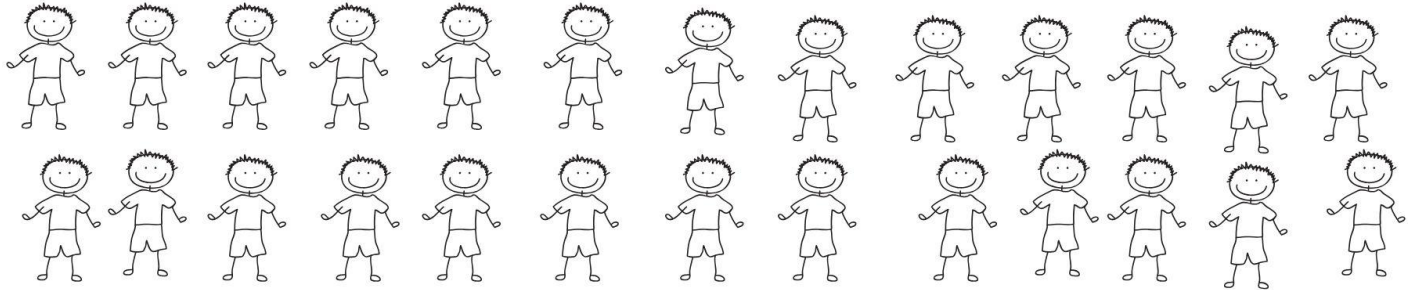
Curtis et al., 2015

Major findings so far - monkeys

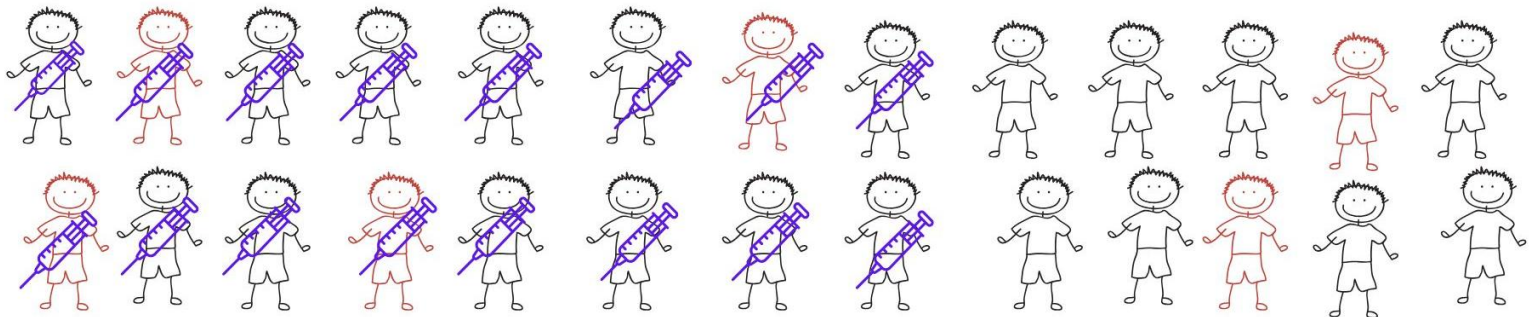
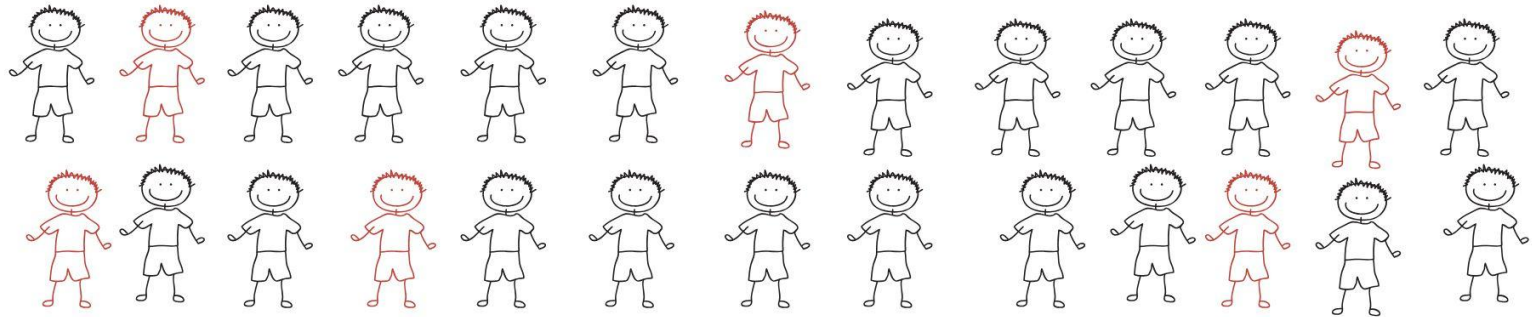
**No differences across vaccine schedules on
any behavioral measure**

Curtis et al., 2015

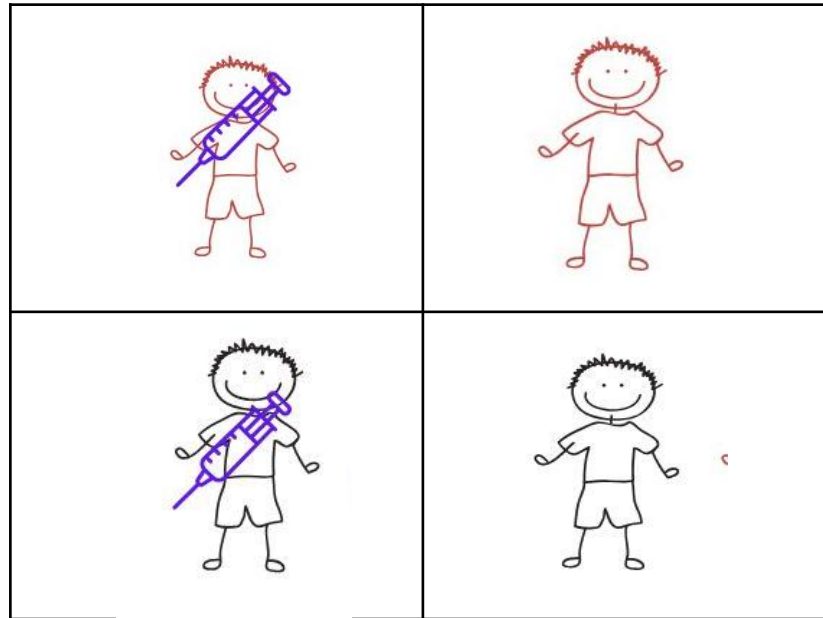
How to read the epidemiological data



How to read the epidemiological data



Relative risk:



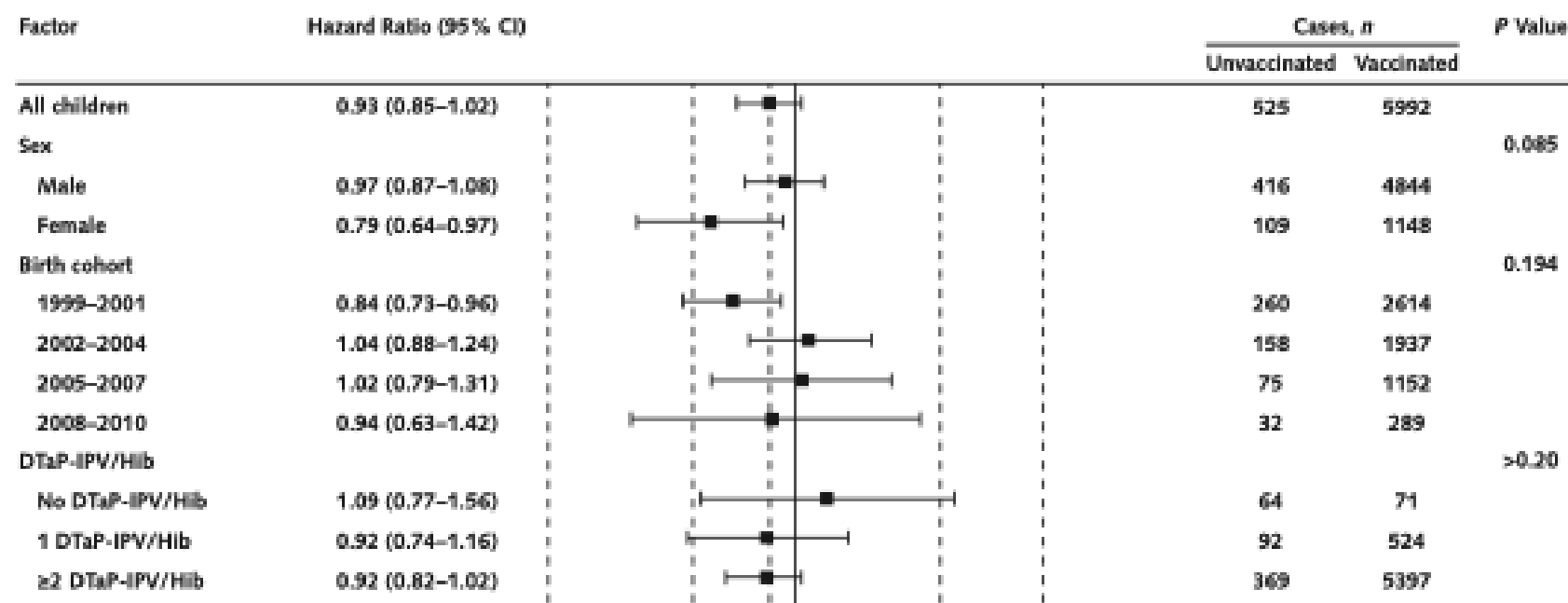
Relative risk = outcome of autism if vaccinated

outcome of autism if not vaccinated

= 1 is no difference

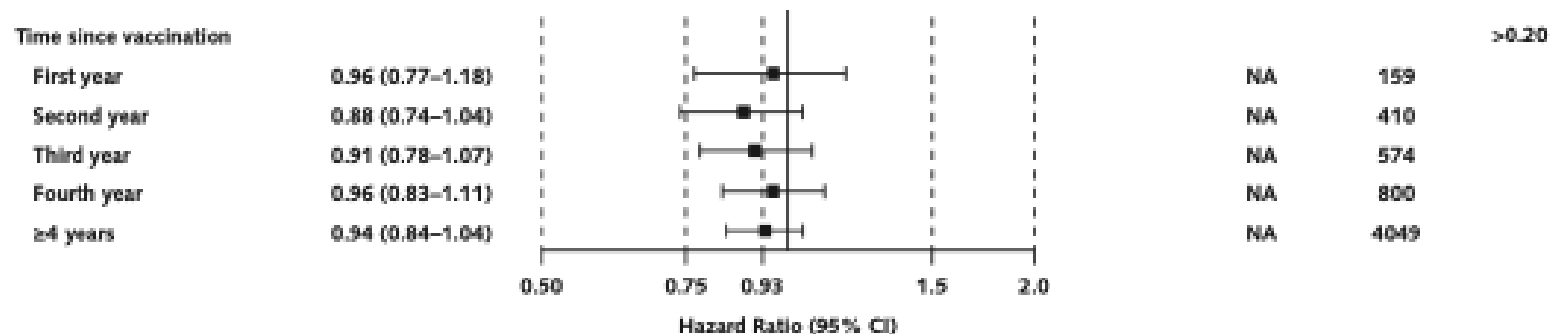
Major findings so far - children

Figure 3. Association between measles, mumps, rubella vaccination and autism in subgroups of 657 461 children born in Denmark between 1 January 1999 and 31 December 2010.



Hviid et al 2019

Major findings so far - children

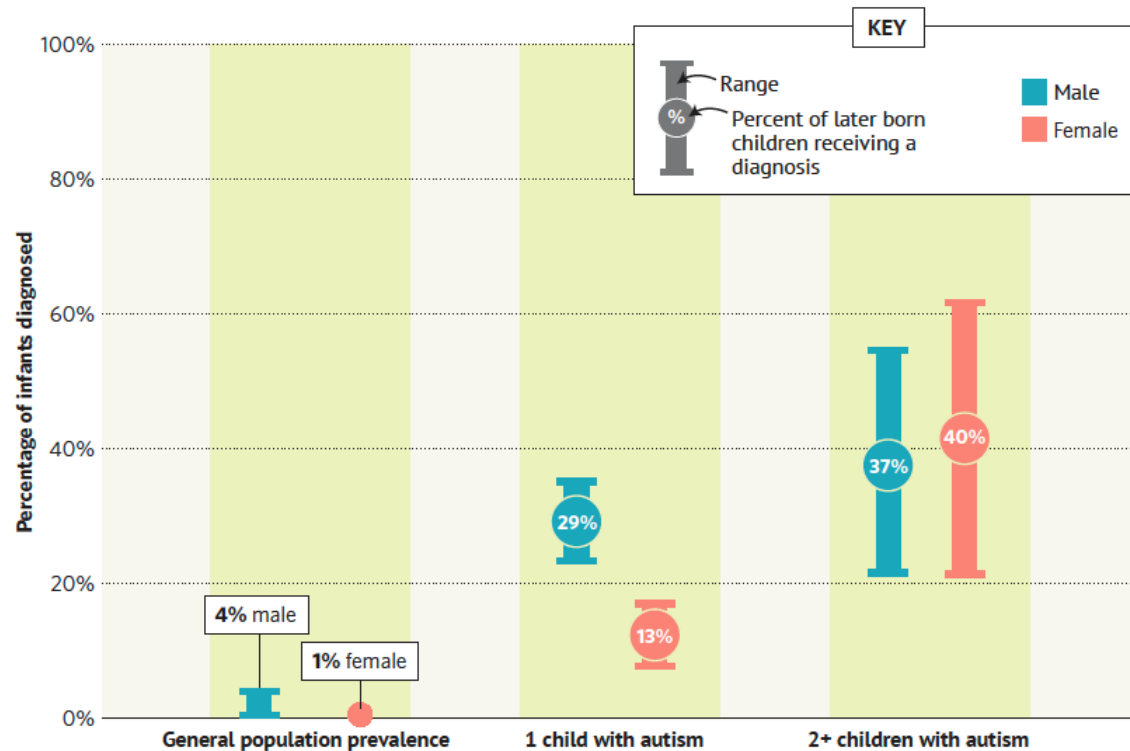


Hviid et al 2019

Genetic vulnerability? Baby sibs!

What is the recurrence of autism in families who already have one or more children with autism?

The CDC reports that the prevalence of autism in the general population is 2.8% (4% of boys and 1% of girls). This study from the Baby Siblings Research Consortium shows the likelihood of diagnosis for a male or female child born to families with 1 or more children already diagnosed with autism.



Ozonoff et al., 2024 PMID: 39011552

Susceptibility to vaccines? No.

Table 2. Unadjusted and Adjusted Relative Risk Estimates for MMR Vaccination and ASD at Ages 2 to 5 Years in Children With Older Siblings With and Without Diagnosed ASD

	Older Sibling Without ASD (n = 93 798)					Older Sibling With ASD (n = 1929)				
	No. of ASD Cases/Total No. ^a	Unadjusted ^b		Adjusted ^c		No. of ASD Cases/Total No. ^a	Unadjusted ^b		Adjusted ^c	
MMR Status		RR (95% CI)	P Value ^d	RR (95% CI)	P Value		RR (95% CI)	P Value ^d	RR (95% CI)	P Value
Age 2 y										
1 dose	53/77 822	0.80 (0.44-1.46)	.57	0.91 (0.68-1.20)	.50	7/1394	0.44 (0.15-1.29)	.22	0.76 (0.48-1.22)	.25
Unvaccinated	13/15 249	1 [Reference]		1 [Reference]		6/520	1 [Reference]			
Age 3 y										
1 dose	239/79 666	0.86 (0.62-1.18)	.39	0.97 (0.77-1.21)	.76	38/1458	0.67 (0.38-1.18)	.22	0.81 (0.53-1.25)	.34
Unvaccinated	45/12 853	1 [Reference]		1 [Reference]		17/438	1 [Reference]			
Age 4 y										
1 dose	395/79 691	0.91 (0.70-1.18)	.53	1.03 (0.81-1.31)	.82	64/1491	0.66 (0.42-1.04)	.10	0.86 (0.56-1.34)	.51
Unvaccinated	65/11 957	1 [Reference]		1 [Reference]		25/387	1 [Reference]			
Age 5 y										
2 doses	244/45 568	0.74 (0.55-0.99)	.049	1.09 (0.76-1.54)	.45	30/796	0.44 (0.26-0.75)	.003	0.56 (0.30-1.04)	.07
1 dose	339/40 495	1.16 (0.87-1.53)	.35	1.10 (0.79-1.53)	.59	51/864	0.69 (0.43-1.11)	.16	0.92 (0.56-1.50)	.74
Unvaccinated	56/7735	1 [Reference]		1 [Reference]		23/269	1 [Reference]		1 [Reference]	

Abbreviations: ASD, autism spectrum disorders; MRM, measles-mumps-rubella; RR, relative risk.

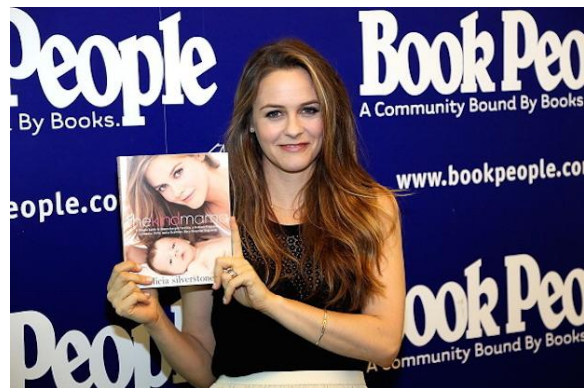
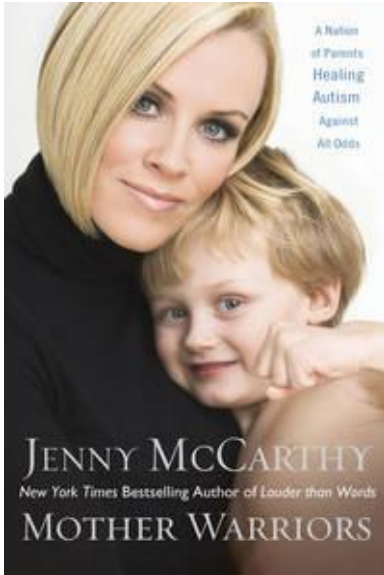
^a For each row, categories for No. and No. of ASD cases will not sum to the total number as ASD cases described in Results because some children were diagnosed with ASD after age 5 years and some children received 2 MMR doses prior to the recommended ages as reported.

^b Cumulative incidence rate ratio based on simple incidence proportions.

^c Hazard rate ratio from Cox proportional hazards model adjusting for birth year, sex, region, race/ethnicity, maternal or paternal highest education level, household income, mother's age at birth of index infant, father's age at birth of index infant, continuous enrollment with mental health carve-out benefit, Childhood Chronic Conditions score, seizure, allergies, and preterm birth.

^d Yates-corrected χ^2 test.

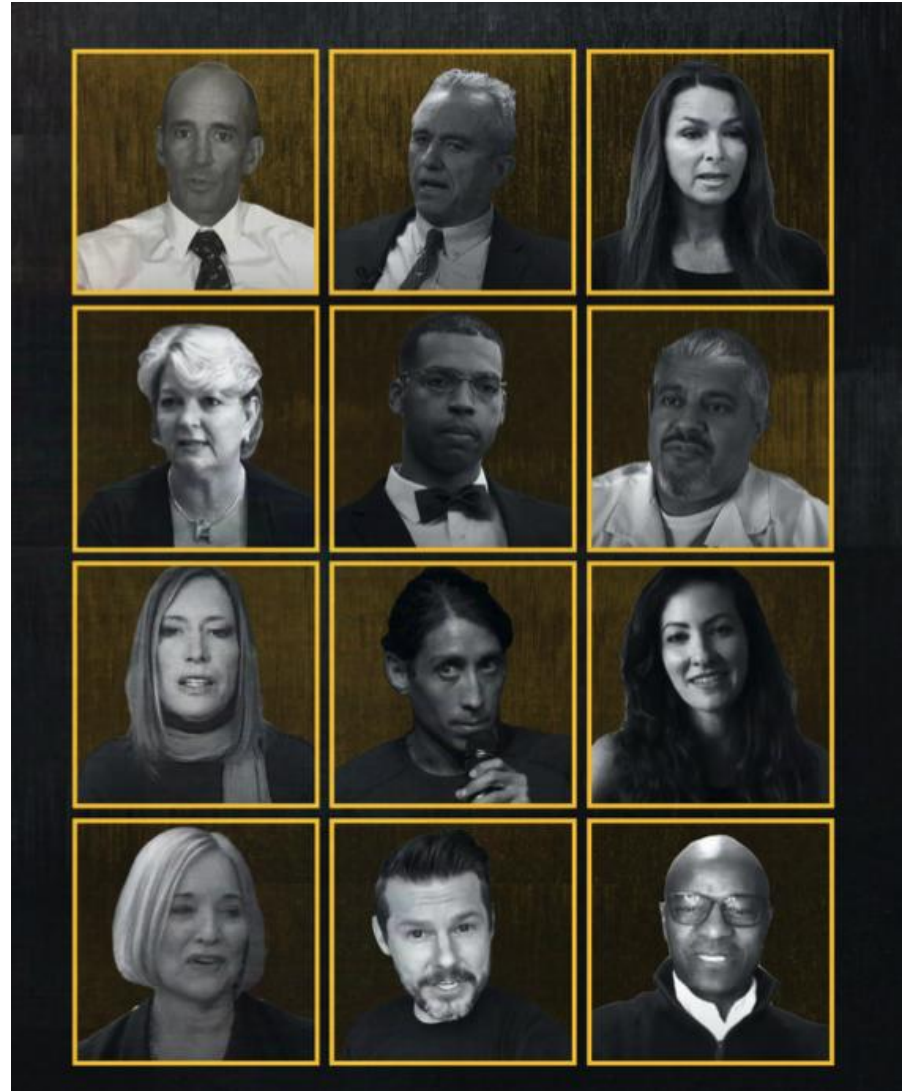
It takes a village



It takes a village



Center for Countering Digital
Hate, 2022



Knowledge check

Which of the following best summarizes the current scientific consensus on the relationship between vaccines and autism?

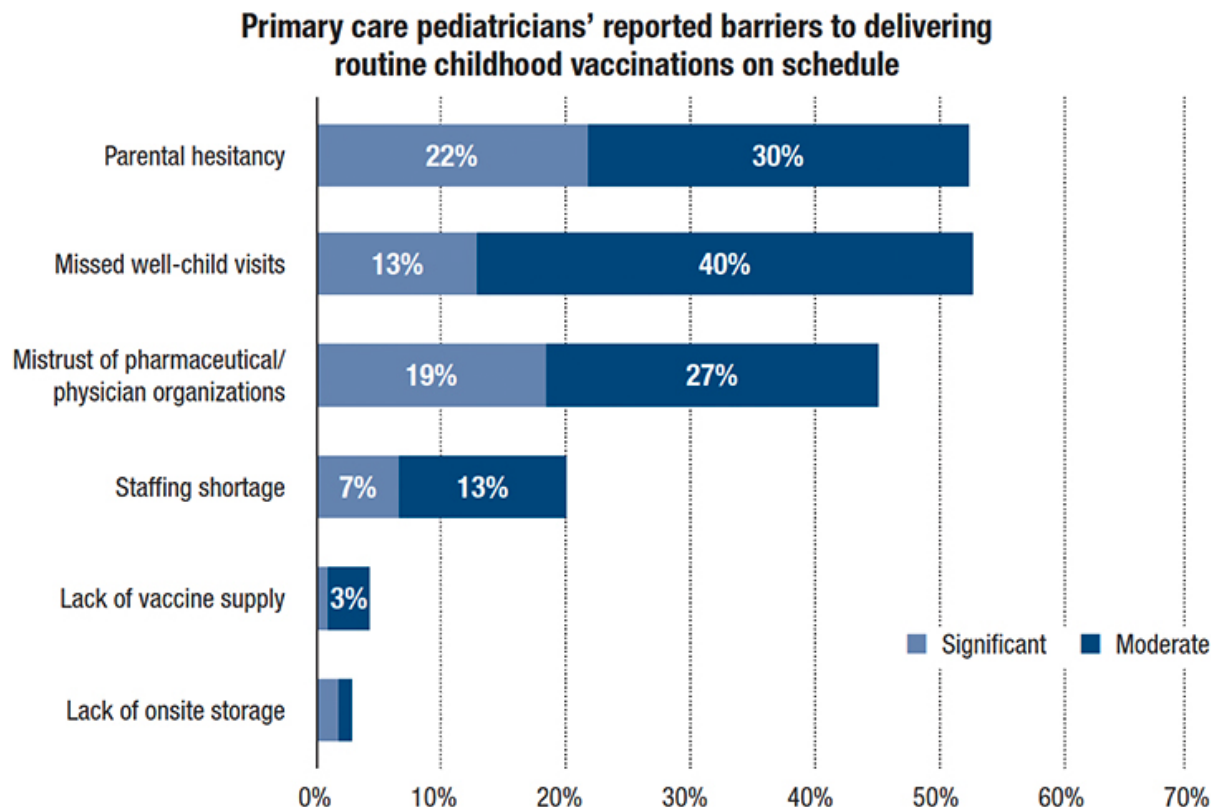
- a. There is strong evidence that vaccines cause autism in some individuals
- b. The evidence is inconclusive and more evidence is needed.
- c. Multiple large scale studies have found no link between vaccines and autism
- d. Vaccines only cause autism when given in combination

What discourages people from vaccinating?

Vaccine controversies lead to hesitancy

- Don't tell me what to put in my body
- Vaccines cause autism
- Adjuvants in vaccines like thimerosal or aluminum are dangerous
- Vaccines are linked to the disease they protect against ("shedding")
- Vaccines cause autoimmune diseases
- Too many vaccines too soon
- Vaccines against STDs
- Religious reasons

What prevents vaccinations?

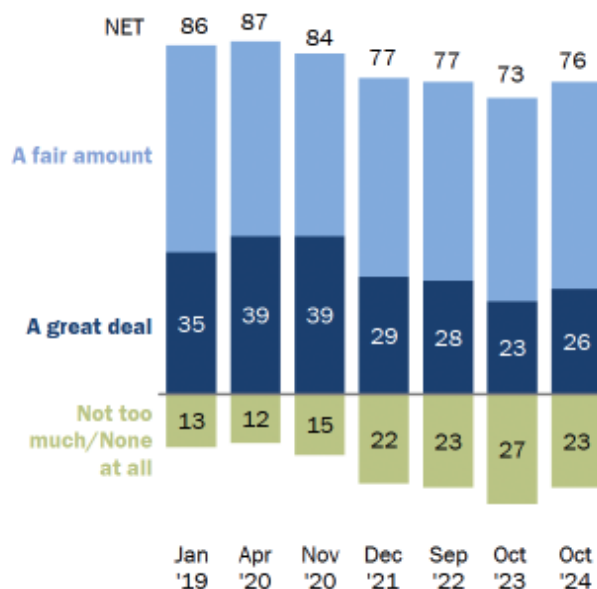


Source: AAP Periodic Survey, 2022 (n=305)

Trust in science is low

Confidence in scientists up slightly but remains lower than before pandemic

% of U.S. adults who have ___ of confidence in scientists to act in the best interests of the public



Note: Respondents who did not give an answer are not shown.

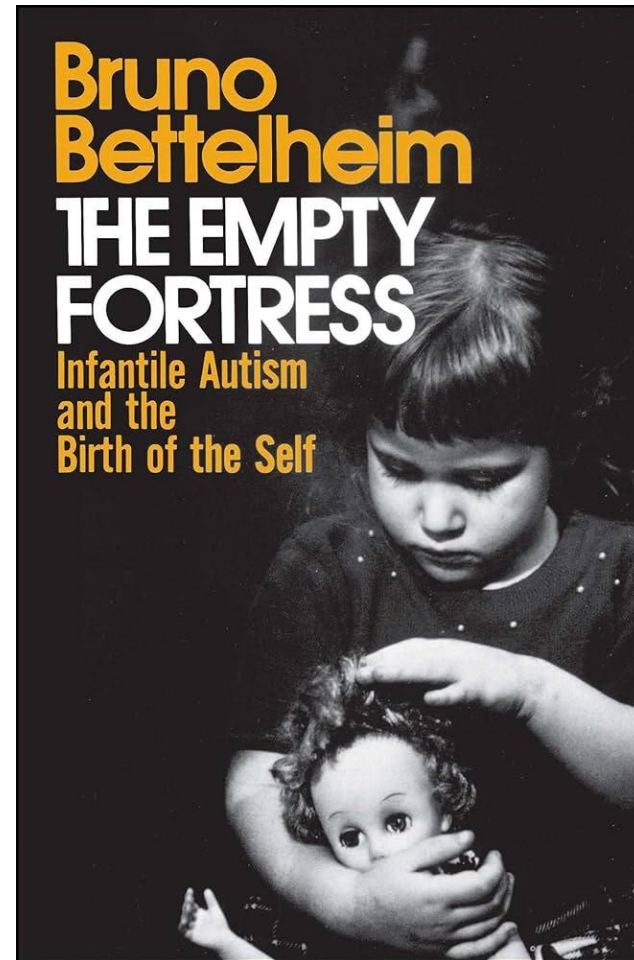
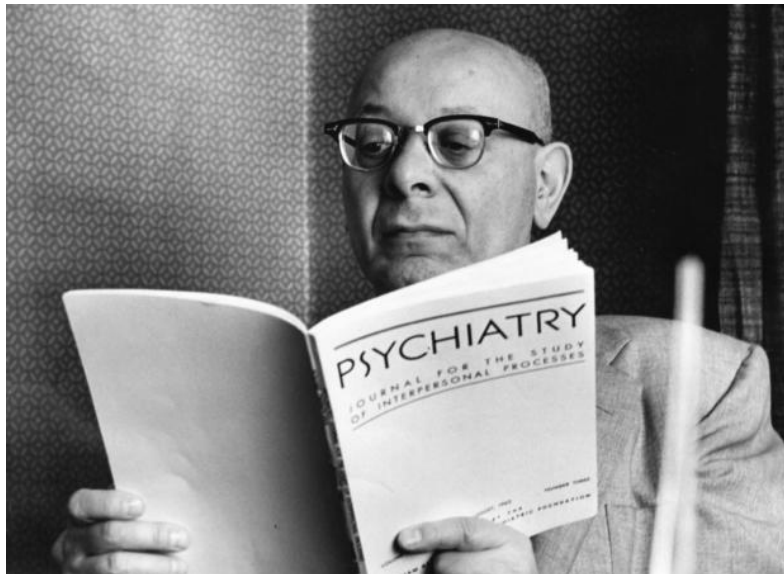
Source: Survey of U.S. adults conducted Oct. 21-27, 2024.

"Public Trust in Scientists and Views on Their Role in Policymaking"

PEW RESEARCH CENTER

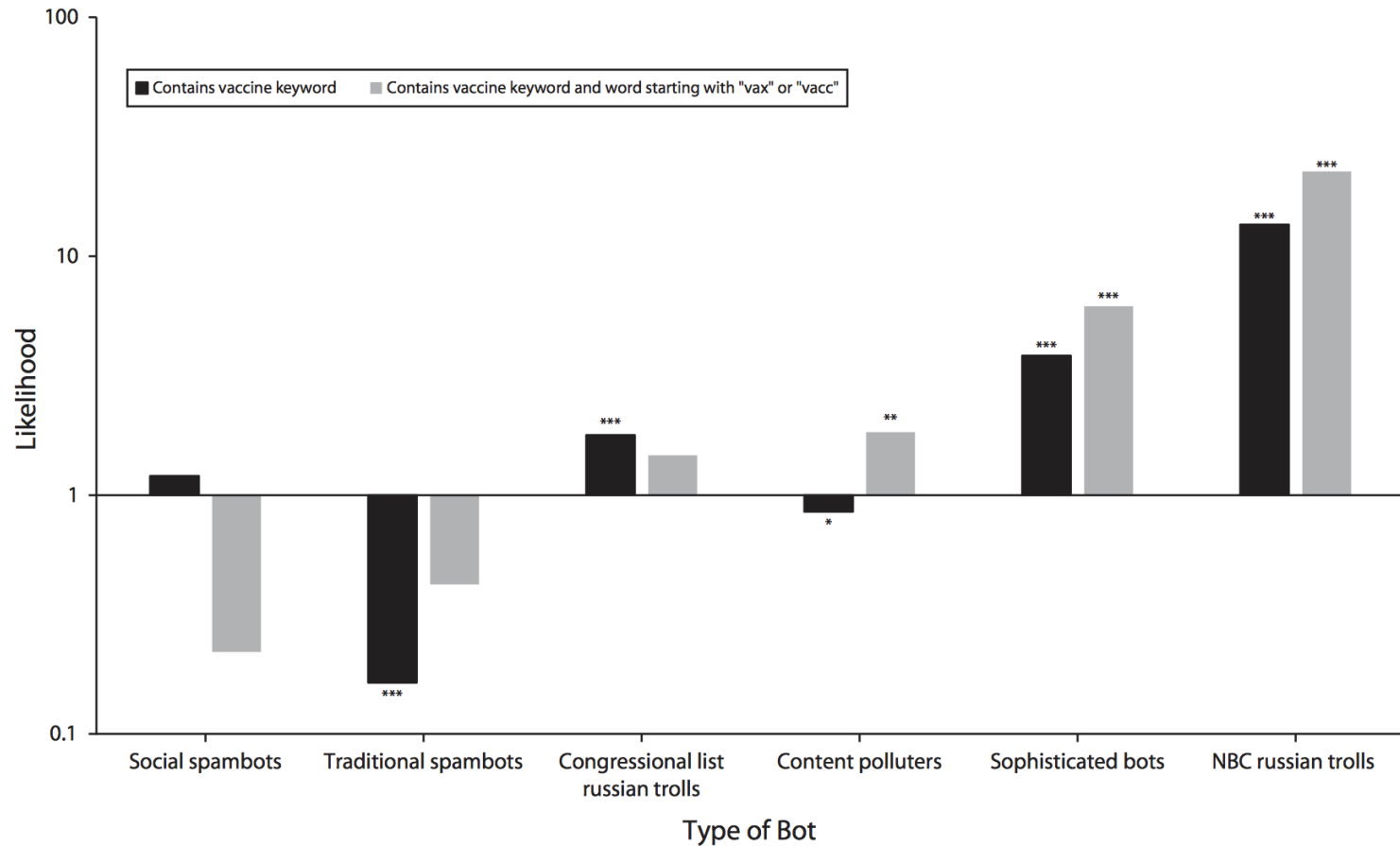
<https://www.pewresearch.org/science/2024/11/14/public-trust-in-scientists-and-views-on-their-role-in-policymaking/>

The history of autism makes things worse



ISBN-13: 9780029031407

Social media is no help either



Note. NBC = National Broadcasting Network. All results remained significant after controlling for multiple comparisons using the Holm–Bonferroni procedure. Raw counts are given in Table B (available as a supplement to the online version of this article at <http://www.ajph.org>).

* $P < .05$; ** $P < .01$; *** $P < .001$.

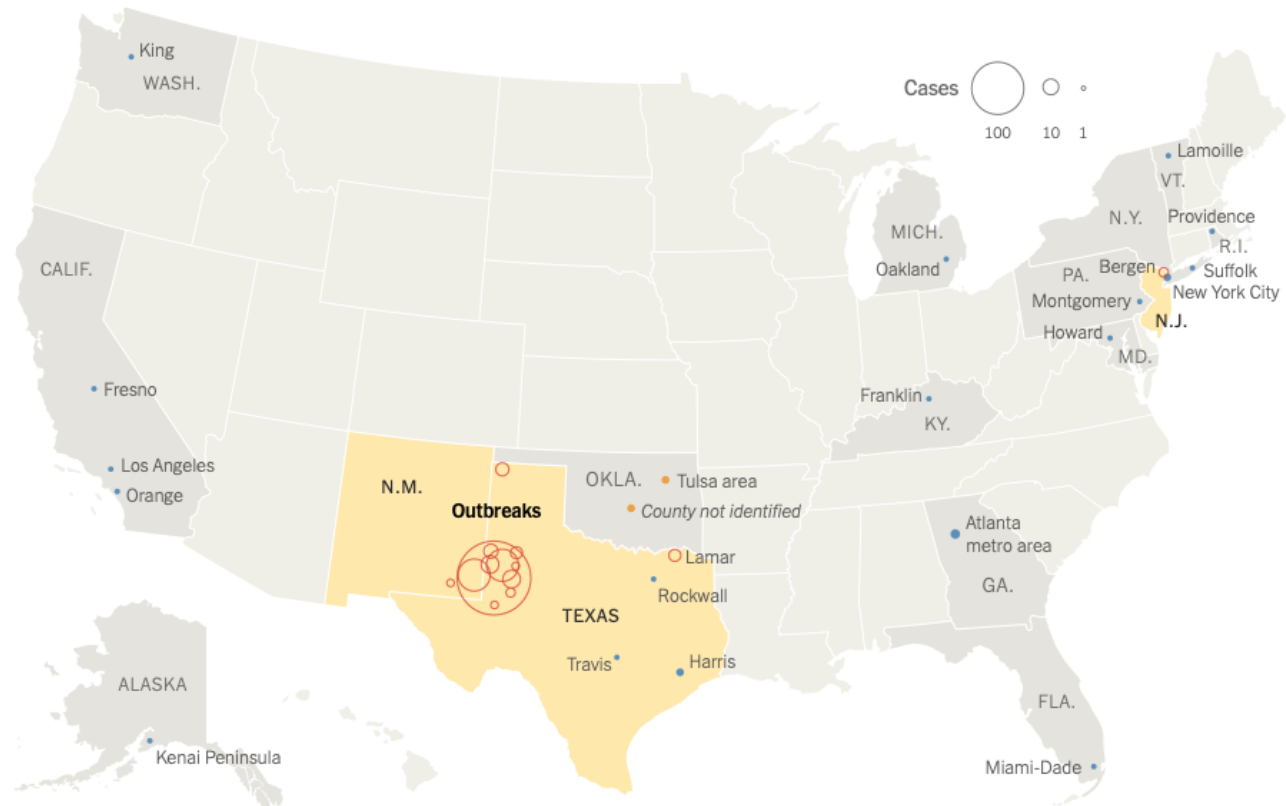
FIGURE 1—Bots' Likelihood of Tweeting About Vaccines Compared With Average Twitter Users: July 14, 2014–September 26, 2017

Broniatowski et al., 2018

What are the consequences?

Measles cases by county in 2025

○ Outbreaks ● Isolated cases ● Cases linked to outbreaks



We listen and we do not judge

- Strong and clear communication
 - Provider communication
 - Understanding specific barriers
- Increase access
- Provider recommendations is one of the key drivers
- Community engagement like vaccine champions
- Listening and preparing for misinformation, pushing back
 - Providers are important and trusted
- Mandates – mixed
- Incentives like tax breaks

Knowledge check

True or False: Delaying or skipping vaccinations is a recommended way to reduce the risk of autism.



The Truth About Autism and Vaccines

Alison Singer, MBA
Founder and President
Autism Science Foundation

Alycia Halladay, PhD
Chief Science Officer
Autism Science Foundation

Mary Koslap-Petraco, DNP, PNP-BC, CPNP
Board Chair
Vaccinate Your Family

Antonio Pisani, MS
Science & Education Post-Grad Intern
Vaccinate Your Family



<https://vaccinateyourfamily.org/wp-content/uploads/2025/03/The-Truth-About-Autism-and-Vaccines-VYF-ASF-Guide-2025-Color-Final-1.pdf>



Autism and Vaccines: Read the Science

Literature Reviews: Autism and Vaccines

Safety of vaccines used for routine immunization in the United States: An updated systematic review and meta-analysis

<https://pubmed.ncbi.nlm.nih.gov/34049735/>

June 2021

Vaccines for measles, mumps, rubella, and varicella in children

<https://pubmed.ncbi.nlm.nih.gov/34806766/>

Cochrane Database Systematic Review

November 2021

The science of vaccine safety: Summary of meeting at Wellcome Trust

<https://pubmed.ncbi.nlm.nih.gov/31987690/>

Vaccine

February 2020

Measles, Mumps, Rubella Vaccination and Autism: A Nationwide Cohort Study

For years, I believed
vaccines caused my
son's autism...

I was wrong.

(Story source below)



**Decades of
research confirm
there is no link
between vaccines
and autism**

Here's how we know



1/5

Summary

1. The history of the proposed link between vaccines and autism is riddled with controversies and ethical problems
2. Two decades of research from around the world in different groups has shown that there is no link between autism and vaccines
3. Trusted medical professionals have a unique opportunity to reach families who are vaccine hesitant by explaining the science and meeting families where they are.

ahalladay@autismsciencefoundation.org

References for slide 13

- Amnaylojaroen et al., 2024. PMID: 38556115
- Dutheil et al., 2021. PMID: 33714060
- Yu et al., 2022. PMID: 34929192
- Gardner et al., 2025. PMID: 39581290
- Lundgren et al., 2025. PMID: 39698790
- Persson et al., 2020. PMID: 32960896
- Dehesh et al., 2024. PMID: 39578893
- Carlsson et al., 2021. PMID: 32703331
- Tartaglione et al., 2024. PMID: 39053787
- Goodrich et al., 2025. PMID: 39694434
- Garza-Martinez et al., 2025. PMID: 39809006
- Bhattacharya et al., 2025. PMID: 40271992
- Ye et al., 2025. PMID: 40209722
- Wu et al., 2017. PMID: 27858958
- Andrade et al., 2025. PMID 400059353