

Vaccines; Pseudo-Science of the Vaccine Doubters

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ACOI 2016
Annual Convention
& Scientific Sessions

The banner features a scenic view of a resort with a large swimming pool, palm trees, and a sunset sky. The text is overlaid in a bold, white, sans-serif font.

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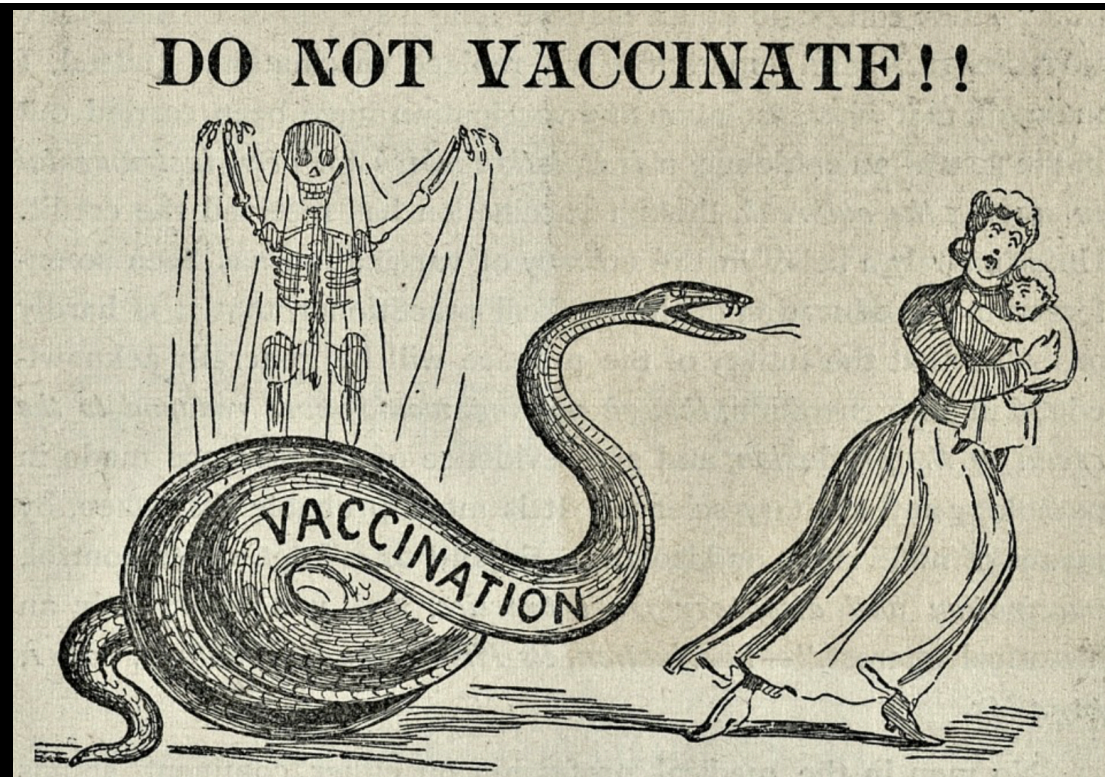
No disclosures.



Vaccines; Pseudo-Science of the Vaccine Doubtters

- Objectives;

Anti-Vaccine Movement



A cartoon from a December 1894 anti-vaccination publication

- Not a new phenomenon.



The Cow Pock — or — the Wonderful Effects of the New Inoculation! — via the Publications of the Anti-Vaccine Society.

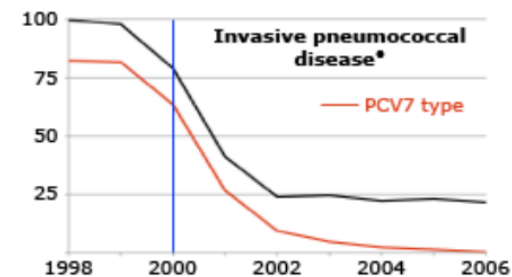
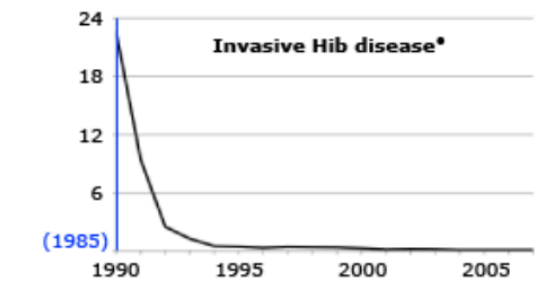
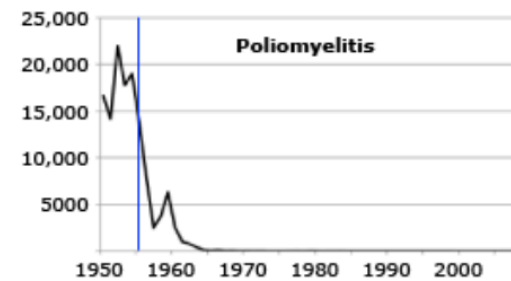
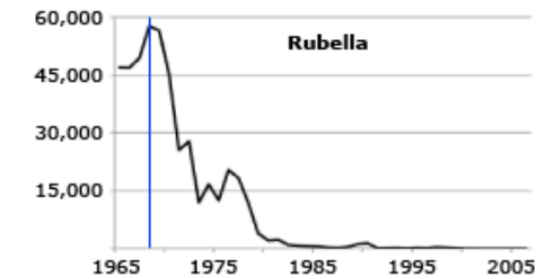
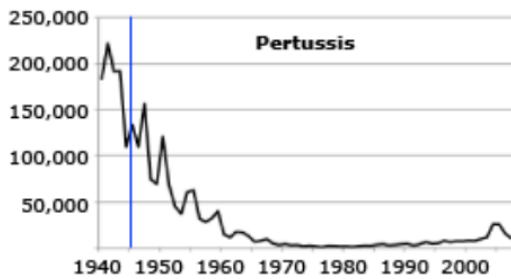
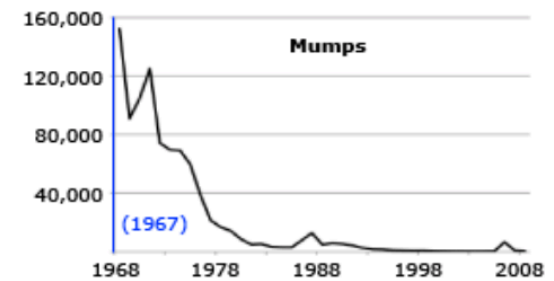
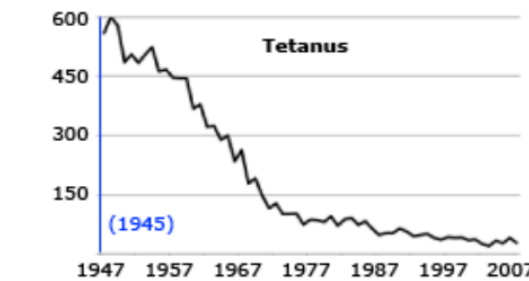
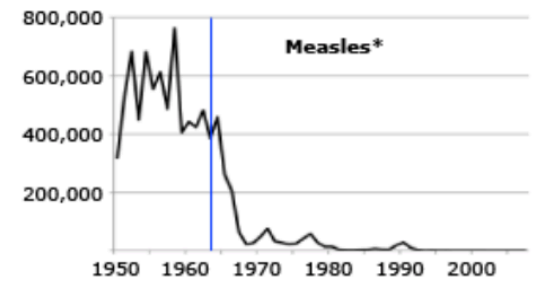
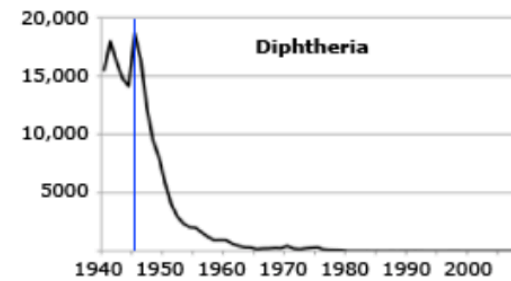
Vaccine Hesitancy

The World Health
Organization Strategic
Advisory Group of
Experts Working Group
on Vaccine Hesitancy

"Vaccine hesitancy refers to a delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence."

Effectiveness of routine childhood immunizations

Immunization is one of the most effective preventative health measures and has saved countless children from death or serious disability.



“The example that I use is an example which happened to my wife. She came into the office on a weekend day. She was helping the nurse give vaccines. She walked into a room. A mother was sitting with her four month old child waiting alongside of the wall. While my wife was drawing the vaccine through the syringe, the child had a seizure and went on to have the permanent seizure disorder, epilepsy.

If my wife had given that vaccine five minutes earlier, I think there are no amount of statistical data in the world that would've convinced that mother of anything other than the vaccine caused it.

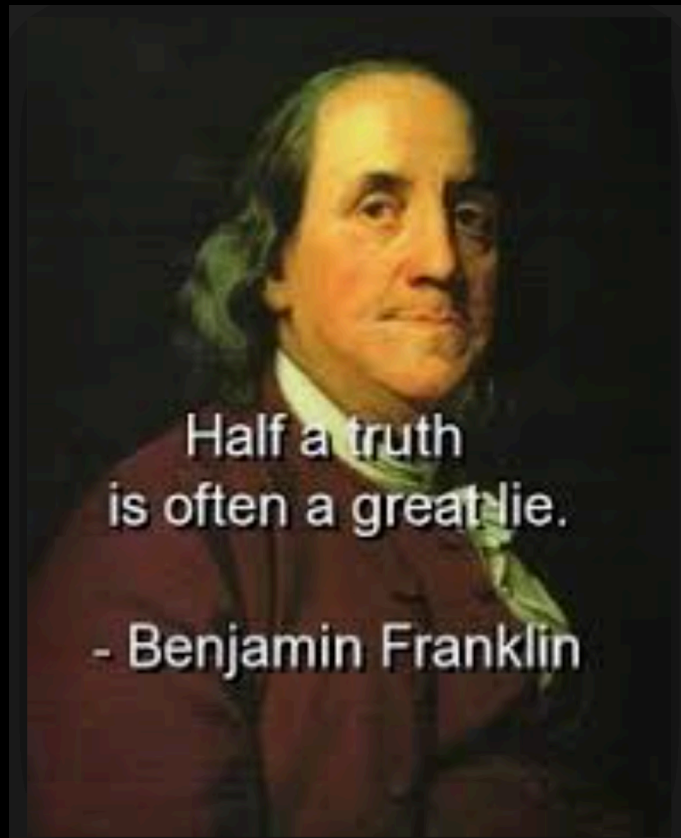
What else could it have been, right? I mean, the child was fine, they got this vaccine, and then they had epilepsy. What else could it have been?”



Paul A. Offit;

- American pediatrician specializing in infectious diseases and an expert on vaccines, immunology, and virology.
- He is the co-inventor of a rotavirus vaccine that has been credited with saving hundreds to thousands of lives every day.

Benjamin Franklin, a prominent early anti-vaccination campaigner, regretted his skepticism about vaccination after his 4-year-old son died from smallpox.



“I long regretted bitterly, and still regret that I had not given it to him by inoculation. This I mention for the sake of parents who omit that operation, on the supposition that they should never forgive themselves if a child died under it, my example showing that the regret may be the same either way, and that, therefore, the safer should be chosen.”

In March 2015, we were struck by the rotavirus. I'll never forget the look of fear on my daughters' faces as they suffered intense pain and diarrhea that lasted for three weeks. I've no idea where we picked it up, but the horrific experience proved that, even living in a highly vaccinated population, we were vulnerable. Thankfully, we pulled through with a combination of rest and rehydration.

I thought, 'Let someone else take on the risks of vaccinating.' It was a very selfish viewpoint.

- Kristen O'Meara



Kristen O'Meara with her daughters Áine (from left), Natasha and Lena, who are now fully vaccinated.

Andrew Jeremy Wakefield

- British former gastroenterologist and medical researcher.
- Fraudulent 1998 research paper in support of the **now-discredited claim** that there was a link between the administration of the MMR vaccine, and the appearance of autism and bowel disease.



Andrew Wakefield, disgraced researcher, failed doctor, scam artist.

Early report

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

A J Wakefield, S H Murch, A Anthony, J Linnell, D M Casson, M Malik, M Berelowitz, A P Dhillon, M A Thomson, P Harvey, A Valentine, S E Davies, J A Walker-Smith

Summary

Background We investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder.

Methods 12 children (mean age 6 years [range 3–10], 11 boys) were referred to a paediatric gastroenterology unit with a history of normal development followed by loss of acquired skills, including language, together with diarrhoea and abdominal pain. Children underwent gastroenterological, neurological, and developmental assessment and review of developmental records. Ileocolonoscopy and biopsy sampling, magnetic-resonance imaging (MRI), electroencephalography (EEG), and lumbar puncture were done under sedation. Barium follow-through radiography was done where possible. Biochemical, haematological, and immunological profiles were examined.

Findings Onset of behavioural symptoms was associated by the parents, with measles, mumps, and rubella vaccination in eight of the 12 children, with measles infection in one child, and otitis media in another. All 12 children had intestinal abnormalities ranging from lymphoid nodular hyperplasia to atrophic ulceration. Histology showed patchy chronic inflammation in 11 children and reactive ileal lymphoid hyperplasia in seven, but no granulomas. Behavioural disorders included autism (nine), disintegrative psychosis (one), and possible postviral or vaccinal encephalitis (two). There were no focal neurological abnormalities and MRI and EEG tests were normal. Abnormal laboratory results were significantly raised urinary methylmalonic acid compared with age-matched controls ($p=0.003$), low haemoglobin in four children, and low serum IgA in four children.

Interpretation We identified associated gastrointestinal disease and developmental regression in a group of previously normal children, which was generally associated in time with possible environmental triggers.

Lancet 1998; **351**: 637–41

See Commentary page

Inflammatory Bowel Disease Study Group, University Departments of Medicine and Histopathology (A J Wakefield FRCS, A Anthony MB, J Linnell PhD, A P Dhillon MRCP, S E Davies MRCP) and the **University Departments of Paediatric Gastroenterology** (S H Murch MB, D M Casson MRCP, M Malik MRCP, M A Thomson FRCP, J A Walker-Smith FRCP), **Child and Adolescent Psychiatry** (M Berelowitz FRCPsych), **Neurology** (P Harvey FRCP), and **Radiology** (A Valentine FRCP), **Royal Free Hospital and School of Medicine, London NW3 2QG, UK**

Correspondence to: Dr A J Wakefield

Introduction

We saw several children who, after a period of apparent normality, lost acquired skills, including communication. They all had gastrointestinal symptoms, including abdominal pain, diarrhoea, and bloating and, in some cases, food intolerance. We describe the clinical findings, and gastrointestinal features of these children.

Patients and methods

12 children, consecutively referred to the department of paediatric gastroenterology with a history of a pervasive developmental disorder with loss of acquired skills and intestinal symptoms (abdominal pain, bloating and food intolerance), were investigated. All children were admitted to the ward for 2 weeks, accompanied by their parents.

Clinical investigations

We took histories including details of immunisations and exposure to infectious diseases, and assessed the children. In 11 cases the history was obtained by the senior clinician (JW-S). Neurological and psychiatric assessments were done by consultant staff (PH, MB) with HMS-4 criteria.¹ Developmental assessments included a review of prospective developmental records from parents, health visitors, and general practitioners. Four children did not undergo psychiatric assessment in hospital; all had been assessed professionally elsewhere, so these assessments were used as the basis for their behavioural diagnosis.

After bowel preparation, ileocolonoscopy was performed by SHM or MAT under sedation with midazolam and pethidine. Paired frozen and formalin-fixed mucosal biopsy samples were taken from the terminal ileum; ascending, transverse, descending, and sigmoid colons, and from the rectum. The procedure was recorded by video or still images, and were compared with images of the previous seven consecutive paediatric colonoscopies (four normal colonoscopies and three on children with ulcerative colitis), in which the physician reported normal appearances in the terminal ileum. Barium follow-through radiography was possible in some cases.

Also under sedation, cerebral magnetic-resonance imaging (MRI), electroencephalography (EEG) including visual, brain stem auditory, and sensory evoked potentials (where compliance made these possible), and lumbar puncture were done.

Laboratory investigations

Thyroid function, serum long-chain fatty acids, and cerebrospinal-fluid lactate were measured to exclude known causes of childhood neurodegenerative disease. Urinary methylmalonic acid was measured in random urine samples from eight of the 12 children and 14 age-matched and sex-matched normal controls, by a modification of a technique described previously.² Chromatograms were scanned digitally on computer, to analyse the methylmalonic-acid zones from cases and controls. Urinary methylmalonic-acid concentrations in patients and controls were compared by a two-sample t test. Urinary creatinine was estimated by routine spectrophotometric assay.

Children were screened for antiendomysial antibodies and boys were screened for fragile-X if this had not been done



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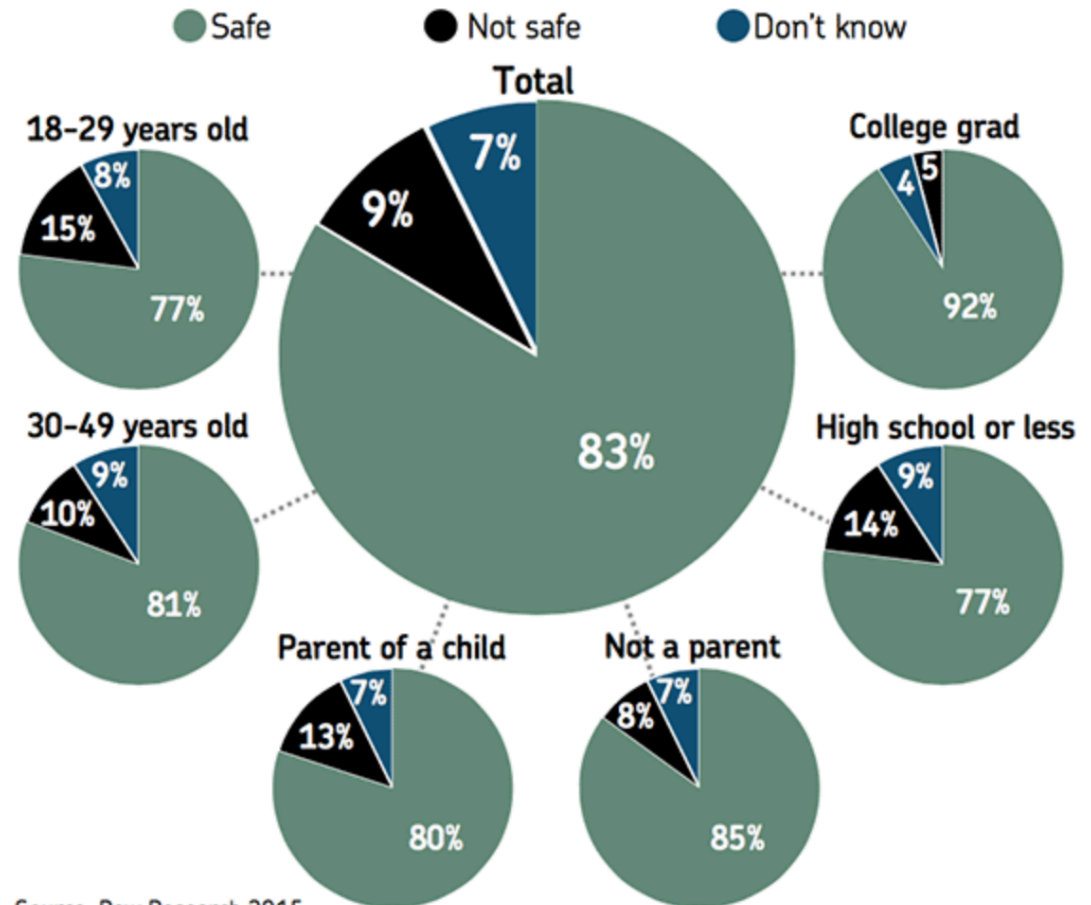
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- After the publication of the paper, other researchers were **unable to reproduce Wakefield's findings or confirm his hypothesis** of an association between the MMR vaccine and autism and GI disease.
- A 2004 investigation by *Sunday Times* reporter Brian Deer identified **undisclosed financial conflicts of interest on Wakefield's part**, and most of his co-authors then withdrew their support for the study's interpretations.
- An investigation centered on Deer's numerous findings, including that children with autism were subjected to unnecessary invasive medical procedures such as colonoscopies and lumbar punctures, and that Wakefield acted **without the required ethical approval from an institutional review board**.

Measles Vaccine Safety

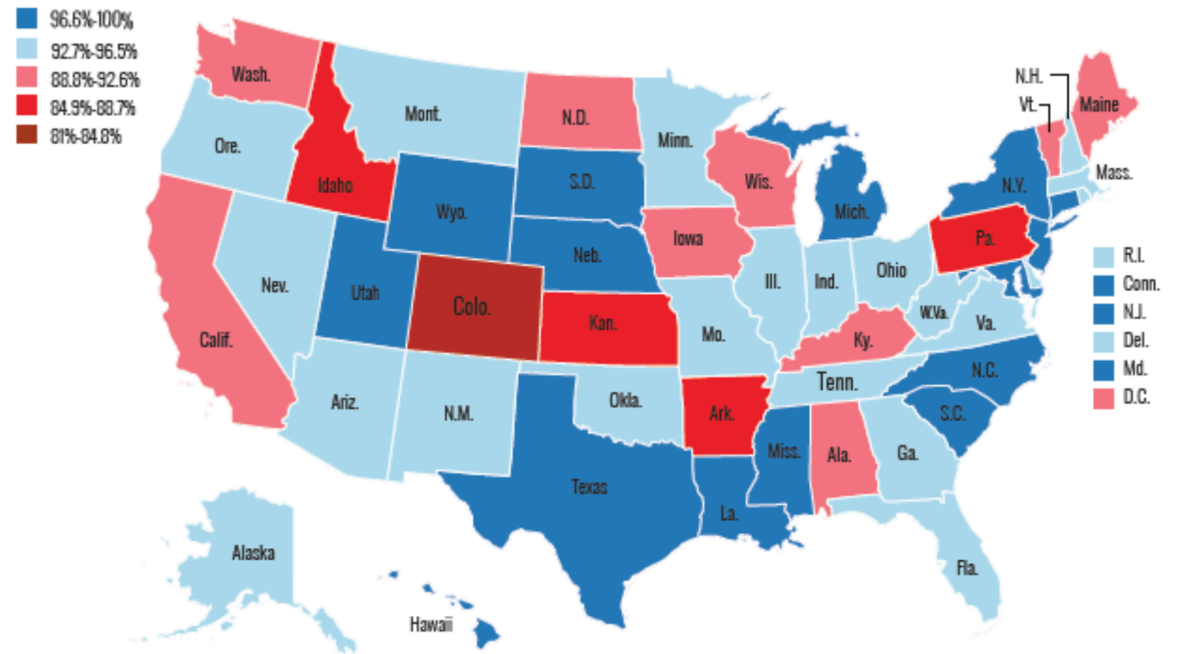
About one in ten think vaccines for diseases such as measles, mumps and rubella are unsafe for healthy children. However the large majority views the vaccines as safe.



Source: Pew Research 2015
Graphic: Tribune News Service

Vaccination Rates by State

Percentage of kindergartners vaccinated by state, 2013-2014 school year



Note: Data for Wyoming is from the 2012-13 school year.

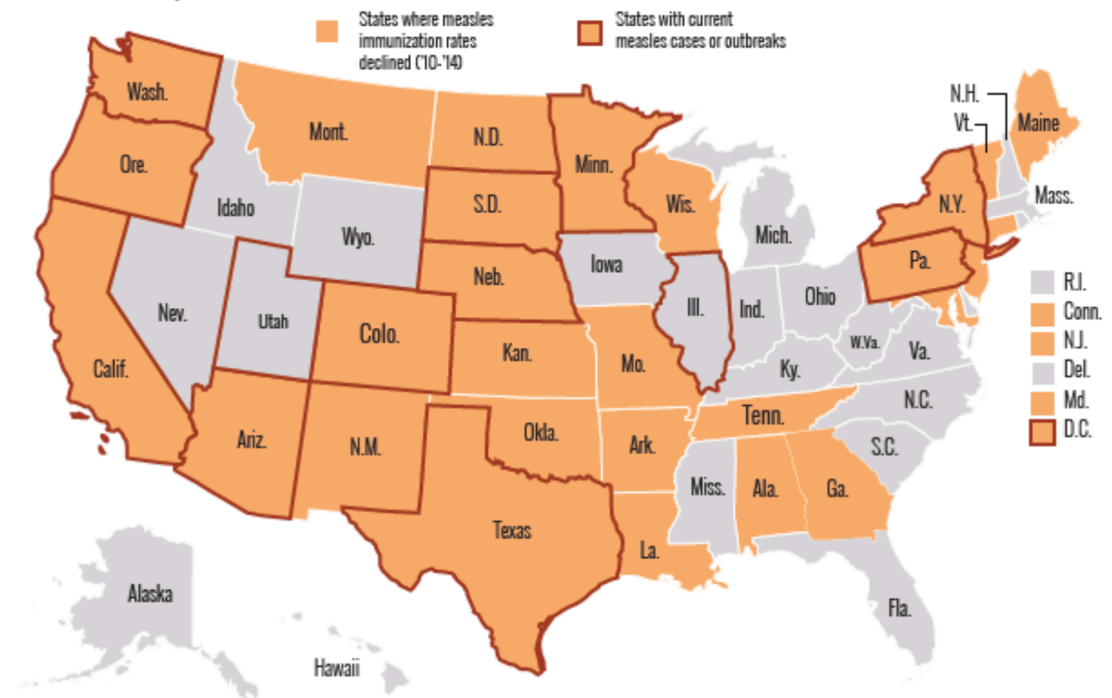
Source: Centers for Disease Control and Prevention

Mother Jones

Where Have Vaccination Rates Dropped?

Many states saw MMR vaccination rates drop between the 2009-10 and 2013-14 school years.

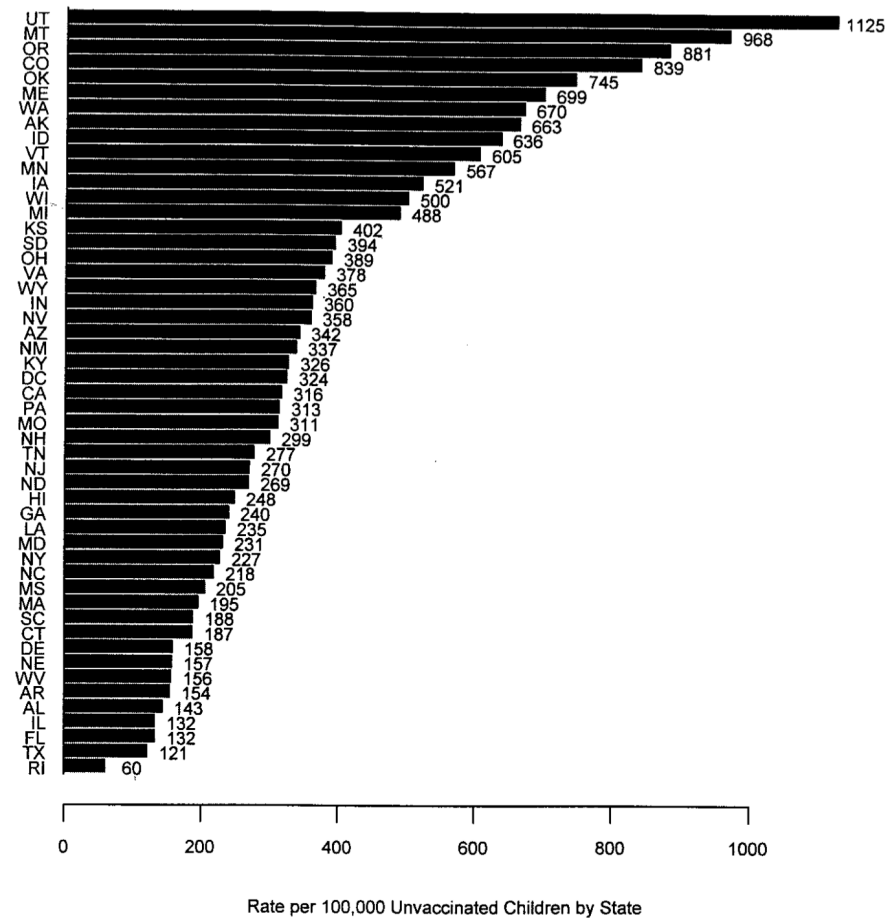
Fourteen have experienced measles outbreaks and cases in 2015.



Note: Data for Alaska, New Hampshire, and Wyoming were incomplete.
Source: Centers for Disease Control and Prevention

Mother Jones

Fig 2. Estimated rates of unvaccinated children per 100 000 children 19 to 35 months of age, according to state (1995-2001 NIS).



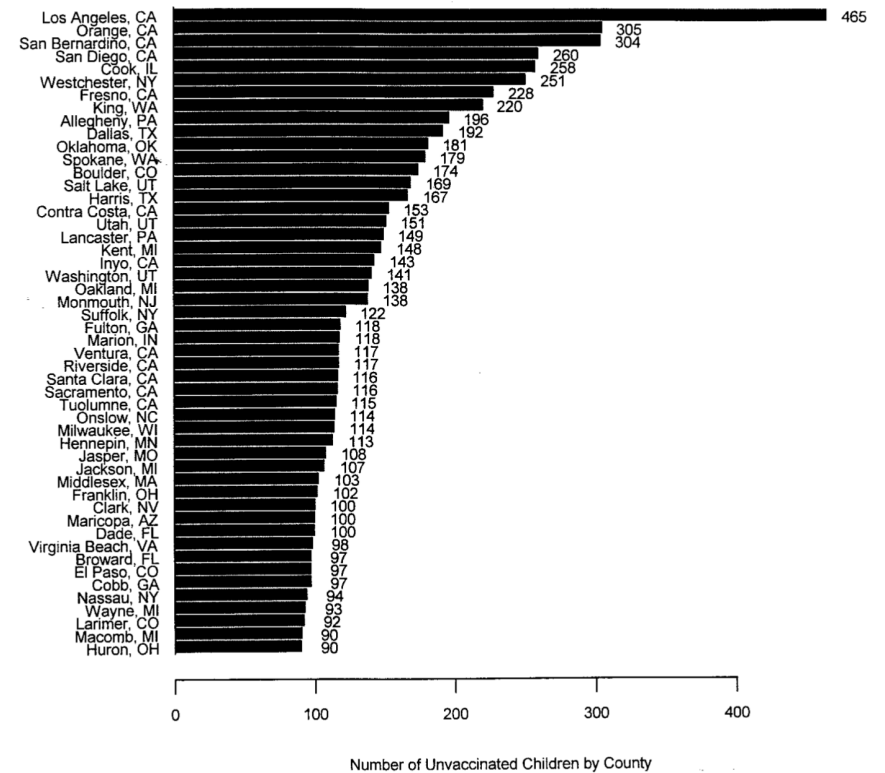


Fig 4. Estimated numbers of unvaccinated children according to county for 30 counties with the greatest numbers of unvaccinated children (1995-2001 NIS).

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Epidemiology





Epidemiology; Pseudo-Science of the Vaccine Doubters

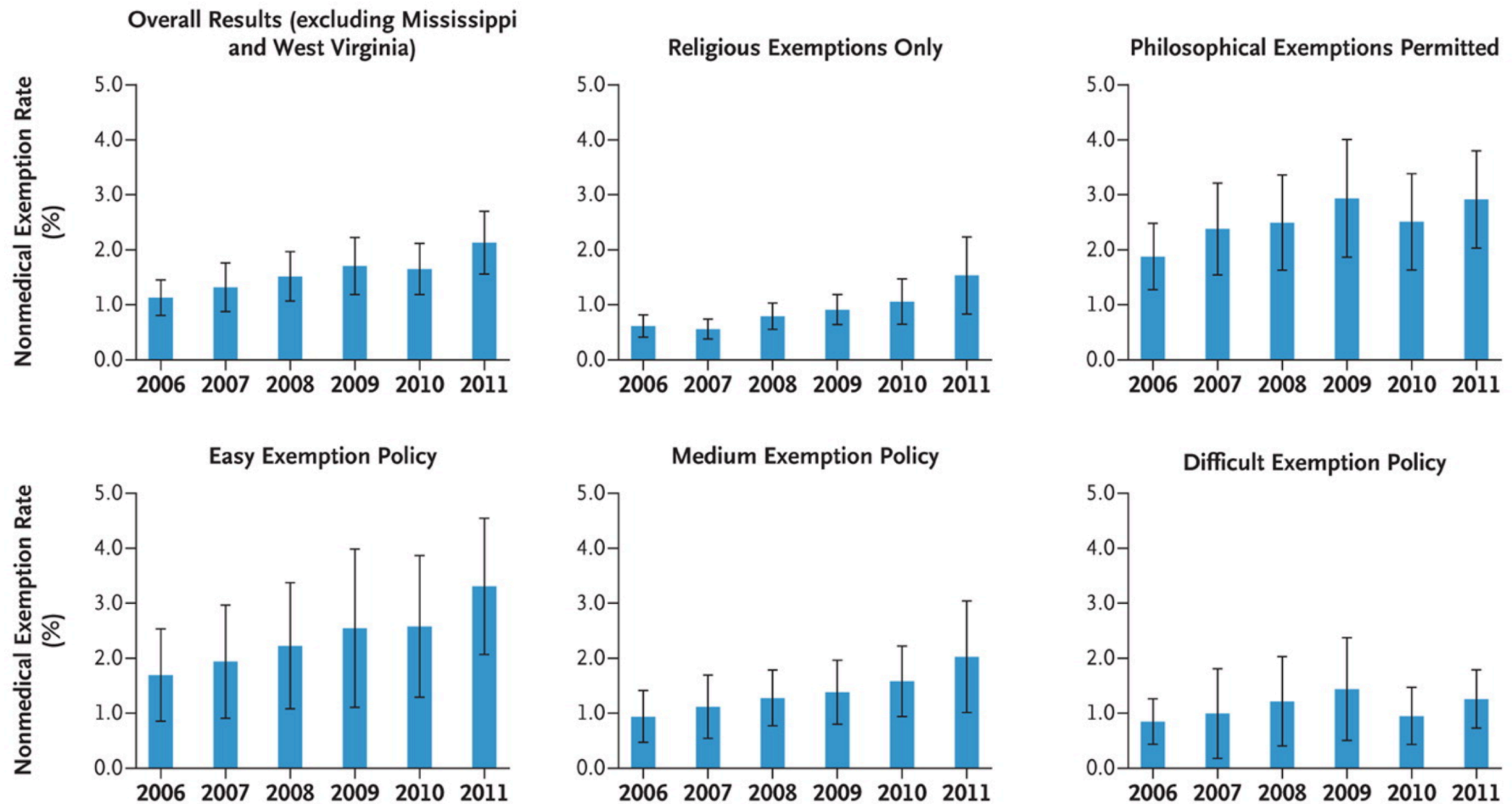
Percent of children 19-35 months old receiving vaccinations for:

- Diphtheria, Tetanus, Pertussis (4+ doses DTP, DT, or DTaP): 84.2%
- Polio (3+ doses): 93.3%
- Measles, Mumps, Rubella (MMR) (1+ doses): 91.5%
- *Haemophilus influenzae* type b (Hib) (primary series + booster dose): 82.0%
- Hepatitis B (Hep B) (3+ doses): 91.6%
- Chickenpox (Varicella) (1+ doses): 91.0%
- Pneumococcal conjugate vaccine (PCV) (4+ doses): 82.9%
- Combined 7-vaccine series: 71.6%

Source: [Health, United States, 2015, table 66 \[PDF - 9.8 MB\]](#) (data are for 2013)

The prevalence of vaccine refusal is low, but not zero.

Exemption from school immunization requirements for non-medical reasons is the primary measure of vaccine refusal in the United States



Rates of Non-medical Exemptions from School Immunization, According to Type of Exemption and Ease of Obtaining One, 2006–2011.

- Increasing difficulty of exception policy decreases opting out.
- Increasing trend in opting out, over all.

Epidemiology; Pseudo-Science of the Vaccine Doubters

- In unadjusted analysis, pertussis incidence in states allowing personal belief exemptions was more than twice as high as in states that only offered religious exemptions (IRR=2.06; 95% CI, 1.77-2.4).
- States with easy procedures for granting exemptions were associated with a 90% higher incidence of pertussis (IRR = 1.90; 95% CI, 1.06-2.28)
- States with a medium difficulty for exemptions were associated with a 27% higher incidence (IRR=1.27; 95% CI, 1.06-1.51) compared with difficult exemptions.

Table 2. Association of Ease of Obtaining Exemptions, Availability of the Personal Belief Exemption Option, and Acceptance of Parental Signature as Sufficient Proof of Having Met School Immunization Requirements With the Incidence of Pertussis From 1986 Through 2004

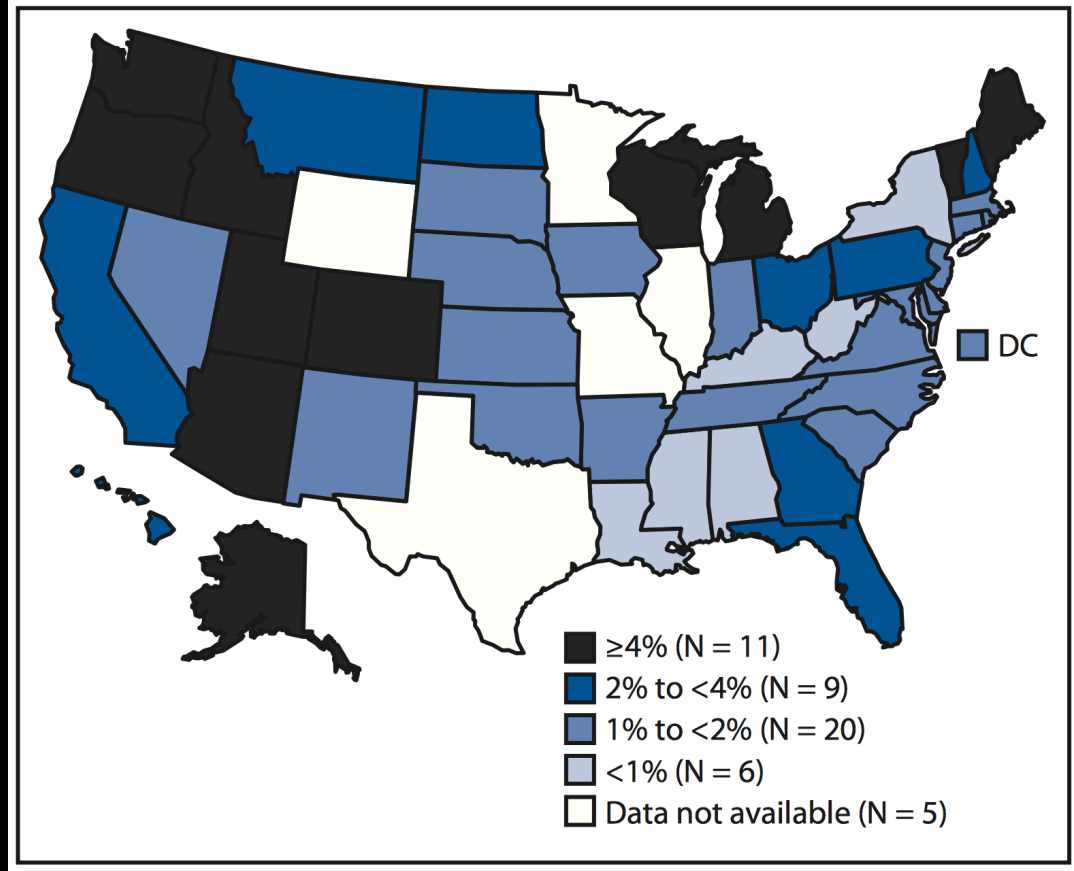
	No. of States	Unadjusted Incidence Rate Ratio (95% Confidence Interval)	Adjusted Incidence Rate Ratio (95% Confidence Interval)
Type of exemption permitted by states for school and daycare			
Only religious exemption	32*	Reference	Reference
Personal belief exemption	17†	2.06 (1.77-2.40)‡	1.48 (1.03-2.13)§
Exemption ease			
Difficult	19	Reference	Reference
Medium	14	1.27 (1.06-1.51)	1.35 (0.96-1.91)
Easy	15	1.90 (1.60-2.28)	1.53 (1.10-2.14)
Parental signature accepted as sufficient proof of compliance with school immunization requirements			
No	45	Reference	Reference
Yes	6	1.41 (1.12-1.77)	1.10 (0.73-1.68)

State policies granting personal belief exemptions and states that easily grant exemptions are associated with increased pertussis incidence.

Epidemiology; Pseudo-Science of the Vaccine Doubters

The rate of non-medical exemptions at kindergarten entry varies geographically 0.5 to 6.2% for 2014-2015 nationally among states that allow religious or philosophic exemptions.

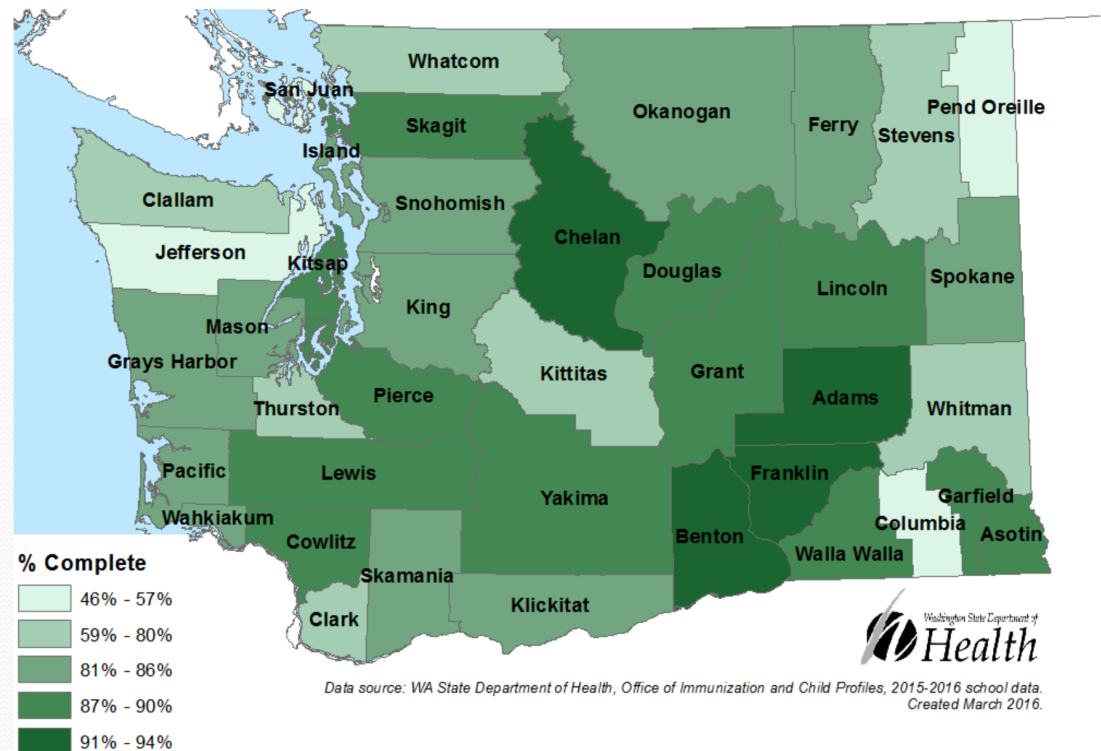
FIGURE. Estimated percentage of children enrolled in kindergarten who have been exempted from receiving one or more vaccines,* by state[†] — United States, 2014–15 school year



Epidemiology; Pseudo-Science of the Vaccine Doubters

The rate of non-medical exemptions at kindergarten entry varies geographically (ranging from 1.1 to 24.2 percent) by county in Washington state

Kindergartners complete for required immunizations by county Washington, school year 2015-16



Washington State Department of Health

Epidemiology; Pseudo-Science of the Vaccine Doubters

Study of Peds/FPs;


- 68% of surveyed physicians had 'a lot' of parents who expressed concern would suffer **long term complication** from vaccination.
- 62% of surveyed physicians had 'a lot' of parents who expressed concern would **develop autism** from vaccination.

Table 2. Based on the physician's experience, how much do each of the following contribute to vaccine refusal among parents of children aged <2 years in their practice ($n=614$)

Concern/belief	A lot	Some	A little/not at all
Concern that their child will suffer long-term complications from vaccines ^a	68 (64, 72)	24 (20, 27)	8 (6, 10)
Concern that their child could develop autism as a result of vaccination ^a	62 (58, 66)	25 (22, 29)	12 (10, 15)
Concern about possible ill effects of thimerosal ^a	33 (29, 36)	39 (35, 42)	29 (25, 32)
Belief that their child is unlikely to get a vaccine-preventable disease	32 (29, 36)	37 (34, 41)	30 (27, 34)
Concern that vaccines will weaken their child's immune system ^a	18 (15, 21)	35 (31, 38)	48 (44, 52)
General worries about vaccines without a specific concern ^a	19 (16, 22)	43 (39, 47)	38 (34, 42)
Belief that vaccine-preventable diseases are not severe enough to warrant vaccination	11 (9, 14)	43 (39, 47)	46 (42, 50)
Concern that their child will suffer immediate, short-term effects (such as fever, pain, or excessive crying)	10 (7, 12)	29 (25, 33)	61 (57, 65)
Opinion that vaccination recommendations are driven by profit considerations of drug companies	6 (4, 8)	24 (20, 27)	70 (66, 74)
Belief that vaccines are not very effective	2 (1, 3)	17 (14, 20)	81 (78, 84)

Note: Values are % (95% CI). Boldface indicates significance.

^aPediatricians more likely than family medicine physicians to report ($p<0.001$ by Kolmogorov-Smirnov test)



Epidemiology; Pseudo-Science of the Vaccine Doubters

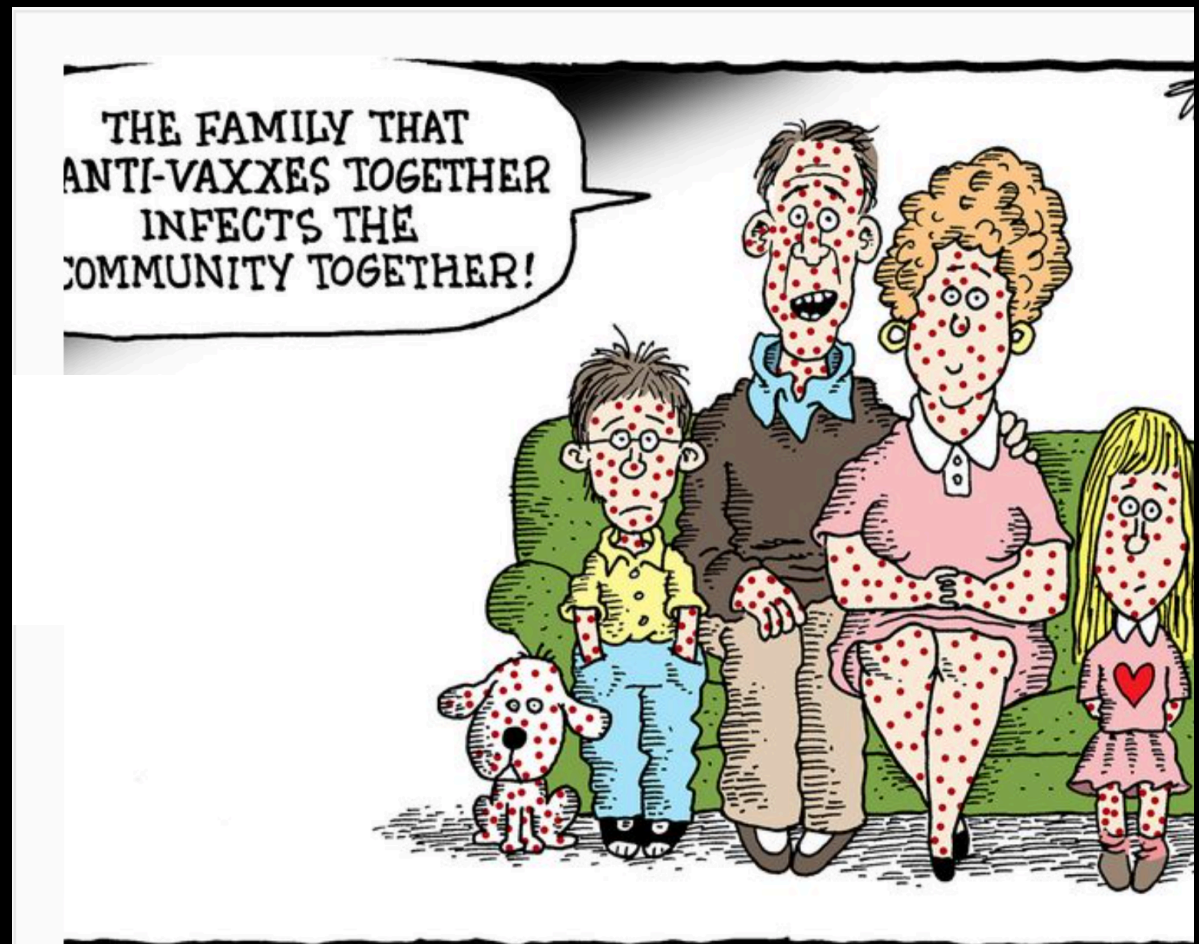
Table 1

Focus Group Consensus Findings of Parents and Providers About Vaccine Refusal

1. Refusal is rare, though some parents have concerns.
2. Refusals were most commonly aimed at certain vaccines, not all vaccines.
3. Reasons for concern/resistance vary.
4. Parents trusted vaccine information given orally by physicians and public health nurses.
5. Parents with concerns commonly responded to providers giving personalized risk/benefit information or reporting they immunized their own children.
6. Parents saw their children as the most important thing to them.
7. Parents did not want the provider to lecture or argue with them.

Vaccines; Pseudo-Science of the Vaccine Doubters

Demographics



Demographics; Pseudo-Science of the Vaccine Doubters

Demographics of Under-Vaccinated Children;

- Under-vaccinated children tended to be **black**, to have a **younger mother** who was **not married**, **did not have a college degree**, and to live in a household near the **poverty** level.

TABLE 3. Percentages of Children at Levels of Child, Maternal, and Household Characteristics According to UTD Status: Results of the Logistic Regression Analysis (2001 NIS)

	Unvaccinated Children	Percent (95% CI)			Fully Vaccinated Children	Odds Ratio, Undervaccinated Versus Fully Vaccinated (95% CI)
		Undervaccinated Children	NUTD on All 6 Vaccines, but 1 Dose	≥NUTD on 2-5 Vaccines		
Child characteristics						
Race/ethnicity						
Hispanic	6.8 (±5.9)	21.3 (±6.6)	20.9 (±2.5)	21.8 (±2.0)	24.4 (±1.2)	0.9 (0.8–1.0)
White, non-Hispanic*	82.0 (±10.3)	52.0 (±7.5)	54.0 (±3.1)	59.0 (±2.2)	56.8 (±1.3)	1.0 (1.0–1.0)
Black, non-Hispanic	9.3 (±8.8)	23.6 (±6.8)	19.4 (±2.6)	15.0 (±1.8)	13.5 (±1.0)	1.3 (1.2–1.5)
Asian, non-Hispanic	2.0 (±2.3)	2.5 (±1.7)	4.4 (±1.2)	3.1 (±0.6)	4.3 (±0.6)	0.9 (0.7–1.1)
Gender						
Male*	57.3 (±13.1)	47.5 (±7.4)	52.9 (±3.0)	50.4 (±2.2)	51.1 (±1.3)	1.0 (1.0–1.0)
Female	42.7 (±13.1)	52.5 (±7.4)	47.1 (±3.0)	49.6 (±2.2)	48.9 (±1.3)	1.0 (0.9–1.1)
Age of child						
19–24 mo	36.7 (±13.0)	50.7 (±7.5)	45.6 (±3.0)	36.6 (±2.1)	33.6 (±1.3)	1.5 (1.3–1.6)
25–29 mo	28.2 (±12.1)	21.1 (±5.6)	26.4 (±2.5)	28.8 (±2.0)	29.6 (±1.2)	1.1 (1.0–1.2)
30–35 mo*	35.2 (±13.5)	28.1 (±6.5)	28.0 (±2.8)	34.6 (±2.1)	36.7 (±1.3)	1.0 (1.0–1.0)
Foreign born						
Yes	1.7 (±3.0)	0.5 (±0.7)	2.7 (±0.9)	1.1 (±0.4)	1.0 (±0.3)	1.8 (1.3–2.7)
No*	98.3 (±3.0)	99.5 (±0.7)	97.3 (±0.9)	98.9 (±0.4)	99.0 (±0.3)	1.0 (1.0–1.0)
Maternal characteristics						
Marital status						
Widowed/divorced/separated	6.4 (±9.1)	12.8 (±5.4)	10.1 (±1.9)	9.8 (±1.4)	8.0 (±0.8)	1.4 (1.2–1.6)
Never married	16.9 (±10.3)	27.0 (±6.7)	25.1 (±3.0)	20.7 (±2.0)	19.6 (±1.2)	1.3 (1.1–1.5)
Married*	76.8 (±12.6)	60.2 (±7.4)	64.8 (±3.1)	69.5 (±2.2)	72.3 (±1.3)	1.0 (1.0–1.0)
Educational attainment						
<12 y	16.0 (±10.9)	18.8 (±5.2)	20.6 (±2.8)	15.3 (±1.7)	16.2 (±1.1)	1.4 (1.3–1.7)
12 y	32.1 (±12.8)	49.8 (±7.5)	39.6 (±3.1)	38.7 (±2.2)	34.8 (±1.4)	1.5 (1.3–1.6)
>12 y, non-college graduate	15.1 (±12.3)	13.7 (±5.5)	14.9 (±1.9)	15.0 (±1.5)	14.1 (±0.9)	1.3 (1.2–1.5)
College graduate*	36.8 (±12.2)	17.7 (±4.4)	24.8 (±2.3)	31.0 (±1.9)	34.8 (±1.2)	1.0 (1.0–1.0)
Preferred language						
English	92.5 (±6.5)	89.6 (±4.1)	87.4 (±2.2)	88.1 (±1.5)	85.5 (±1.1)	1.2 (1.1–1.4)
Spanish*	5.0 (±5.5)	9.6 (±4.0)	10.1 (±1.9)	10.8 (±1.4)	12.8 (±1.0)	1.0 (1.0–1.0)
Other	2.6 (±3.6)	0.9 (±0.8)	2.5 (±1.2)	1.1 (±0.4)	1.7 (±0.4)	1.3 (0.8–2.0)
Age						
≤19 y	5.7 (±8.6)	4.9 (±3.3)	4.8 (±1.8)	3.1 (±0.8)	4.1 (±0.6)	1.1 (0.8–1.5)
20–29 y	33.1 (±13.1)	59.8 (±7.1)	49.8 (±3.1)	47.4 (±2.2)	43.3 (±1.3)	1.3 (1.2–1.4)
≥30 y*	61.2 (±13.8)	35.3 (±6.8)	45.4 (±3.0)	49.6 (±2.2)	52.6 (±1.3)	1.0 (1.0–1.0)
Household characteristics						
Annual family income						
Above, >\$75 000*	21.8 (±12.0)	5.8 (±2.4)	11.4 (±1.6)	14.4 (±1.4)	17.3 (±0.9)	1.0 (1.0–1.0)
Above, <\$75 000	39.5 (±12.9)	49.3 (±7.5)	47.9 (±3.0)	50.2 (±2.2)	48.7 (±1.3)	1.4 (1.3–1.6)
Below	19.0 (±11.0)	29.2 (±6.6)	25.8 (±2.9)	21.9 (±2.0)	19.6 (±1.2)	1.7 (1.5–2.0)
Unknown	19.7 (±11.8)	15.7 (±7.0)	14.9 (±2.8)	13.4 (±1.7)	14.4 (±1.1)	1.4 (1.2–1.7)

Demographics; Pseudo-Science of the Vaccine Doubters

Demographics of Un-Vaccinated Children;

- Un-vaccinated children tended to be **white**, to have a **mother who was married** and had a **college degree**, to live in a household with an **annual income exceeding \$75K**, and to have parents who **expressed concerns regarding the safety** of vaccines and indicated that **medical doctors have little influence** over vaccination decisions for their children.

TABLE 4. Results from the Logistic Regression Analysis: Estimated OR of Being Unvaccinated, Compared with Specified Vaccination Status Levels (2001 NIS)

Characteristic	Odds Ratio (95% CI)*			
	Unvaccinated Versus NUTD on All 6 Vaccines	Unvaccinated Versus NUTD on 2-5 Vaccines	Unvaccinated Versus NUTD on 1 Vaccine Only	Unvaccinated Versus Fully Vaccinated Children
Child characteristics				
Race/ethnicity				
Hispanic	5.0 (1.8-13.7)	4.7 (1.8-12.1)	4.5 (1.7-11.5)	5.2 (2.0-13.3)
White, non-Hispanic†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Black, non-Hispanic	4.0 (1.3-12.3)	3.2 (1.1-9.2)	2.2 (0.8-6.5)	2.1 (0.7-6.1)
Asian, non-Hispanic	2.0 (0.5-8.2)	3.4 (1.0-11.9)	2.2 (0.6-7.5)	3.1 (0.9-10.7)
Gender				
Male†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Female	1.5 (0.8-2.7)	1.2 (0.7-2.1)	1.3 (0.8-2.3)	1.3 (0.7-2.2)
Age of child				
19-24 mo	1.7 (0.8-3.6)	1.6 (0.8-3.1)	1.0 (0.5-2.0)	0.9 (0.5-1.7)
25-29 mo	0.9 (0.4-2.1)	1.2 (0.6-2.4)	1.0 (0.5-2.1)	1.0 (0.5-2.0)
30-35 mo†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Foreign born				
Yes†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
No	3.1 (0.3-29.4)	0.6 (0.1-4.0)	1.5 (0.2-9.4)	1.7 (0.3-10.8)
Maternal characteristics				
Marital status				
Widowed/divorced/separated	2.6 (0.5-12.8)	1.9 (0.4-8.8)	1.7 (0.4-7.9)	1.3 (0.3-6.2)
Never married	2.0 (0.9-4.6)	1.8 (0.8-3.8)	1.4 (0.6-2.9)	1.2 (0.6-2.6)
Married†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Educational attainment				
<12 y	2.4 (1.0-6.1)	1.9 (0.8-4.5)	1.1 (0.5-2.7)	1.1 (0.5-2.5)
12 y	3.2 (1.6-6.5)	1.8 (1.0-3.4)	1.4 (0.8-2.6)	1.1 (0.6-2.1)
>12 y, non-college graduate	1.9 (0.6-5.7)	1.5 (0.5-4.0)	1.2 (0.4-3.2)	1.0 (0.4-2.7)
College graduate†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Preferred language				
English†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Spanish	2.0 (0.6-7.0)	2.2 (0.7-7.1)	2.3 (0.7-7.4)	2.8 (0.9-9.0)
Other	0.3 (0.1-1.9)	1.0 (0.2-4.7)	0.5 (0.1-2.0)	0.7 (0.2-3.1)
Age				
≤19 y	1.5 (0.2-8.8)	1.1 (0.2-6.0)	0.7 (0.1-3.4)	0.8 (0.2-4.2)
20-29 y	3.1 (1.6-6.1)	2.0 (1.1-3.7)	1.8 (1.0-3.2)	1.5 (0.8-2.8)
≥30 y†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Household characteristics				
Annual family income				
Above, >\$75 000†	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)	1.0 (1.0-1.0)
Above, <\$75 000	4.7 (2.0-11.3)	2.3 (1.1-5.0)	1.9 (0.9-4.1)	1.6 (0.7-3.3)
Below	5.8 (2.1-16.3)	2.6 (1.0-6.6)	1.7 (0.7-4.4)	1.3 (0.5-3.2)
Unknown	3.0 (1.0-9.4)	1.4 (0.5-3.8)	1.0 (0.4-2.7)	0.9 (0.4-2.4)

Demographics; Pseudo-Science of the Vaccine Doubters

Sources of
information;

Parents of exempt
children vs parents
of vaccinated
children.

Table 4. OR of Child Having a Nonmedical Exemption by Parent's Utilization and Credibility of Sources for Vaccine Information

Source	Used in Past			Rated Good or Excellent		
	Exempt, %*	Vaccinated, %†	OR (95% CI)	Exempt, %*	Vaccinated, %†	OR (95% CI)
Health care professionals	93.5	90.8	1.46 (0.86-2.47)	63.9	89.5	0.21‡ (0.15-0.28)
Vaccine information statement	86.6	82.7	1.35 (0.92-1.99)	51.1	86.3	0.17‡ (0.13-0.22)
Professional (medical) organizations	31.8	21.9	1.66‡ (1.23-2.23)	55.3	84.8	0.22‡ (0.17-0.30)
Alternative health care professional	48.4	9.1	9.34‡ (6.77-12.87)	51.1	30.2	2.41‡ (1.85-3.14)
Parents/friends	70.8	49.7	2.45‡ (1.84-3.27)	34.8	31.7	1.15 (0.89-1.49)
Religious leaders or organizations	8.7	1.7	5.35‡ (2.83-10.11)	7.2	7.9	0.91 (0.54-1.52)
Media	62.1	45.5	1.96‡ (1.49-2.58)	28.8	30.5	0.92 (0.70-1.21)
Local/state health department	44.0	39.7	1.20 (0.91-1.57)	54.6	82.5	0.25‡ (0.19-0.33)
CDC/NIP	25.3	13.5	2.16‡ (1.56-3.00)	62.3	89.4	0.20‡ (0.14-0.27)
FDA	9.4	7.0	1.38 (0.86-2.22)	41.8	66.3	0.37‡ (0.28-0.48)
Vaccine companies	15.5	5.2	3.33‡ (2.17-5.13)	16.4	32.7	0.41‡ (0.30-0.56)
Pharmacists	9.4	10.3	0.90 (0.57-1.41)	38.4	61.6	0.39‡ (0.30-0.50)
Internet	36.8	14.8	3.37‡ (2.49-4.55)	42.8	39.3	1.16 (0.89-1.50)
Institute of Medicine	4.3	1.5	2.90‡ (1.34-6.27)	55.8	67.1	0.62‡ (0.46-0.84)
Dissatisfied Parents Together	9.4	1.0	10.01‡ (4.76-21.02)	37.7	15.2	3.39‡ (2.42-4.74)
NVIC	15.5	2.5	7.29‡ (4.34-12.25)	61.9	82.2	0.35‡ (0.26-0.47)

Abbreviations: CDC, Centers for Disease Control and Prevention; CI, confidence interval; FDA, Food and Drug Administration; NIP, National Immunization Project; NVIC, National Vaccine Information Center; OR, odds ratio.

*n = 277.

†n = 976.

‡P<.05.

Demographics; Pseudo-Science of the Vaccine Doubters

Compared with the parents of vaccinated children, parents of exempt children were;

- Less likely to report their child's primary health care professional to be a physician (75.8% vs 93.9%; OR, 0.20; 95% CI, 0.14-0.30).
- More likely to report their child's primary health care professional to be a nurse practitioner (7.4% vs 2.7%; OR, 2.90; 95% CI, 1.59-5.28) or SCAM† professional (11.5% vs 0.3%; OR, 41.77; 95% CI, 12.66-137.78).

Table 4. OR of Child Having a Nonmedical Exemption by Parent's Utilization and Credibility of Sources for Vaccine Information

Source	Used in Past			Rated Good or Excellent		
	Exempt, %*	Vaccinated, %†	OR (95% CI)	Exempt, %*	Vaccinated, %†	OR (95% CI)
Health care professionals	93.5	90.8	1.46 (0.86-2.47)	63.9	89.5	0.21‡ (0.15-0.28)
Vaccine information statement	86.6	82.7	1.35 (0.92-1.99)	51.1	86.3	0.17‡ (0.13-0.22)
Professional (medical) organizations	31.8	21.9	1.66‡ (1.23-2.23)	55.3	84.8	0.22‡ (0.17-0.30)
Alternative health care professional	48.4	9.1	9.34‡ (6.77-12.87)	51.1	30.2	2.41‡ (1.85-3.14)
Parents/friends	70.8	49.7	2.45‡ (1.84-3.27)	34.8	31.7	1.15 (0.89-1.49)
Religious leaders or organizations	8.7	1.7	5.35‡ (2.83-10.11)	7.2	7.9	0.91 (0.54-1.52)
Media	62.1	45.5	1.96‡ (1.49-2.58)	28.8	30.5	0.92 (0.70-1.21)
Local/state health department	44.0	39.7	1.20 (0.91-1.57)	54.6	82.5	0.25‡ (0.19-0.33)
CDC/NIP	25.3	13.5	2.16‡ (1.56-3.00)	62.3	89.4	0.20‡ (0.14-0.27)
FDA	9.4	7.0	1.38 (0.86-2.22)	41.8	66.3	0.37‡ (0.28-0.48)
Vaccine companies	15.5	5.2	3.33‡ (2.17-5.13)	16.4	32.7	0.41‡ (0.30-0.56)
Pharmacists	9.4	10.3	0.90 (0.57-1.41)	38.4	61.6	0.39‡ (0.30-0.50)
Internet	36.8	14.8	3.37‡ (2.49-4.55)	42.8	39.3	1.16 (0.89-1.50)
Institute of Medicine	4.3	1.5	2.90‡ (1.34-6.27)	55.8	67.1	0.62‡ (0.46-0.84)
Dissatisfied Parents Together	9.4	1.0	10.01‡ (4.76-21.02)	37.7	15.2	3.39‡ (2.42-4.74)
NVIC	15.5	2.5	7.29‡ (4.34-12.25)	61.9	82.2	0.35‡ (0.26-0.47)

Abbreviations: CDC, Centers for Disease Control and Prevention; CI, confidence interval; FDA, Food and Drug Administration; NIP, National Immunization Project; NVIC, National Vaccine Information Center; OR, odds ratio.

*n = 277.

†n = 976.

‡P < .05.

†SCAM; Supplemental Complimentary Alternative Medicine

Demographics; Pseudo-Science of the Vaccine Doubters

Parents of exempt children were less likely than parents of vaccinated children to perceive the following sources as good or excellent for vaccine information:

- Health care professionals
- Professional organizations
- Pharmacists
- Health departments
- CDC, IOM, and FDA
- Vaccine companies
- National Vaccine Information Center

Table 4. OR of Child Having a Nonmedical Exemption by Parent's Utilization and Credibility of Sources for Vaccine Information

Source	Used in Past			Rated Good or Excellent		
	Exempt, %*	Vaccinated, %†	OR (95% CI)	Exempt, %*	Vaccinated, %†	OR (95% CI)
Health care professionals	93.5	90.8	1.46 (0.86-2.47)	63.9	89.5	0.21‡ (0.15-0.28)
Vaccine information statement	86.6	82.7	1.35 (0.92-1.99)	51.1	86.3	0.17‡ (0.13-0.22)
Professional (medical) organizations	31.8	21.9	1.66‡ (1.23-2.23)	55.3	84.8	0.22‡ (0.17-0.30)
Alternative health care professional	48.4	9.1	9.34‡ (6.77-12.87)	51.1	30.2	2.41‡ (1.85-3.14)
Parents/friends	70.8	49.7	2.45‡ (1.84-3.27)	34.8	31.7	1.15 (0.89-1.49)
Religious leaders or organizations	8.7	1.7	5.35‡ (2.83-10.11)	7.2	7.9	0.91 (0.54-1.52)
Media	62.1	45.5	1.96‡ (1.49-2.58)	28.8	30.5	0.92 (0.70-1.21)
Local/state health department	44.0	39.7	1.20 (0.91-1.57)	54.6	82.5	0.25‡ (0.19-0.33)
CDC/NIP	25.3	13.5	2.16‡ (1.56-3.00)	62.3	89.4	0.20‡ (0.14-0.27)
FDA	9.4	7.0	1.38 (0.86-2.22)	41.8	66.3	0.37‡ (0.28-0.48)
Vaccine companies	15.5	5.2	3.33‡ (2.17-5.13)	16.4	32.7	0.41‡ (0.30-0.56)
Pharmacists	9.4	10.3	0.90 (0.57-1.41)	38.4	61.6	0.39‡ (0.30-0.50)
Internet	36.8	14.8	3.37‡ (2.49-4.55)	42.8	39.3	1.16 (0.89-1.50)
Institute of Medicine	4.3	1.5	2.90‡ (1.34-6.27)	55.8	67.1	0.62‡ (0.46-0.84)
Dissatisfied Parents Together	9.4	1.0	10.01‡ (4.76-21.02)	37.7	15.2	3.39‡ (2.42-4.74)
NVIC	15.5	2.5	7.29‡ (4.34-12.25)	61.9	82.2	0.35‡ (0.26-0.47)

Abbreviations: CDC, Centers for Disease Control and Prevention; CI, confidence interval; FDA, Food and Drug Administration; NIP, National Immunization Project; NVIC, National Vaccine Information Center; OR, odds ratio.

*n = 277.

†n = 976.

‡P < .05.

- Parents of exempt children were more likely than parents of vaccinated children to consider SCAM† professionals and the organization Dissatisfied Parents Together as good or excellent sources for vaccine information.

†SCAM; Supplemental Complimentary Alternative Medicine

Demographics; Pseudo-Science of the Vaccine Doubters

Parents who seek vaccine exemptions have a low level of trust in the government and health care professionals and SCAM professionals whom they consider to be reliable sources of vaccine information.

Table 4. OR of Child Having a Nonmedical Exemption by Parent's Utilization and Credibility of Sources for Vaccine Information

Source	Used in Past			Rated Good or Excellent		
	Exempt, %*	Vaccinated, %†	OR (95% CI)	Exempt, %*	Vaccinated, %†	OR (95% CI)
Health care professionals	93.5	90.8	1.46 (0.86-2.47)	63.9	89.5	0.21‡ (0.15-0.28)
Vaccine information statement	86.6	82.7	1.35 (0.92-1.99)	51.1	86.3	0.17‡ (0.13-0.22)
Professional (medical) organizations	31.8	21.9	1.66‡ (1.23-2.23)	55.3	84.8	0.22‡ (0.17-0.30)
Alternative health care professional	48.4	9.1	9.34‡ (6.77-12.87)	51.1	30.2	2.41‡ (1.85-3.14)
Parents/friends	70.8	49.7	2.45‡ (1.84-3.27)	34.8	31.7	1.15 (0.89-1.49)
Religious leaders or organizations	8.7	1.7	5.35‡ (2.83-10.11)	7.2	7.9	0.91 (0.54-1.52)
Media	62.1	45.5	1.96‡ (1.49-2.58)	28.8	30.5	0.92 (0.70-1.21)
Local/state health department	44.0	39.7	1.20 (0.91-1.57)	54.6	82.5	0.25‡ (0.19-0.33)
CDC/NIP	25.3	13.5	2.16‡ (1.56-3.00)	62.3	89.4	0.20‡ (0.14-0.27)
FDA	9.4	7.0	1.38 (0.86-2.22)	41.8	66.3	0.37‡ (0.28-0.48)
Vaccine companies	15.5	5.2	3.33‡ (2.17-5.13)	16.4	32.7	0.41‡ (0.30-0.56)
Pharmacists	9.4	10.3	0.90 (0.57-1.41)	38.4	61.6	0.39‡ (0.30-0.50)
Internet	36.8	14.8	3.37‡ (2.49-4.55)	42.8	39.3	1.16 (0.89-1.50)
Institute of Medicine	4.3	1.5	2.90‡ (1.34-6.27)	55.8	67.1	0.62‡ (0.46-0.84)
Dissatisfied Parents Together	9.4	1.0	10.01‡ (4.76-21.02)	37.7	15.2	3.39‡ (2.42-4.74)
NVIC	15.5	2.5	7.29‡ (4.34-12.25)	61.9	82.2	0.35‡ (0.26-0.47)

Abbreviations: CDC, Centers for Disease Control and Prevention; CI, confidence interval; FDA, Food and Drug Administration; NIP, National Immunization Project; NVIC, National Vaccine Information Center; OR, odds ratio.

*n = 277.

†n = 976.

‡P < .05.

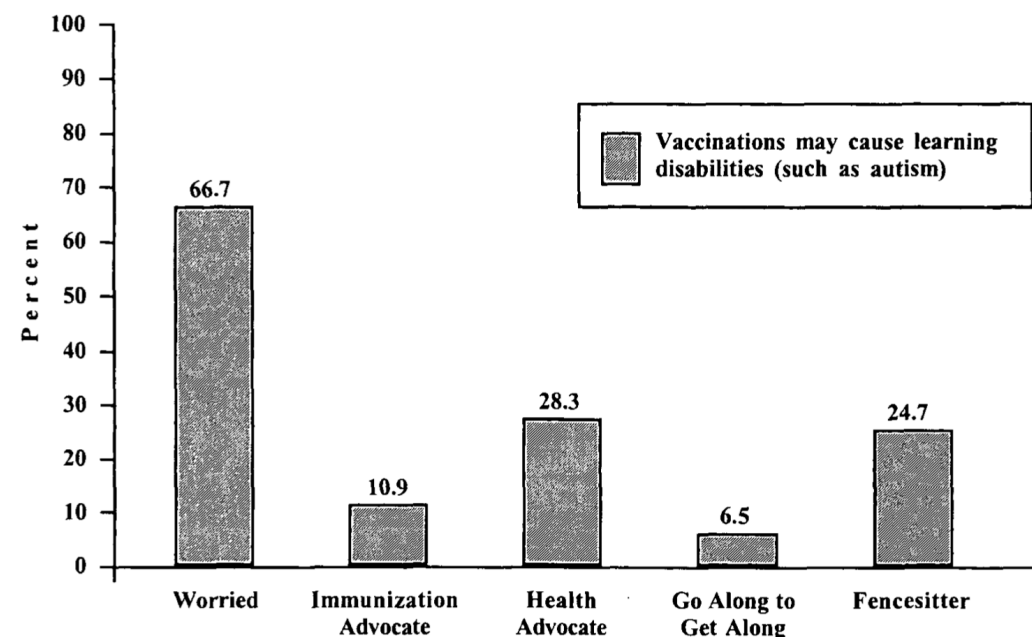
Demographics; Pseudo-Science of the Vaccine Doubters

The CDC has identified 5 types of parents, according to clusters of attitudes and beliefs about vaccines:

1. Worried- 3%.
2. Immunization advocate - 33%.
3. Health advocates- 25%.
4. Go along to get along"- 26%.
5. Fence-sitters-13%.

Worried; most likely to believe that vaccines cause autism.

Figure 2
Responses to the Question (% of total) "Which concerns, if any, do you have about childhood immunizations?"



Note.

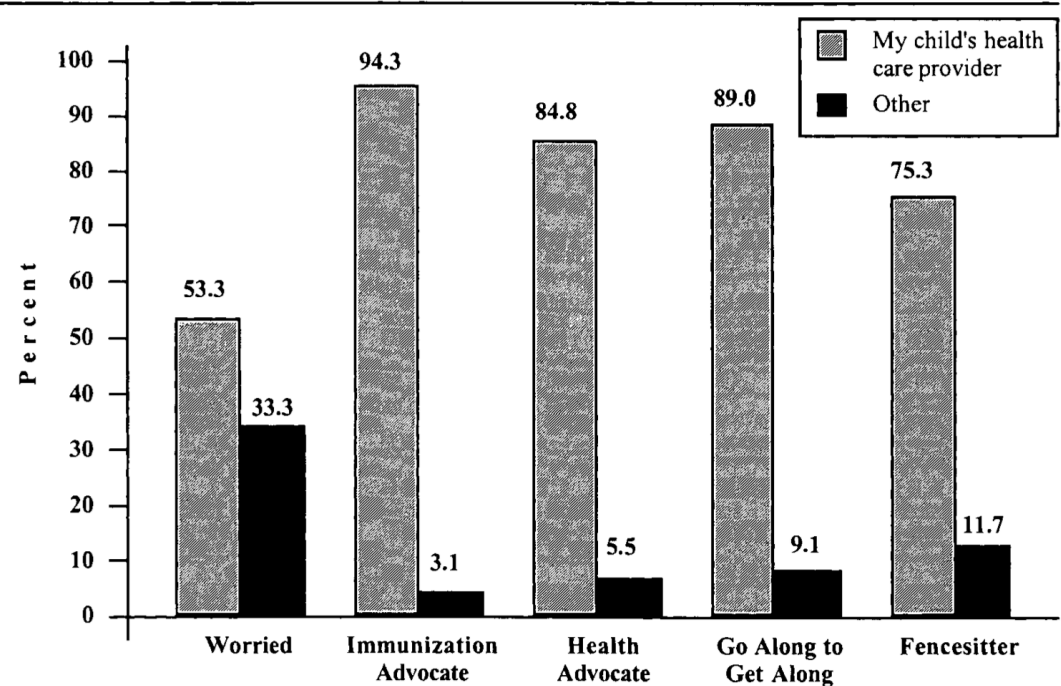
Multiple options could be chosen. Only one option was significantly different across clusters and had sufficient cell size.

Demographics; Pseudo-Science of the Vaccine Doubters

“In the last year, what were the 3 most important sources of information that helped you make decisions about your child’s health care?”

- Worried;
 - Significantly more likely to get information about their children health from SCAM† professionals.

Figure 3
Responses to the Question (% of total) “In the last year, what were the 3 most important sources of information that helped you make decisions about your child’s health care?”



Note.

Only those that were significantly different across clusters and had sufficient cell size are presented. There is no information concerning which was the first, second, or third choices.