

BATTLING THE MYTHS AND FEARS REGARDING PEDIATRIC VACCINES

RC Hellinga, Pharm.D., BCPPS
UNMH Pediatric ICU Pharmacist
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Disclosures

- Nothing to disclose

Pharmacist Objectives

- Describe 5 of the most common myths/fears surrounding pediatric vaccines
- Review the pediatric vaccine schedule and frequency
- Explain the mechanism of action for pediatric vaccines
- Evaluate the data surrounding the most common myths/fears of pediatric vaccines
- Construct a plan for families with concerns regarding pediatric vaccines

Technician Objectives

- List 5 of the common myths/fears surrounding pediatric vaccines
- Describe the pediatric vaccine schedule and frequency
- Describe the mechanism of action for pediatric vaccines
- Explain the potential side effects regarding pediatric vaccines

Background

- Misconceptions about vaccinations are common
 - Patients and/or parents question the safety and utility of vaccines
 - Healthcare workers need to be:
 - Mindful
 - Knowledgeable
 - Timely
 - Healthcare workers miss opportunities to vaccinate based on their own false contraindications and unnecessary rules
- This presentation will help you as a provider address the patient's and/or parent's concern regarding the safety and efficacy surrounding pediatric vaccines

Vaccine Preventable Diseases – General Pediatric Population in the USA

- | | |
|--|--|
| <ul style="list-style-type: none"> • Hepatitis <ul style="list-style-type: none"> • Hepatitis A • Hepatitis B • Rotavirus • Diphtheria, Tetanus, Pertussis <ul style="list-style-type: none"> • DTaP • Tdap • <i>Haemophilus influenzae</i> type b • Pneumococcal <ul style="list-style-type: none"> • Pneumococcal conjugate (PCV 13) • Pneumococcal polysaccharide (PPSV 23) | <ul style="list-style-type: none"> • Poliovirus • Influenza <ul style="list-style-type: none"> • Inactivated influenza vaccine • Live attenuated influenza vaccine • Measles, Mumps, Rubella • Varicella • Meningococcal <ul style="list-style-type: none"> • MenACWY-D/MenACWY-CRM • Meningococcal B • Human papillomavirus |
|--|--|

Andrew Wakefield

THE LANCET

The Lancet, Volume 351, Issue 9103, Pages 637 - 641, 28 February 1998
doi:10.1016/S0140-6736(97)11096-0

This article was retracted

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

Dr [AJ Wakefield](#) FRCS ^a, [SH Murch](#) MB ^b, [A Anthony](#) MB ^a, [J Linnell](#) PhD ^a, [DM Casson](#) MRCP ^b, [M Malik](#) MRCP ^b, [M Berelowitz](#) FRCPsych ^c, [AP Dhillon](#) MRCPath ^a, [MA Thomson](#) FRCP ^b, [P Harvey](#) FRCP ^d, [A Valentine](#) FRCR ^e, [SE Davies](#) MRCPath ^a, [JA Walker-Smith](#) FRCP ^a

Summary

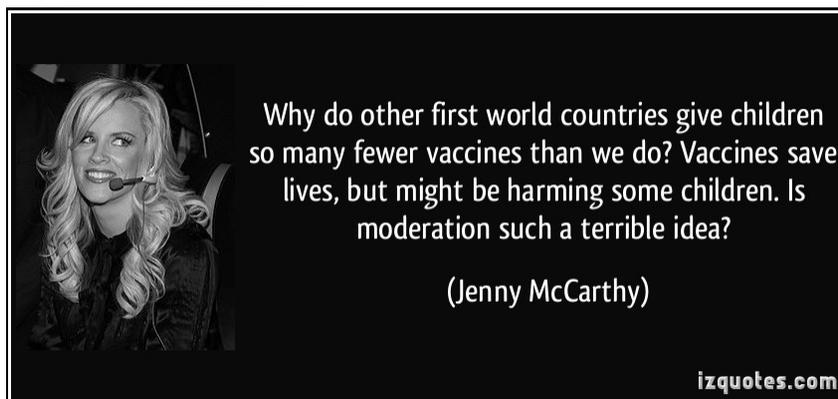
Background

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.

Jenny McCarthy and Vaccines



Comparison of Vaccine Schedules

- Total number of vaccines in the USA – 35+ vaccines
 - Schedule breaks it into individual products
 - Combination products: Pentacel, Pediarix, etc.
- Total number of vaccines in Canada – 20+ vaccines (British Columbia)
 - Schedule does not break apart combination products
 - Does not include influenza vaccines
- Total number of vaccines in the UK – 20+ vaccines
 - Schedule does not break apart the combination products
 - 3-4 vaccines are optional

Comparison of Vaccine Schedules

References:
 CDC.gov/vaccines
 Canada.ca/vaccines
 Nhs.uk/vaccines

Figure 1. Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger—United States, 2018.
 (FOR THOSE WHO FALL BEHIND OR START LATE, SEE THE CATCH-UP SCHEDULE (FIGURE 2)).
 These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are shaded in gray.

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Hepatitis B ¹ (HepB)	1 st dose	2 nd dose															
Rotavirus ² (RV) RV1 (2-dose series); RV5 (3-dose series)			1 st dose	2 nd dose	See footnote 2												
Diphtheria, tetanus, & acellular pertussis ³ (DTaP; <7 yrs)		1 st dose	2 nd dose	3 rd dose				4 th dose				5 th dose					
<i>Haemophilus influenzae</i> type b ⁴ (Hib)		1 st dose	2 nd dose	See footnote 4			3 rd or 4 th dose	See footnote 4									
Pneumococcal conjugate ⁵ (PCV13)		1 st dose	2 nd dose	3 rd dose			4 th dose										
Inactivated poliovirus ⁶ (IPV; <18 yrs)		1 st dose	2 nd dose				3 rd dose					4 th dose					
Influenza ⁷ (IV)																	
Measles, mumps, rubella ⁸ (MMR)					See footnote 8		1 st dose					2 nd dose					
Varicella ⁹ (VAR)							1 st dose					2 nd dose					
Hepatitis A ¹⁰ (HepA)																	
Meningococcal ¹¹ (MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)																1 st dose	2 nd dose
Tetanus, diphtheria, & acellular pertussis ¹² (Tdap; ≥7 yrs)																	Tdap
Human papillomavirus ¹⁴ (HPV)																	See footnote 14
Meningococcal B ¹²																	See footnote 12
Pneumococcal polysaccharide ⁵ (PPSV23)																	See footnote 5

Other issues

The case for vaccines



VS

The case against



Every government, every major health agency of every country around the world, the consensus of respectable, peer-reviewed medical journals, medical doctors, researchers and scientists

vs

a handful of pseudoscientific paperbacks and self-published bunk

Refutations to Anti-Vaccine Memes

The Vaccine Meme Machine

JPPT Article – Exploring the reasons behind parental refusal of vaccines

- Religious reasons
 - Linked to the core beliefs of parents
 - Very difficult to dissuade these individuals
 - Complete refusal of vaccines
 - Refusal due to animal products as well as human fetus tissue within vaccines e.g. gelatin

- Personal beliefs or philosophical reasons
 - Some benefit of contracting preventable diseases
 - Minimal risk of contracting preventable diseases
 - Negative side effects outweigh the benefits
 - Do not want extra chemicals in their children's bodies
 - Healthy diets/lifestyles = decreased risk of contracting preventable diseases
 - If disease is contracted, easily treated

JPPT Article – Exploring the reasons behind parental refusal of vaccines (Cont.)

- Safety concerns
 - Discovered from the media or from other individuals
 - Doubts about short and long term effects of vaccines
 - Partial refusal of vaccines due to issues with individual vaccines
 - Timing of vaccines questioned, thus may delay and administer only 1 at a time
 - Side effects are not fully explained prior to administration
 - Healthy relationship needed between patient/parent and healthcare provider

- Desire for additional education
 - Want more information about vaccines
 - Be able to make informed decisions knowing both risks and benefits

McKee C. J Pediatr Pharmacol Ther. 2016.

Common Myths and Fears

1. Vaccines, specifically MMR causes autism
2. The administration of multiple vaccines can overload the immune system
3. Better to space out the vaccines more than current recommendations
4. Natural infection confers better immunity
5. Ingredients in vaccines can cause harm
6. Disease rates have dropped due to factors other than vaccines
7. Mandatory vaccines violate civil rights
8. Abortions are required to produce vaccines
9. VAERs data prove vaccines are dangerous

MYTH/FEAR 1 – VACCINES CAUSE AUTISM

MMR and Thimerosal

MMR and Autism - Source

- 1998 Andrew Wakefield article published in Lancet
 - 12 children who were preselected for the study
 - Suggested MMR could trigger autism
- 2016 movie directed by Andrew Wakefield - Vaxxed
 - 2004 CDC study found no difference
 - Bioengineer Brian Hooker from CDC study
 - Reanalyzed data in 2014
 - Claimed CDC hid evidence
 - Black boys had increased risk



<https://www.bmj.com/content/342/bmj.c7452>



<http://vaxxedthemovie.com/>

MMR Lancet Article Timeline

- 1998: Andrew Wakefield article published in Lancet
- 2004: 10 of the 13 authors retracted the study's interpretation
- 2010: Editors of Lancet retracted the paper following the ruling of the UK's Medical Council and announced that Wakefield was:
 - Dishonest and irresponsible
 - Callous disregard for the suffering children
 - Removed from UK medical register
 - No longer able to practice medicine
- 2011: BMJ published series of articles showing his work was deliberately fraudulent



Wessel L. Science. April 17.

MMR and Autism - Truth

- Autism = multiple components
 - Hereditary factors
 - Parental history of psychiatric disorders
 - Pre-term births
 - Fetal exposure to psychotropic drugs or insecticides
 - Maternal bacterial or viral infections during 1st or 2nd trimester
- Autism diagnosis and MMR vaccine given around the same time
 - MMR recommended at age 1-2 and again 4-6 years old
 - Concerns of autism expressed around 15-18 months
 - Average age of diagnosis is 4-5 years old
- Many large, well-designed studies have found no link

Sharma SR. Pharmacology and Therapeutics. 2018.
Yates K. Paediatrics and Child Health. 2016.

MMR Safety Studies

	Uno Y. Vaccine. 2015.	Jain A. JAMA. 2015.	Mrozek-Budzyn D. Pediatr Infect Dis J. 2010
Design	Case-control	Retrospective cohort	Case-Control
Population	Matching age & sex of each case	Child > 5 with an older sibling	96 cases ASD = 192 controls matched by year of birth, sex
Exposure	Vaccination history: MMR vaccine OR thimerosal	MMR vaccine (0+ doses) after 1 year of age	Vaccination: MMR or Measles
Outcomes	ASD	ASD	ASD diagnosis
Results	ORs for MMR/thimerosal <ul style="list-style-type: none"> • 18 mos: 0.875/1.205 • 24 mos: 0.724/1.343 • 36 mos: 1.040/0.844 No significant difference	Total N – 95,727 Kids w ASD sibling: <ul style="list-style-type: none"> • Age 2 RR 0.76 • Age 5 RR 0.56 Kids w/o ASD sibling: <ul style="list-style-type: none"> • Age 2 RR 0.91 • Age 5 RR 1.09 	Before diagnosis (MMR): OR 0.17 95%CI 0.06-0.52 Before diagnosis (Measles): OR: 0.44 95%CI 0.22-0.91 Vaccinated vs nonvaccinated: OR: 0.28 95%CI 0.1-0.76
Conclusion	MMR/Thimerosal ≠ ASD	MMR ≠ ASD	MMR/Measles ≠ ASD

Thimerosal and Autism - Source

- 2005 Magazines: Rolling Stone and Salon co-published a story by Robert F Kennedy, Jr.
 - Government covered up evidence that thimerosal, neurotoxin, linked to causing autism
- 1992 Rumor in Denmark: the incidence of autism dropped once thimerosal was removed

Thimerosal and Autism – Truth

- 2005 Magazines: Rolling Stone and Salon co-published a story by Robert F Kennedy, Jr.
 - Multiple corrections soon appeared
 - Kennedy had incorrectly stated the mercury levels
 - 2011 Salon retracted and removed the story – “continued revelation of the flaws and even fraud tainting the science behind the connection”
- 1992 Rumor in Denmark
 - Arose from misinterpretation of epidemiologic data

Wessel L. Science. April 17.

Thimerosal and Autism - Truth

- Mercury – found naturally on earth: air, soil, and water
 - Thimerosal or ethylmercury
 - Cleared more quickly from the body
 - Used in vaccines to prevent growth of dangerous bacteria and fungus
 - Methylmercury
 - Found in fish
 - High exposures can be toxic
- Uno study as discussed previously
- 2001: US removed thimerosal from all childhood vaccines
 - Except for multi-dose influenza vaccines

Wessel L. Science. April 17.

Uno Y. Vaccine. 2015.

CDC.gov. "Understanding Thimerosal, Mercury, and Vaccine Safety." 2013.

MYTH/FEAR 2 – ADMINISTRATION OF MULTIPLE VACCINES OVERLOAD THE IMMUNE SYSTEM

Source

- 2014: CDC expanded the pediatric vaccine schedule
- The scheduled amount of vaccines cause an overload of the immune system
 - Risks of immune system overload thought to be:
 - Neurodevelopmental delays such as autism
 - Type 1 diabetes
 - Sudden infantile death syndrome (SIDS)
- Led parents to spread vaccines out for multiple reasons:
 - Pain
 - Safety
 - Efficacy

Wessel L. Science. April 17.

Truth

- Infants are exposed to many immunologic challenges throughout life
 - During birth and post birth, exposed to trillions of bacteria
 - While eating, exposed to more bacteria
 - While breathing, exposed to both bacteria and viruses

- Immunologic challenges to vaccines
 - 1900: Smallpox: ~200 proteins/sugars
 - 1960: 5 vaccine preventable diseases had ~3,217 proteins
 - 1980: 7 vaccine preventable diseases had ~3,041 proteins
 - 2000: 12 vaccine preventable diseases had 134-137 proteins
 - Now: 14 vaccine preventable diseases have ~150 proteins

Vaccine Education Center at Children's Hospital of Philadelphia. Volume 4. Winter 2018.
Offit PA. Pediatrics. 2002.

Truth – Safety

- Study by Offit and colleagues - Theoretical capacity to respond to at least 10,000 vaccines at one time

- Study by Hviid and colleagues
 - Cohort study of 805,206
 - Multiple antigen vaccines and non-targeted infectious disease hospitalizations
 - 2,900,463 person-years of follow up – 84,317 cases of infectious disease hospitalized
 - Only Hib vaccine and acute upper respiratory tract infections significant (RR: 1.05; 95%CI 1.01-1.08)
 - Increasing aggregate vaccine exposure did not increase the risk for non-targeted infectious disease hospitalization

- Study by Karvonen and colleagues
 - Cohort study of 245,288: 3 groups
 - Hib vaccine and type 1 diabetes
 - No statistically significant difference found at any time during 10 year follow up

- Study by Griffin and colleagues
 - Cohort study of 129,834 children who received at least 1 DTP vaccine
 - DTP vaccines and SIDS
 - Risk of SIDS within 30 days of immunization compared to 31 day or more
 - 0-3 days: 0.18 (95%CI 0.04-0.8)
 - 4-7 days: 0.17 (95%CI 0.04-0.7)
 - 8-14 days: 0.75 (95%CI 0.4-1.5)
 - 15-30 days: 1 (95%CI 0.6-1.6)

Offit PA. Pediatrics. 2002.
Hviid A. JAMA. 2005
Karvonen M. BMJ. 1999.
Griffin MR. N Engl J Med. 1988.

Truth - Issues with delaying vaccines

- Increasing the time that infants/children are susceptible to preventable diseases
- Delaying vaccines lead to more doctor visits due to:
 - Illness from vaccine preventable disease
 - More appointments for shots – although research has shown, stress response to the injection is similar to 1 vaccine as it is for 2 vaccines
- Previously healthy infants/children are hospitalized or die from vaccine preventable diseases
 - Varicella – prior to vaccine, 70-100 children died each year
 - Pertussis – estimated 195,000 deaths worldwide in 2008
 - *Haemophilus influenzae* type b – even with treatment, 1 out of 20 with Hib meningitis dies
 - Influenza – 75-100 children die from flu each year
 - Pneumococcus – children < 5: 1 in 15 die if meningitis, 1 in 100 die if bacteremia
- Increases the risk of vaccine administration errors

Cohn M. Immunol Rev. 1990.

CDC. Pneumococcal Disease. September 2017.

CDC, AAP, AAFP. Hib Disease and the Vaccine (Shot) to Prevent It. April 2017.

CDC. Pink Book Chapter: Pertussis. 2012.

Vaccine Education Center at Children's Hospital of Philadelphia. Volume 4. Winter 2018.

MYTH/FEAR 3 – NATURAL INFECTION CONFERS BETTER IMMUNITY

Source

- “Natural infections better immunity than vaccines”
- Biggest differences = Price paid for immunity

Sequalae of Vaccine Preventable Infections

	Varicella	<i>Haemophilus influenzae</i> Type b	Pneumococcus	Rubella	Hepatitis B	Measles
Outcome 1	SSTIs	Loss of limbs	Death	Heart problems	Cirrhosis	Ear infections
Outcome 2	Pneumonia	Brain damage	Hearing loss	Hearing loss	Hepatocellular Carcinoma	Hearing loss
Outcome 3	Encephalitis	Hearing loss	Developmental delay	Eyesight loss	Death	Diarrhea
Outcome 4	Bleeding problems	Death	Pericarditis	Intellectual disability		Pneumonia/ encephalitis
Outcome 5	Sepsis		Empyema	Liver damage		Death
Outcome 6	Death		Endobronchial obstruction	Spleen damage		Premature/LBW newborns

<https://www.cdc.gov/chickenpox/about/complications.html>

<https://www.cdc.gov/hi-disease/about/diagnosis-treatment.html>

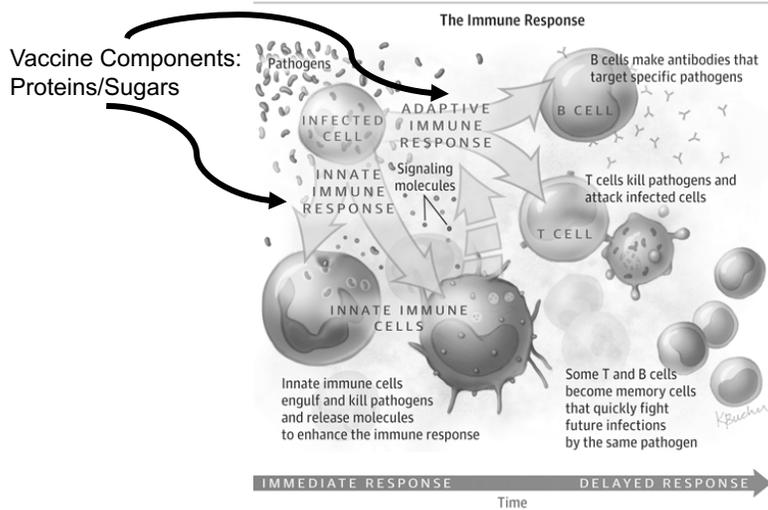
<https://www.cdc.gov/pneumococcal/about/symptoms-complications.html>

<https://www.cdc.gov/rubella/about/complications.html>

<https://www.cdc.gov/measles/about/complications.html>

Ormecci N. *Fundam Clin Pharmacol*. 2003.

The Immune System: Infections and Vaccines



Thompson AE. JAMA. April 2015.

Truth

- Infection can confer immunity after one exposure
- Reasons why infection may confer better immunity
 - Dose of antigen
 - Time of exposure
- Reasons why vaccines require multiple doses
 - Increases total dose of antigen
 - Increases total time of exposure
 - Decreases probability of antibody response waning
- German Study:
 - 496 infants randomized
 - 60th day of life vs 90th day of life
 - General "non-specific" morbidity
 - Coughing 19 vs 64 P < 0.001
 - Rhinitis 28 vs 95 P < 0.001
 - Restlessness 14 vs 60 P < 0.001
 - Vomiting 3 vs 25 P < 0.01
 - Rash 16 vs 56 P < 0.01
 - Pain 5 vs 29 P < 0.01
 - Infants immunized within the first 90 days:
 - Fewer infections with vaccine related
 - Fewer infections with unrelated pathogens

Otto S. J Infect. 2000.
<https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-safety/immune-system-and-health>

Truth continued

- Some vaccines actually confer better immunity than natural infection
 - HPV vaccine
 - Tetanus vaccine
 - Hib vaccine
 - Pneumococcal vaccine
- 1993 study comparing naturally acquired and vaccine induced antibodies to *Haemophilus influenzae* type b capsular polysaccharide

	Natural	<i>Haemophilus</i> type B capsular polysaccharide (PRP)	PRP-diphtheria	PRP-group B Neisseria meningitis	<i>Haemophilus</i> type B oligosaccharide (HbOC)
Total patients	24	17	22	24	20
Mean Titer	0.97	0.86	1.43	5.86	16.64

Jelonek MT. Infection and Immunity. Dec 1993.
<https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-safety/immune-system-and-health>

MYTH/FEAR 4 – INACTIVE INGREDIENTS CAN CAUSE HARM

Source

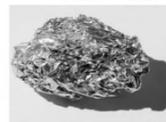
- Thimerosal – autism discussed
- Aluminum
 - Poisonous to the nervous system
 - High levels – insomnia, nervousness, emotional instability, memory loss, headaches
 - Prevents bone growth and reduces bone density by decrease Ca, P, and fluoride absorption
 - Forces Ca out of bones
 - Aching muscles, speech problems, anemia, digestive problems, decreased liver function, and impaired kidney function
- Formaldehyde
 - Cancer
 - Respiratory distress
 - Long term lung damage
 - Systemic organ damage
 - Skin irritation and rashes
 - Nervous system toxicity
- Miscellaneous
 - Antibiotics – neomycin
 - Additives – gelatin, albumin, sucrose, lactose, MSG, and glycine

Truth

- Aluminum
 - Adjuvant that helps vaccine stimulate a better response
 - Most common metal in nature
 - Found in most foods and drinks
 - Breast milk, formula, and soy formula contain more aluminum
- Formaldehyde
 - Detoxify diphtheria and tetanus toxins
 - Inactivate viruses and bacterial products
 - Removed from vaccine prior to being packaged
 - Found in other products such as: paper towels, mascara, and carpeting
 - Human normally have higher levels in their blood than vaccines contain
- Miscellaneous
 - Antibiotics – prevent bacterial contamination; no vaccines contain penicillin
 - Additives – prevent product degradation while being stores

CDC.gov. "Ingredients of Vaccines – Fact Sheet." July 2018.
 FDA.gov. "Common Ingredients in US Licensed Vaccines. April 2018.

Concerned about aluminium in vaccines? Consider this:



Pure Al



Aluminium salts used in vaccines
Al hydroxide & Al phosphate

Aluminium salt is an adjuvant used in some vaccines.

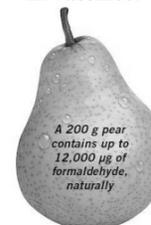
The aluminium bond in vaccine adjuvants is extremely strong and does not break down into Al ions easily. Aluminium hydroxide & aluminium phosphate are poorly absorbed and mostly excreted by the body no matter whether injected or ingested.

While infants will receive about 4 mg of aluminium in the first 6 months from vaccines, they will receive much more from breastmilk or formula. About half the aluminium in vaccines or food is eliminated in less than 24 hours, more than 3/4 is eliminated in 2 weeks and virtually all is gone in 3 years.

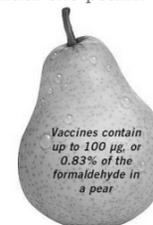
www.tinyurl.com/AL-CHOP-vax

Refutations to Anti-Vaccine Memes

Concerned about formaldehyde in vaccines? Consider the pear...



A 200 g pear contains up to 12,000 µg of formaldehyde, naturally



Vaccines contain up to 100 µg, or 0.83% of the formaldehyde in a pear

The amount of formaldehyde in a vaccine is so tiny that it doesn't even affect the naturally occurring levels of formaldehyde in a child's blood.

Source: <http://tinyurl.com/foodCH20>

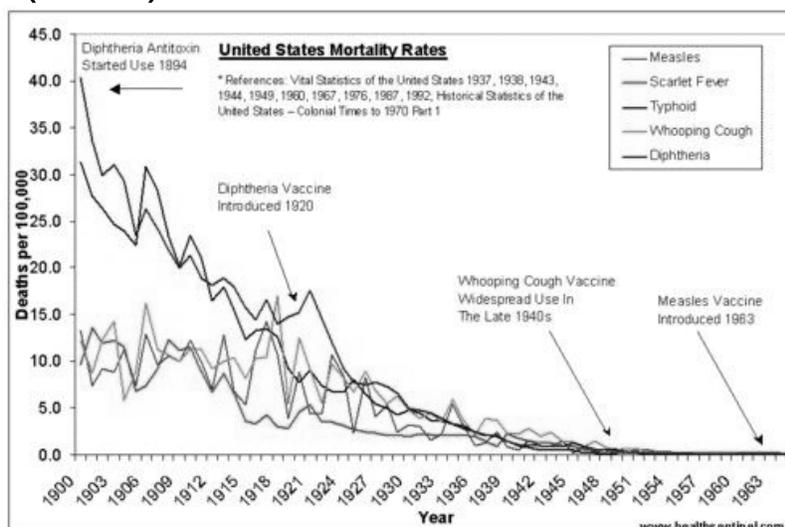
Refutations to Anti-Vaccine Memes

MYTH/FEAR 5 - DISEASE RATES HAVE DROPPED DUE TO FACTORS OTHER THAN VACCINES

Source

- Disease rates dropped due to:
 - Less crowded living spaces
 - Better nutrition
 - Indoor plumbing
- Mortality rates dropped due to:
 - Better respiratory support
 - Better medical care
 - Better pharmaceutical care

Source (cont.)

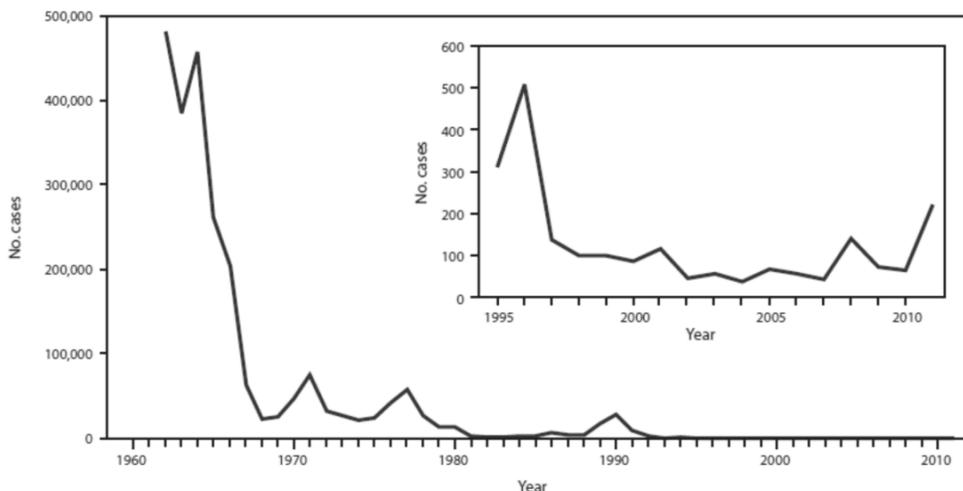


Truth

- Source = some truth
 - Better living conditions and healthcare led to a decrease in disease rates and mortality
- BUT the truth is:
 - People still get infected with vaccine preventable diseases
 - Infected people still die from these diseases
 - These diseases can be very infectious and dangerous to certain patient populations
- Meta-analysis in 2016
 - Substantial amount of US measles cases are due to intentional unvaccination (70.6%)
 - Measles: vaccine refusal = increased risk amongst vaccinated and unvaccinated patients
 - Pertussis: vaccine refusal = increased risk amongst vaccinated and unvaccinated patients
 - Waning immunity may be an issue in vaccinated patients

Measles Disease Rates

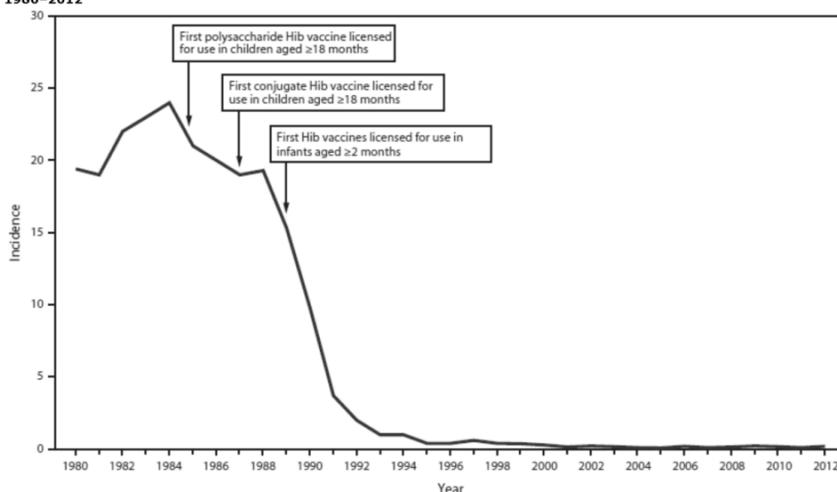
FIGURE 1. Number of measles cases — United States, 1962–2011



Sources: McLean HQ. MMWR. Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory committee on Immunization Practices. June 2013; 62(RR04);1-34. Measles data provided were reported voluntarily to CDC from state health departments.

Haemophilus influenzae Type B Rates

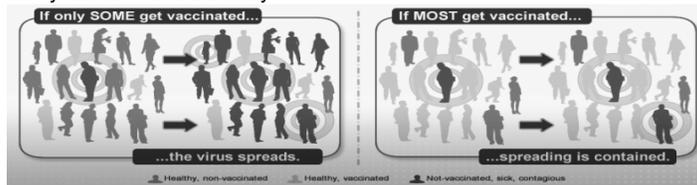
FIGURE 1. Estimated annual incidence* of invasive *Haemophilus influenzae* type b (Hib) disease in children aged <5 years — United States, 1980–2012



Source: 1980–1997: National Bacterial Meningitis Reporting System and National Notifiable Diseases Surveillance (NNDSS) data; Adams WG, Deaver KA, Cochi SL, et al. Decline of childhood *Haemophilus influenzae* Type b (Hib) disease in the Hib vaccine era. JAMA 1993;269:221–6; CDC. Progress toward elimination of *Haemophilus influenzae* type b disease among infants and children—United States, 1987–1995. MMWR 1996;45:901–6; CDC. Progress toward elimination of *Haemophilus influenzae* type b disease among infants and children—United States, 1987–1997. MMWR 1998;47:993–8. 1998–2009: NNDSS and Active Bacterial Core Surveillance (ABCs) data. 2010–2012: ABCs cases estimated to the U.S. population.

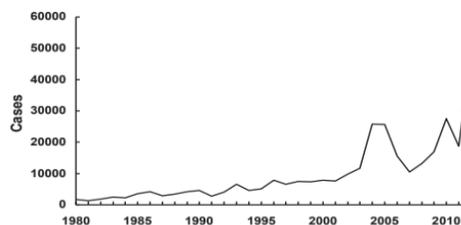
What Happens If We Stop Vaccinating

- Vaccines don't just protect yourself – Herd immunity



- Diseases have not disappeared
 - Measles > 350,000 cases worldwide with outbreaks everywhere
- Real world examples
 - Japan required pertussis vaccine in 1974
 - 80% of children received it – 393 cases of whooping cough with no deaths
 - By 1979 – vaccination rates back down to 10% - 13,000+ cases with 41 dead
 - Routine vaccination resumed and rates dropped again
 - US Pertussis cases in 1980-2012
- Overall
 - Vaccines help protect you and your neighbors
 - Vaccines protect you today and future self

Pertussis—United States, 1980-2012



Source: National Notifiable Diseases Surveillance System, CDC

CDC.gov. "What Would Happen If We Stopped Vaccinations." June 2018.
 CDC. Pink Book Chapter: Pertussis. 2012.

ADVERSE EFFECTS

Known Contraindications and Precautions

• Contraindications

- All vaccines – Severe allergic reaction (anaphylaxis) after a previous dose or to a vaccine component

• Precautions

- All vaccines – GBS within 6 weeks of previous dose
- All vaccines – moderate or severe acute illness w/ or w/o fever

IAC. "Guide to Contraindications and Precautions to Commonly Used Vaccines." Accessed 2018.

CDC. "Best Practices Guidance of the Advisory Committee on Immunization Practices (ACIP)" available at www.cdc.gov/vaccines/hcp/acip-recs/general-recs/index.html.

Adverse Effects of Vaccines

• Evidence supports a causal relationship

- Varicella vaccines
 - Disseminated varicella infection
 - Disseminated varicella infection with subsequent infection in immunodeficient patients such as:
 - Pneumonia
 - Meningitis
 - Hepatitis
 - Vaccine strain viral reactivation
 - Vaccine strain viral reactivation with subsequent infections:
 - Meningitis
 - Encephalitis
- MMR
 - Measles inclusion body encephalitis
 - Febrile seizures
- Anaphylaxis with 6 vaccines: MMR, varicella, influenza, hepatitis B, meningococcal, tetanus containing
- All vaccines carry risk for:
 - Syncope
 - Deltoid bursitis

Clayton EW. Institute of Medicine. August 2011.

Adverse Effects of Vaccines

- Evidence favors acceptance of causal relationship
 - HPV vaccine and anaphylaxis
 - MMR vaccines and transient arthralgias in female adults
 - MMR vaccines and transient arthralgia

- Evidence favors rejections of causal relationship
 - MMR vaccine and autism
 - MMR vaccine and type 1 diabetes
 - DTaP vaccine and type 1 diabetes
 - Inactivated influenza vaccine and Bell's palsy
 - Inactivated influenza vaccine and exacerbation of asthma or reactive airway disease

- Evidence cannot favor or reject a causal relationship = 135 other vaccine-adverse effect pairs

Clayton EW. Institute of Medicine. August 2011.

Other Known Adverse Effects of Vaccines

- *Haemophilus influenzae* type B
 - Redness – OR 2.71 95%CI 1.57-4.67
 - Swelling – OR 9.44 95%CI 4.9-18.19

- Hepatitis A: Thrombocytopenic purpura - children aged 7-17 (Incidence rate: 23.14 95%CI 3.59-149.3)

- Hepatitis B: Food allergy - may increase risk for food allergies in patients with familial history

- Inactivate Polio: Food allergy - may increase risk for food allergies

- PCV13: Febrile seizures - 13.7 per 100,000 w/o TIV & 44.9 per 100,000 w/ TIV

- Rotavirus: Intussusception – epidemiologic study and 2 case-control studies found an association with the rotavirus vaccine and intussusception; 1.1-1.5 per 100,00 w/ RotaTeq and 5.1 per 100,000 with Rotarix

Maglione MA. Pediatrics. 2014.

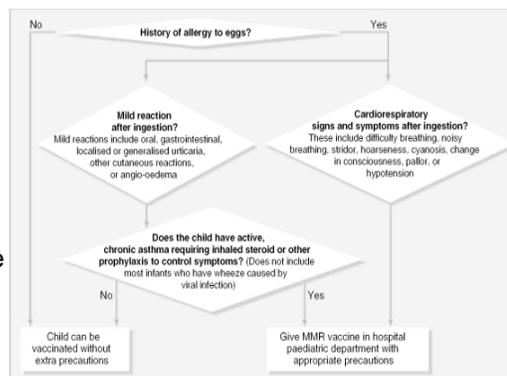
Egg Allergy and Vaccines

• MMR

- See algorithm on the right
- Safe in all children with egg allergies

• Influenza

- If patient can eat cooked eggs – administer vaccine
- If eggs cause patient to have hives
 - Administer inactivated influenza vaccine
 - Observe for 30 minutes
- If eggs cause patient to have more serious reaction
 - Administer inactivate influenza vaccine by provider with expertise in allergy management
 - Observe for 30 minutes
- If the child develops a severe allergic reaction – do NOT administer again



Khakoo GA. BMJ. 2000.
 CDC.gov. "Flu vaccine and People with Egg Allergies." December 2017.

VACCINE CASE PRESENTATIONS

Patient Case #1 – Religious Case

- A family recently moved to Albuquerque. This family comes into your clinic today to establish care at your facility. The family contains the mother, father, and 2 children. The oldest child is going to start school this upcoming year. The youngest child was born 4 months ago. As the pharmacist for the clinic, you talk to the family to determine what has been done previously for both children.
- When questioning about vaccinations, the mother states neither child has received any vaccinations.
- Talking to the mom about the youngest child, how would you approach this mom regarding vaccines?

How would you approach this family regarding vaccines?

What I would do?

- Determine why family is against vaccines
- If it is due to the animal products or human fetus(es) that are used, I would state the truth regarding the purpose for these ingredients
- I would educate the importance of vaccines, especially:
 - DTaP
 - Hib
 - PCV13

Patient Case #2 – Autism Case

- A single mother presents to your pharmacy wanting to discuss vaccinations. She tells you her pediatrician stated that it is required for her child, who is now 15 months old, to receive the MMR vaccine.
- Mom states that she is very fearful about vaccines and their safety. She mentions that she googled information regarding the MMR vaccine. She shows you information stating the MMR vaccine causes autism.
- Regarding this mom, how would you address this parent's fear about the MMR vaccine and autism?

How would you approach this mom's fear?

What I would do?

- Do NOT judge the mom for her fears
- Present the unbiased facts
- Show studies that demonstrate the safety of the MMR and other vaccines
- Discuss how autism is diagnosed and risk factors associated
- Discuss inactive ingredients in the vaccine
 - Thimerosal is no longer in vaccines, even though studies have shown it did not increase risk

Patient Case #3 – Too Many Vaccines Case

- Recently, a 2 month old infant was admitted to the hospital for bronchiolitis. As the rounding pharmacist, you determine that this infant was not vaccinated yet. The team tells you that mom has a fear that giving the infant all the 2 month vaccines may cause harm.
- You let the team know that you will discuss with parents. How would you approach this family?

How would you approach these parents?

What I would do?

- Do NOT judge the family for their concerns
- Discuss how the immune system works
- Approach family with safety data
- Show parents how many proteins are in vaccines compared to what they are actually exposed
- Discuss the potential complications with the family if vaccines are delayed

Our Role as Healthcare Providers

- For ourselves as healthcare providers
 - Understand the main reasons for vaccine refusal
 - Stay up to date with recommended vaccines and understand the recommendation
- For the patients and families
 - Have open conversations with the family
 - Provide unbiased, factual information
 - Do NOT judge or attack the family at any time, especially if they have questions

Take home: Education and taking time with the family has shown modest improvements regarding attitude towards vaccines

Conclusion

- Described 5 of the most common myths/fears:
 - MMR and thimerosal do not cause autism
 - Administration of multiple vaccines do not overload the immune system
 - Natural infection does not necessarily confer better immunity than vaccines
 - Inactive ingredients do not cause harm
 - Disease rates, while dropped prior to vaccines, have further decreased due to vaccines
- Reviewed and compared the US pediatric vaccine schedule and frequency to other countries
- Explained the mechanism of action for pediatric vaccines
- Evaluated studies and data surrounding these common myths/fears
- Constructed our own plans for several cases regarding pediatric vaccines

Questions?



BATTLING THE MYTHS AND FEARS REGARDING PEDIATRIC VACCINES

RC Hellinga, Pharm.D., BCPPS
UNMH Pediatric ICU Pharmacist
10/8/2018

Additional Resources

- Vaccine Excipient Table – CDC’s “Pink Book”
 - <https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/B/excipient-table-2.pdf>
- CHOP’s vaccine education center
- [CDC.gov/vaccines](https://www.cdc.gov/vaccines)