

Addressing Vaccine Hesitancy

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(NCIRD)**

Centers for Disease Control and Prevention

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Benefit/Risk Communication Challenges

Time

Complicated science

Disease versus vaccine

Emotions (fear, anxiety) can be driving conversation

Comparison of 20th Century Annual Morbidity and Current Morbidity: Vaccine-Preventable Diseases

Disease	20th Century Annual Morbidity [†]	2014 Reported Cases ^{††}	Percent Decrease
Diphtheria	21,053	1	> 99%
Measles	530,217	644	> 99%
Mumps	162,344	1,151	99%
Pertussis	200,752	28,660	86%
Polio (paralytic)	16,316	0	100%
Rubella	47,745	8	> 99%
Congenital Rubella Syndrome	152	0	100%
Tetanus	580	21	96%
<i>Haemophilus influenzae</i>	20,000	27*	> 99%
Total	999,159	30,512	97%
Vaccine Adverse Events	Not available	~30,000	Not available

[†] JAMA. 2007;298(18):2155-2163

^{††} CDC. MMWR January 9, 2015 / 63(53);ND-733-ND-746. (MMWR 2014 provisional week 53 data)

* *Haemophilus influenzae* type b (Hib) < 5 years of age. An additional 12 cases of Hib are estimated to have occurred among the 226 reports of Hi (< 5 years of age) with unknown serotype.



National Center for Immunization & Respiratory Diseases

Historical Comparisons of Vaccine-Preventable Disease Morbidity in the U.S.

Importance of Vaccine Safety

Vaccinations universally recommended or mandated

Ongoing safety monitoring needed for the development of sound policies and recommendations

Pre-licensure Vaccine Safety Studies

Laboratory

Animals

Humans



Pre-licensure Human Studies

Phase I trials – 20 to 100 volunteers
Serious adverse reactions

Phase 2 trials – hundreds of volunteers
Best dose for safety and efficacy
Correct number of doses

Phase 3 trials – few hundred to several thousand volunteers
(2000-5000)

Usually include a control group which receive a placebo
Looks at safety and efficacy
Common adverse reactions are identified

Post-licensure Surveillance

Identify rare reactions

Monitor increases in known reactions - Identify risk factors for reactions

Identify vaccine lots with increased rates of reactions

Identify “signals” – reports of adverse events more numerous than would be expected

Vaccine Adverse Event Reporting System (VAERS)

Jointly administered by CDC and FDA

National reporting system

Passive - depends on healthcare providers and others to report

Receives ~30,000 reports per year

<http://vaers.hhs.gov/>

The **Vaccine Adverse Event Reporting System (VAERS)** is a national vaccine safety surveillance program co-sponsored by the Centers for Disease Control and Prevention ([CDC](#)) and the Food and Drug Administration ([FDA](#)). VAERS is a post-marketing safety surveillance program, collecting information about adverse events (possible side effects) that occur after the administration of vaccines licensed for use in the United States.

VAERS provides a nationwide mechanism by which adverse events following immunization may be reported, analyzed, and made available to the public. VAERS also provides a vehicle for disseminating [vaccine safety](#)-related information to parents and guardians, health care providers, vaccine manufacturers, state vaccine programs, and other constituencies. [more...](#)

Have you or your child had a reaction following vaccination?

1. Contact your health care provider
2. [Report the reaction ▶](#)
3. [Submit Follow-Up Information ▶](#)
4. Visit the [National Vaccine Injury Compensation](#) (if appropriate)

Important note: CDC and FDA do not provide individual medical treatment, advice, or diagnosis. If you need individual medical or health care advice, consult a qualified health care provider.

¿Ha tenido usted o su hijo una reacción adversa después de recibir una vacuna?

1. Contacte a su proveedor de salud
2. [Reporte una reacción adversa ▶](#)
3. Visite el [Programa Nacional de Compensación por Daños Derivados de Vacunas](#) (si es necesario)

[Search VAERS Data ▶](#)

VAERS Data last updated: 09/14/2015



Featured Resources

Seasonal Flu Update

- [Summary of 2015-2016 Influenza Vaccine Information](#)

Government Agencies

- [Immunization Safety Office](#)
- [National Center for Immunization and Respiratory Diseases](#)
- [National Vaccine Injury Compensation Program](#)

Vaccine Adverse Event Reporting System (VAERS)

Detects:

- New or rare events
- Increases in rates of known events
- Patient risk factors

VAERS cannot establish causality

- Reportable Events Table
(https://vaers.hhs.gov/resources/VAERS_Table_of_Reportable_Events_Following_Vaccination.pdf)
- Not all reports of adverse events are causally related to vaccine
- Additional studies required to confirm VAERS signals and causality

Post hoc ergo propter hoc

“After this therefore because of this”

Temporal association does not prove causation

Just because one event follows another does not mean that the first caused the second

Elements Needed To Assess Correlation of Vaccine Adverse Events

	<u>Disease</u>	<u>No disease</u>
<u>Vaccine</u>	a	b
<u>No vaccine</u>	c	d

Rate in “vaccine” group

=

$a / a + b$

Rate in “no vaccine” group

$c / c + d$

If the rate in “vaccine” group is higher than the rate in the “no vaccine” group, then vaccines may be the cause

Risk of Autism Spectrum Disorder (ASD) Among Children in Denmark, 1991-1998

	<u>ASD</u>	<u>No ASD</u>
<u>Vaccine</u>	345	440,310
<u>No vaccine</u>	77	96,571
Risk in “vaccine” group		7.83/10,000
Risk in “no vaccine” group	=	7.96/10,000

Relative Risk = 0.98

Madsen et al. *N Eng J Med* 2002;347:1477-82



Post-licensure Vaccine Safety Activities

Phase IV Trials

~10,000 participants

Better but still limited

Vaccine Safety Data Link (Large Linked Databases)

Clinical Immunization Safety Assessment Project

Vaccine Safety Datalink

Vaccine Safety Datalink (Large linked database):

Links vaccination and health records

Partnership with large health plans: population under “active surveillance”

- 9 HMOs
- 3% (9 million) of U.S. population

Plans, executes immunization safety studies

Investigates hypotheses from medical literature, VAERS reports, changes in schedules, introduction of new vaccines

CISA

Clinical
Immunization
Safety
Assessment
Network



Safer Healthier People

Improve understanding of vaccine safety issues at individual level

Evaluate individual cases with adverse health events

Develop strategies to assess individuals

Conduct studies to identify risk factors

<http://www.vaccinesafety.org/CISA>

Vaccine Injury Compensation Program

Established by National Childhood
Vaccine Injury Act (1986)

□ <http://www.hrsa.gov/vaccinecompensation/>

“No fault” program

Covers all routinely recommended
childhood vaccines

Vaccine Injury Table

(www.hrsa.gov/vaccinecompensation/vaccineinjurytable.pdf)

Recent (and Ongoing) Vaccine Safety Concerns by the Public

Immune system overload

Aluminum

Thimerosal and autism/neurologic injury

Syncope

Immune System Overload

Data overall suggest that two vaccines given simultaneously can be as immunogenic and safe compared with an arbitrary interval between the doses

As many as NINE vaccine doses could potentially be given at one visit

What about simultaneous administration of multiple vaccine doses?

Simultaneous Vaccination – Multiple Vaccines

Biological mechanism of immune system capacity

- Antibody level (10 ng/mL) a proxy for seroprotection
- Certain number of B cells required within one week to provide that level ($N = 1000$)
- Rate at which B cells divide (every 16 hours) mean that one B cell clone is sufficient for each vaccine epitope (one B cell clone per epitope can accomplish this in one week)
- 100 epitopes per vaccine
- Need 100 B cells to provide protection in one mL of blood

Simultaneous Vaccination – Multiple Vaccines

Since we have 10,000,000 B cells / mL of blood

We only need 100 cells / single vaccine response

We have immune capacity to generate a response to 100,000 vaccines, if needed

Offit, Paul, et. Al. Vaccine Safety, Vaccines 6th ed. 2013

Aluminum

Many inactivated vaccines contain aluminum adjuvants

Aluminum can be toxic to preterm infants and renal dialysis patients

Aluminum

Exposure to preterm and renal patients is via IV fluids

Aluminum content in vaccines is small – 4 mg by 6 months of age

By contrast: 10-30 mg from milk ingestion

Aluminum is a common component of many foods (baked goods, cheese)

Thimerosal (ethylmercury) in Vaccines

Preservatives used in vaccines to reduce bacterial growth in multidose vials

Thimerosal is a preservative used in many biologic products (including vaccines) since the 1930s

Thimerosal is 50% ethylmercury by weight

All Mercury is Not the Same

Methylmercury

- Neurotoxic
- Found in fish – environmental contaminant

Ethylmercury

- Used in thimerosal

Methylmercury Reference Values

Agency

Value

Environmental
Protection Agency

0.1 ug/kg/day (Rfd)

World Health
Organization

3.3 ug/kg/week

Half Life of Total Mercury (Hg) Washout of Infant Monkeys Given Methyl Mercury Orally or Thimerosal (Ethyl Mercury) Intramuscularly †

Infant Monkeys – 4 doses of 20 µg/Kg at days 0, 7, 14, 21

T1/2	Methyl Hg	Ethyl Hg
Blood	59.5 days ± 24.1	24.2 days ± 7.4
Brain	19.1 days ± 5.1	6.9 days ± 1.7

Brain concentrations of thimerosal exposed ~3 fold lower than methyl mercury exposed

† Burbacher TM et al in Environmental Health Perspectives, doi:10.1289/ehp.7712 (available at <http://dx.doi.org>) – Online 21 April 2005

Thimerosal and Autism

Cohort study: 14,000 children in UK

**Exposure was determined by time
since vaccination**

**Outcomes collected through parental
questionnaires**

Heron J, Golding J, Pediatrics 2004

Thimerosal and Autism

No association between dose of thimerosal and speech, behavior at 3 months, 6 months of age

Association between dose of thimerosal at 3 months of age and poor prosocial behavior, not observed at 6 months of age

Authors concluded that early exposure to thimerosal had no deleterious effect on neurologic or psychologic outcomes

Another Thimerosal Study Showing No Association with Autism

**Case-control study conducted in 3 managed care organizations
256 children with autism spectrum disorder (ASD), 752 without
ASD**

**Case and control children had similar cumulative exposure to
ethylmercury**

**Exposure to ethylmercury from thimerosal-containing
immunizations during pregnancy or in the first 20 months was not
associated with an increased risk of any ASD**

Cristofer, Pediatrics, 2010

[Autism Speaks™](#)[Be Informed](#)[Get Involved](#)[Walk Events](#)[Community](#)[Science](#)

Autism Speaks™

[Science News](#)[News Archive](#)[CAN News Archive](#) [SEARCH](#)[Overview](#)

An Interview with Dr. Geri Dawson, Chief

“... given what the scientific literature tells us today, there is no evidence that thimerosal or the MMR vaccine cause autism. Evidence does not support the theory that vaccines are causing an autism epidemic.”

- Dr. Geri Dawson, July 30, 2009

discovered some of the risk genes for autism, but we still know little about the

...ks, about the
...ding and
...tism



Gerri Dawson
Chief Science Officer
Autism Speaks

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Syncope

Vasovagal reaction

Can occur after
vaccination or any
other anxiety
provoking activity

Syncope

Since 2001, 666 reports of syncope reported to VAERS

80% of reports occur in the first 15 minutes of vaccination

Increasing reports since 2005, coincident with vaccines recommended for adolescents

Syncope and Head Injury

Concerning public health issue is head injury following syncope

76% of VAERS reports of head injury following syncope occur in adolescents

Syncope and CDCs General Recommendations

Adolescents and adults should be seated during vaccination

Consider a 15 minute waiting period following vaccination of adolescents

Benefit and Risk Communication

Opportunities for questions should be provided before each vaccination

Vaccine Information Statements (VISs)

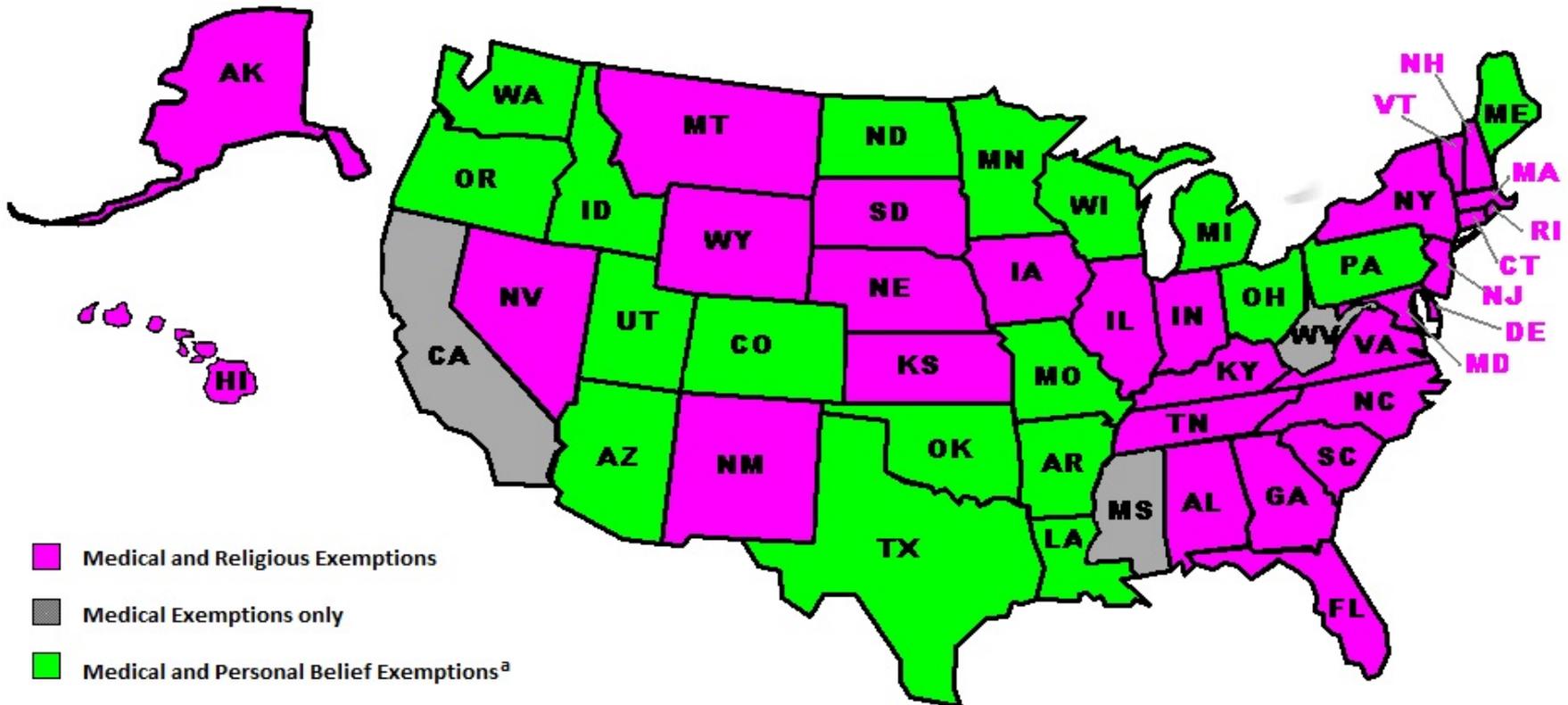
- Must be provided before each dose of vaccine
- Public and private providers
- Available in multiple languages

VACCINE EXEMPTIONS

It is law in all US states that children be properly immunized before attending school. However, in addition to medical exemptions offered in each state, the vast majority of states allow for religious exemptions and various states allow personal belief exemptions for daycare and school.

School Exemption Laws by State

(updated September 15, 2015)



Your Source for VISs

www.immunize.org

immunize.org | vaccineinformation.org | hepprograms.org | izcoalitions.org

Immunization Action Coalition

Vaccination Information for Healthcare Professionals

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VISs

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- ▶ [VISs by Language](#)
- ▶ [VISs Alphabetical](#)
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Vaccine Information Statements

VISs by language

English	Chinese	Ilokano	Polish	Somali
Amharic	Croatian	Italian	Portuguese	Spanish
Arabic	Farsi	Japanese	Punjabi	Tagalog
Armenian	French	Karen	Romanian	Thai
Bengali	German	Korean	Russian	Turkish
Bosnian	Haitian Creole	Laotian	Samoan	Urdu
Burmese	Hindi	Marshallese	Serbo-Croatian	Vietnamese
Cambodian	Hmong			

Communicating with Parents

For providers:

- If provider recommends it, parents more likely to follow
- Ask, acknowledge, and advise
- Start at prenatal visit, develop trust
- Offer reliable resources
- Know the science
- Do not get defensive

Use the Four C's of Effective Communication

Chemistry

Clarity

Consistency

Credibility

Institute of Medicine Studies, August 2011

Committee findings:

- **CAUSAL RELATIONSHIP** between some vaccines and adverse events
 - MMR, VZV, Influenza, etc., and anaphylaxis
- **REJECTION OF 5 RELATIONSHIPS**
 - Including MMR and autism, TIV and asthma

Overall, the committee concluded that few health problems are caused by, or clearly associated with, vaccines

Communicating with Parents

What parents want:

- Delayed vs. alternate schedules
- Facts and statistics
- Trust good websites
- Do not want to be talked down to
- Unbiased, non-coercive, credible, non-judgmental information

Childhood Immunization Schedule and Safety

Institute of Medicine - Mission

- Review scientific findings and stakeholder concerns related to the safety of the recommended childhood immunization schedule
- Identify potential research approaches, methodologies, and study designs that could inform this question
- Issue a summary report

Findings

- IOM committee finds no evidence that the schedule is unsafe
- Following the complete childhood immunization schedule is strongly associated with reducing vaccine-preventable diseases
- Committee calls for continued study of the immunization schedule using existing data systems

CDC Vaccines and Immunization Resources

- ❑ Questions? E-mail CDC

- nipinfo@cdc.gov or www.cdc.gov/cdcinfo

- ❑ Website

www.cdc.gov/vaccines

- ❑ HCP

www.cdc.gov/vaccines/hcp

- ❑ Twitter

@CDCIZlearn

- ❑ Influenza

www.cdc.gov/flu

- ❑ Vaccine Safety

www.cdc.gov/vaccinesafety