

# Epidemiology of Vaccine Refusal and Evidence Base for Addressing Vaccine Hesitancy

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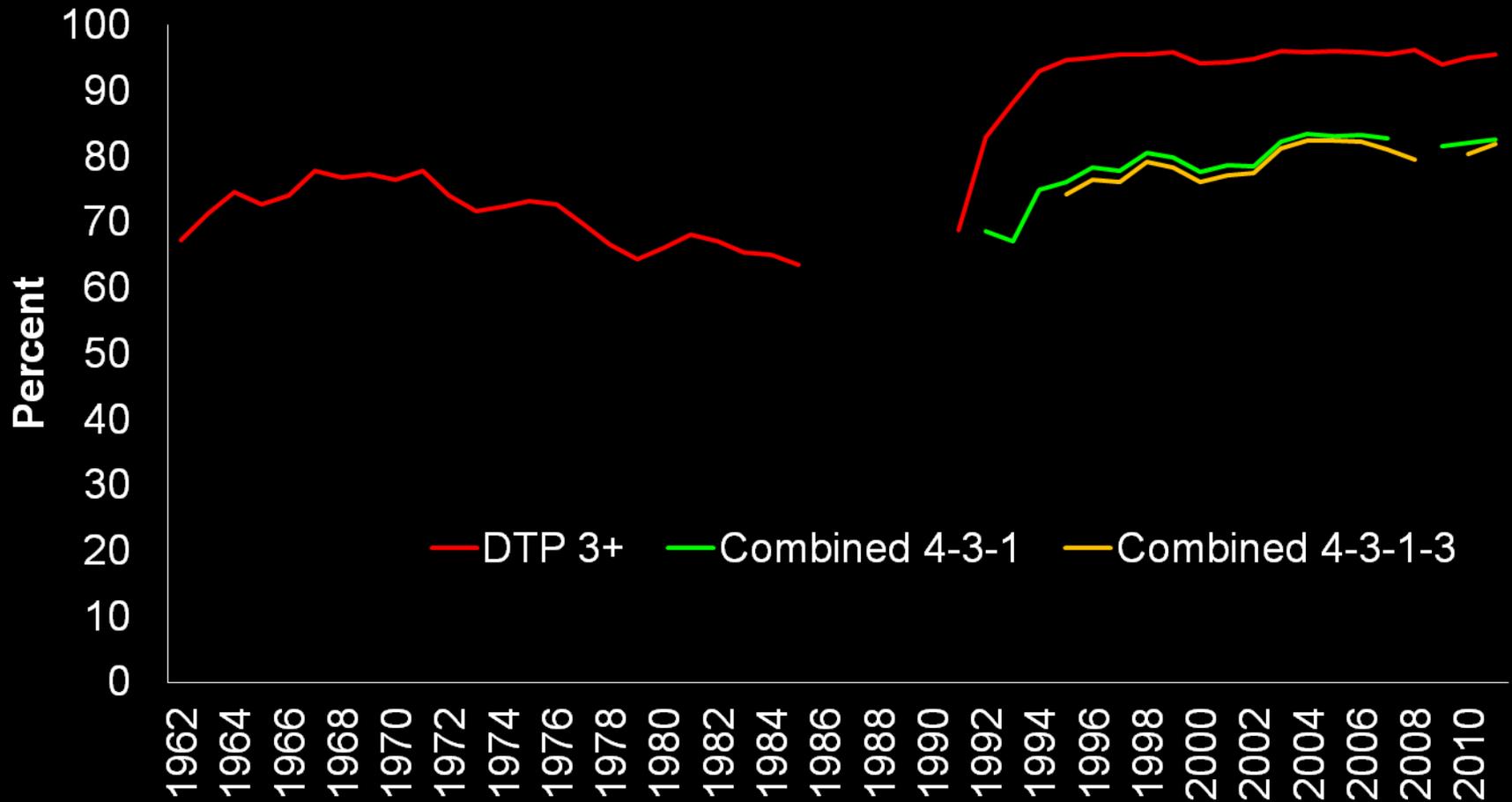
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Emory Vaccine Center

# Disclosure Statement

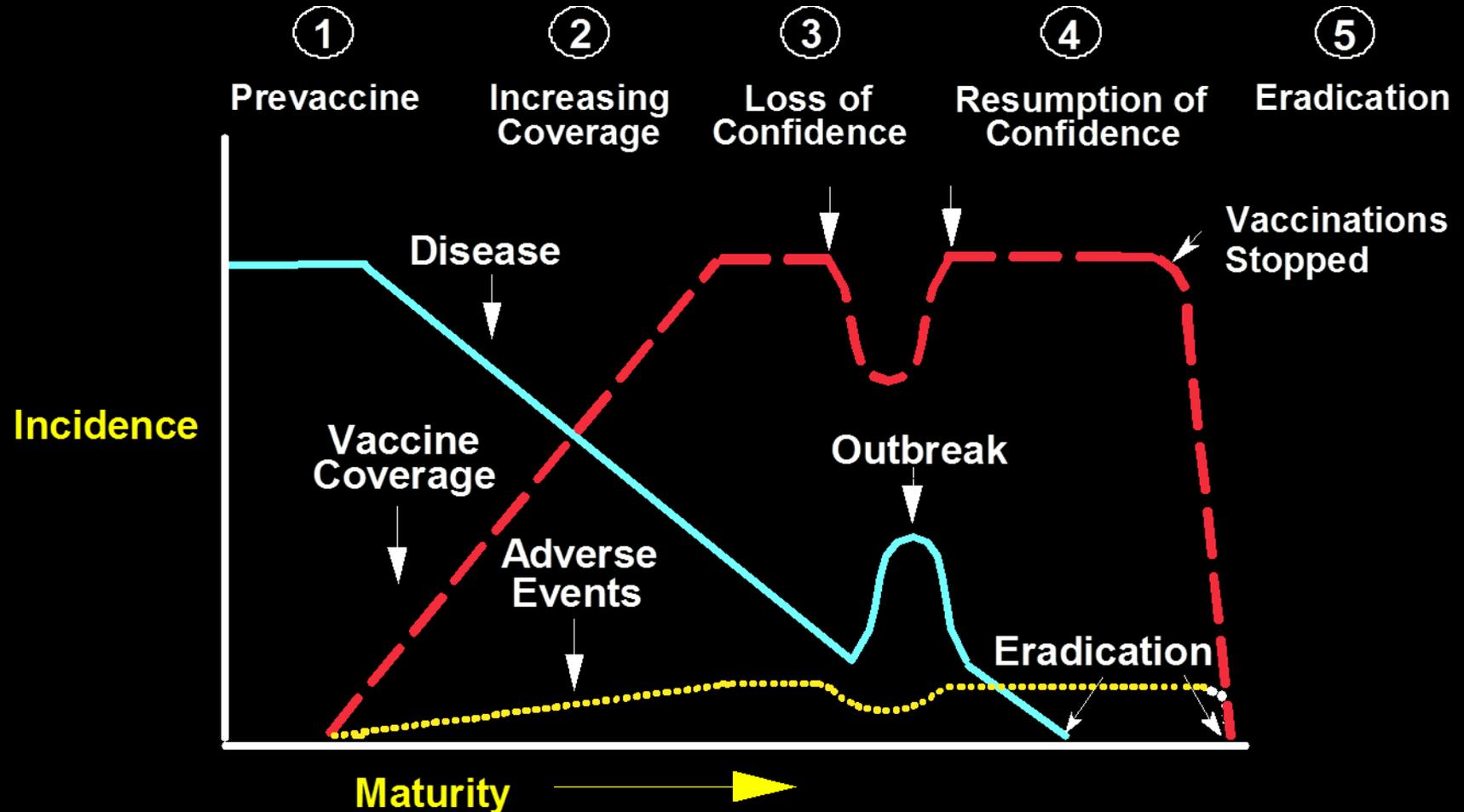
I was awarded the Maurice R. Hilleman Early-stage Career Investigator Award by the National Foundation for Infectious Diseases. The award was funded by an unrestricted educational grant to the National Foundation for Infectious Diseases from Merck and Co, Inc. However, I had no direct interaction with Merck.

# Vaccine Coverage Levels – United States, 1962-2011



Data Source: CDC Pink Book; 2012  
NIS Data & MMWRs multiple years

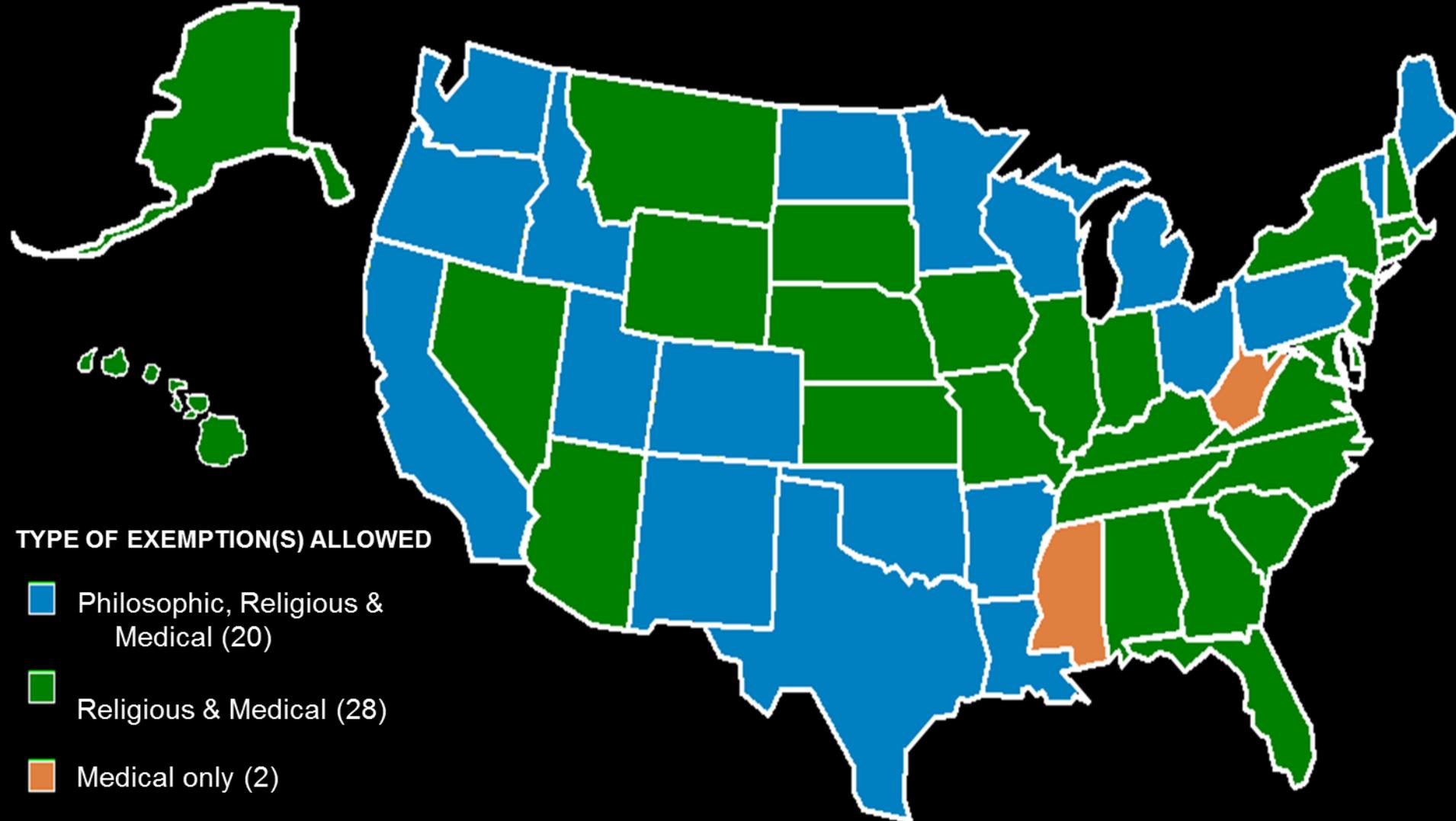
# Evolution of Immunization Program and Prominence of Vaccine Safety



# School Immunization Requirements

- State laws (not federal)
- Major role in low rates of vaccine preventable diseases
- Exemptions
  - Medical
  - Religious
  - Personal belief (philosophical) exemptions

# Exemptions to School Immunization Laws



# Relative Risk of Measles and Pertussis in Exemptors from School Laws

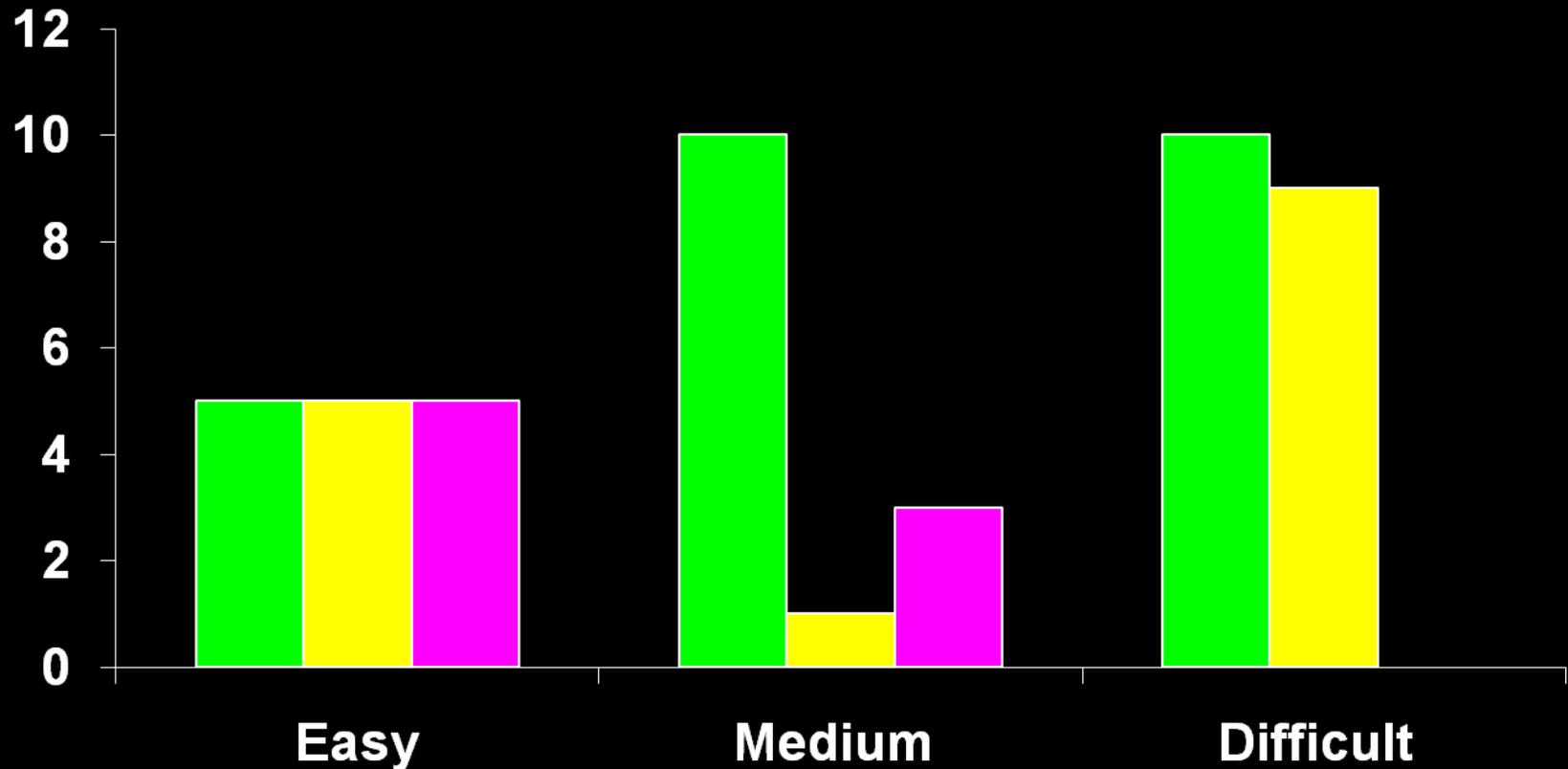
	Measles	Pertussis
CO (1987-98)	22	5.9
U.S. (1985-1992)	35	

Feikin et al. JAMA. 2000;

Salmon et al, JAMA. 1999.

# Complexity of Administrative Procedures to Obtain Exemptions & Proportion of Children with Exemptions

■ Low Exemption Rates   ■ Medium Exemption Rates   ■ High Exemption Rates



Source: Rota et al., AJPH, 2001

# State Policies

- Easy process = High exemption rates
- Exemption rates associated with individual risk of pertussis & measles
- State policies  $\longrightarrow$  Disease incidence?

# ASSOCIATIONS BETWEEN STATE EXEMPTION POLICIES AND PERTUSSIS INCIDENCE, 1986-2004

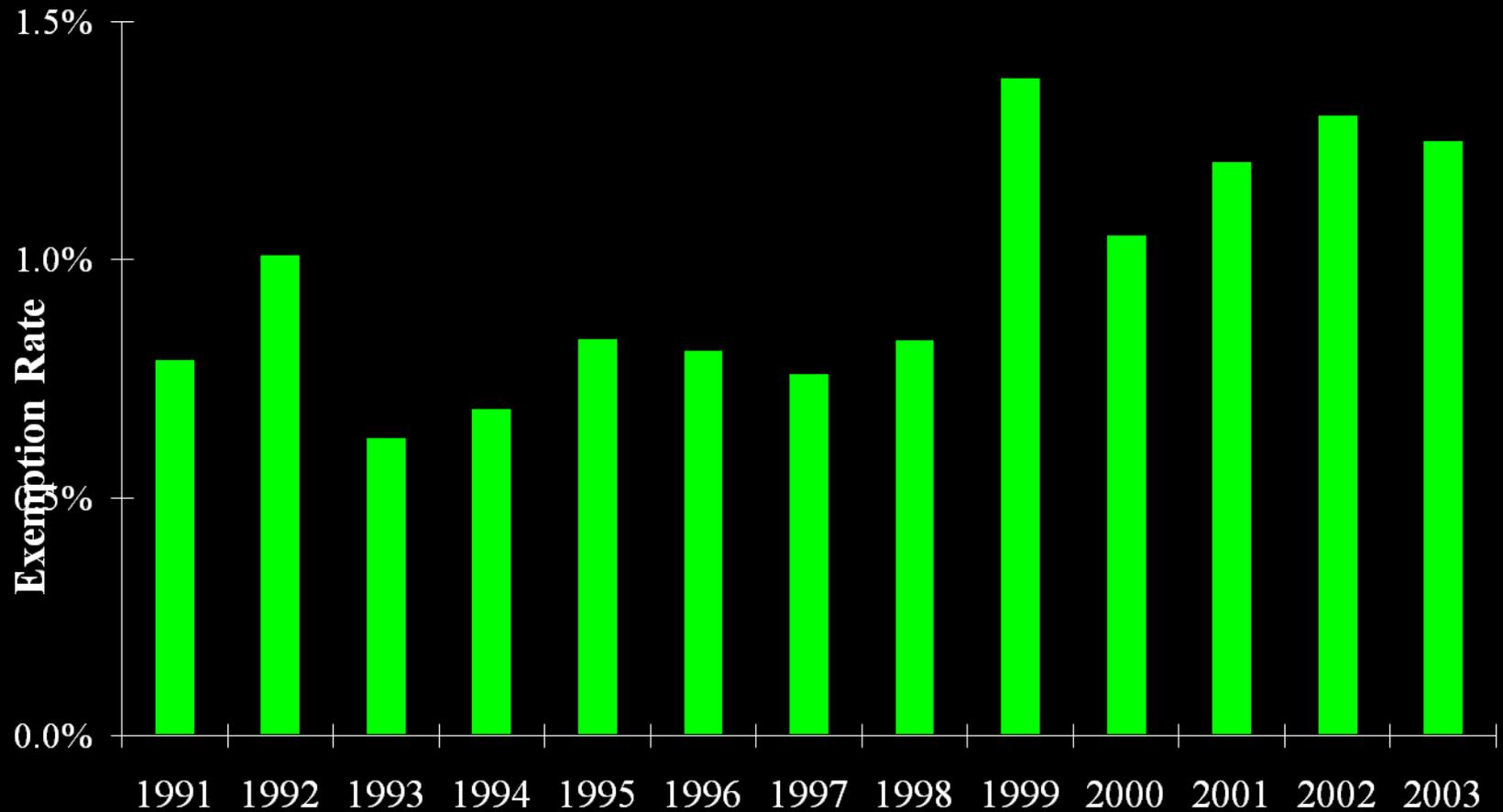
	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)
<b>Type of exemption</b>		
Only Religious Exemption	Reference	Reference
Personal Belief Exemption	2.06 (1.77-2.40)	1.48 (1.03-2.13)
<b>Exemption ease</b>		
Difficult	Reference	Reference
Medium	1.27 (1.06-1.51)	1.35 (0.96-1.91)
Easy	1.90 (1.60-2.28)	1.53 (1.10-2.14)

Adjusting for allowing parental signature for school immunization forms, proportion inside urbanized area, income (11 categories), and education (7 categories)

# Financial Impact of a State Adopting a Personal Belief Exemption

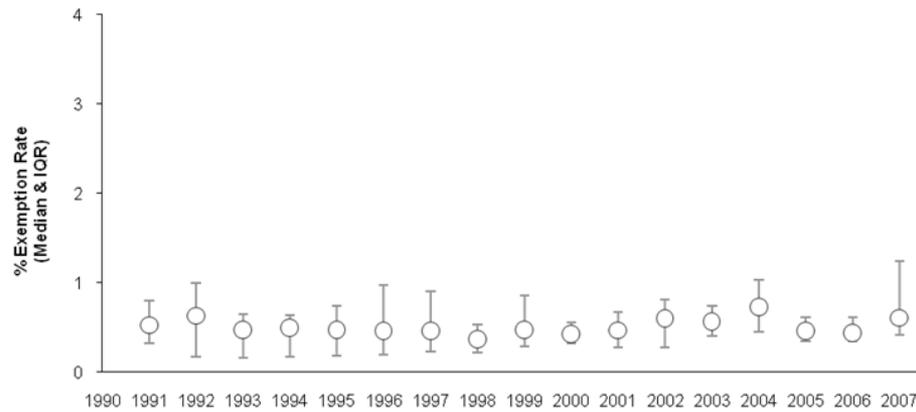
- Modeled cost of pertussis in infants, children and adolescents in Iowa
- Annual projected impact of pertussis
  - Without PBE: \$273,365
  - With PBE: \$410,047 (range \$281,566-\$582,267)
    - 50% projected increase in cost

# Non-Medical Exemptions by year 1991 - 2003

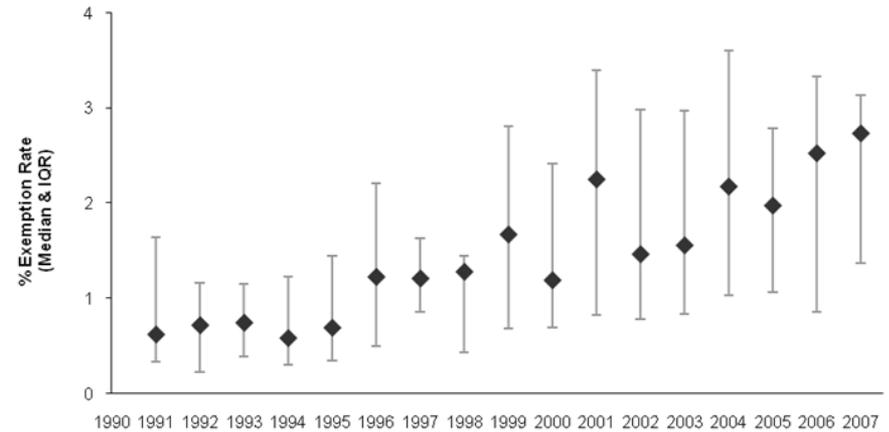


# Nonmedical Exemptions for States With Religious Exemptions and With Personal Belief Exemptions -1991 - 2004

## Only Religious Exemptions Permitted

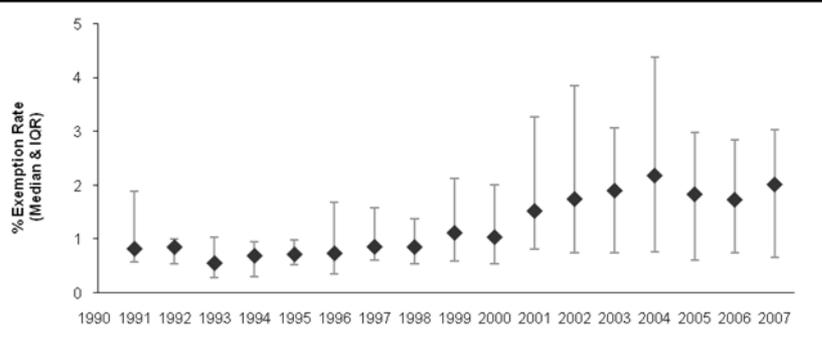


## Personal Belief Exemptions Permitted

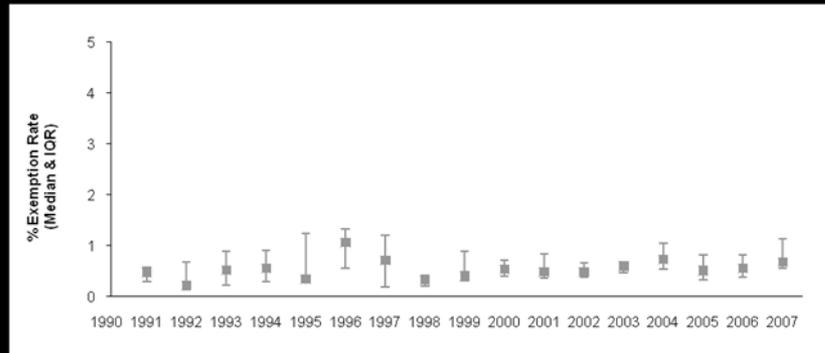


# Nonmedical Exemptions by Ease of Exemption 1991 - 2007

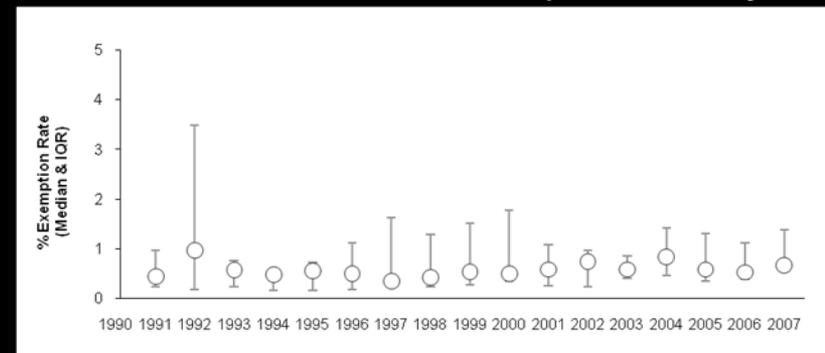
## Easy Exemption Policy



## Medium Exemption Policy



## Difficult Exemption Policy

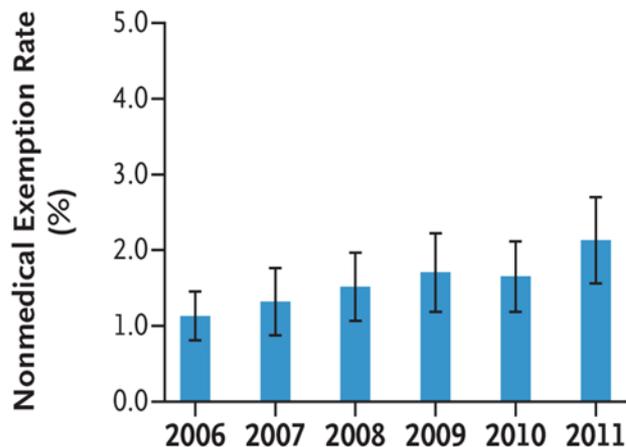


Omer et al., JAMA, 2006

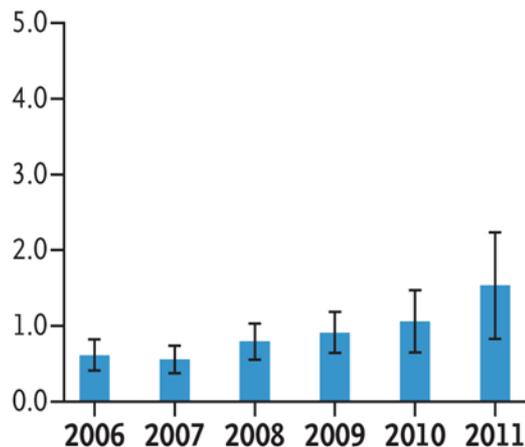
Data updated

# Mean (95% CI) Rates of Nonmedical Exemptions by Type & Ease of Exemption, 2006–2011

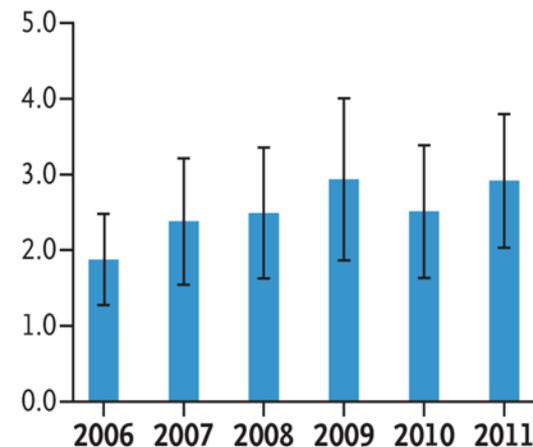
Overall Results (excluding Mississippi and West Virginia)



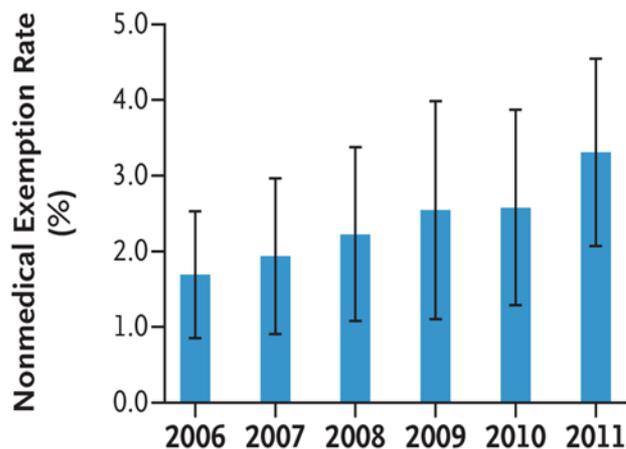
Religious Exemptions Only



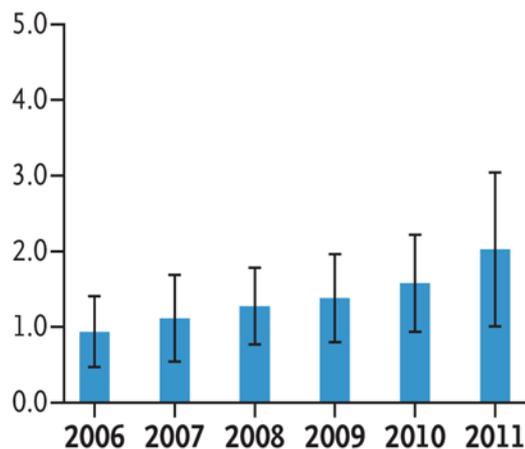
Philosophical Exemptions Permitted



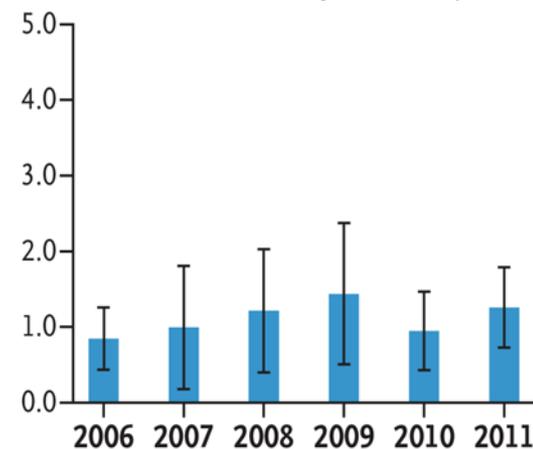
Easy Exemption Policy



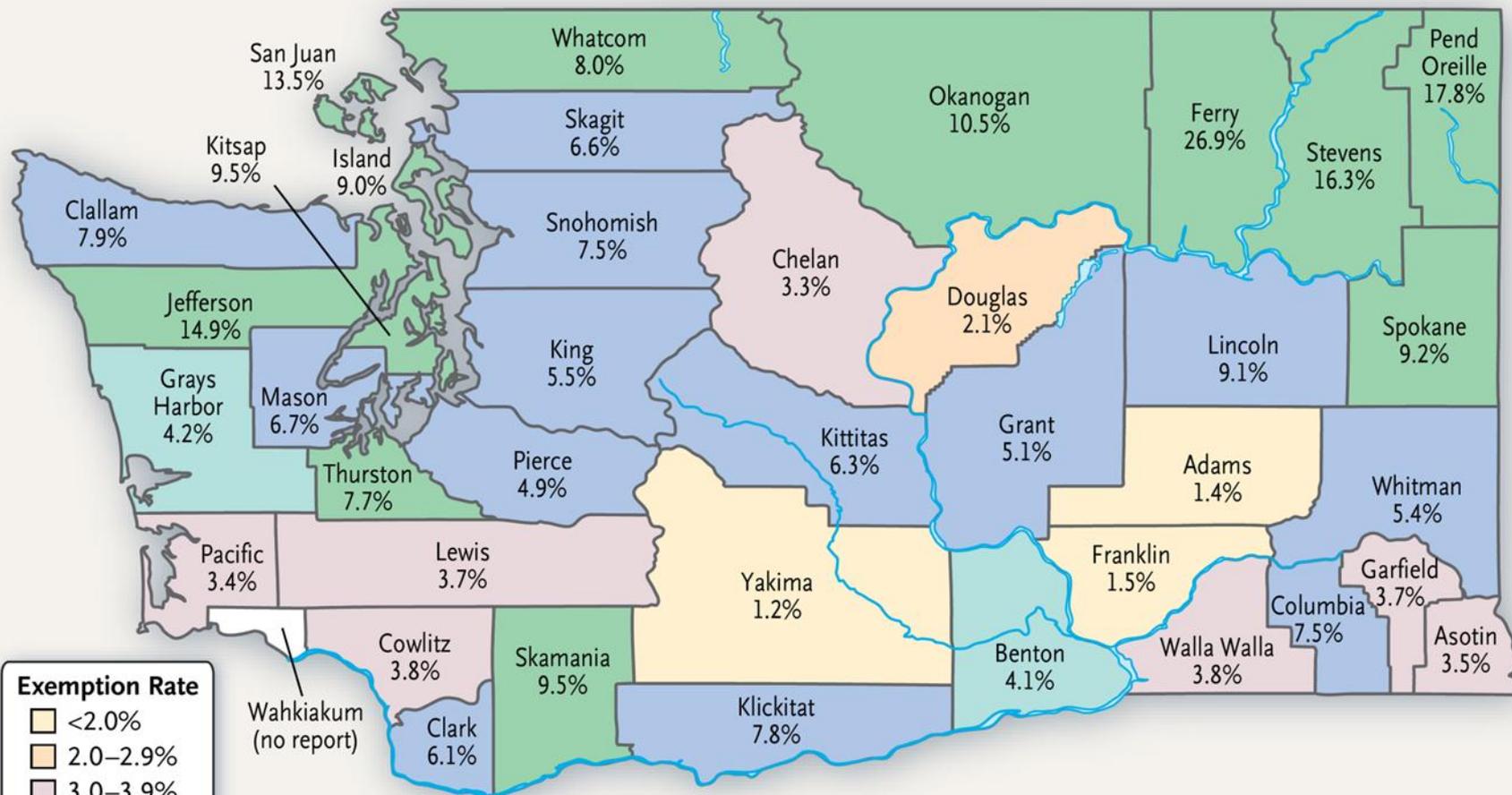
Medium Exemption Policy



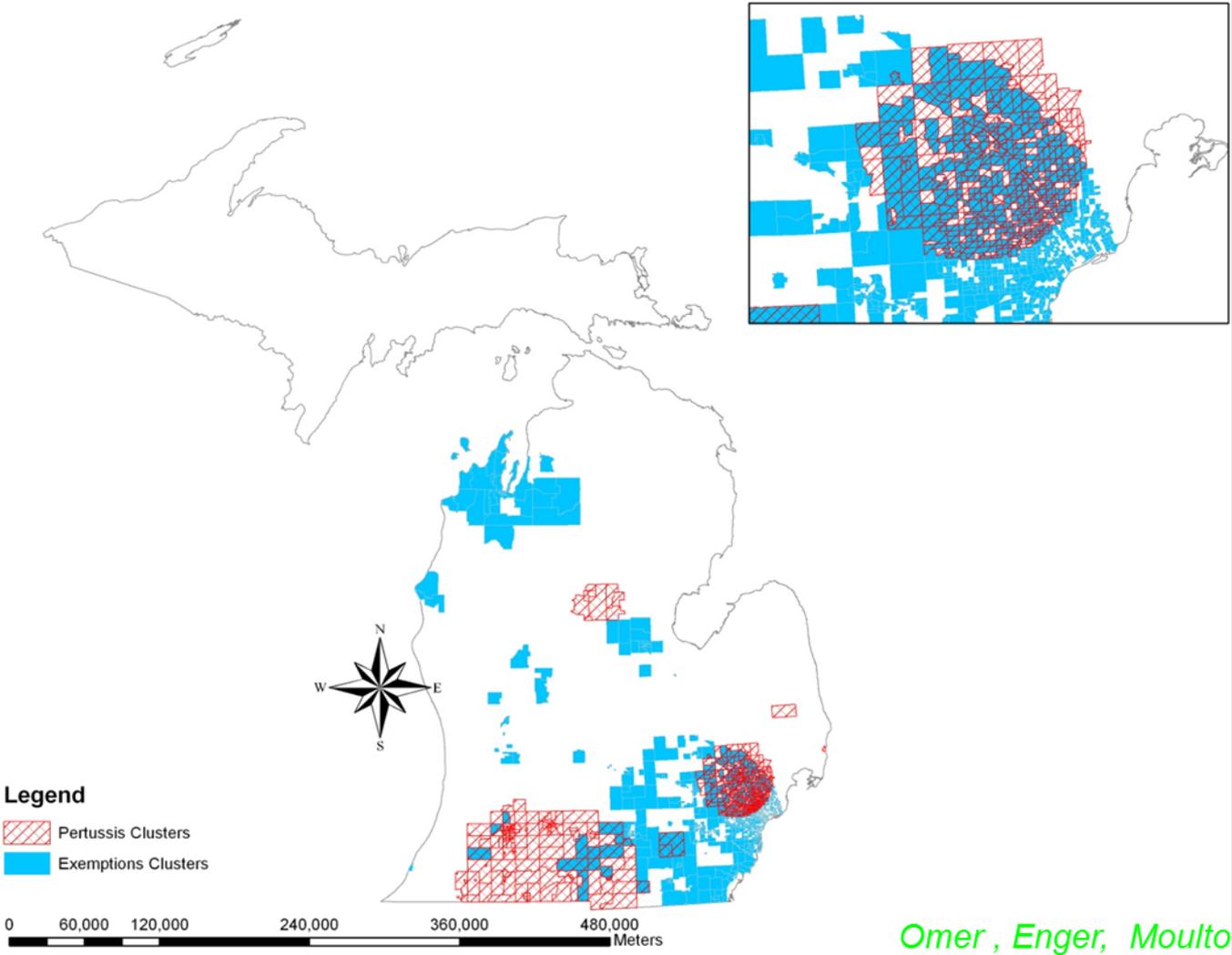
Difficult Exemption Policy



# WA State Counties' School Entry Exemption Rates 2006-2007



# Relative Locations of Pertussis Space-time Clusters & Exemptions Spatial Clusters



Overlap of Exemptions Clusters with Pertussis Clusters

Unadjusted OR

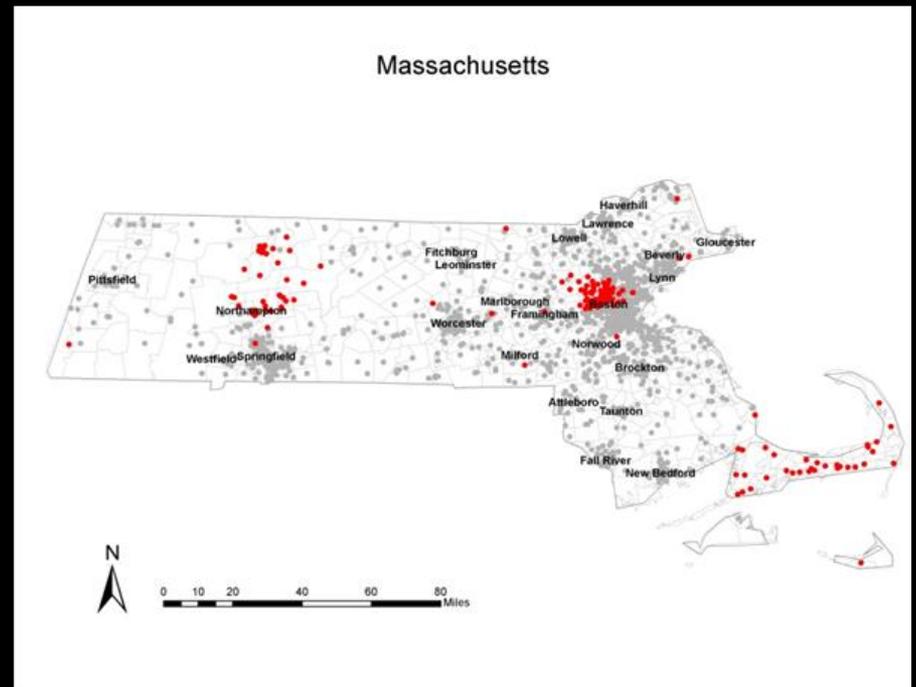
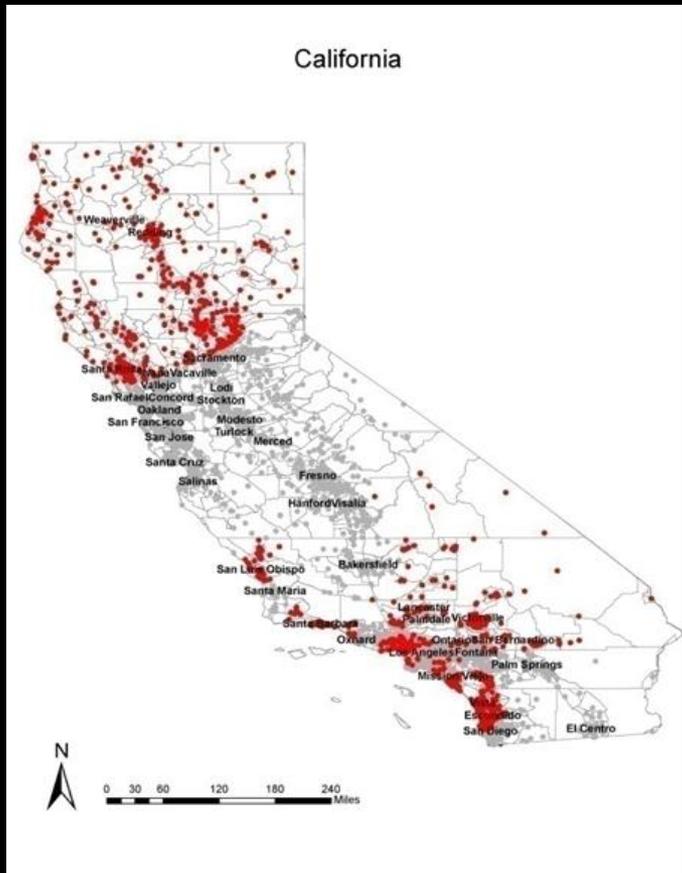
3.0 (2.5 – 3.6)

Adjusted OR

2.7 (2.2 – 3.3)

Omer, Enger, Moulton et al., Am. J. Epi., 2008

# Locations of Schools Included in Exemption Clusters in California and Massachusetts



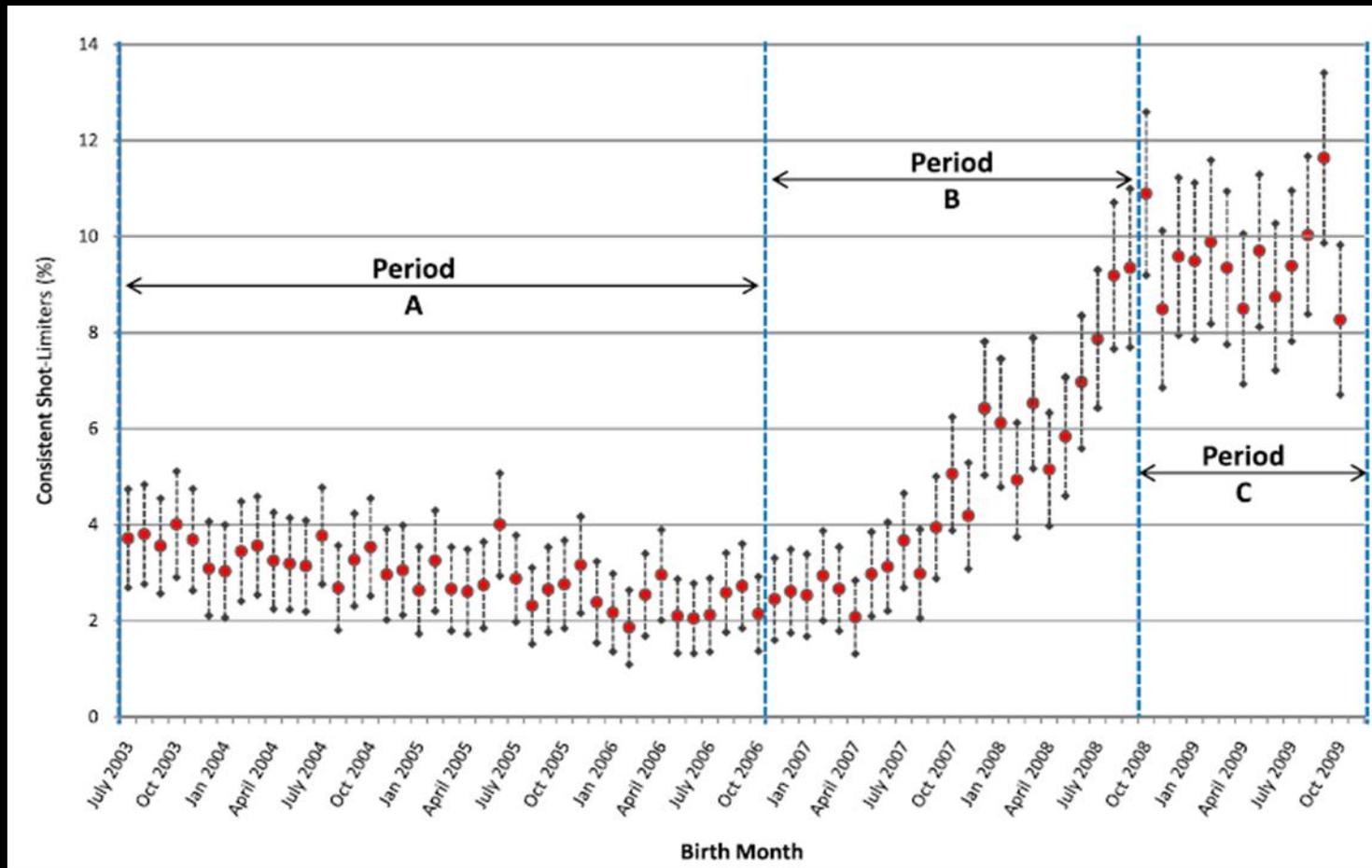
# Overlap Between Personal Beliefs Exemption Clusters 2006-2010 & 2010 Pertussis clusters

	Odds Ratios (95% CI)
Unadjusted	2.47 (2.21, 2.75)
Adjusted	1.73 (1.53, 1.96)

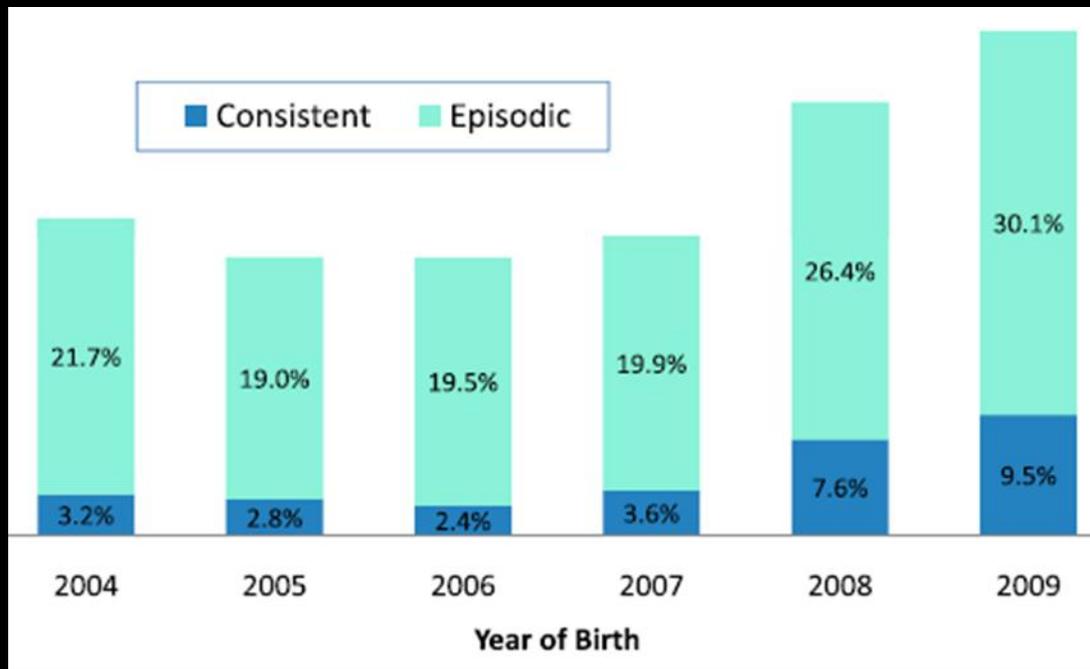
# Pertussis Incidence in 2010 Inside PBE vs. Outside PBE Clusters in California

	Incidence Rate Ratio (95% Confidence Interval)
Unadjusted	1.19 (1.10, 1.30)
Adjusted	1.12 (1.02, 1.23)

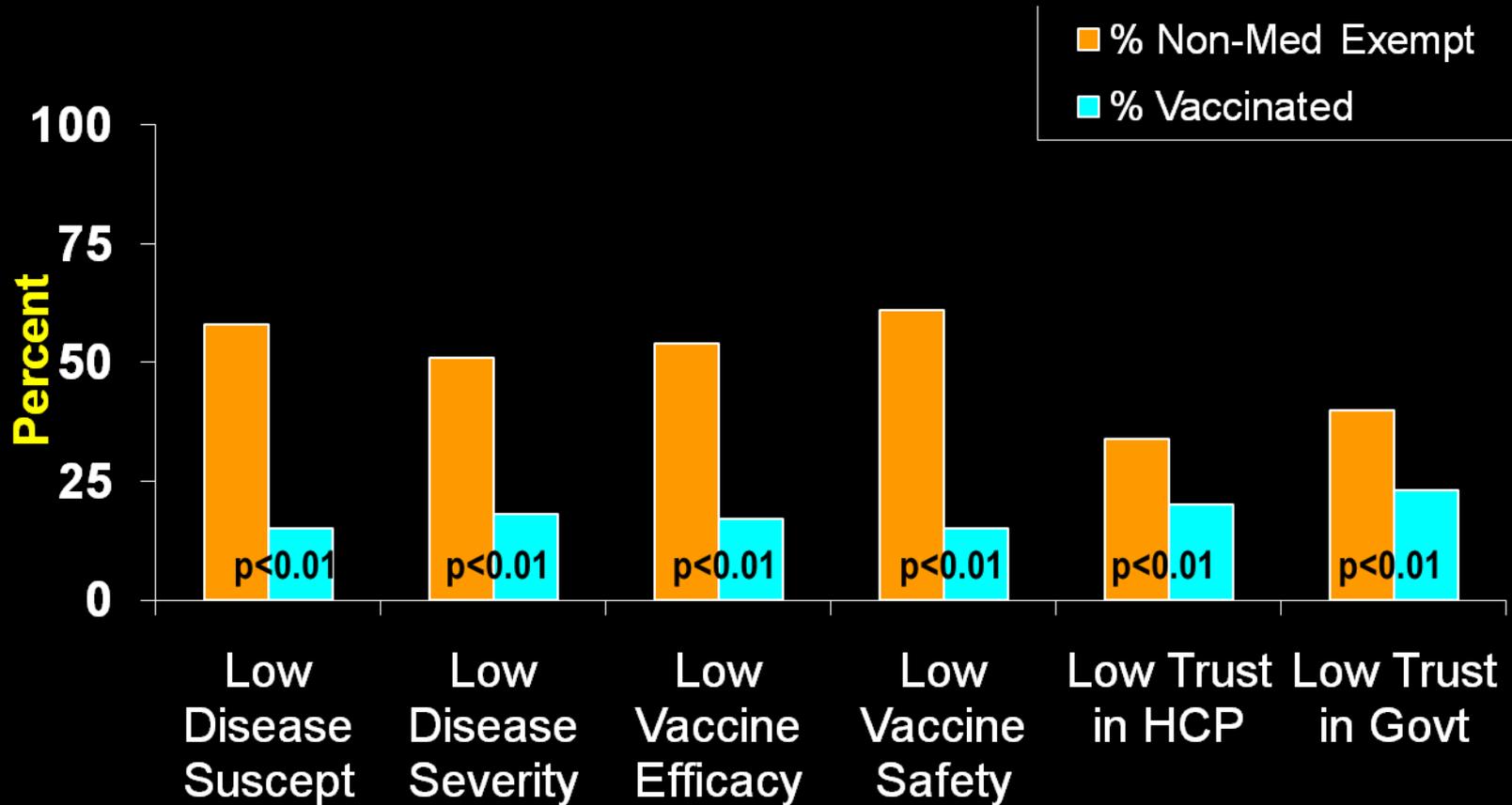
# Consistent shot-limiting rates according to birth month



# Consistent and episodic shot-limiters as a percentage of yearly birth cohort



# Parents' Perceptions by Child's Vaccination Status



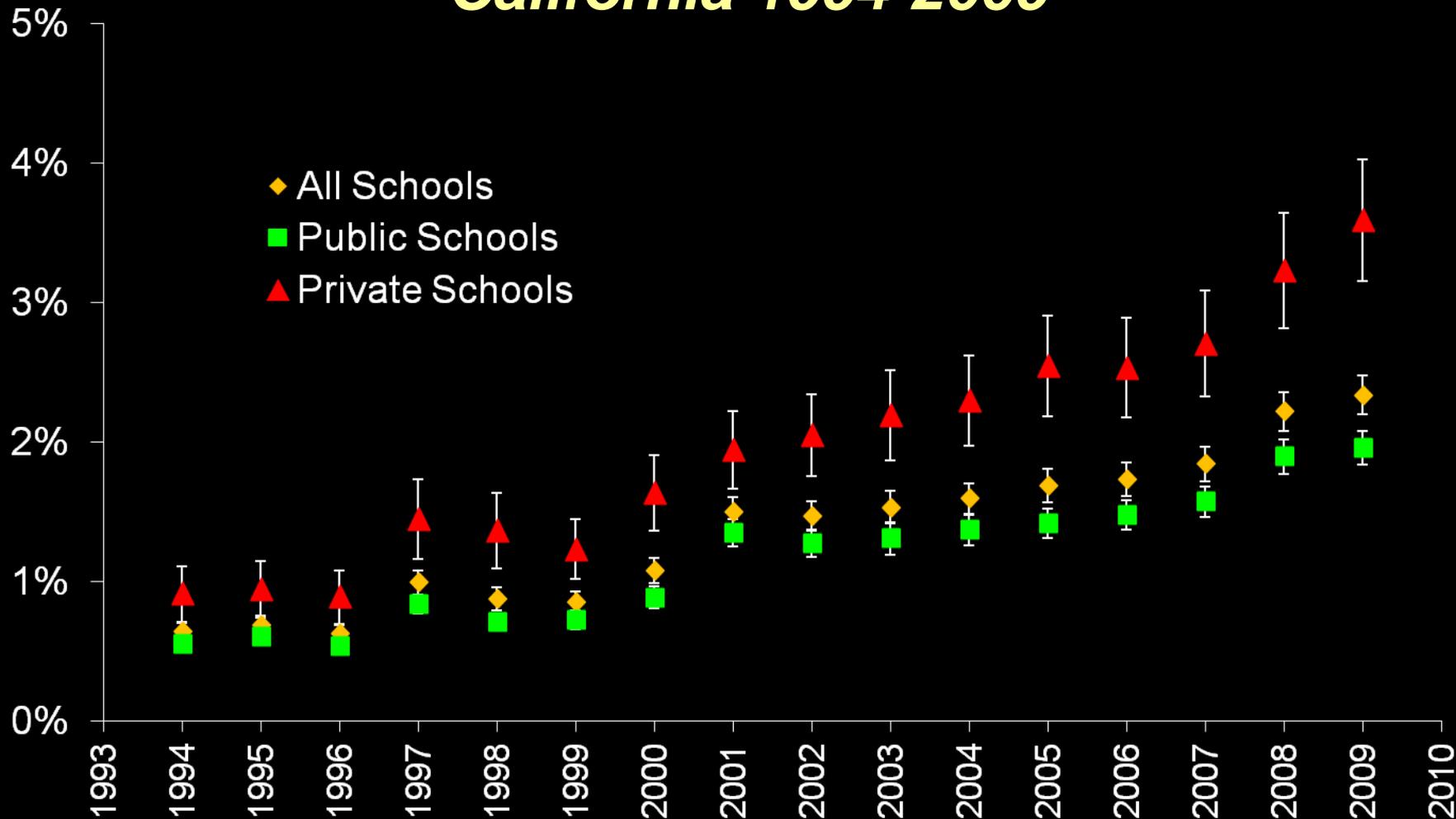
# Characteristics of Unvaccinated (“Zero Dose”) vs. Under-vaccinated Children

- Unvaccinated children more likely to be:
  - Male
  - White
  - Belong to households with higher income
  - Married mother with a college education
  - Live with  $\geq 4$  children

*Smith, Chu , & Baker, Pediatrics, 2004*

# School-level Personal Belief Exemption Rates Overall & by School Type

## California 1994-2009



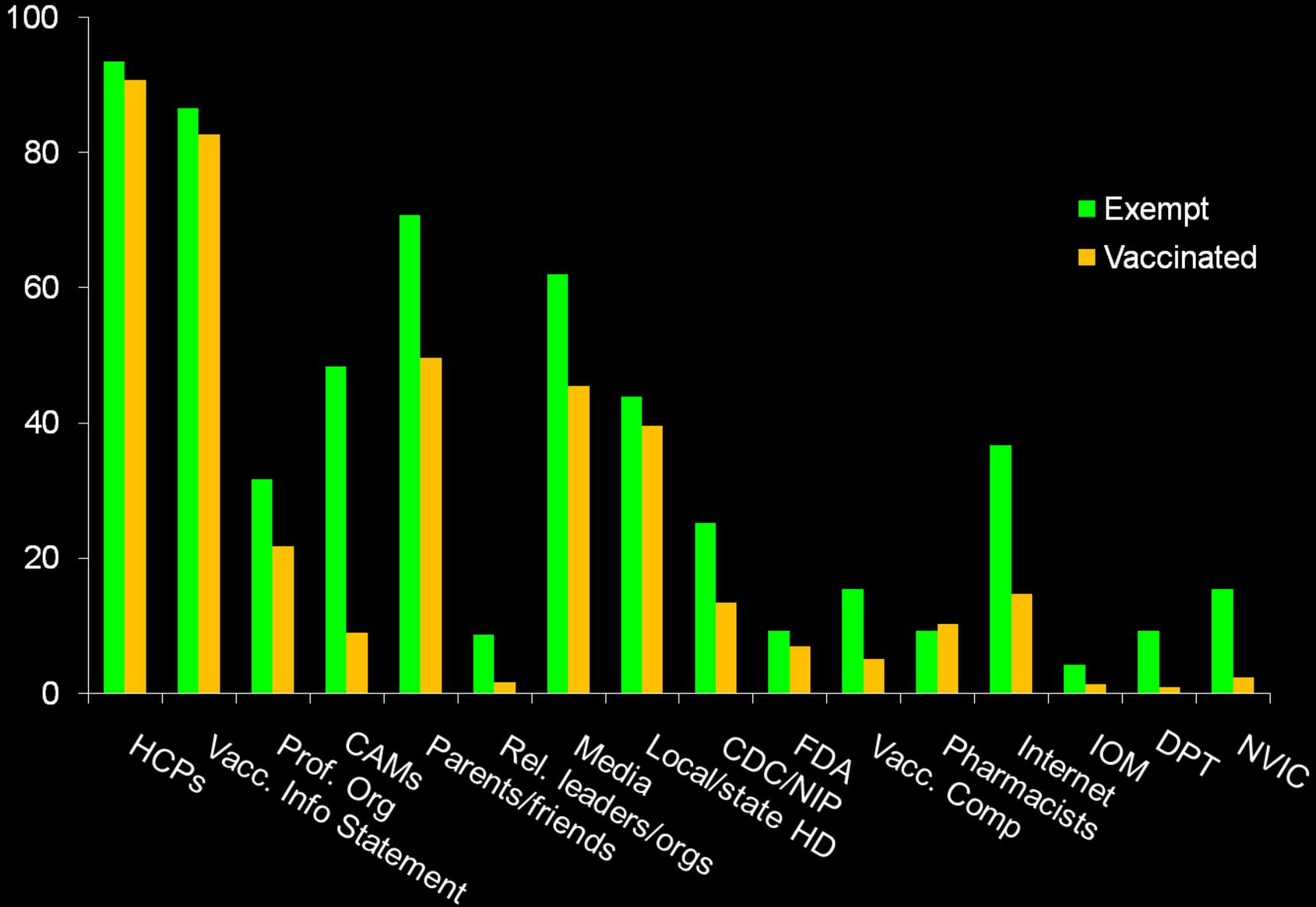
# PROVIDER PERCEPTIONS OF EXEMPT VS. VACCINATED CHILDREN

	Health Care Provides in High Category		Odds Ratio
	Exempt	Vaccinated	
Disease Susceptibility	11.3	5.7	1.34
Disease Severity	30.2	29.4	1.36
Vaccine Efficacy	87.0	88.8	1.21
Vaccine Safety	88.9	93.9	3.28*

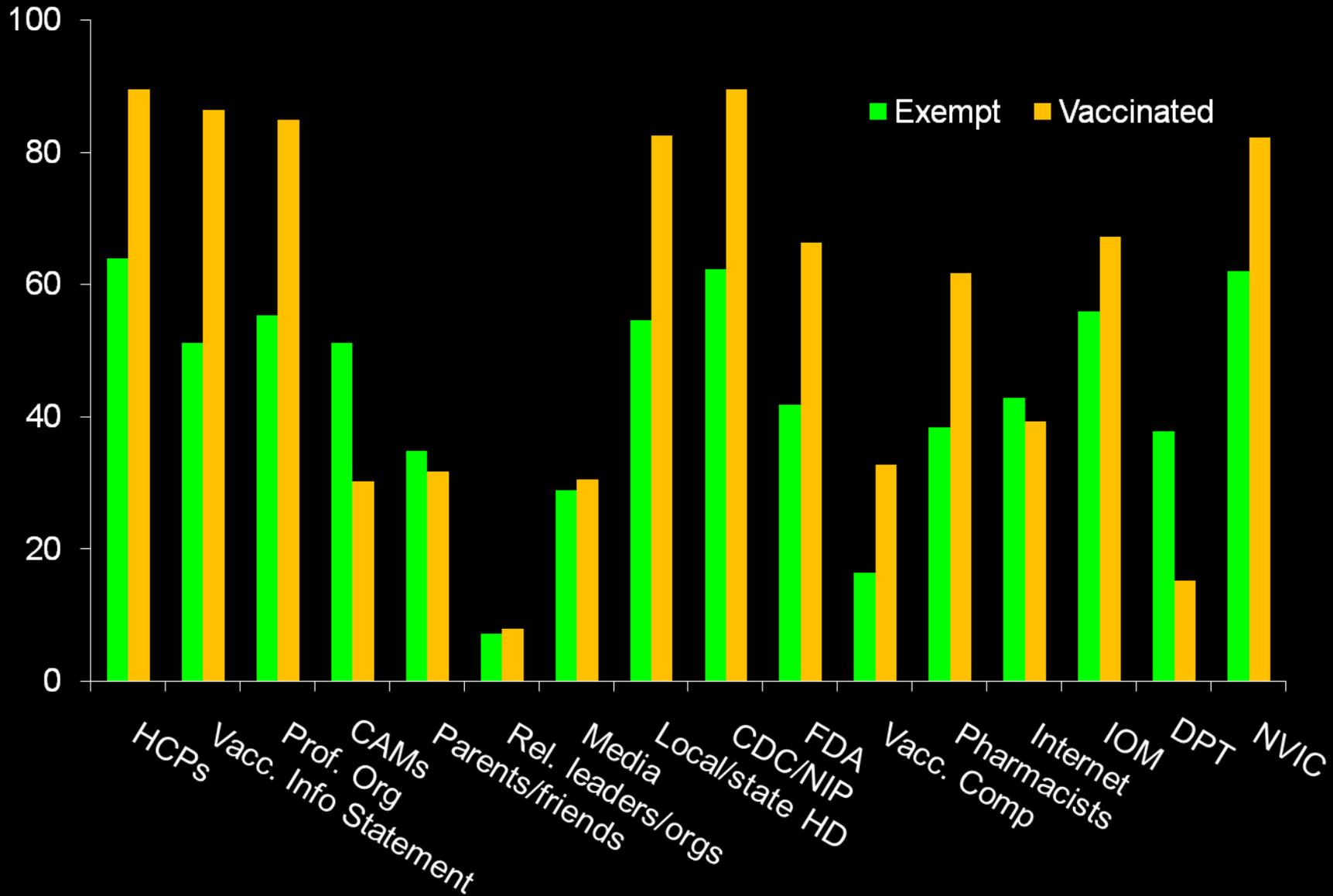
\* P Value <0.05

Salmon , Pan, Omer et al., Human Vacc. 2009

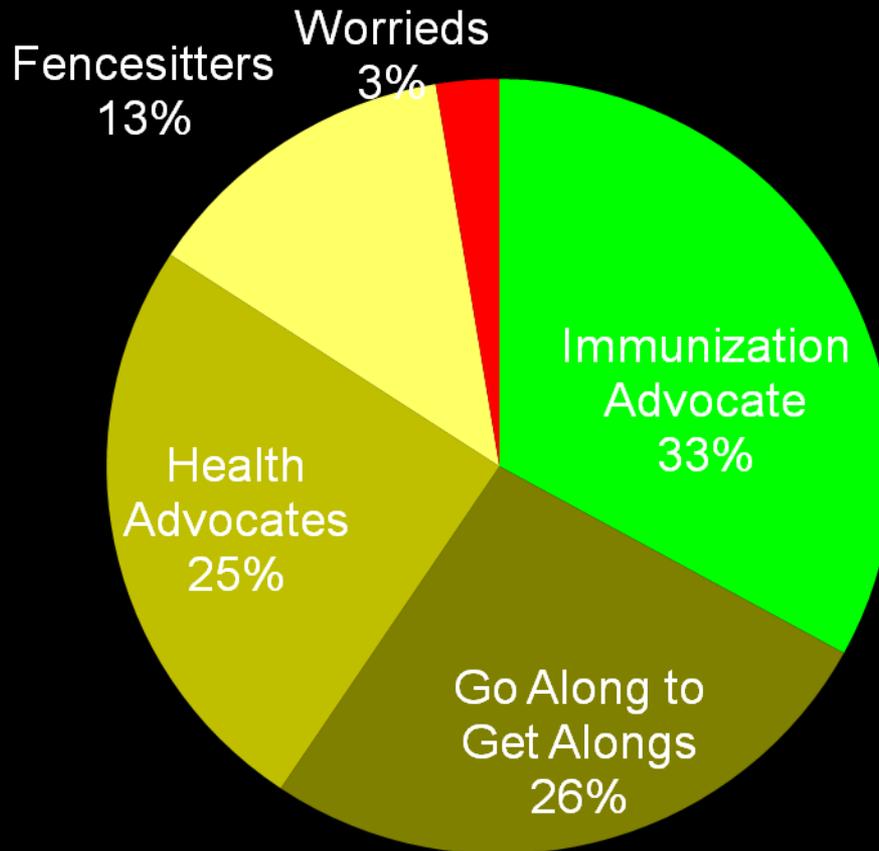
# Sources of Vaccine Information



# Trust in Sources of Vaccine Information

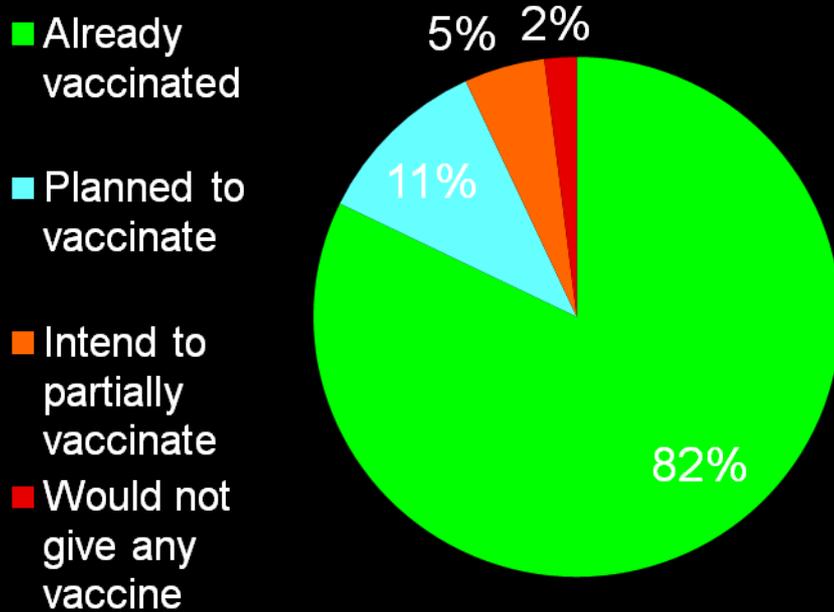


# A Nuanced View of Vaccine Acceptance

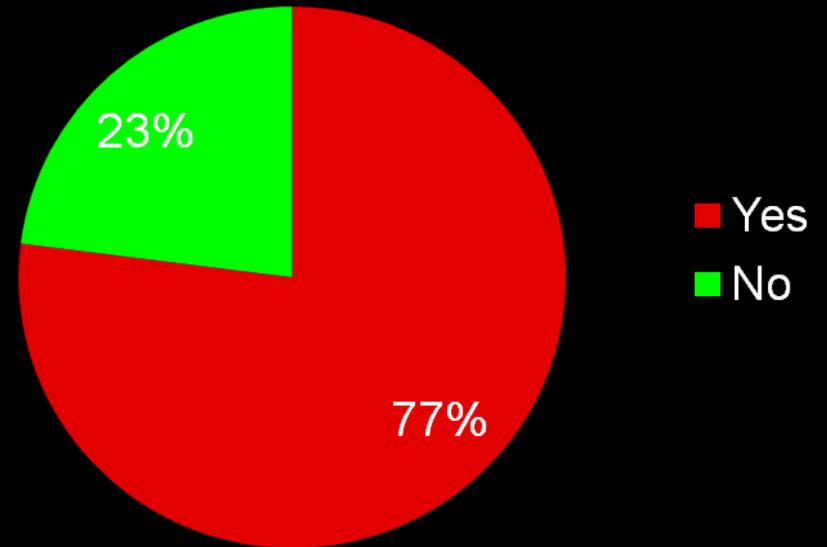


# 2010 HealthStyles Survey

## Intentions to Vaccinate



## Specific Vaccine Concerns



# Percentage of parents who reported hearing unfavorable information about vaccines

<i>Characteristic</i>	<i>Parents who intentionally delayed vaccines Percent (95% CI)</i>	<i>Parents who did not intentionally delay vaccines Percent (95% CI)</i>
Unweighted sample size	546	2,365
Parents who reported hearing or reading any unfavorable information about vaccines	87.6 (83.6, 91.6) <sup>a</sup>	71.9 (68.6, 75.2)
Examples of unfavorable information about vaccines		
Sometimes not preventing disease	51.6 (44.3, 58.9) <sup>a</sup>	39.4 (35.7, 43.1)
Are not safe or have serious side effects	78.2 (72.6, 83.8) <sup>a</sup>	60.9 (57.3, 64.5)
Are opposed by groups for political or religious reasons	44.8 (37.5, 52.1) <sup>a</sup>	32.6 (29.2, 36.0)
Are opposed by groups that oppose vaccines for health reasons	39.7 (32.6, 46.8) <sup>a</sup>	30.1 (26.7, 33.5)

<sup>a</sup>Estimated percentage among parents who intentionally delayed vaccines who heard or read the unfavorable information about vaccines is significantly different from the estimated percentage among parents who did not delay vaccines.

# Informed Declination

- Signed informed declination form for non-medical exemptions
- Provides information on risks to child, family, & community associated with personal belief exemption

## Refusal of Vaccination for My Child

*I am the parent/guardian of the child named at the bottom of this form. My healthcare provider has recommended that my child be vaccinated against the diseases indicated below. I have been given a copy of the Vaccine Information Statement (VIS) that explains the benefits and risks of receiving each of the vaccines recommended for my child. I have carefully reviewed and considered all of the information given to me. However, I have decided not to have my child vaccinated at this time. I have read and acknowledge the following:*

- I understand that some vaccine-preventable diseases (e.g., measles, mumps, pertussis [whooping cough]) are infecting unvaccinated U.S. children, resulting in many hospitalizations and even deaths.
- I understand that though vaccination has led to a dramatic decline in the number of U.S. cases of the diseases listed below, some of these diseases are quite common in other countries and can be brought to the U.S. by international travelers. My child, if unvaccinated, could easily get one of these diseases while traveling or from a traveler.
- I understand that my unvaccinated child could spread disease to another child who is too young to be vaccinated or whose medical condition (e.g., leukemia, other forms of cancer, immune system problems) prevents them from being vaccinated. This could result in long-term complications and even death for the other child.
- I understand that if *every* parent exempted their child from vaccination, these diseases would return to our community in full force.
- I understand that my child may not be protected by "herd" or "community" immunity (i.e., the degree of protection that is the result of having most people in a population vaccinated against a disease).
- I understand that some vaccine-preventable diseases such as measles and pertussis are extremely infectious and have been known to infect even the very few unvaccinated people living in highly vaccinated populations.
- I understand that if my child is not vaccinated and consequently becomes infected, he or she could experience serious consequences, such as amputation, pneumonia, hospitalization, brain damage, paralysis, meningitis, seizures, deafness, and death. Many children left intentionally unvaccinated have suffered severe health consequences from their parents' decision not to vaccinate them.
- I understand that my child may be excluded from his or her child care facility, school, sports events, or other organized activities during disease outbreaks. This means that I could miss many days of work to stay home with my child.
- I understand that the American Academy of Pediatrics, the American Academy of Family Physicians, and the Centers for Disease Control and Prevention all clearly support preventing diseases through vaccination.

Vaccine / Disease	VIS given (✓)	Vaccine recommended by doctor or nurse (Dr./Nurse initials)	I decline this vaccine (Initials of parent/guardian)
Diphtheria-tetanus-pertussis (DTaP)			
<i>Haemophilus influenzae</i> type b (Hib)			
Hepatitis A (HepA)			
Hepatitis B (HepB)			
Human papillomavirus (HPV)			
Influenza			
Measles-mumps-rubella (MMR)			

Vaccine / Disease	VIS given (✓)	Vaccine recommended by doctor or nurse (Dr./Nurse initials)	I decline this vaccine (Initials of parent/guardian)
Meningococcal (MCV)			
Varicella (Var)			
Pneumococcal conjugate (PCV)			
Polio, inactivated (IPV)			
Rotavirus (RV)			
Tetanus-diphtheria (Td)			
Tetanus-diphtheria-pertussis (Tdap)			

In signing this form, I acknowledge I am refusing to have my child vaccinated against one or more diseases listed above; I have placed my initials in the column titled "I decline this vaccine" to indicate the vaccine(s) I am declining. I understand that at any time in the future, I can change my mind and vaccinate my child.

Child's name: \_\_\_\_\_ Date of birth: \_\_\_\_\_  
 Parent/guardian signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Doctor/nurse signature: \_\_\_\_\_ Date: \_\_\_\_\_

# Selected Focus Group Findings About Vaccine Hesitancy

- Parents trusted vaccine information given **orally** by physicians
- Parents with concerns responded to providers giving **personalized** risk/benefit information or
  - reporting they immunized **their own children**
- Parents did not want the provider to lecture or argue with them

# Interacting with Vaccine Hesitant Parents

- Share honestly what is and is not known about the risks and benefits of the vaccine in question
- Listen respectfully to parental concerns
- Explain the risk of being unimmunized
- Discuss **specific** vaccines that parents are most concerned about

# Examples of Innovative Intervention Studies

- Interactive & moderated social media website for parents concerned about vaccines
- Gain frame vs. loss frame messaging
- Practice + Provider + Patient intervention trial in OBGYN offices
- Social marketing campaign in Washington state

# Approaches to Reduce Exemption Rates & Vaccine Hesitancy

- Rational administrative requirements for granting exemptions
- Informed declination
- Effective provider-parent communication tools
- Development of a robust evidence base of effective interventions

# Thank You!

