

35th Remington Winter Course in Infectious Diseases

Update on Vaccines for Adolescents and Adults

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FINANCIAL DISCLOSURE:

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*In the past 12 months, I have **not** had a significant financial interest or other relationship with the manufacturer(s) of the product(s) or provider(s) of the service(s) that will be discussed in this presentation.*

Objectives

- To review vaccine recommendations for adolescents and adults made by the Advisory Committee on Immunization Practices
- To summarize successes achieved by the immunization program including benefits that childhood vaccines have on adults
- To highlight the status of immunization of health care professionals
- To discuss what happens when people are not appropriately immunized

Clinical Preventive Services

	Score	Receiving services nationally
Aspirin chemoprophylaxis	10	50%
Childhood immunization	10	>90%
Tobacco screening and intervention	10	35%
Colorectal cancer screening	8	35%
Hypertension screening	8	90%
Influenza immunization ($\geq 50y$)	8	36-65%*
Pneumococcal immunization ($\geq 65y$)	8	56%

*36%: 50-64 years of age 65%: ≥ 65 years of age

Burden of Disease

- Influenza – Adults \geq 50 years of age
 - 226,000 hospitalizations
 - 36,000 deaths
- Pneumococcal disease
 - 175,000 hospitalizations
 - 6,000 deaths
- Herpes Zoster
 - 1,000,000 affected annually
 - 60% of affected people \geq 50 years of age

Burden of Disease

- Human Papillomavirus
 - Causes 100% of cervical cancer
 - 6.2 million cases of infection per year
- Pertussis
 - Immunity wanes 5-10 years after immunization
 - 7000 cases in adults reported annually
- Hepatitis B
 - 50,000 new cases per year
 - Major cause of chronic hepatitis, cirrhosis, hepatocellular carcinoma

Advisory Committee on Immunization Practices - Structure

- 15 voting members including the chair
 - 4 year terms
 - ACIP steering committee nominates, OS DHHS selects
 - Chairman selected from current members
- 8 *ex officio members* – representing other government agencies including CMS, DOD, DVA, FDA, HRSA, IHS, NIH, NVPO
- 26 liaison members – representatives of professional societies and organizations, including the American College of Physicians, responsible for vaccine development and immunization programs

Immunization Policy Products: Three Immunization Schedules

- ACIP, AAP, and AAFP produce a “harmonized” childhood and adolescent immunization schedule
 - First harmonized in 1994
 - Before 1994, differing schedules existed
 - In 2007 format of childhood and adolescent schedules changed
- ACIP, AAFP, ACOG and ACP produce a harmonized adult immunization schedule
 - October 11, 2002 (MMWR 51:904-908)
- Schedules are updated annually and are published in January
- Each vaccine is displayed in the context of other vaccines in the schedule

Adult Immunization Schedule, 2009

- Vaccines recommended across 5 age groups beginning at 19 years of age
- Vaccines recommended for 8 different medical and lifestyle indications

www.cdc.gov/vaccines

Recommended Adult Immunization Schedule

UNITED STATES - 2009

Note: These recommendations *must* be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

Figure 1. Recommended adult immunization schedule, by vaccine and age group

VACCINE ▼	AGE GROUP ▶	19–26 years	27–49 years	50–59 years	60–64 years	≥65 years
Tetanus, diphtheria, pertussis (Td/Tdap) ^{1,*}		Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yr				Td booster every 10 yrs
Human papillomavirus (HPV) ^{2,*}		3 doses (females)				
Varicella ^{3,*}		2 doses				
Zoster ⁴					1 dose	
Measles, mumps, rubella (MMR) ^{5,*}		1 or 2 doses		1 dose		
Influenza ^{6,*}		1 dose annually				
Pneumococcal (polysaccharide) ^{7,8}		1 or 2 doses				1 dose
Hepatitis A ^{9,*}		2 doses				
Hepatitis B ^{10,*}		3 doses				
Meningococcal ^{11,*}		1 or more doses				

*Covered by the Vaccine Injury Compensation Program.

For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of prior infection)

Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)

No recommendation

Vaccines that might be indicated for adults based on medical and other indications

VACCINE ▼	INDICATION ►	Pregnancy	Immuno-compromising conditions (excluding human immunodeficiency virus [HIV]) ¹³	HIV infection ^{3,12,13} CD4+ T lymphocyte count		Diabetes, heart disease, chronic lung disease, chronic alcoholism	Asplenia ¹² (including elective splenectomy and terminal complement deficiencies)	Chronic liver disease	Kidney failure, end-stage renal disease, receipt of hemodialysis	Health-care personnel
				<200 cells/μL	≥200 cells/μL					
Tetanus, diphtheria, pertussis (Td/Tdap) ^{1,*}	Td	Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs								
Human papillomavirus(HPV) ^{2,*}		3 doses for females through age 26 yrs								
Varicella ^{3,*}	Contraindicated	2 doses								
Zoster ⁴	Contraindicated	1 dose								
Measles, mumps, rubella (MMR) ^{5,*}	Contraindicated	1 or 2 doses								
Influenza ^{6,*}		1 dose TIV annually								1 dose TIV or LAIV annually
Pneumococcal (polysaccharide) ^{7,8}		1 or 2 doses								
Hepatitis A ^{9,*}		2 doses								
Hepatitis B ^{10,*}		3 doses								
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No recommendation

Changes in the 2009 Adult Immunization Schedule

- Zoster: previous episode not a contraindication
- HPV: occupation exposure does not increase HCP risk; give vaccine for standard indication
- PPSV23: asthma and smokers
- Influenza: vaccinate children from 6 months through 18 years of age and vaccinate care providers

Diseases Prevented by Vaccination

1986	2008	
Diphtheria	Diphtheria	Hepatitis A
Tetanus	Tetanus	Hepatitis B
Pertussis	Pertussis	Human papilloma virus
Polio (OPV)	Polio (IPV)	Influenza
Measles	Measles	Meningococcal disease
Mumps	Mumps	Pneumococcal disease
Rubella	Rubella	Rotavirus
Hib disease	Hib disease	Varicella
		Zoster

Baseline 20th Century Annual Morbidity and 2007 Morbidity From 10 Infectious Diseases With Vaccines Recommended Before 1990 for Universal Use in Children: United States

Disease	Baseline 20 th Century Annual Morbidity	2007 Morbidity	% Decrease
Smallpox	48 164	0	100
Diphtheria	175 885	0	100
Pertussis	147 271	10 454	93
Tetanus	1314	28	98
Poliomyelitis (paralytic)	16 316	0	100
Measles	503 282	43	>99
Mumps	152 209	800	>99
Rubella	47 745	12	>99
Congenital rubella syndrome	823	0	100
<i>Haemophilus influenzae</i> type b	20 000	22	>99

Pertussis and Mumps Cases in the U.S. from 2002-2008

Year	Pertussis	Mumps
2002	9,771	270
2003	11,647	231
2004	25,827	258
2005	25,616	314
2006	15,632	6584
2007	10,454	800
2008*	9499	367

*provisional

Licensed Vaccines for Adolescents and Adults

Category

Vaccine

Recommended

Tdap (Td)
HPV
Varicella
Zoster
MMR
Influenza
PPSV23

High risk

MMR
Influenza
PPSV23
Hepatitis A
Hepatitis B
MCV4

Ann Intern Med 2009; 150:40-44.

*if they lack evidence of immunity

** risk factor based

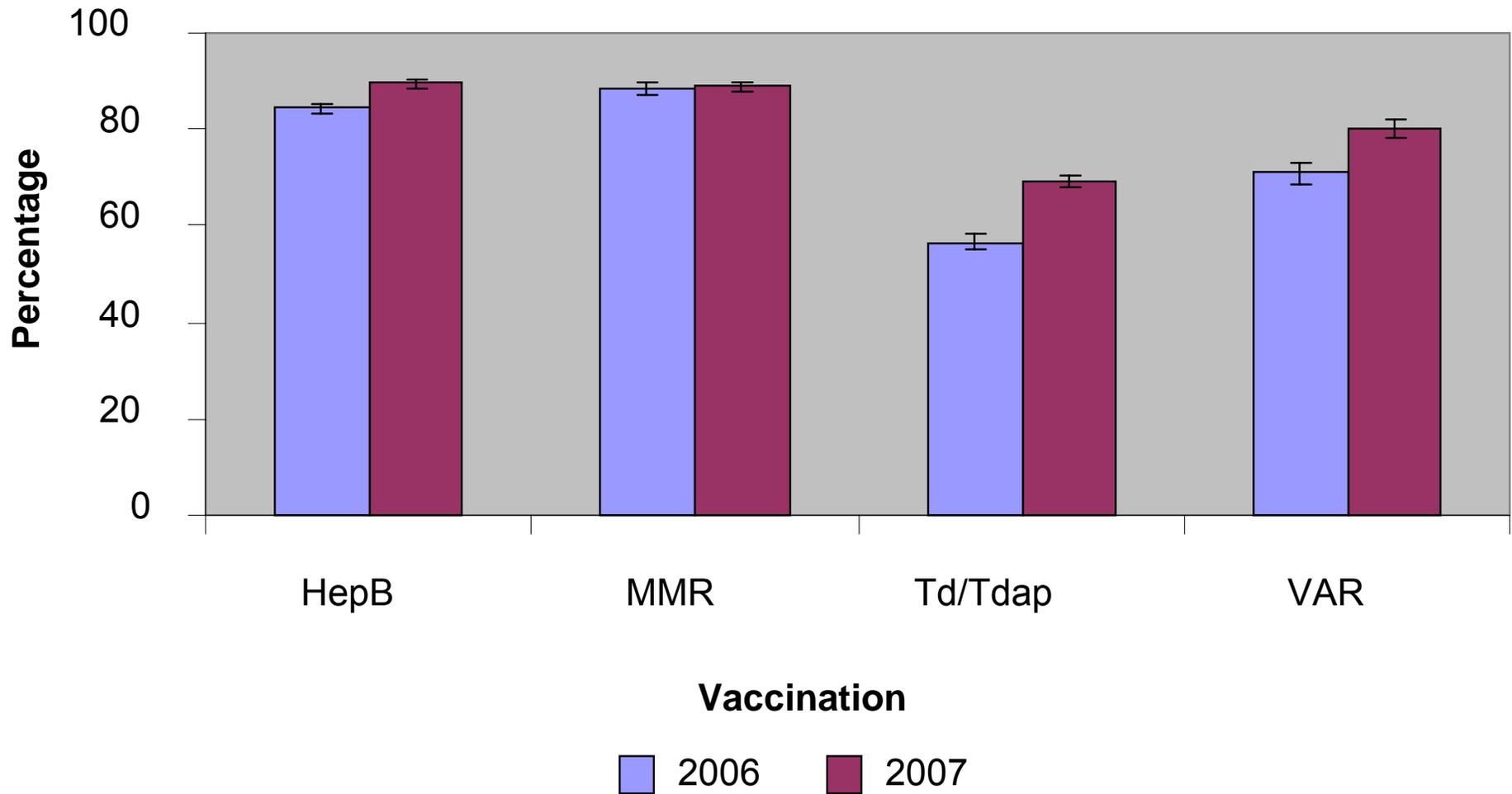
Recommended Immunizations For Adults by Age Group

Vaccine	Age (years)
Tdap (Td)	≥ 19
HPV	19 through 26
Varicella	≥ 19
Zoster	≥ 60
MMR	19 through 49
Influenza	≥ 50
PPSV23	≥ 65

ACIP/AAP Recommendations for Adolescent Vaccines

- Adolescents 11 through 18 years of age should receive single dose Tdap instead of Td booster.
- Routine vaccination with three doses of HPV vaccine is recommended for females 11 through 12 years of age.
- All adolescents 11 through 18 years of age previously not given meningococcal conjugate vaccine should receive a dose.

Achievement of Healthy People 2010 Objectives Among Adolescents 13 Through 15 Years of Age, National Immunization Survey-Teen, 2006-2007



Coverage of Adolescent Vaccines Licensed Since 2005

Vaccine (licensed)	2006	2007
Tdap (2005)	11%	30%
MCV4 (2005)	12%	32%
HPV- (females only initiated series) (2006)	-	25%

Adult Immunization Rates in the US, 2007

Vaccine	%Vaccinated
Influenza	
18-49 years, high risk	37
50-64 years	42
≥ 65 years	69
Health care providers	42 *
Pneumococcal disease	
18-64 years, high risk	33
≥ 65 years	66
Human papillomavirus	
Women 18-26 years	10
Shingles	
≥ 60 years	2
Tdap booster	
18-64 years	2
Hepatitis B	
18-49 years	23

Data from CDC

* 57% of adults report having a Td booster in the past 10 years

What Happens When Adults Are Not Immunized Against Pertussis?

- Lack of HCP immunization
- Lack of non-HCP adult immunization
- Lack of recognition of diseases



Hospital-Acquired Pertussis Among Newborns --- Texas, 2004

On July 10, 2004, staff members at a children's hospital in Texas noted that six infants with pertussis diagnosed by clinical symptoms and confirmed by polymerase chain reaction (PCR) testing had all been born during June 4--16 at the same area general hospital. The infants had symptoms consistent with pertussis, including cough, congestion, cyanosis, emesis, or apnea. Infection-control personnel at the general hospital (general hospital A), children's hospital (children's hospital A), and the county health department investigated and determined that an outbreak of pertussis among 11 newborns at general hospital A had occurred after direct exposure to a health-care worker (HCW) with pertussis. This report describes the outbreak investigation and highlights the importance of following recommendations to administer tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine to HCWs to prevent transmission of pertussis to patients.

Immediately after identification of the six infants with pertussis at children's hospital A, hospital staff members reviewed newborn nursery charts at general hospital A. One staff member (HCW A) was identified as having directly cared for all six infants during their stay in the newborn nursery. Review of work logs for all shifts identified four additional hospital workers who had been present while the six infants were in the newborn nursery.

Hospital Acquired Pertussis

- 6 infants born at hospital A in June 2004 developed pertussis
- Investigation found 5 more cases
- All 11 infants exposed to HCW (24 years old) who worked with cough, post-tussive emesis and dyspnea from mid June to July when she was furloughed. Husband had similar symptoms
- During this time, cared for 113 infants (10% attack rate)
- 11 infants treated and all recovered (5 admitted to PICU, 4 to pediatric floor)

Health Care Personnel Can Transmit Infections to Patients

- Pertussis
- Influenza
- Hepatitis B
- Rubella
- Measles

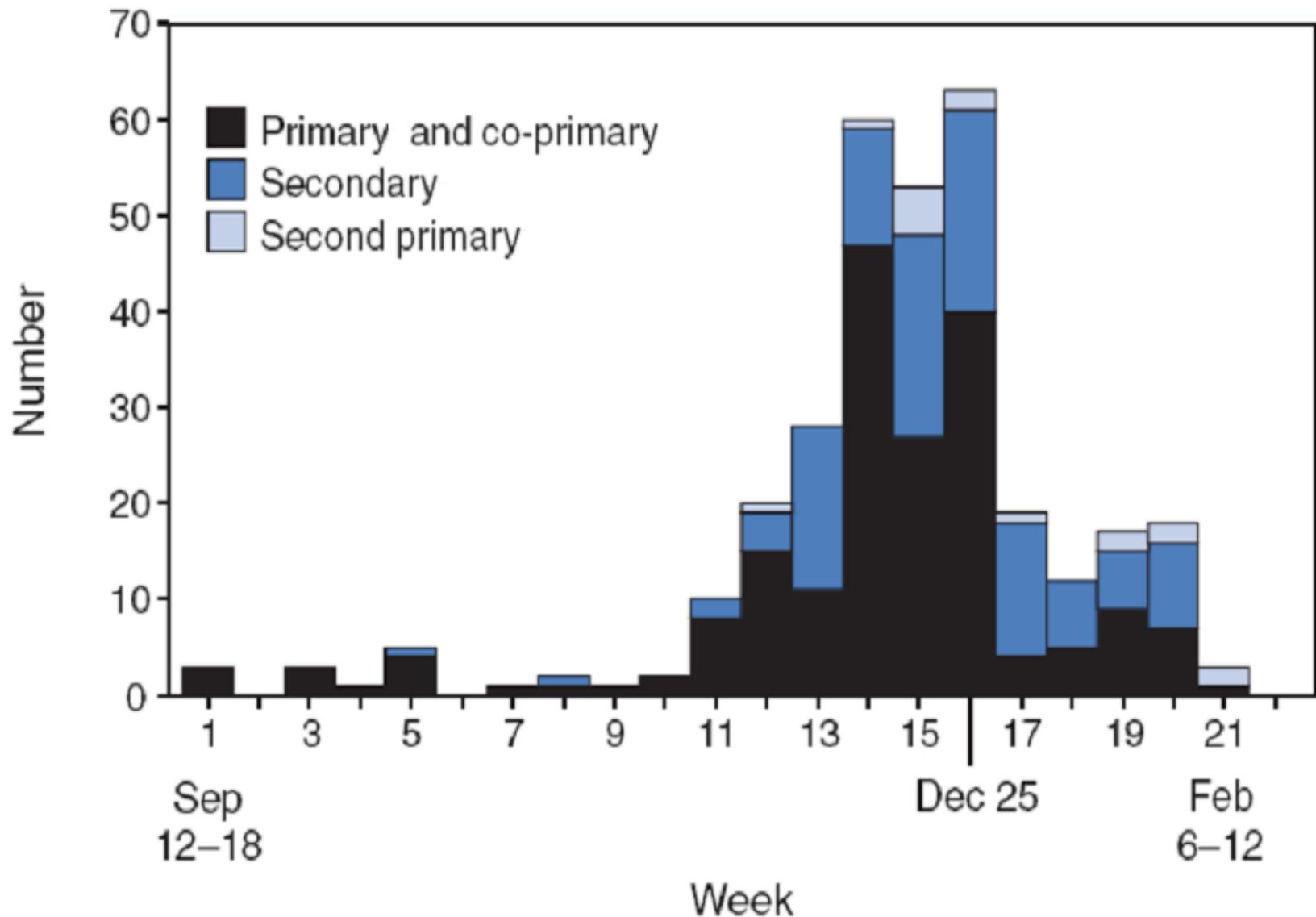


Pertussis Outbreak in an Amish Community --- Kent County, Delaware, September 2004--February 2005

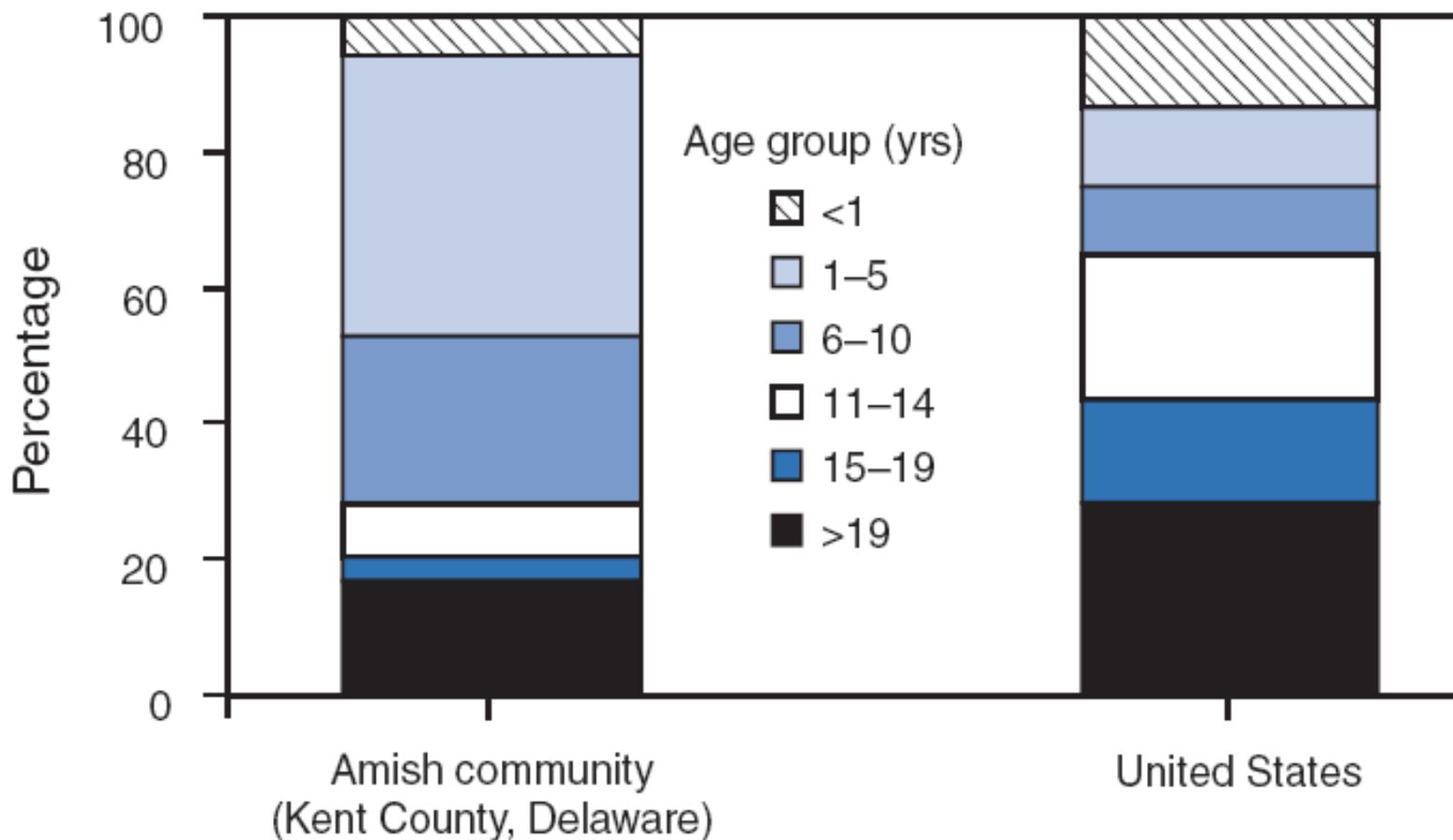
Vaccine-preventable disease outbreaks continue to occur among undervaccinated populations in the United States, including contained religious communities (1,2). The Amish practice separation from the world through group solidarity and caring for their own (3). Amish religious doctrine does not prohibit vaccination; however, coverage levels for routine childhood vaccination remain low in many Amish communities (1). This report describes an outbreak of pertussis in an Amish community in Kent County, Delaware, during September 2004--February 2005, that resulted in 345 cases and affected primarily preschool-aged children. The outbreak underscores the need to promote vaccination in Amish communities through culturally appropriate strategies, such as education and outreach to community leaders.

For this outbreak, a clinical case was defined as an acute cough illness lasting ≥ 2 weeks with onset during September 2004--February 2005 and without other apparent cause in a person living in the Amish community in Kent County (4). A confirmed case was defined as a clinical case of pertussis that 1) was laboratory confirmed by polymerase chain reaction (PCR) for *Bordetella pertussis* DNA or 2) had a direct epidemiologic link to a laboratory-confirmed case through a common household residence. All other clinical cases were considered probable.

Number* of pertussis cases in an Amish community outbreak by week and type of case - Kent County, Delaware September 2004–February 2005



Proportion of pertussis cases in an Amish community outbreak, by age group -Kent County, DE, 9/2004 – 2/2005, compared with the overall US, 2004





Brief Report: Fatal Case of Pertussis in an Infant --- West Virginia, 2004

In December 2004, an infant aged 29 days in West Virginia died from pertussis after exposure to adult family members with probable undiagnosed pertussis. Pertussis (i.e., whooping cough) is a prolonged respiratory illness caused by the bacterium *Bordetella pertussis* and characterized by a violent cough, inspiratory whoop, and posttussive vomiting. The cough often lasts from several weeks to up to 3 months. However, adolescents and adults, even those previously vaccinated as children, often have disease not recognized as pertussis, leading to intrafamilial and nosocomial transmission (1). In the United States, children aged <6 months are at the highest risk for severe illness or death from pertussis because most infants do not complete their primary vaccination series until age 6 months (1). This report summarizes results of the West Virginia Department of Health and Human Resources (WVDHHR) case investigation, which underscore the critical need to prevent pertussis transmission to infants from adolescents and adults with undiagnosed disease.

On December 11, the infant was taken by her parents to a local emergency department (ED) with difficulty breathing. The infant had been coughing for approximately 5 days with increasing severity, resulting in posttussive vomiting and several choking episodes. At presentation, the infant was lethargic, and examination revealed tachycardia and mild fever (99.5°F [37.5°C]). Before intubation and oxygen supplementation, the infant had thick, foamy mucus coming from her mouth, appeared cyanotic, and had an O₂ saturation of 70% by pulse oximetry. Seizure activity was noted during intubation. Laboratory results revealed severe leukocytosis (white blood cell count: 104,100/μL; normal: 5,000--19,500/μL), severe lymphocytosis (26,600/μL; normal: 2,500--16,500/μL), and a nasopharyngeal swab was positive for respiratory syncytial virus (RSV) by rapid immunoassay alone. A chest radiograph revealed right upper lobe and perihilar infiltrates, and an electrocardiogram indicated supraventricular tachycardia. Three hours after arrival at the ED, the infant was transferred to a pediatric intensive care unit (PICU) with diagnoses of pneumonia and respiratory failure.

Pertussis in an Infant: Warning Signs

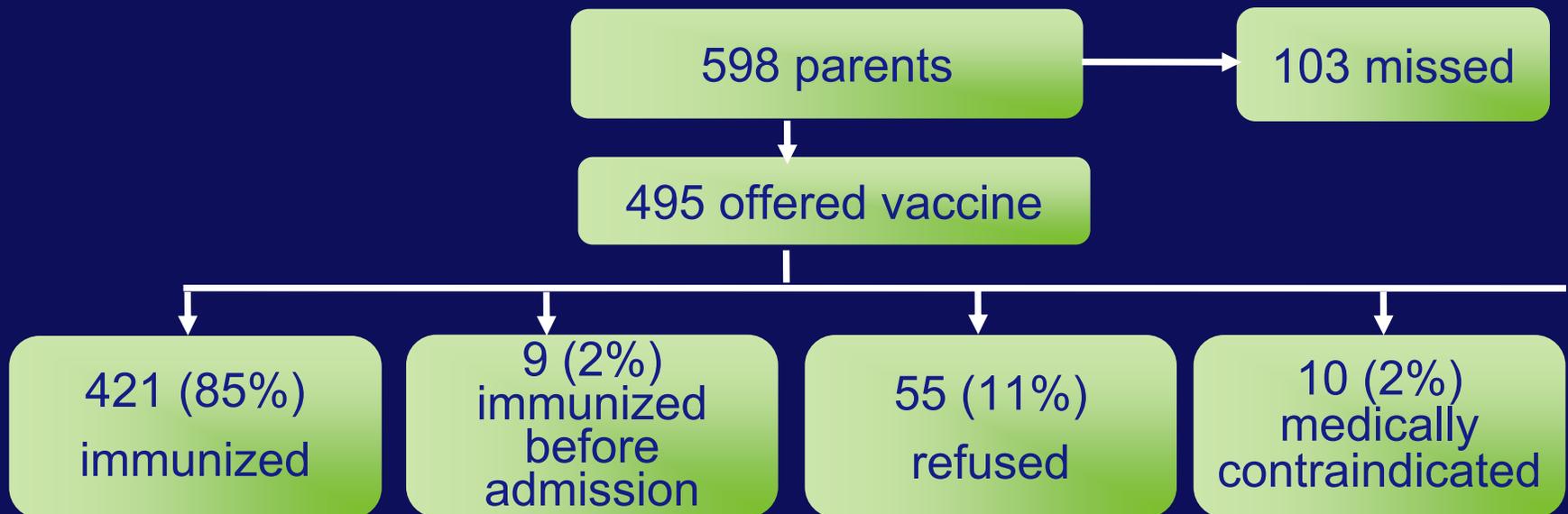
- 29 day old infant died from pertussis 30 hours following ICU hospitalization
 - 5 days of cough
 - Respiratory distress
 - WBC count 104,100 cells/uL
 - NP swab positive for *B. pertussis* by PCR

Pertussis in an Infant: Warning Signs

- 20 year old mother had a prolonged paroxysmal cough with post-tussive vomiting. Given cough syrup
- 58 year old grandmother had cough and vomiting. Given azithromycin for sinusitis
- 22 year old father had a paroxysmal cough for > 3 weeks
- 4 additional close contacts (2 cousins, paternal grandmother and great grandmother) had 3-8 week cough
- 30 birth hospital and 11 ED employees identified as potential contacts

Administration of Tdap Vaccine to Parents of High-risk Infants in the Neonatal ICU

- 4 month study in New York
- 352 children (598 parents) were admitted to the NICU at 23 to 42 weeks gestation



Source of Infant Pertussis: Four State Survey

<u>Relation</u>	<u>Number (%)</u>
mother	84 (32)
father	39 (15)
grandparent	22 (8)
sibling	
0-4 years	22 (8)
5-9 years	14 (5)
10+ years	16 (6)
neighbors, friends, ccc (2%)	<u>67</u> (25)
	264*

* Source identified in 264/616 (43%) of infants

Consumer Awareness from NFID Survey on Adult Immunization

- 35% of respondents say they had vaccines as a child so they do not need them again
- 18% say vaccines are not necessary for adults
- 34% are not concerned about catching diseases that can be prevented by vaccines
- 32% are not concerned about spreading an illness to friends, family, and co-workers
- 25% think diseases prevented by vaccines are not serious or life threatening

Consumer Awareness from NFID Survey on Vaccine Safety and Cost

Safety

- 40% have heard or read that vaccines are not safe
- 14% think that vaccines do not work
- 25% report that a vaccine made them sick

Cost

- 26% think vaccines are too expensive
- 27% think insurance won't cover vaccines
- 22% say they would not seek vaccination if they had to pay for it

Challenges of Adult Immunization: Standards from ACP and IDSA

- Conduct regular immunization reviews with adult patients
- Provide recommended immunizations or refer to someone who will
- Immunization of physicians and staff according to CDC recommendations

www.acponline.org/running_practice/quality_improvement/projects/adult_immunization/acp_idsa_statement.pdf

Summary

- Routine immunizations provide a tremendous benefit to infants, children, adolescents, adults and to society
- The immunization process is a shared public/private responsibility
- Many challenges face implementation of immunization programs in the US including vaccine financing* vaccine supply** and vaccine acceptance issues
- Future vaccines will further decrease disease

* www.cdc.gov/vaccines/programs/vfc/cdc-vac-price-list.htm

** www.cdc.gov/vaccines/vac-gen/shortages