immunizations 411

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hosted by the Missouri Department of Health and Senior Services' Bureau of Immunization Assessment and Assurance
www.health.mo.gov/immunizations

webinar series

Rachel C. Orscheln, MD

The Importance Of Pediatric Immunizations

April 16, 2015

Once upon a time, there was a Magic Kingdom….

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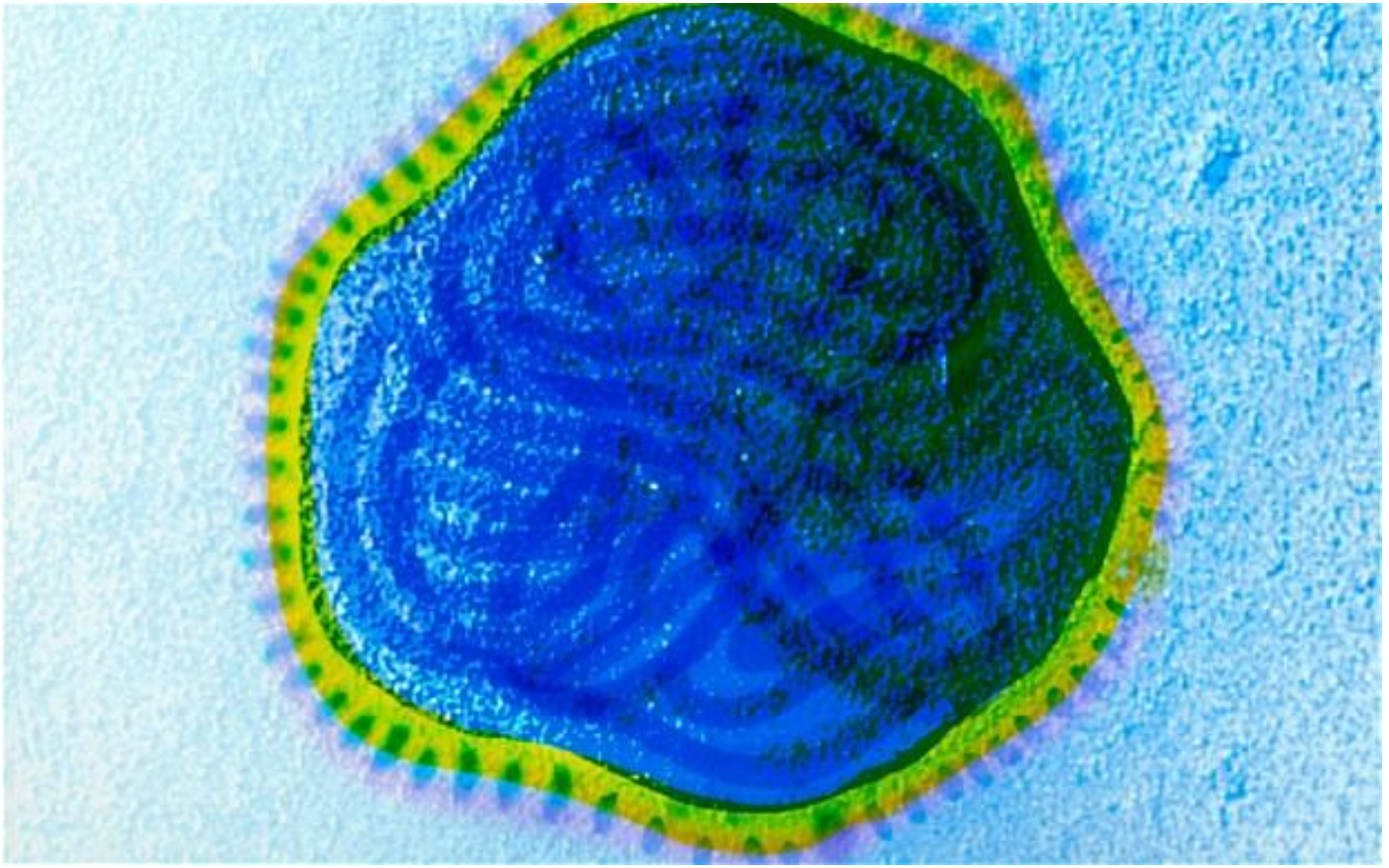
Children and families from all over the world visited this magical place…..

Unfortunately, an unwelcome visitor was also circulating…



Measles Virus

http://www.telegraph.co.uk/news/worldnews/northamerica/usa/10834778/Massive-dose-of-measles-virus-kills-cancer-cells.html

Index Case

- 11 y.o. unvaccinated child who had visited 2 theme parks in Orange County, CA was hospitalized with measles in December of 2014

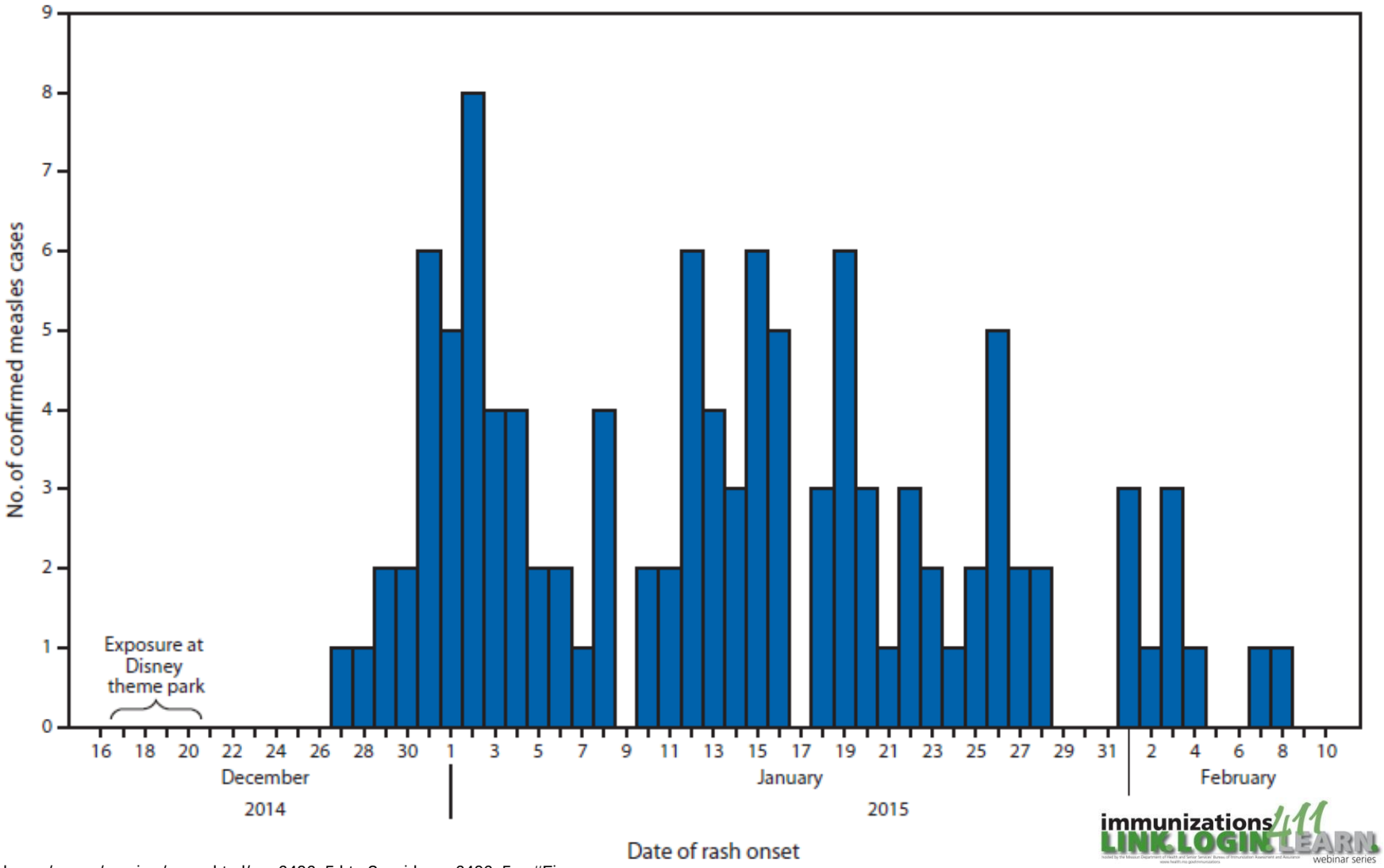
Measles

- Measles: RNA virus with 1 serotype
  - Transmission: By direct contact with respiratory droplets
  - Epidemiology: Incidence in the US is low, <120 cases/year, usually imported
  - Illness: Acute illness characterized by:
    - Fever
    - Cough
    - Runny nose
    - Conjunctivitis
    - Erythematous maculopapular rash
    - Koplik spots

  - Complications: pneumonia, otitis media, croup, diarrhea, encephalitis (1/1000 cases), death (1-3/1000 cases), SSPE (rare degenerative CNS disease)
  - Treatment: Vitamin A supplementation is associated with reduced morbidity and mortality

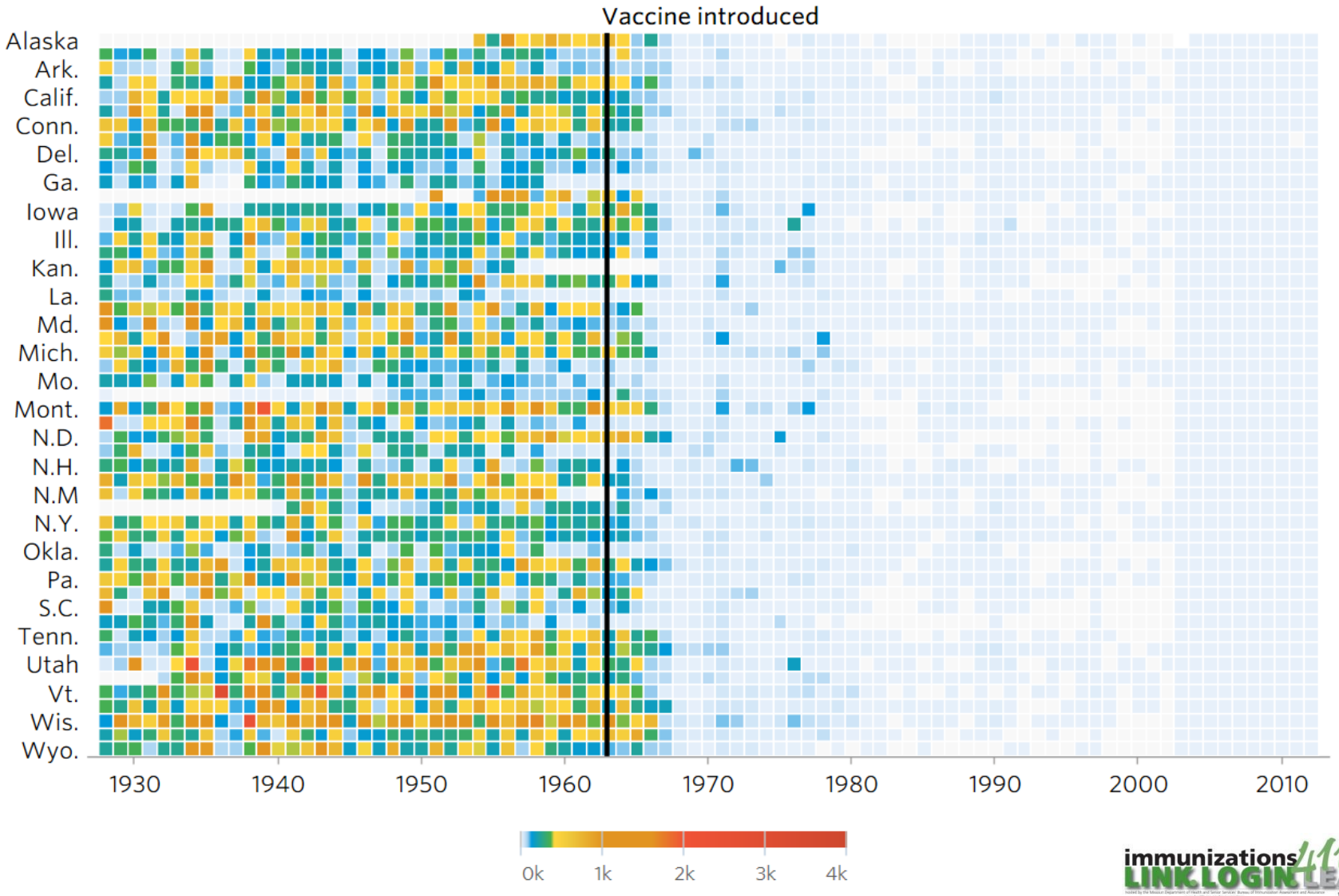
Redbook, 2006

Confirmed Measles Cases by Date of Onset



http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6406a5.htm?s_cid=mm6406a5_w#Fig

Measles Cases by State and Year



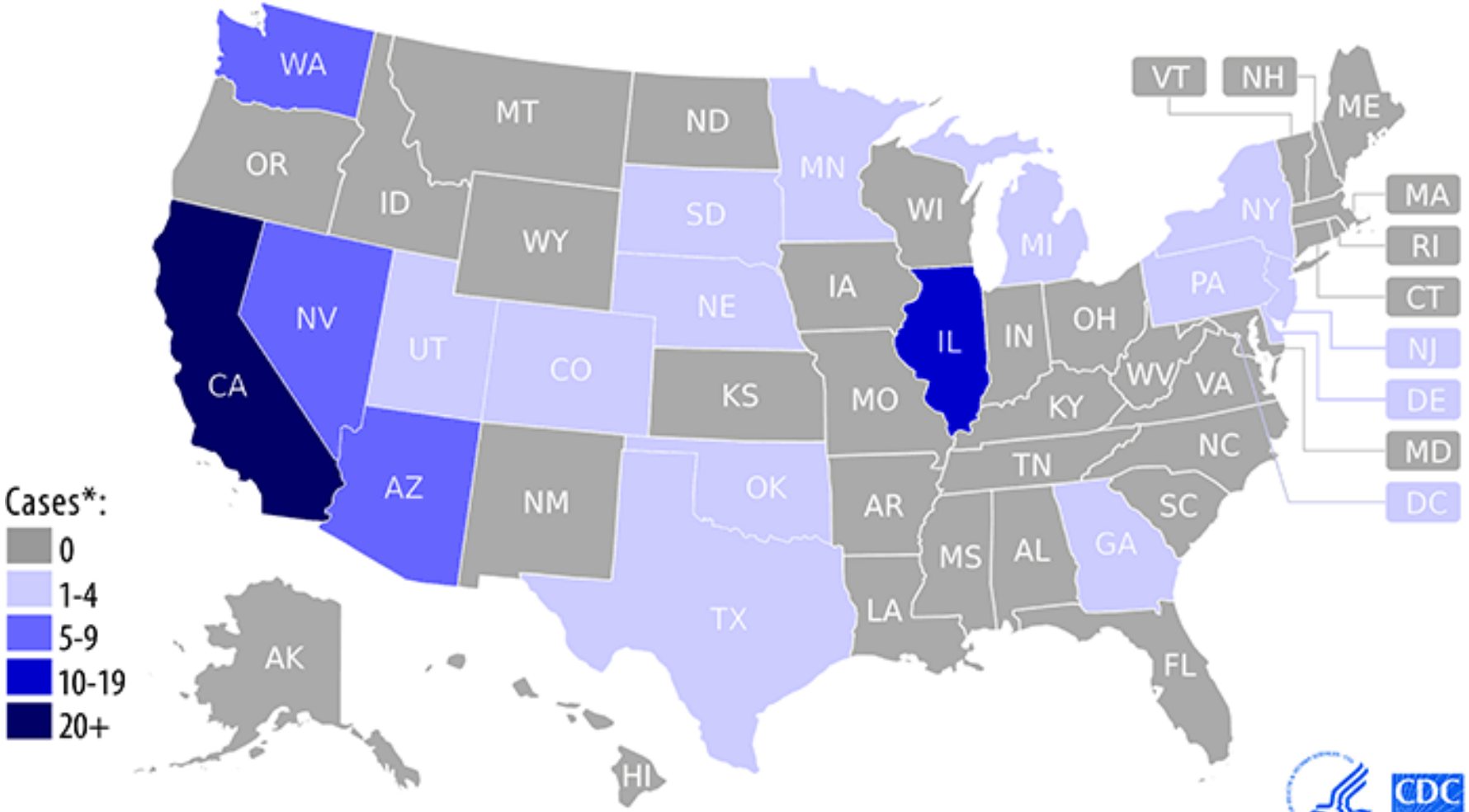
http://graphics.wsj.com/infectious-diseases-and-vaccines/

Most cases had NO documented measles vaccine

- California cases:
  - 45% were completely unvaccinated
    - 67% intentionally unvaccinated for personal belief
    - 23% were too young to be vaccinated
  - 5% had one dose of measles vaccine
  - 7% had two or more doses of measles vaccine
  - 43% unknown vaccine history
- Twenty percent of patients were hospitalized

2015 Measles Cases in the U.S.

January 1 to April 3, 2015



*Provisional data reported to CDC's National Center for Immunization and Respiratory Diseases

CDC

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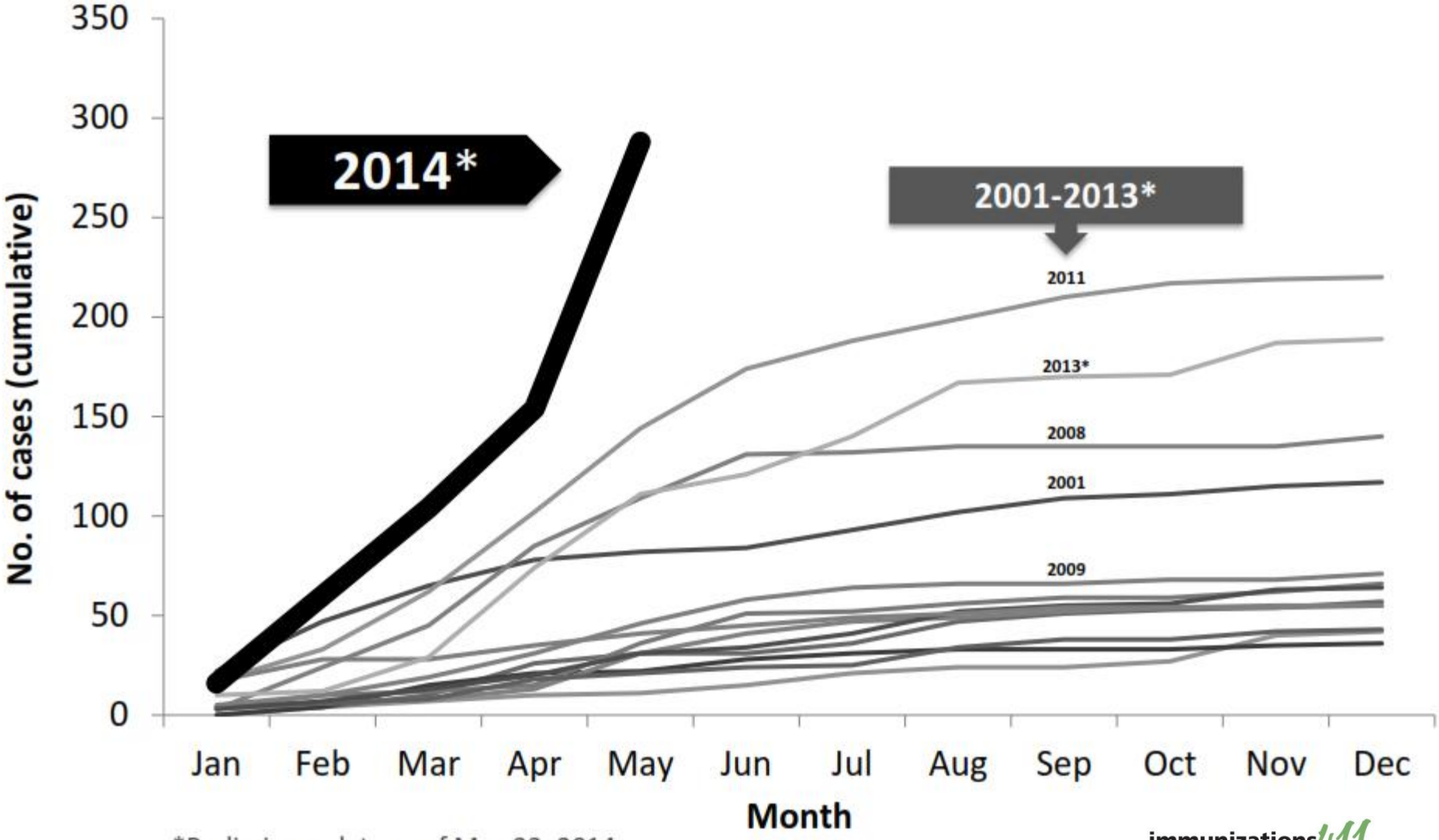
Measles, U.S., 2001-2014*

Cumulative Number by Month of Rash Onset



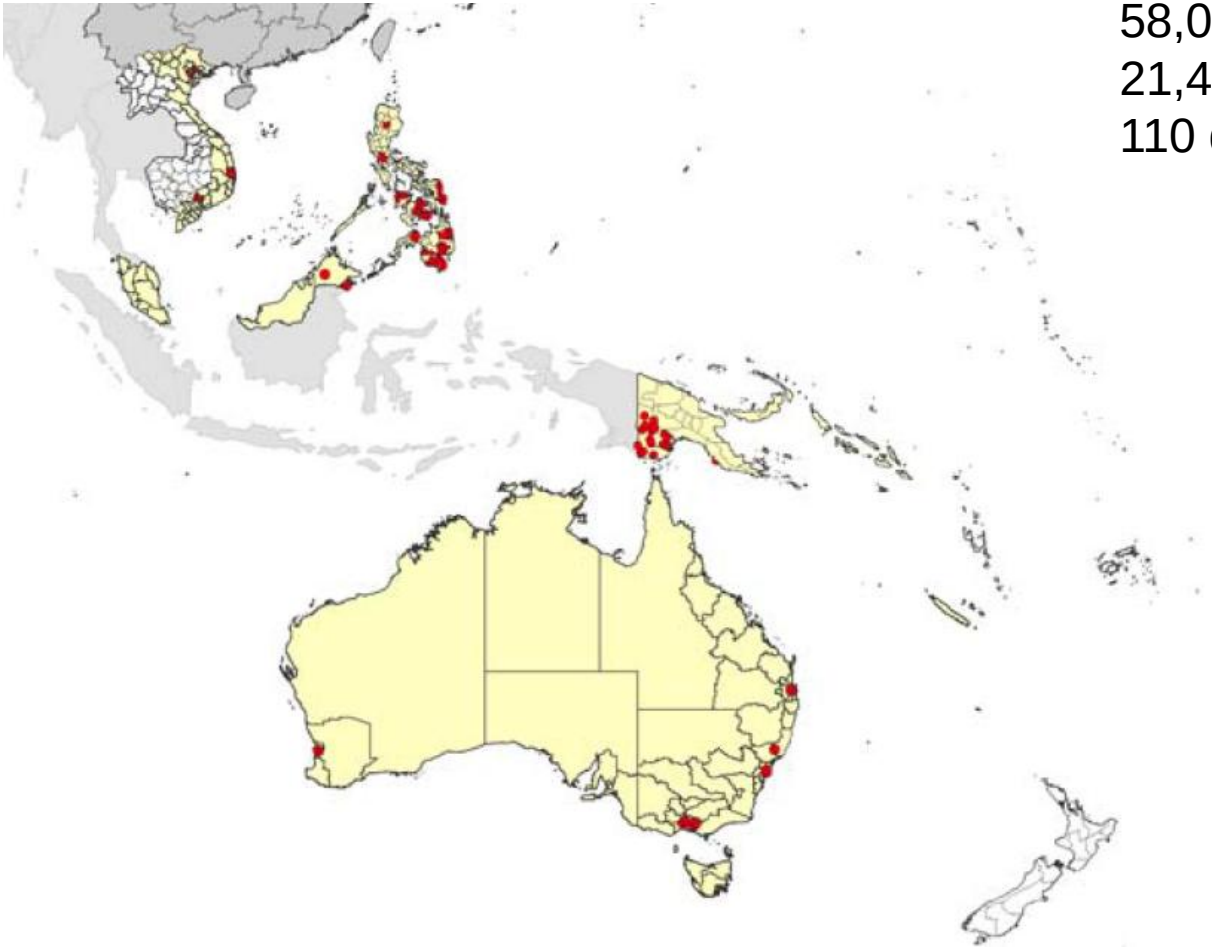
*Preliminary data as of May 23, 2014

Source: National Notifiable Diseases Surveillance System (NNDSS) and direct report to CDC

2014 Outbreak

- 23 Outbreaks of Measles in the US in 2014
- Largest outbreak in Amish community in Ohio affects 383 people
  - Index case is Amish missionary who traveled to the Philippines

Measles in the Philippines



2014

58,010 suspected cases
21,420 confirmed cases
110 deaths

http://www.wpro.who.int/immunization/documents/mrbulletinvol9issue2.pdf?ua=1

The Moral of the Story

"It's a small world after all!"

Objectives

- Review basic vaccinology
- Understand the concept of “herd immunity”
- Review infections prevented by vaccinations and the impact of vaccination programs on these diseases
- Examine controversies related to vaccinations and vaccine refusal

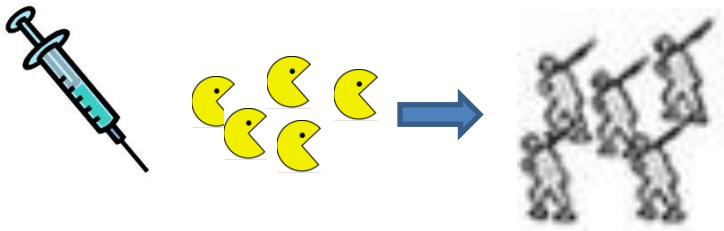
Introduction

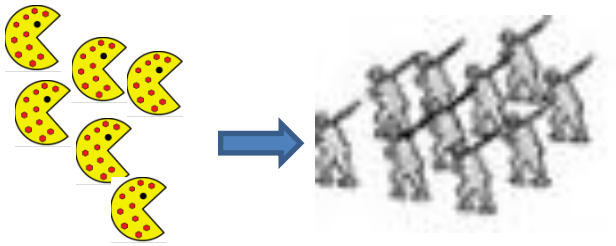
- Vaccines are among the most effective preventative health tools
- The success of vaccination programs depends on high rates of uptake
- High immunization coverage results in a decline in vaccine-preventable diseases
- A reduction in these diseases may result in increased complacency about vaccine-preventable diseases

Omer, et al. *NEJM*. May 7, 2009, Vol. 360:1981-8.

How Vaccines Work

- Weakened or part of a germ is injected
- The immune system recognizes the germ as a “foreign invader” (called antigen) and forms immune proteins (antibodies) to the germ
- If the body faces the real germ in the future, the pre-formed antibodies are prepared to attack and prevent infection





Adapted from: http://www.cdc.gov/vaccines/vac-gen/howvpd.htm

Specific Types of Vaccines

Type of Vaccine	Description	Example
Live-attenuated	Weakened virus which does not cause disease	MMR Varicella Flu
Inactivated	Inactivated (killed) virus	Polio
Toxoid	Weakened toxin from bacteria	Tetanus
Subunit	Contains part of bacteria or virus	Pertussis
Conjugate	Target polysaccharide (sugar-like) coating on bacteria by connecting (conjugating) them to antigens the developing immunes system can recognize	Pneumococcal HiB

If I don’t vaccinate my child, won’t they be protected by “Herd Immunity”?

Herd Immunity

"The resistance of a group attacked by a disease because of the immunity of a large proportion of the members and consequent lessening of the likelihood of an infected individual coming into contact with a susceptible individual."

Rashid, et al. *Curr Opin Infect Dis*. 2012, Vol. 25:243-249.

Herd Immunity

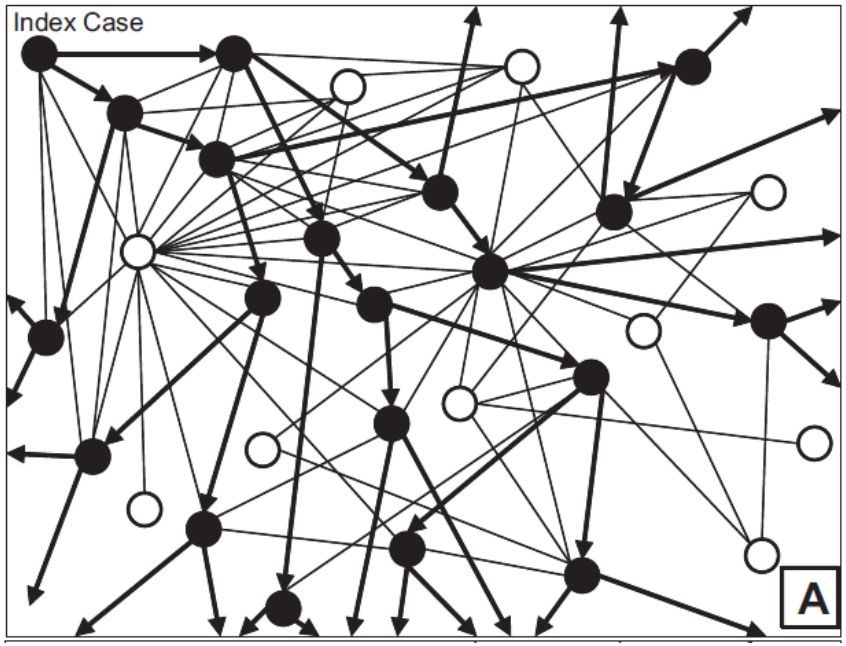
- Determinants
  - R_0 = The average number of individuals each infected person will infect in susceptible population
  - 1-1/R_0 = The proportion needed to vaccinate to eliminate infection
  - E = vaccine effectiveness
  - (1-1/R_0)/E = critical vaccine coverage
  - Measles
    - (1-1/12)/0.95=96%

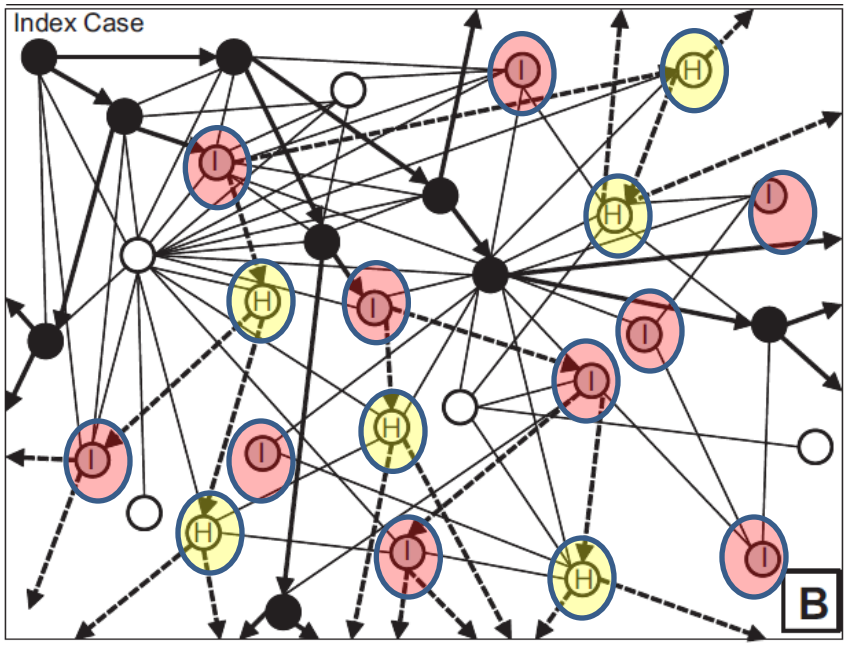
Disease	Ro (# of usual secondary transmissions)
Diphtheria	6-7
Measles	12-18
Mumps	4-7
Pertussis	12-17
Polio	5-7
Rubella	6-7

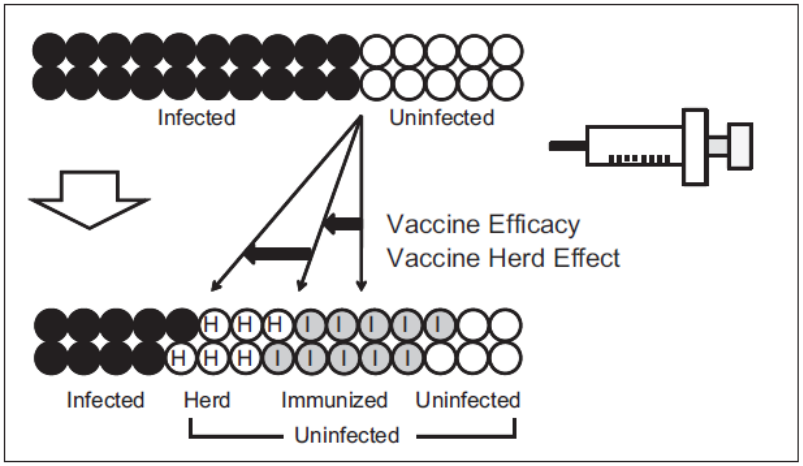
http://practice.sph.umich.edu/micphp/epicentral/basic_reproduc_rate.php

Rashid, et al. *Curr Opin Infect Dis*. 2012, Vol. 25:243-249.

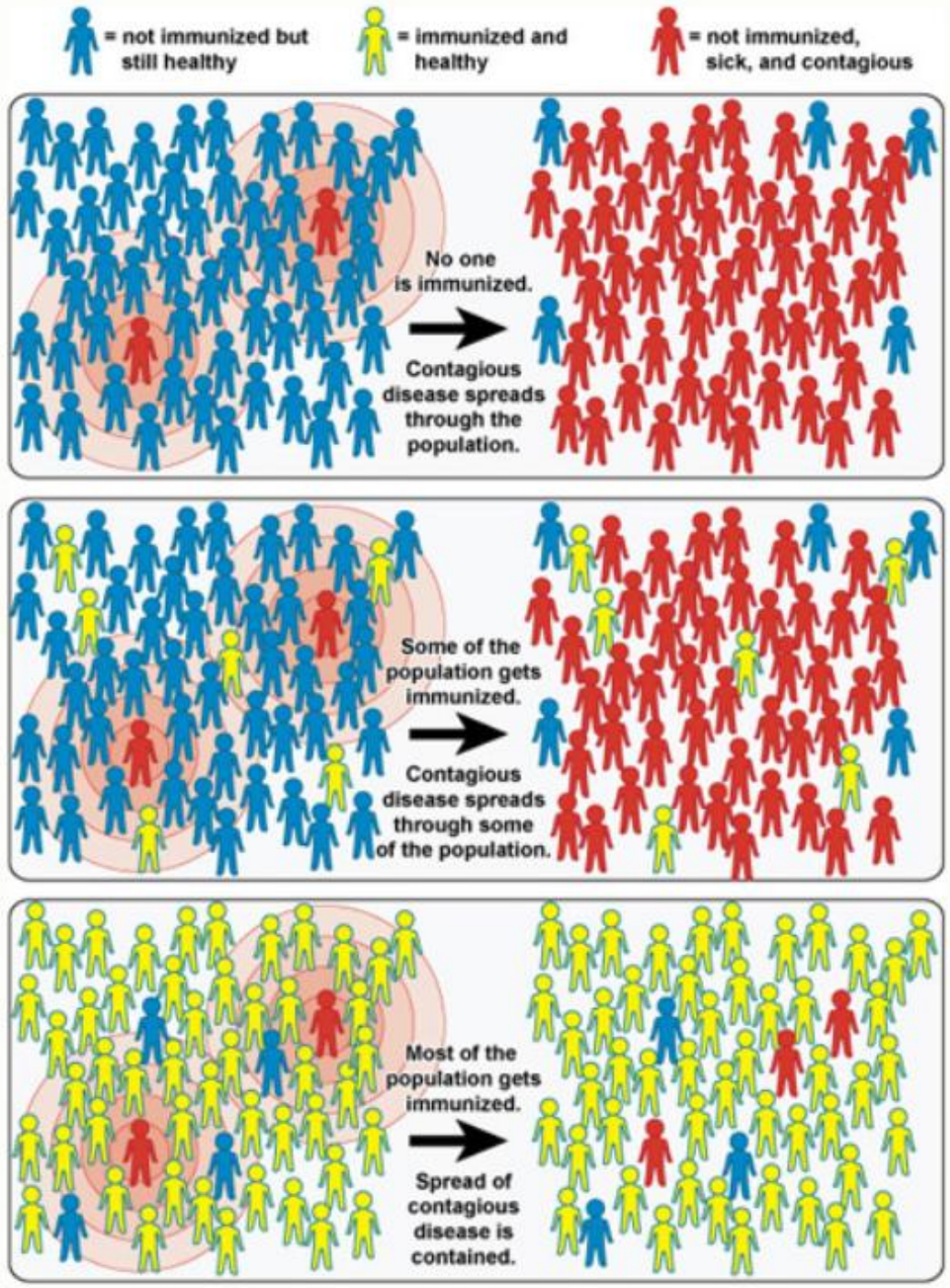
Herd Immunity



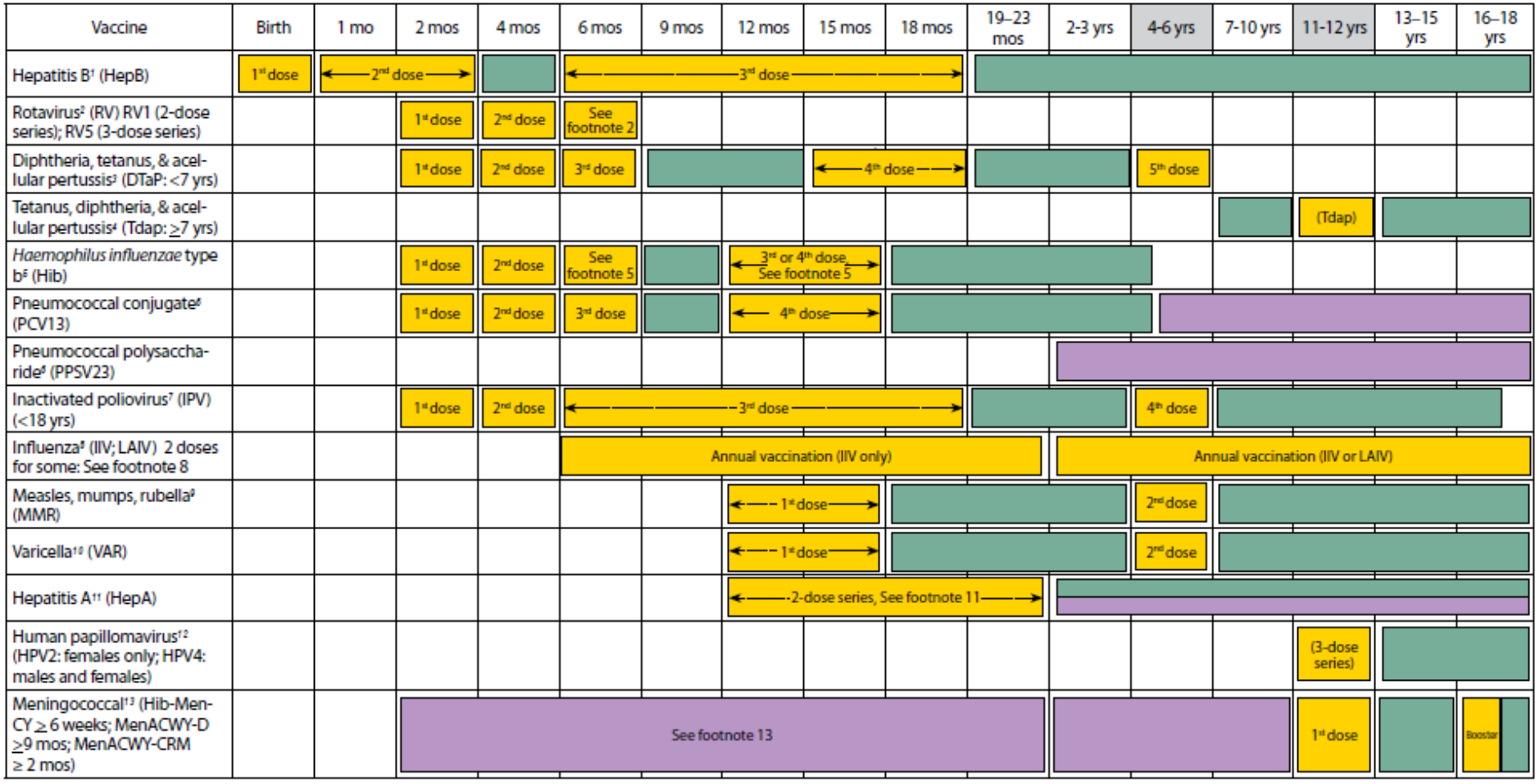




Kim, et al. *Scand J Infect Dis*. 2011, Vol. 43:683-689.

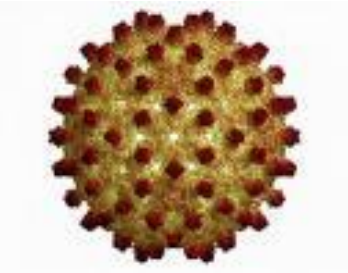


Recommended Immunization Schedule for Persons Aged 0 to 18 Years

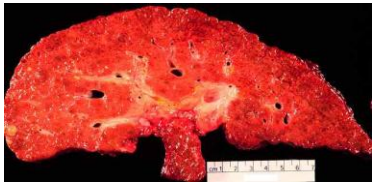


http://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-schedule.pdf

Hepatitis B Virus

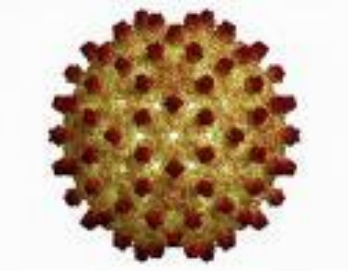


- Transmission: Contact with blood or body fluids
- Disease state:
  - Acute: Liver dysfunction with fever, jaundice, malaise, nausea, vomiting, and abdominal pain
  - Chronic: Duration of infection dependent on age at acquisition (90% of infants vs. 5% of adults)
  - Outcome:
    - Cirrhosis or liver cancer occurs in 25% of chronic childhood infections and 15% of chronic adult infections

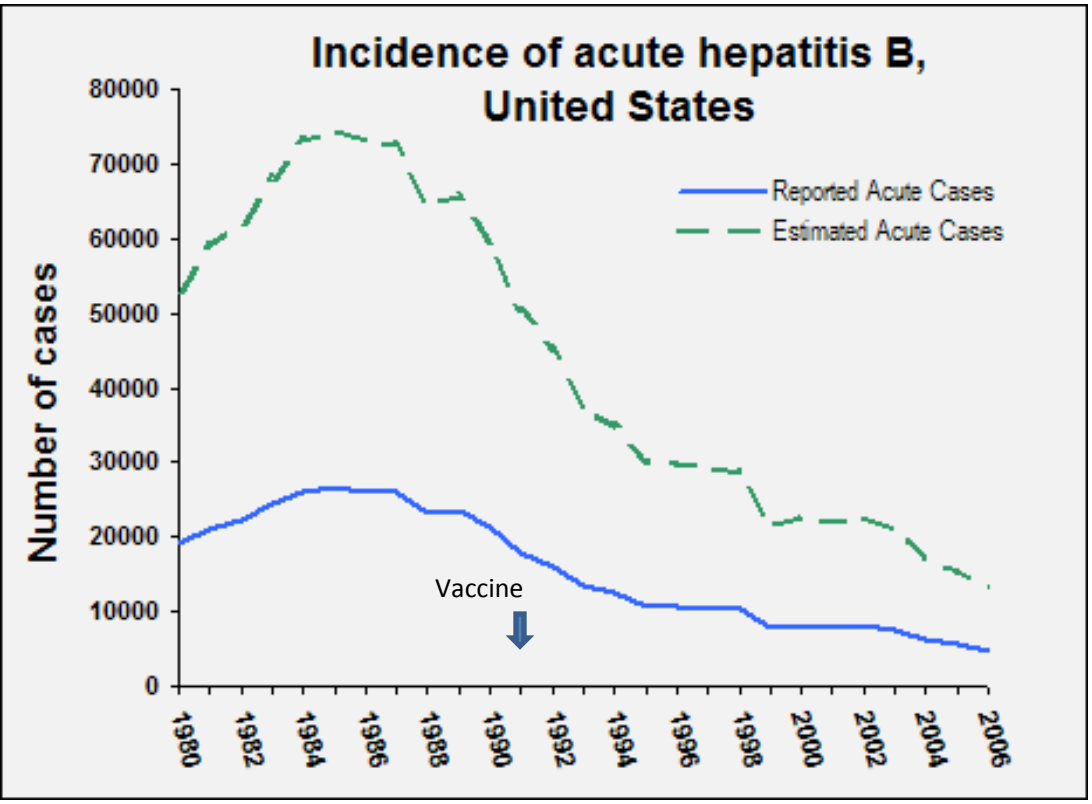


http://www.cdc.gov/hepatitis/HBV/HBVfaq.htm#overview

Hepatitis B Virus



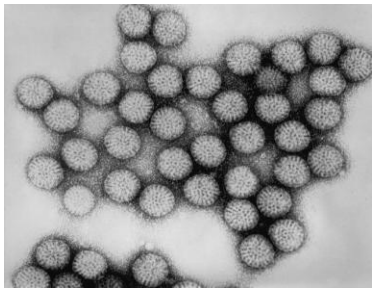
- Vaccine: 3 doses (birth, 1 month, and 6 months)



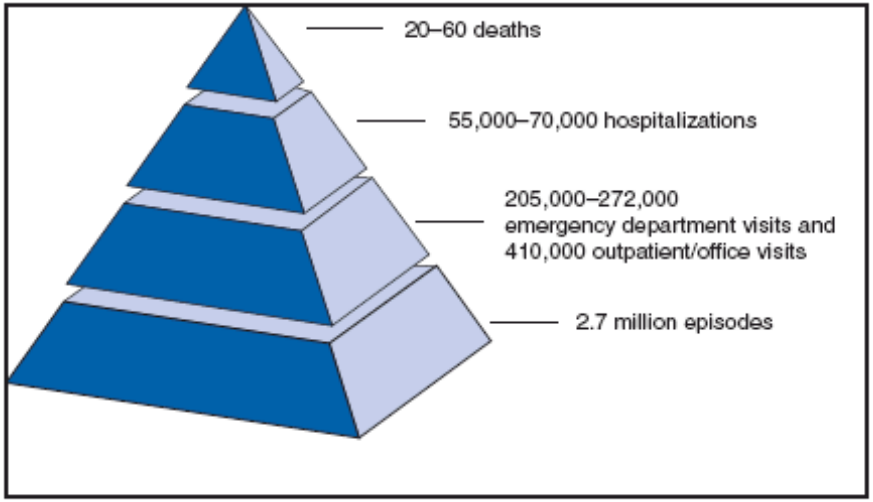
- Vaccine efficacy:
  - Infants: 95% develop protective immunity
  - Adults < 40 years: 90% develop protective immunity

http://www.cdc.gov/hepatitis/HBV/HBVfaq.htm#overview
Redbook, 2006.
http://www.dpd.cdc.gov/vaccines/pubs/pinkbook/hepb.html#reactions

Rotavirus

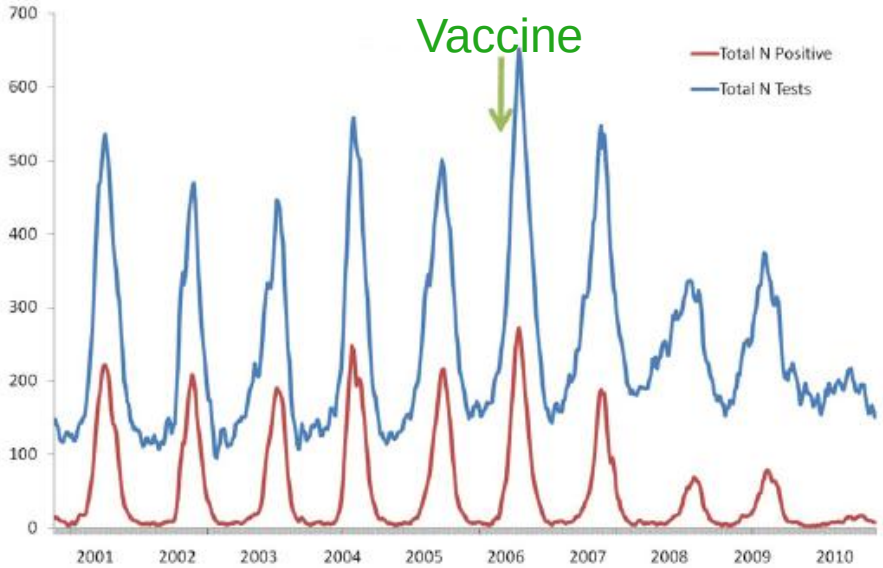


- Transmission: Fecal-oral
- Disease: Fever, vomiting, watery diarrhea (3-8 days), abdominal pain
- Epidemiology:
  - Most common cause of severe diarrhea among children



- Vaccine: Live, oral, 2 or 3 doses
- Efficacy: 85-98% effective against severe disease

Rotavirus Tests and Positives by Week
June 2000-July 2010

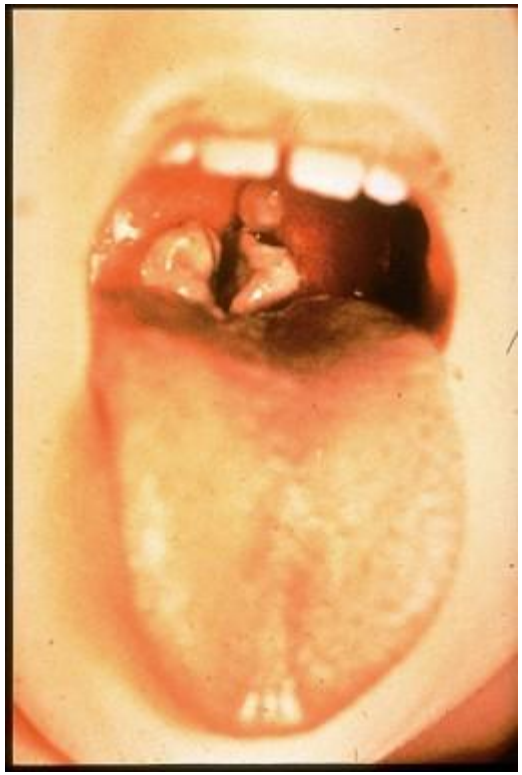


http://www.cdc.gov/rotavirus/

Diphtheria

- **Diphtheria:** Caused by toxigenic strains of *Corynebacteria diphtheriae*
  - Transmission: Respiratory droplet or contact with skin lesions
  - Illness:
    - Membranous nasopharyngitis or obstructive laryngotracheitis
    - Absorbed toxin affects heart and brain
  - Treatment: Anti-toxin, erythromycin or penicillin
  - Outcome:
    - Death in 1 in 10

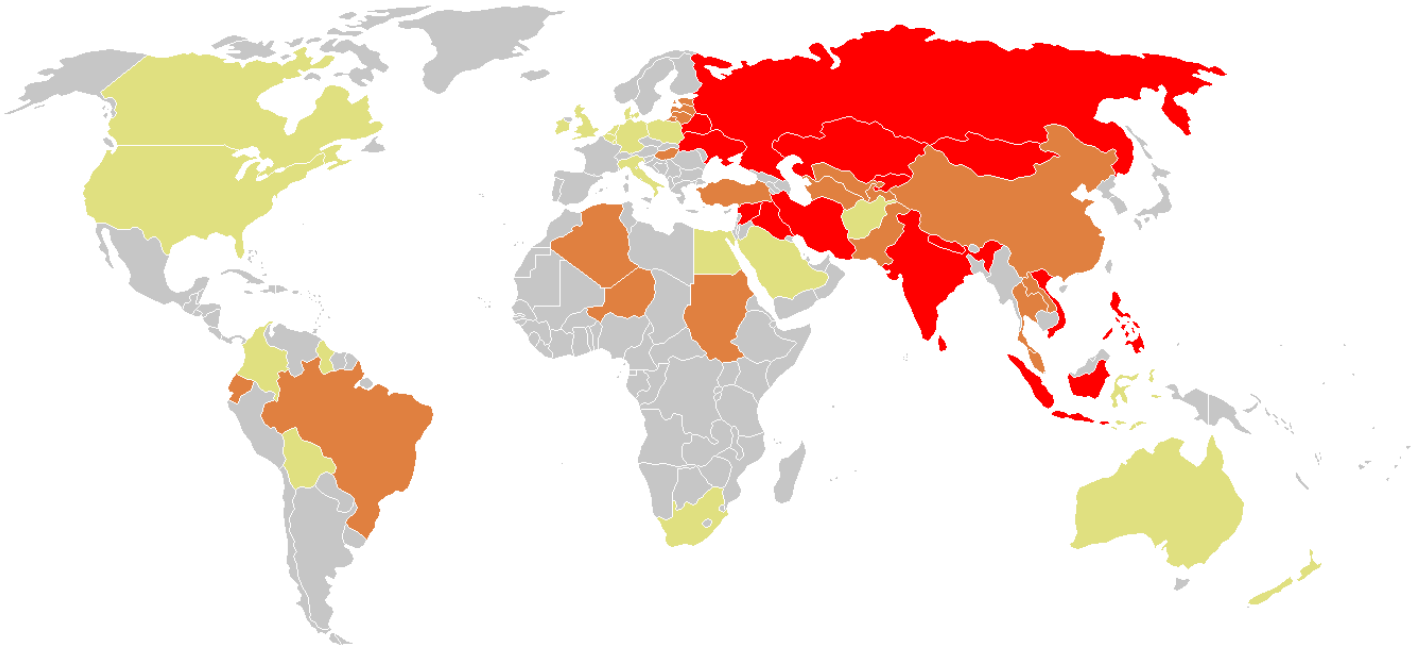
http://www.cdc.gov/vaccines/vpd-vac/diphtheria/photos.htm



http://www.vaccineinformation.org/photos/diphiac001.jpg

Redbook, 2006

Diphtheria Epidemiology

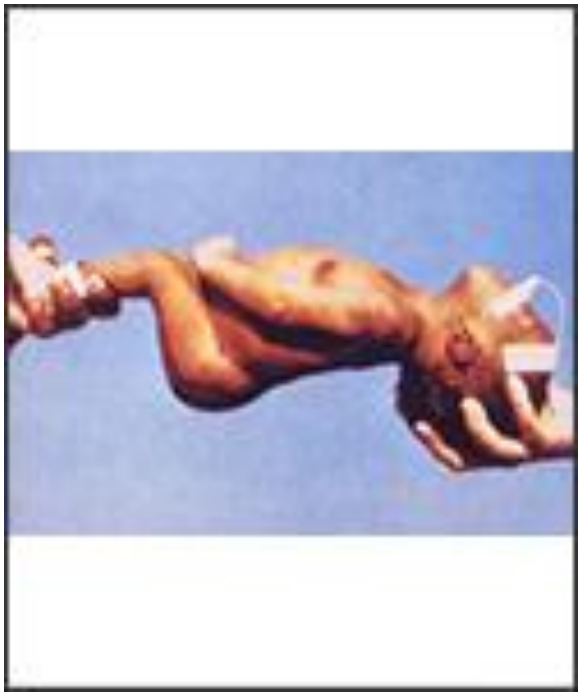


Diphtheria Hotspots 1997 - present; cases reported to the WHO

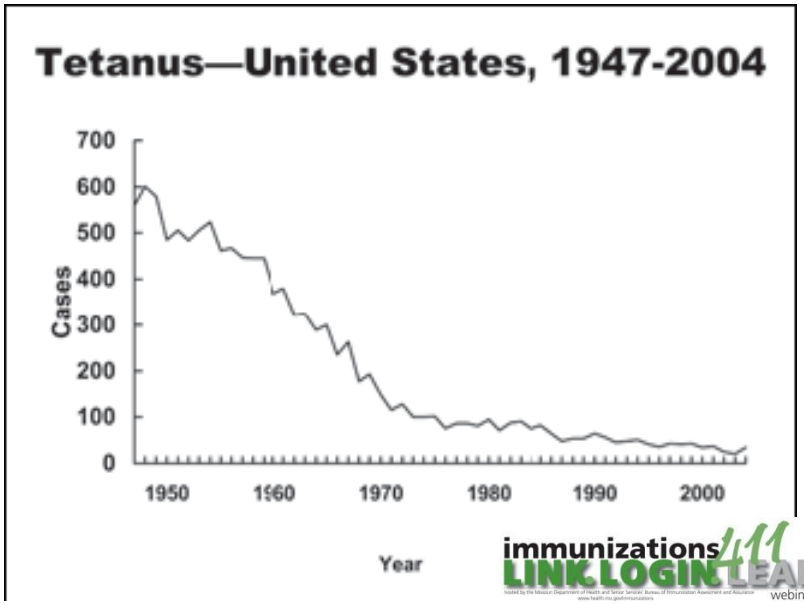
- Over 100 reported cases
- Between 50 and 100 reported cases
- Betweem 1 and 49 reported cases
- No cases reported

http://en.wikipedia.org/wiki/File:Diphterie.png

Tetanus



- Tetanus: Caused by bacterium *Clostridium tetani*
  - Transmission: Contamination of wounds
  - Illness:
    - Generalized tetanus (Lockjaw): Neurologic disease with severe muscle spasms
    - Localized tetanus: Localized muscle spasms
  - Treatment:
    - Wound and supportive care
    - Tetanus immune globulin
    - Antibiotics
  - Outcome:
    - Death in 1 in 5



http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/tetanus-508.pdf

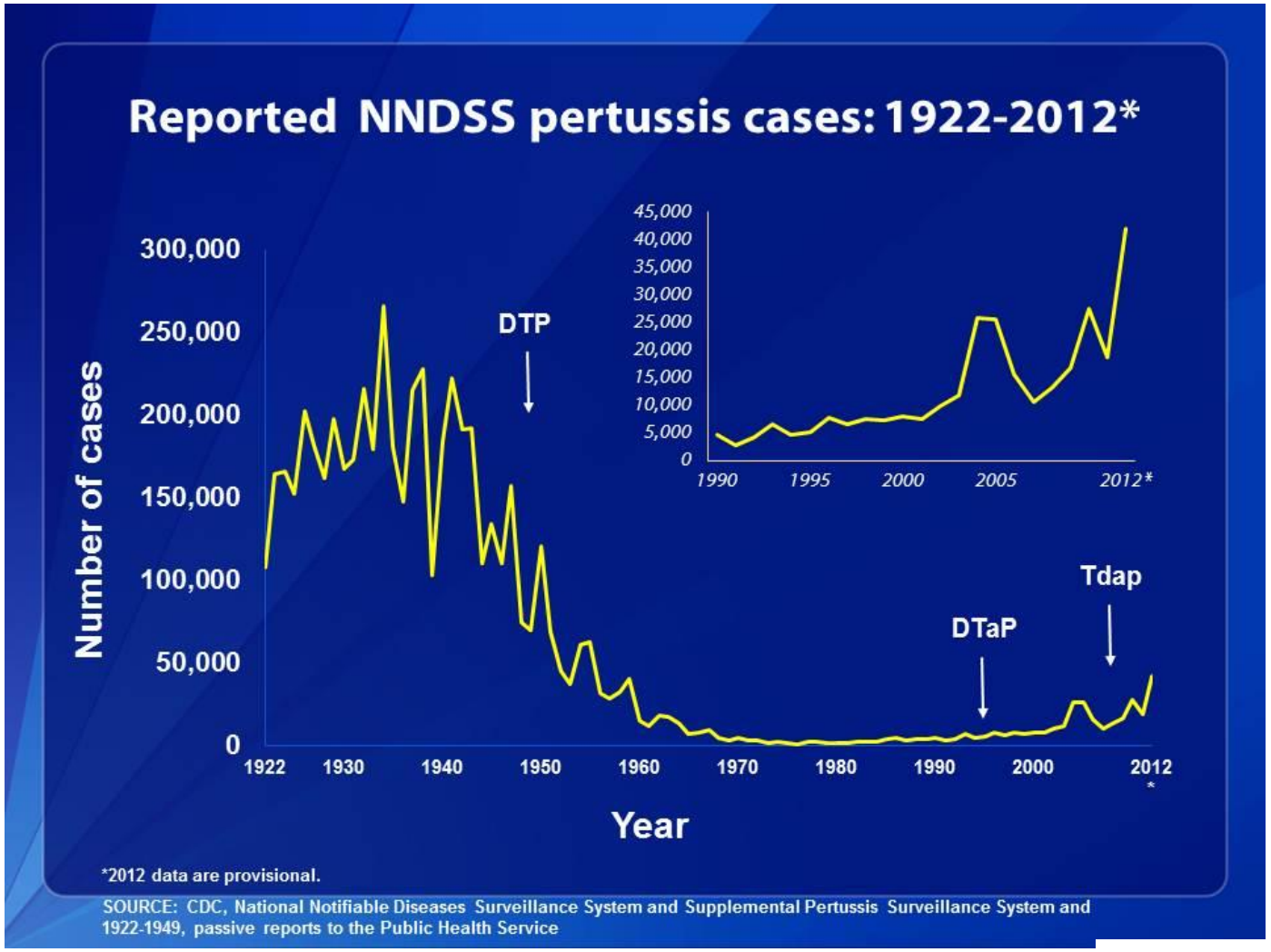
Pertussis

- Pertussis: Caused by *Bordetella pertussis*
  - Transmission: Respiratory droplets
  - Illness: Respiratory tract illness in phases:
    - Catarrhal: cold symptoms
    - Paroxysmal: paroxysms of cough followed by inspiratory whoop and vomiting
    - Convalescent: symptoms wane over weeks to months
    - Apnea and sudden death in infants without many other symptoms
  - Treatment:
    - Supportive care
    - Antibiotics: Macrolide antibiotics
  - Outcome:
    - Pneumonia in 1 in 4
    - Encephalopathy in 1 in 300
    - Death in 1-2 in 100

http://www.co.dakota.mn.us/Departments/PublicHealth/News/Nov08.htm

Redbook, 2006

Pertussis Epidemiology



http://www.cdc.gov/pertussis/about/complications.html

Pertussis and Vaccine Refusal

PEDIATRICS®
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Nonmedical Vaccine Exemptions and Pertussis in California, 2010

Jessica E. Atwell, Josh Van Otterloo, Jennifer Zipprich, Kathleen Winter, Kathleen Harriman, Daniel A. Salmon, Neal A. Halsey and Saad B. Omer

Pediatrics 2013;132;624; originally published online September 30, 2013;
DOI: 10.1542/peds.2013-0878

- Evaluated the relationship between Non-medical exemptions (NME) and pertussis outbreaks
  - Geocoded NME for vaccination for schools during the 2005-6 through 2009-10 school years
  - Geocoded confirmed, probable, and suspected cases of pertussis in 2010

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- From 2000 to 2010 NME rates tripled
- NME as high as 84% in some schools
- >95% vaccine coverage rate is necessary for prevention of outbreaks
- Clusters of pertussis outbreaks overlapped significantly with areas with high rates of NME

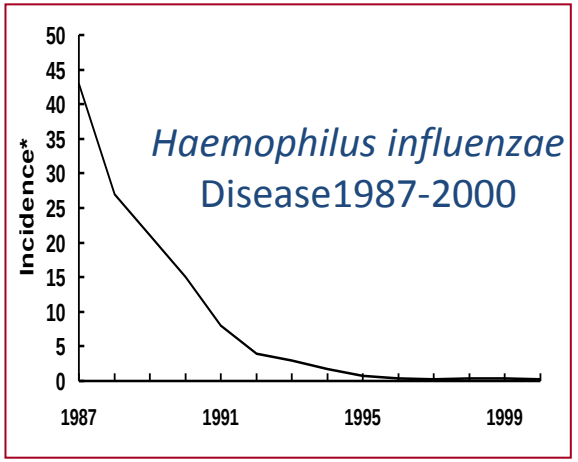
Diphtheria, Tetanus, Pertussis

- Vaccine recommendations: 5 doses (2, 4, 6 , 15-18 mos, and 4-6 years)
  - Tdap booster at 11 years
  - Tdap with pregnancy
- Efficacy:
  - Tetanus 100%
  - Diphtheria 95%
  - Pertussis 80-85%

http://www.cdc.gov/vaccines/vpd-vac/tetanus/downloads/pg_why_vacc_tetanus.pdf
Redbook, 2006.

Haemophilus influenzae type B

- Transmission: Respiratory droplet or direct contact with respiratory secretions
- Disease states:
  - Pneumonia
  - Sepsis
  - Meningitis (8-10K cases/year)
  - Epiglottitis
  - Bone and joint infections
  - Cellulitis
  - Otitis media
- Treatment: Antibiotics
- Outcome:
  - Death in 3-6%
  - Permanent disability in 30% of meningitis
- Vaccine: 3 or 4 doses
- Efficacy: 95-100%

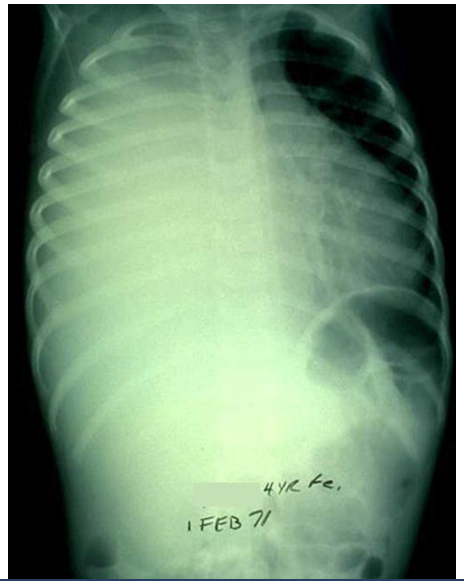


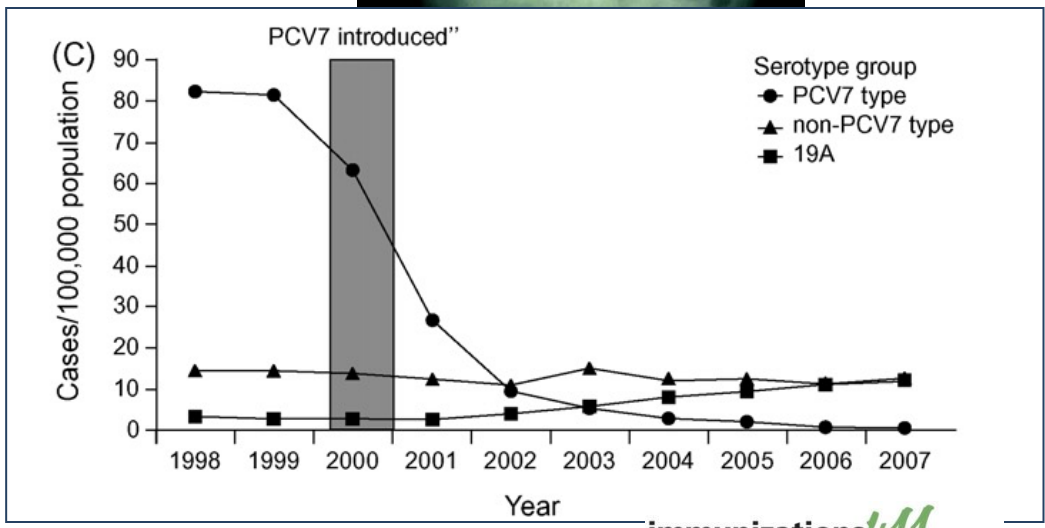
*Rate per 100,000 children age <5 yrs

Redbook online accessed 4/2015
http://www.cdc.gov/hi-disease/clinicians.html

Streptococcus pneumoniae

- Transmission: Respiratory droplet
- Disease states:
  - Otitis media (most common)
  - Sinusitis
  - Pneumonia
  - Meningitis
  - Skin and eye infections
  - Bone and joint infections
- Treatment: Antibiotics
- Vaccine: 4 dose series
- Efficacy: > 90% against invasive disease



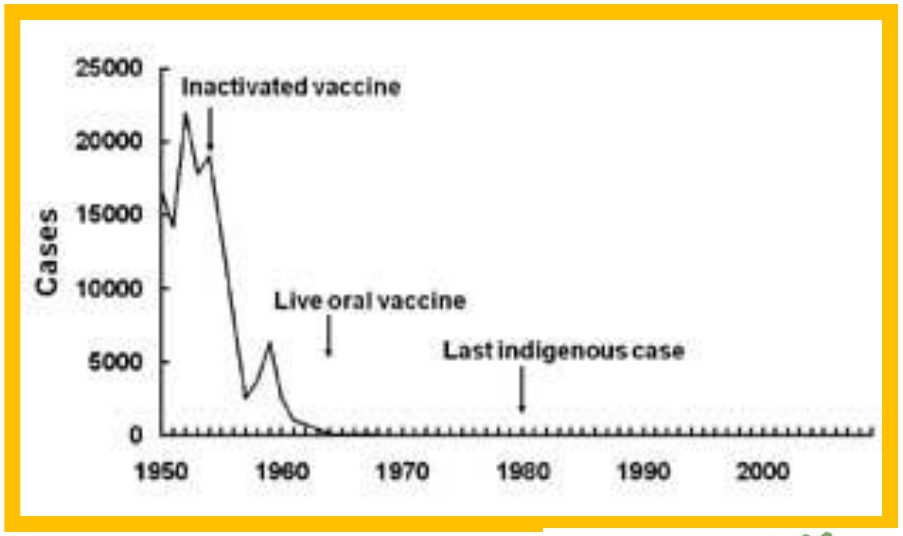


Redbook online accessed 4/2015.

Poliovirus

- Viruses: Enteroviruses of 3 serotypes, 1, 2, and 3
- Transmission: Fecal-oral and respiratory
- Disease states:
  - 95% of infections are asymptomatic
  - 4-8% non-specific illness with fever and pharyngitis
  - 1-5% aseptic meningitis
  - 0.1-2% assymmetric acute flaccid paralysis with areflexia of the affected limb (2/3 will have residual paralytic polio)

- Vaccine: 4 dose series
- Efficacy: 99-100%

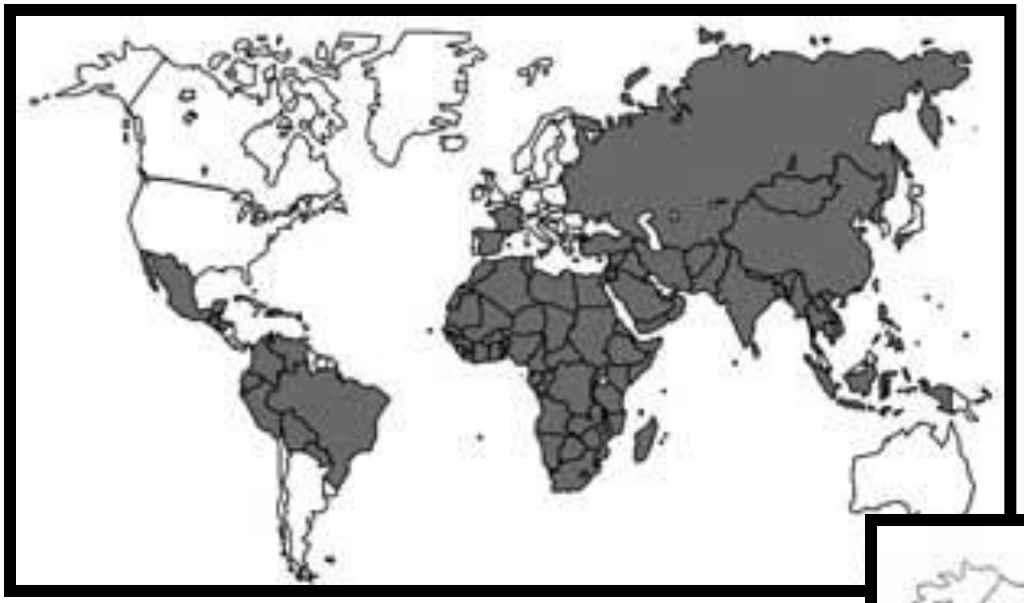


http://www.cdc.gov/vaccines/pubs/pinkbook/polio.html

Redbook, 2006

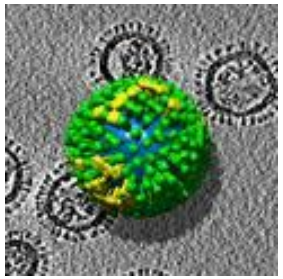
POLIO GLOBAL ERADICATION INITIATIVE

every last child



Poliovirus 1988

Poliovirus 2008

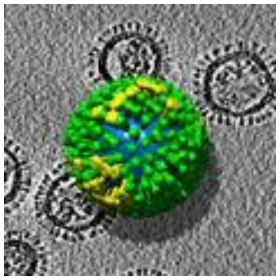


Influenza

- Viruses:
  - Influenza A: Subtyped based on 2 surface proteins
    - Hemaglutinin (16 subtypes)
    - Neuraminidase (9 subtypes)
  - Influenza B
- Transmission: Respiratory droplets
- Illness: "The Flu"
  - Fever -Headache -Fatigue
  - Myalgias -Cough -Sore throat
  - Congestion -Gastrointestinal complaints
- Treatment: Antivirals
- Complications on Influenza:
  - Bacterial pneumonia
  - Ear and sinus infections
  - Asthma exacerbation
- Yearly influenza mortality:
  - 3,000-49,000 deaths per year in the US
  - Up to 350 pediatric deaths each year

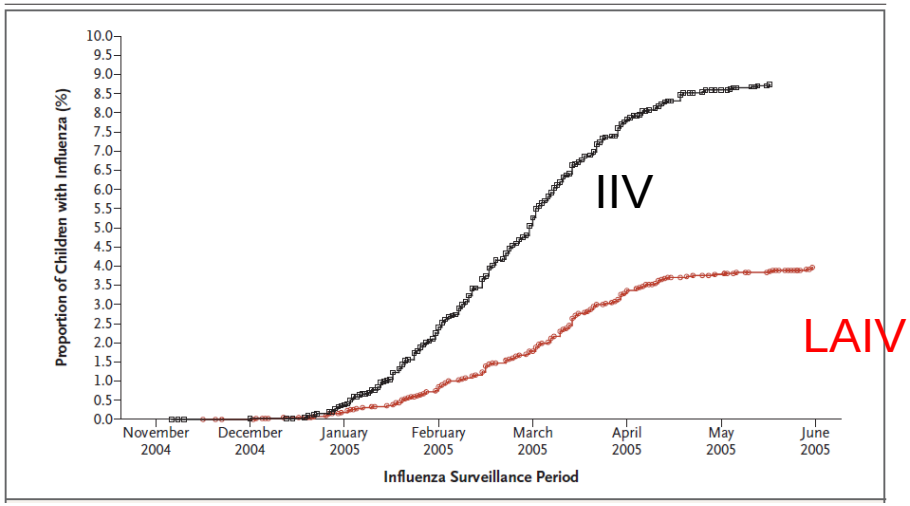
http://www.cdc.gov/flu

Influenza



- Vaccines:
  - Inactivated influenza vaccine (IIV), trivalent and quadrivalent
  - Live-attenuated influenza vaccine (LAIV4), quadrivalent
  - Recommendations: Yearly vaccine (2 doses for first year if < 9 years)

- Vaccine efficacy depends on:
  - Host status
  - Match of vaccine to strains
  - Type of vaccine given:
    - LAIV> IIV
  - 50-90% when strains well-matched



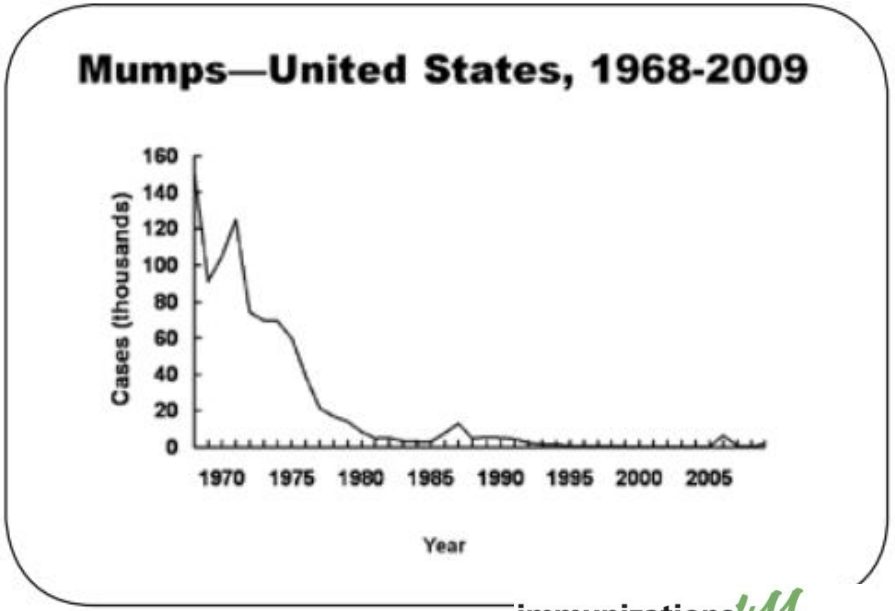
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6207a1.htm?s_cid=rr6207a1_w#Tab1

Belshe, et al. *NEJM*, 356(7):687-696, Feb 15, 2007.

Mumps

- Mumps: RNA virus
  - Transmission: Respiratory secretions
  - Epidemiology: <300 cases/year
  - Illness:
    - Swelling of the glands
    - Meningitis
    - Orchitis
  - Treatment: Supportive care
  - Outcome:
    - Death is rare
    - Deafness in 1 in 20,000
    - Sterility in post-pubertal males (rare)

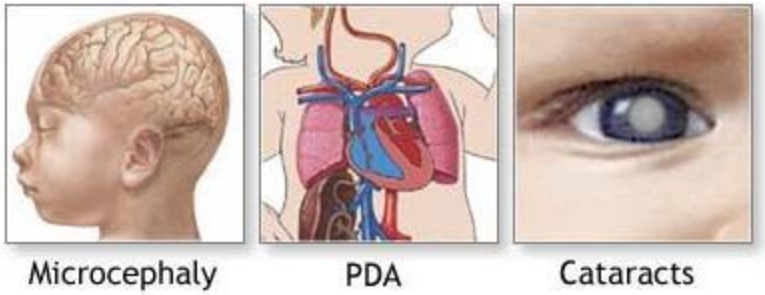
Mumps: Note the bilateral parotid and submandibular gland enlargement.



Redbook, 2006

Rubella

- Rubella: RNA virus
  - Transmission:
    - Respiratory droplet
    - Congenital infection
  - Epidemiology:
    - Before vaccine: epidemic disease
    - Post-vaccine: <25 cases/year (99% reduction in incidence)
  - Illness (aka German measles or 3-day measles)
    - Fever
    - Rash
    - Arthritis
    - Lymphadenopathy
    - Rarely: Encephalitis or low platelet cou
    - Congenital rubella syndrome

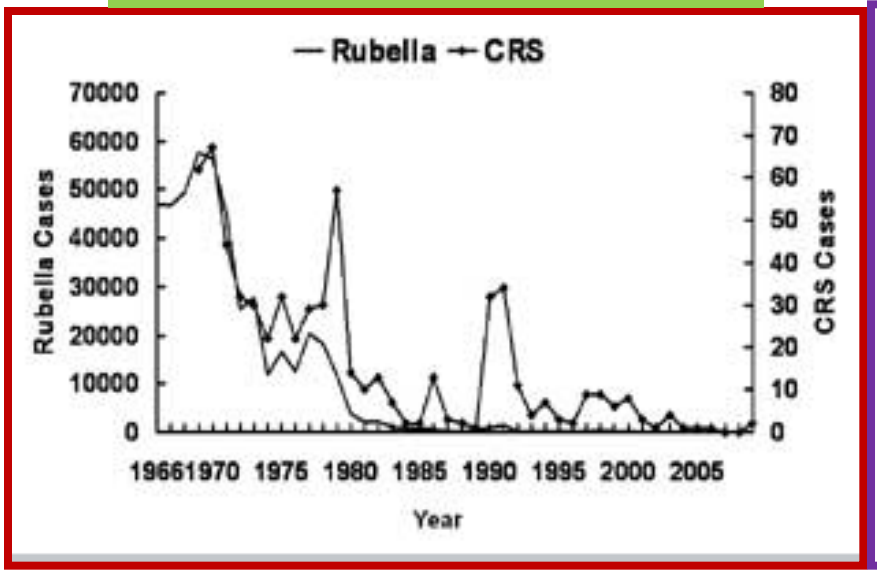


Redbook online accessed 4/2015.

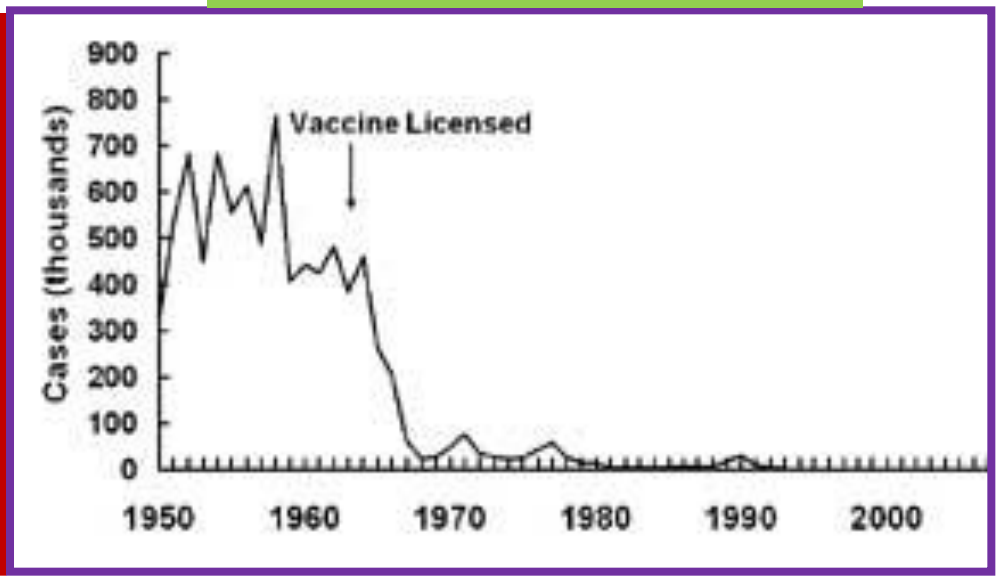
MMR

- Vaccine: MMR is a live, attenuated, 3 component vaccine
- Vaccine recommendations: 2 doses (12-15 mos and 4-6 years)
- Efficacy: 99% for Measles and 95% for Mumps and Rubella

Rubella in the US by Year

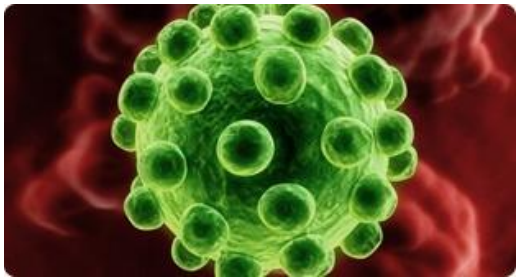


Measles in the US by Year



http://www.cdc.gov/vaccines/pubs/pinkbook

Varicella

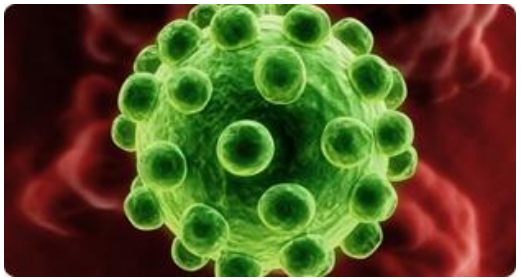


- Virus: Varicella-zoster virus of the herpesvirus family
- Transmission: Airborne spread or by direct contact
- Illness:
  - Chicken pox
  - Shingles

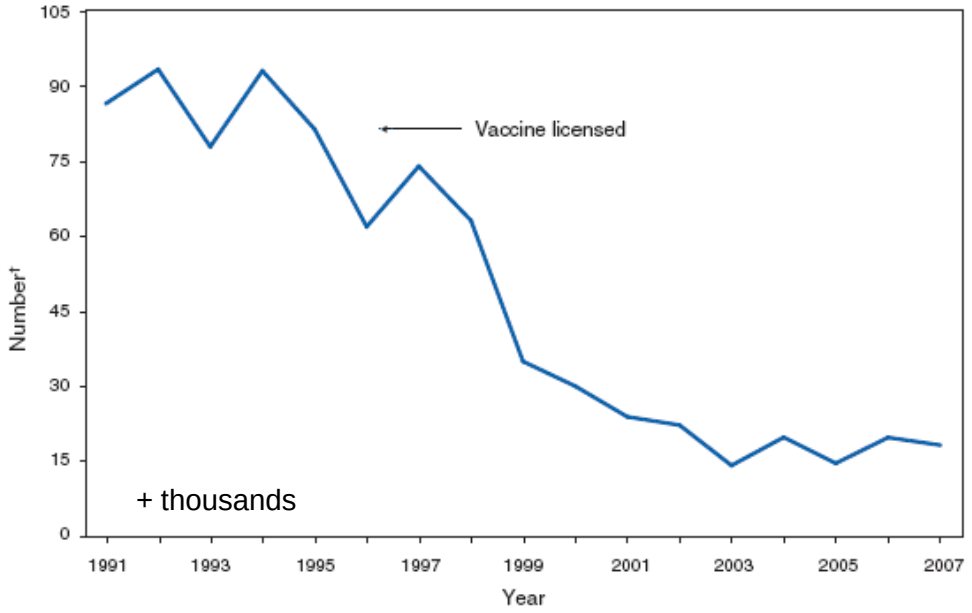
- Epidemiology: Pre-vaccine era, most infections occurred in children <10 years
  - 1/500 children hospitalized
  - 1/50 adults hospitalized
  - 1/100,000 children died
    - Pneumonia
    - Bacterial superinfection
    - Hepatitis
    - Encephalitis
- Treatment: supportive and antivirals for certain patients

Redbook, 2006

Varicella



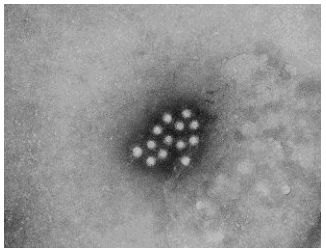
- Vaccine: Varicella vaccine is a live-attenuated virus vaccine
- Vaccine recommendations: 2 doses (12-15 mos and 4-6 years)
- Efficacy:
  - Prevents chicken pox in 70-90%
  - Prevents severe varicella in 95%



Varicella Reported by year for 4 States

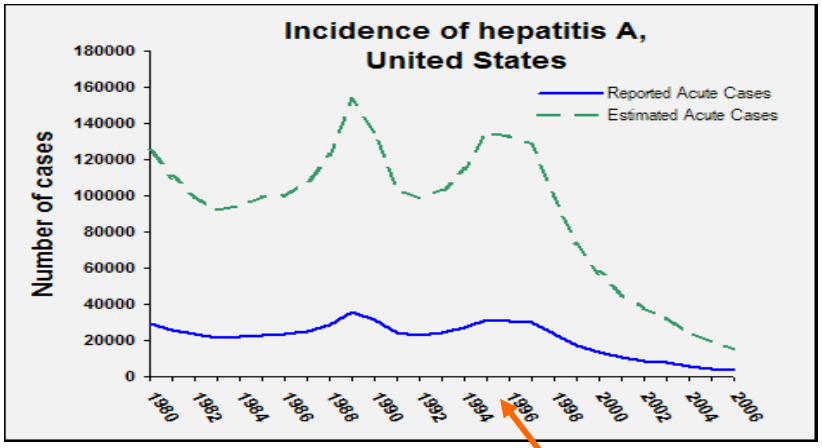
http://www.dpd.cdc.gov/vaccines/pubs/pinkbook/varicella.html#
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5653a1.htm

Hepatitis A Virus



http://commons.wikimedia.org/wiki/File:Hepatitis_A_virus_01.jpg

- Transmission: Person-to-person by fecal-oral route
- Epidemiology: Prior to vaccination, approximately 20 K cases/year in the US with 100 deaths
- Disease:
  - Asymptomatic in young children
  - Acute hepatitis with fever, malaise, jaundice, anorexia, and nausea
  - Fulminant hepatitis may occur but is rare
- Treatment: supportive care
- Vaccine: 2 doses
- Efficacy: 94-100%

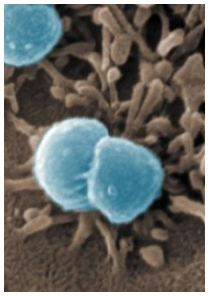


Vaccine available

Redbook, 2006

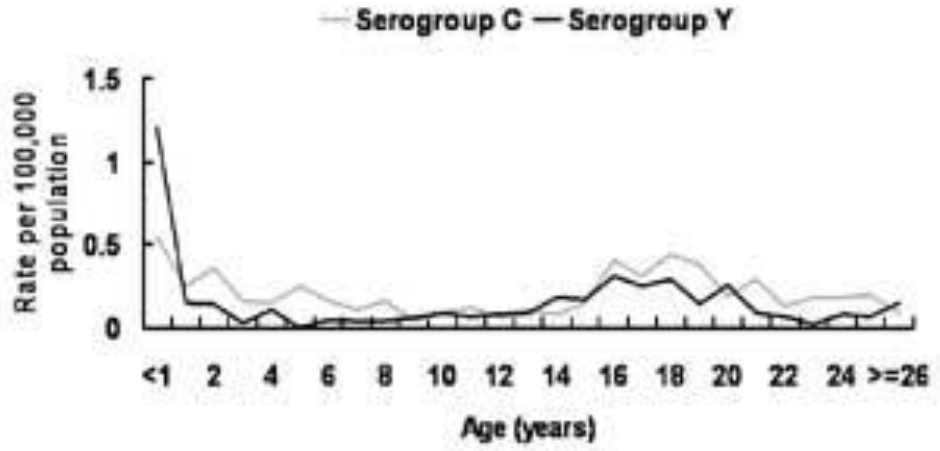
http://www.cdc.gov/vaccines/vpd-vac/hepa/downloads

Meningococcus



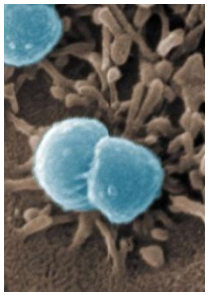
http://www.nature.com/nature/journal/v404/n6777/fig_tab/404451a0_F1.html

- *Neisseria meningiditis:* Gram-negative bacterial infection with at least 13 serogroups
- Transmission: Person-to-person through respiratory droplets.
- Epidemiology:
  - Peak occurrences:
    - < 5 years of age (peak attack rate age < 1 year)
    - Adolescents 15-18
  - Freshman college students in dorms have higher rates than non-college students



http://www.cdc.gov/vaccines/pubs/pinkbook/mening.html#epi
Redbook, 2006

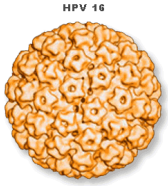
Meningococcus



- Disease states:
  - Asymptomatic colonization is common
  - Invasive infections:
    - Meningococcemia: Abrupt onset of fever, chills, malaise, prostration, and rash
    - Meningococcal meningitis
- Treatment: Antibiotics and supportive care
- Vaccines: 2 dose series for routine vaccination at age 11 and 16 years

Redbook, 2006

Human Papillomaviruses



- Epidemiology:
  - Anogenital HPV is most common STD (occurring in >40% of sexually active females)
- Disease states:
  - Clinically unapparent infection →Cervical dysplasia
  - Cervical cancer (12,000 cases/year with 4000 deaths)
  - Penile cancer
  - Head and neck cancer
  - Anogenital warts
  - Respiratory tract papillomatosis
- Vaccines: Inactivated subunit
  - Bivalent- HPV 16 and 18
  - Quadrivalent- HPV 6, 11, 16, 18

http://www.cdc.gov/vaccines/pubs/pinkbook/hpv.html

Summary- Part 1

- Diseases prevented by vaccination are serious
- Most of these infections continue to be in transmission in the US
- Vaccinations are an effective strategy to prevent these diseases
- Herd immunity provides an additional layer of protection, especially for the most vulnerable

Are vaccines safe?

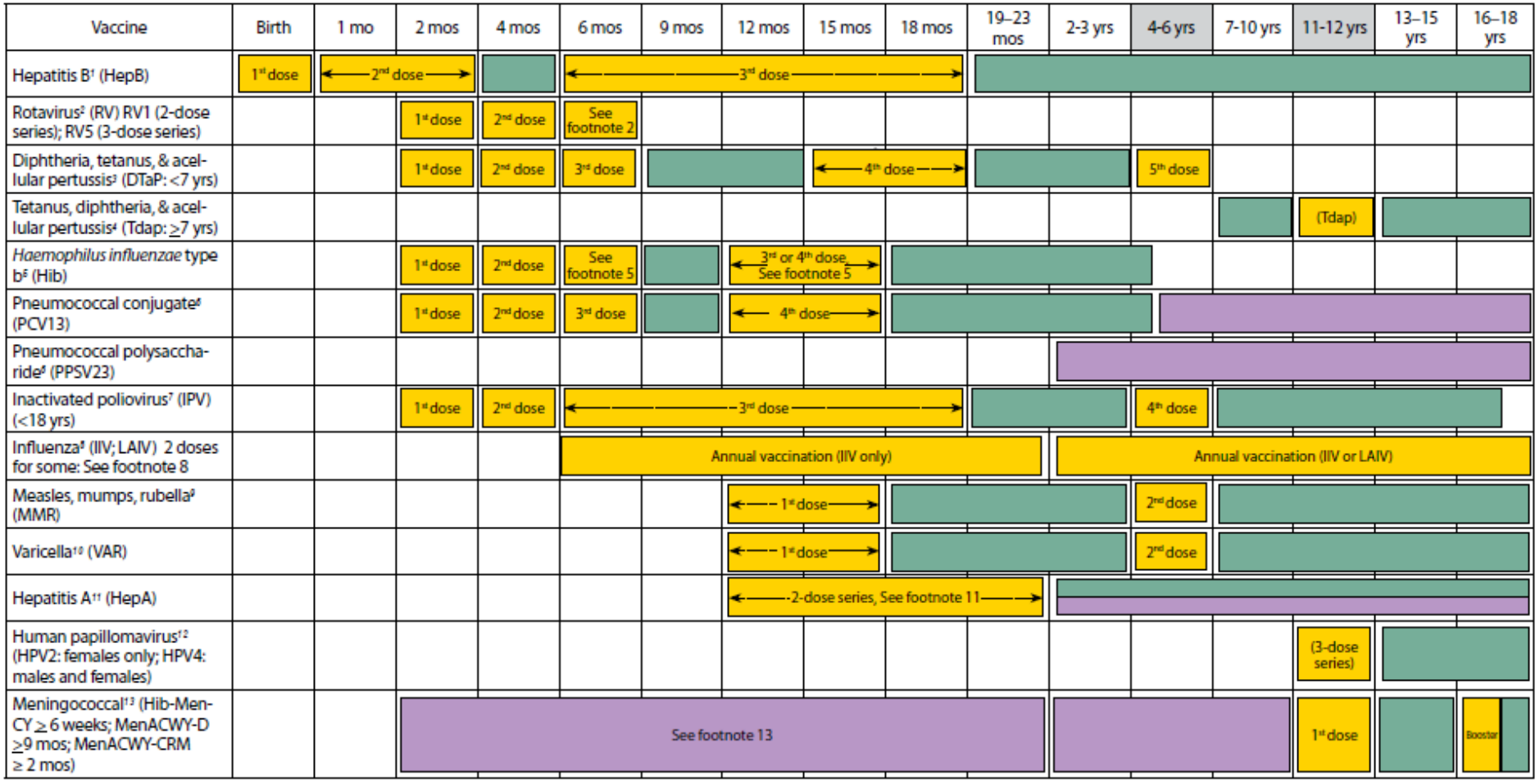
- Minor side effects are possible for all vaccines: pain, redness, tenderness at the site of injection
- Serious side effects are uncommon and unlikely to be permanent
  - Pertussis vaccine: crying, high fever, febrile seizure
  - Hepatitis B vaccine: anaphylaxis in 1 in 600,000

Are vaccines safe?

Comparison	Adverse Event	Odds
Measles	Pneumonia	6 in 100
	Encephalitis	1 in 1,000
	Death	2 in 1,000
MMR	Encephalitis or severe allergic reaction	1 in 1,000,000
Living in the US	Lightning strike	1 in 960,000
Walking	Dying	1 in 54,538

http://www.cdc.gov/vaccines
http://www.lightningsafety.noaa.gov/odds.htm
http://www.economist.com/blogs/graphicdetail/2013/02/daily-chart-7

Recommended Immunization Schedule for Persons Aged 0 to 18 Years



http://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-schedule.pdf

1970 Recommended US Childhood Immunization Schedule

Range of recommended ages

Preadolescent assessment

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	12 mos	15 mos	18 mos	24 mos	4-6 yrs	11-12 yrs	13-18 yrs
Diphtheria, tetanus, pertussis			DTP	DTP	DTP		DTP			DTP	Td	
Oral polio			OPV	OPV	OPV			OPV		OPV		
Measles						Measles						

Adapted from Centers for Disease Control and Prevention (CDC).

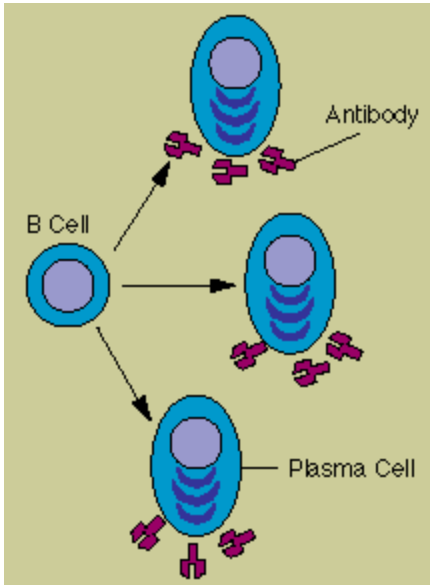
Do vaccines overwhelm the immune system?

- The immune system is primed *in utero* to respond to antigens
- The neonate in challenged with multiple antigens from the moment of birth

https://adelaidebirth.wordpress.com/2013/07/20/the-child-birth-photograph-victoria-berekmeri-adelaide-birth-photographer/

Chatterjee and O'Keefe, *Expert Rev Vaccines.* 2010, Vol 9 (5):497-502.

Do vaccines overwhelm the immune system?



- The immune system can respond to billions of antigens
  - 10,000,000 B-cells are present in every mL of blood
  - Each B-cell can produce enough new B-cells to make an effective vaccine response (10 ng/mL of antibody) in one week
  - Vaccines in use today contain between 1 and 70 antigens per vaccine
- If 11 vaccines were given all at once, this would temporarily use only 0.1% of this arm of the immune system

Offit, et al. *Pediatrics* 2002: 109:124-129.

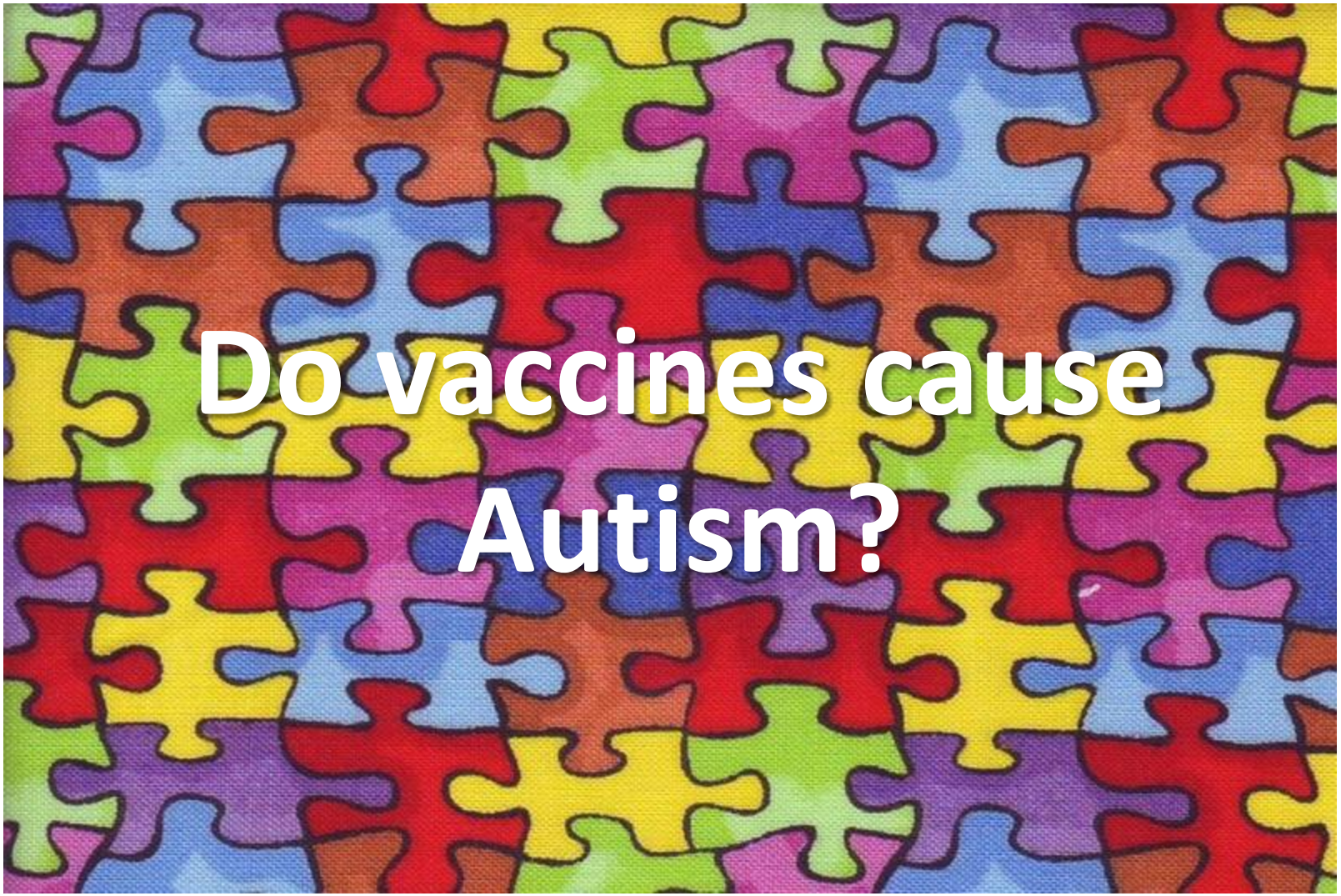
Do vaccines overwhelm the immune system?

- Current vaccines have fewer antigens than older vaccines

1900		1960		1980		2000	
Vaccines	Proteins	Vaccines	Proteins	Vaccines	Proteins	Vaccines	Proteins/polysaccharides
1	200	5	3217	7	3041	11	126

- Vaccines contain far less antigens than any natural infection

Offit, et al. *Pediatrics* 2002: 109:124-129.



What is Autism?

- Developmental disorder with the following characteristics:
  - Social impairments
  - Communication difficulties
  - Restricted, repetitive, and stereotyped patterns of behavior
  - Most often identified in toddlers from 18 to 30 months of age

http://www.ninds.nih.gov/disorders/autism/detail_autism.htm#268263082

What is the cause of Autism?

- ?????
  - Genetics
    - Twin studies show increased concordance with identical twins
    - Increased risk if sibling is affected
    - Parents and siblings of autistic children often exhibit mild traits on sensitive testing
    - Males affected at a rate of 4:1 compared to females

http://www.uptodate.com/contents/autism-spectrum-disorder-terminology-epidemiology-and-pathogenesis?source=machineLearning&search=autism&selectedTitle=3%7E150&sectionRank=1&anchor=H12#H12

Do vaccines cause Autism?

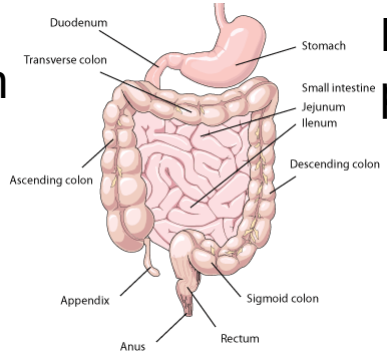
- The Wakefield Study:
  - 1998- Dr. Andrew Wakefield published paper describing 12 children with bowel symptoms and developmental disorders that he linked to the MMR vaccine

Wakefield's Theory

MMR

Inflammation

Leaky gut



Neurotoxic proteins

AUTISM

Offit, PA, "Vaccines and Autism", Immunization Action Coalition.

The Wakefield Study

- Wakefield was paid by lawyer seeking to sue vaccine manufacturers for 2 years prior to study (total sum paid $750,000)
- Most patients in the study were contacts of lawyer (not sequentially presenting patients as presented)
- Wakefield was seeking patent on mono-valent measles vaccines at the same time

Brian Deer, *British Medical Journal,* 2011

The Wakefield Study

- Data was fabricated when compared to actual patient medical records
  - Onset of developmental concerns was altered to fit timing after MMR
    - 5/12 had pre-existing developmental concerns
    - Developmental symptoms were reported to have occurred within days of MMR, but records showed concerns months later
  - GI symptoms developed after diagnosis of autism in 4/12 patients
  - Abnormal pathological findings reported by Wakefield were actually normal
- Paper was retracted and Wakefield lost his license to practice medicine

Brian Deer, *British Medical Journal,* 2011

Vaccines are not the cause of Autism!

- Developmental disorders are diagnosed in childhood and vaccines are given during childhood

≠

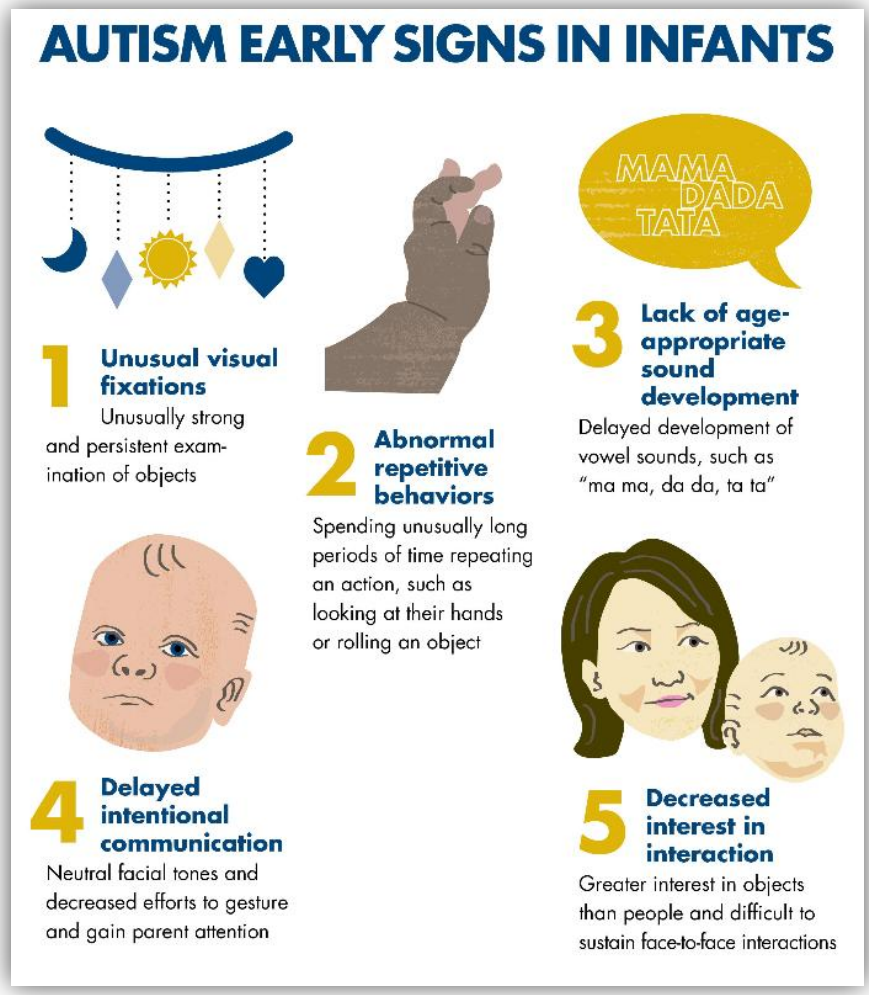
- Multiple studies in the US and Europe have found no association between the MMR and autism

Vaccines are not the cause of Autism!

- Multiple studies demonstrate NO LINK between MMR and autism:
  - 59 studies between 2004-2011
  - 14,700,000 children
  - Multiple countries

Vaccines are not the cause of Autism!

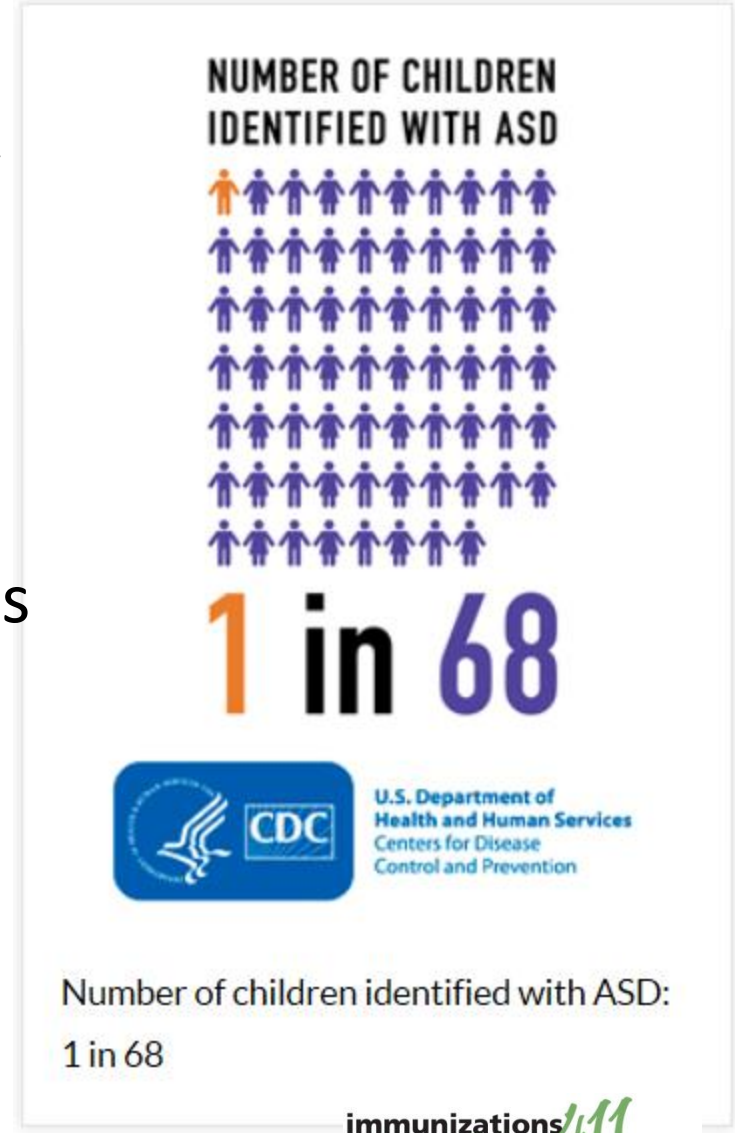
- Home movie studies:
  - Review of home videos of 1st B-day
  - Blinded comparison of children with autism to typically developing children
  - Investigators can identify autistic children (pre-diagnosis)
  - MMR is typically given AFTER 1st birthday



Offit, PA, "Vaccines and Autism", Immunization Action Coalition.

Vaccines are not the cause of Autism?

- Reported rates of autism may have increased
  - Change in diagnostic criteria
  - Increased awareness
  - Increased availability of services
- Rates of vaccination have been stable



Do vaccines contain unnecessary additives?

- Vaccines contain preservatives and additives to keep the product sterile and increase efficacy
- The amount of chemical additives is small
  - Aluminum salts:
    - Increase vaccine efficacy
    - Amount in vaccine = amount in 32 oz of infant formula
  - Formaldehyde:
    - Inactivates viruses and detoxifies bacteria
    - Amount in vaccine similar to what is naturally in the human blood stream

Blendell and Fehr, *J Perinat Neonat Nurs*, 2012, Vol 26(3):230-241.
http://www.cdc.gov/vaccines/vac-gen/additives.htm

Do vaccines contain unnecessary additives?

- Polyethelene glycol:
  - Viral inactivator and vaccine purifier
  - Found in many household products like toothpaste
- Thimerosol
  - Mercury containing preservative
  - Metabolizes to ethylmercury (different from environmental neurotoxin methylmercury)
  - Numerous studies demonstrate NO LINK to developmental disorders
  - Thimerosol has been removed from pediatric vaccines

Blendell and Fehr, *J Perinat Neonat Nurs*, 2012, Vol 26(3):230-241.
http://www.cdc.gov/vaccines/vac-gen/additives.htm

Does my child need vaccines if I breastfeed?

- Breastfeeding provides numerous benefits to health including reducing risk of disease:
  - Bacteremia
  - Diarrhea
  - Respiratory tract infection
  - Otitis media
  - Urinary tract infection
  - Late-onset sepsis in preterm infants
  - Necrotizing enterocolitis
  - Type 1 and type 2 diabetes
  - Lymphoma, leukemia, and Hodgkins disease
  - Childhood overweight and obesity

https://www2.aap.org/breastfeeding/files/pdf/Breastfeeding2012ExecSum.pdf

Does my child need vaccines if I breastfeed?

- Breastfeeding is insufficient protection against vaccine preventable diseases
- Breastfeeding and vaccinations work synergistically
  - Breastfeeding boosts immune responses to some vaccines
  - Breastfeeding is associated with a decreased pain response in infants

What About Delaying Vaccines?

- There is no benefit to delaying vaccines
- Delaying vaccines results in:
  - Increased window of vulnerability for the most vulnerable
  - Increased exposure to infectious diseases through increased number of office visits
  - Increased painful encounters

Offit, P.A. and C.A. Moser. *Pediatrics*, Vol 123(1):e164--9, Jan 2009.

Summary

- Vaccines are among the most effective preventative health tools
- High rates of vaccination within a community result in protection for those who cannot be vaccinated
- When rates of vaccination fall, diseases reemerge
- Refusal of vaccination often results from misunderstanding regarding the benefits of vaccination