Diphtheria and Tetanus Toxoids
Contraindications and Precautions

Severe allergic reaction to vaccine component or following a prior dose

Moderate or severe acute illness, Hx of seizures

Note that If diphtheria vaccination is interrupted outbreaks occur since some people carry the bacterium but are asymptomatic and immunity may decrease with time. Hence diphtheria vaccine should continue inspite of control of the disease

Natural infection does not lead to immunity and even patients who recover from diphtheria should be vaccinated

Tetanus

- First described by Hippocrates
- Cl tetani is an Anaerobic gram-positive, spore-forming bacteria
- Spores are found in soil, animal feces etc; may persist for months to years, hence any dirty wound may get infected with the bacterium and if there are anerobic conditions, an exotoxin maybe released
- The exotocin also called Tetanospasmin is very lethal, estimated human lethal dose = 2.5 ng/kg

Tetanus Epidemiology

- Reservoir Soil and intestine of animals
- and humans
- Transmission Contaminated wounds
  Tissue injury
- Temporal pattern Peak in summer or
  wet season
- Communicability Not contagious

Pathogenesis of tetanus

- Anaerobic conditions allow germination of spores in wounds
- The vegetative form of *C tetani* produces a potent plasmid-encoded exotoxin (tetanospasmin)
- This binds to gangliosides at the myoneural junction of skeletal muscle and on neuronal membranes in the spinal cord, blocking inhibitory impulses to motor neurons.
- This Leads to unopposed muscle contraction and spasm which are the cornerstone of the disease
- NOTE that C tetani is in the environment and soil, every dirty wound has the potential to lead to tetanus unless the host is vaccinated or receives antitoxin

Tetanus Toxoid (inactivated toxin)

- Formalin-inactivated tetanus toxin
- Schedule Three or four doses + booster
  Booster every 10 years
- Efficacy Approximately 100%
- Duration Approximately 10 years
- Vaccine content same for children and adults
- Should be administered with diphtheria toxoid as DTP, DTaP, DT, Td, or Tdap

Tetanus Wound Management

Vaccination History	Clean, minor wounds		All other wounds	
	Td	TIG	Td	TIG
Unknown or <3 doses	Yes	No	Yes	Yes
3+ doses	No*	No	No**	No

Yes, if >10 years since last dose

Yes, if >5 years since last dose

Dose of TIG is 250 units regardless of age and weight

Pertussis

- Highly contagious respiratory infection caused by *Bordetella pertussis a fastidious gram negative bacterium*
- Outbreaks first described in 16th century
- *Bordetella pertussis* isolated in 1906
- Estimated 285,000 deaths worldwide in 2001

Pertussis Epidemiology

- Reservoir Human
  Adolescents and adults
- Transmission Respiratory droplets
- Communicability Maximum in catarrhal stage
  Secondary attack rate
  up to 80%

Pertussis Pathogenesis

- Attachment to cilia of ciliated epithelial cells in respiratory tract
- Pertussis antigens allow evasion of host defenses (lymphocytosis promoted but impaired chemotaxis)
- Local tissue damage in respiratory tract
- Systemic disease may be toxin mediated
- Antigenic and biologically active components:
  - pertussis toxin (PT)
  - filamentous hemagglutinin (FHA)
  - agglutinogens
  - adenylate cyclase
  - pertactin
  - tracheal cytotoxin
- NO Bacteremia

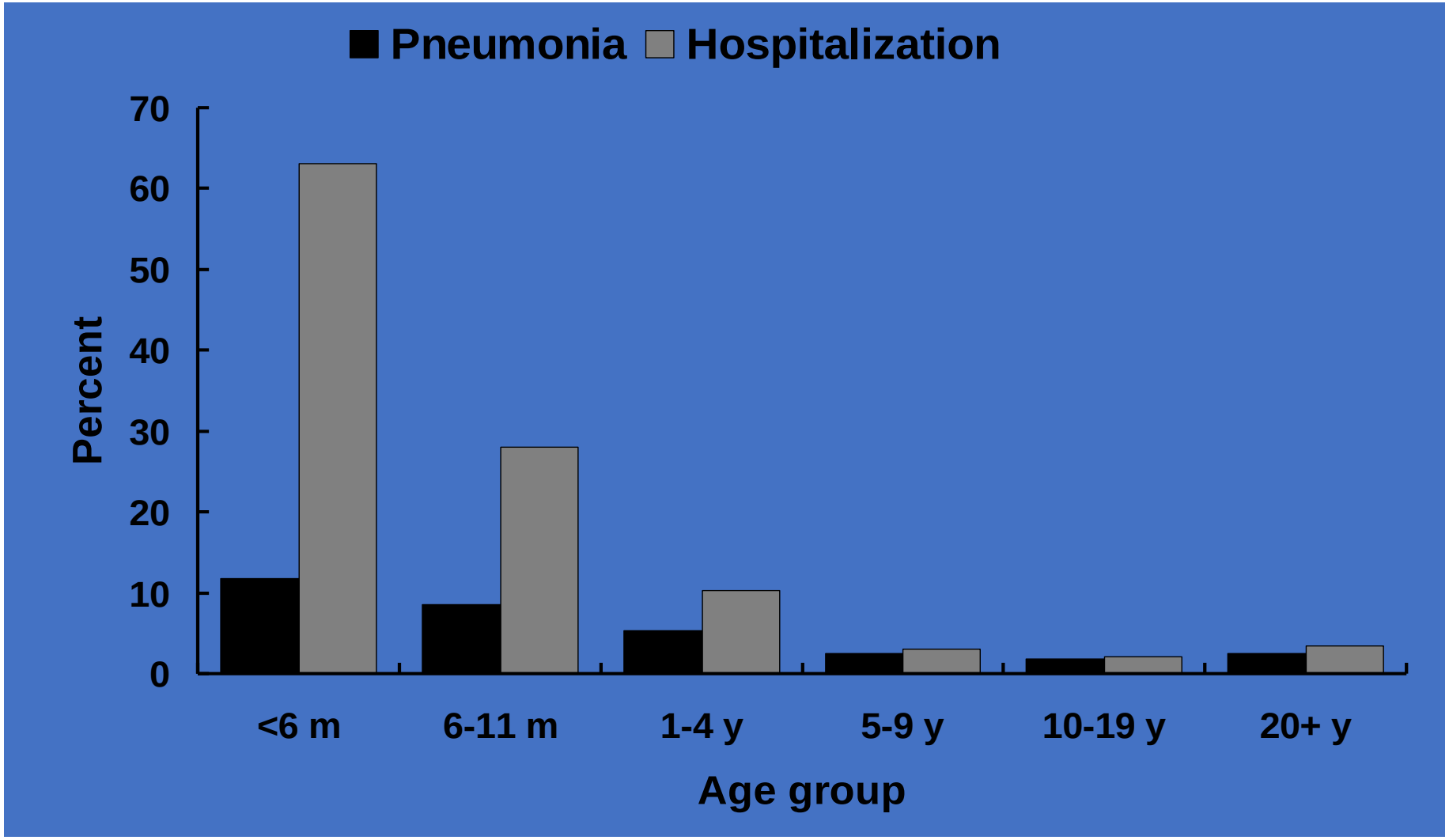
Pertussis Clinical Features

- Incubation period 7-10 days (range 4-21 days
- Insidious onset, similar to minor upper respiratory infection with nonspecific cough
  - Catarrhal stage — 1-2 weeks
  - Paroxysmal cough stage — 1-6 weeks
  - Convalescence — Weeks to months
- Fever usually minimal throughout course of illness

Pertussis Among Adolescents and Adults

- Disease often milder than in infants and children
- Infection may be asymptomatic, or may present as classic pertussis or chronic irritative cough
- Adolescents and adults account for more than half of reported cases
- Older persons often source of infection for children
- Infants less than six months of age are at increased risk since maternal antibodies are not sufficient to prevent infection unless mother is immunized in pregnancy

Pertussis Complications by Age



Pertussis vaccines

- Whole cell inactivated vaccine or acellular pertussis
- WC Should not be administered after the age of 6 years
- Immunity decreases with time and hence re vaccination in older individuals is needed
- Acellular vaccines are available for adolescents and for older individuals as well.
- Different antigen content

Pertussis vaccines in use

- DTwP made of whole cell vaccine
- DTaP acellular pertussis vaccine
- Tdap Made of acellular vaccine for use in adolescence and adults

Whole-Cell Pertussis Vaccine

- Developed in mid-1930s and combined as DTP in mid-1940s
- 70%-90% efficacy after 3 doses
- Protection for 5-10 years
- Local adverse reactions common

Acellular Pertussis Vaccines

- Purified "subunit" vaccines
- Pediatric formulations (DTaP) licensed for full series in 1996
- Adolescent and adult formulations (Tdap)

Composition* of Acellular Pertussis Vaccines

Product	PT	FHA	PERT	FIM
Daptacel	10	5	3	5
Infanrix	25	25	8	--
Tripedia	23	23	--	--
Boostrix	8	8	2.5	--
Adacel	2.5	5	3	5

mcg per dose

DTP whole cell reactions

- Fever 40%
- Local reactions 35%
- Seizures 1/1750
- HHE 1/1750
- Encephalopathy 1/110,000

DTaP Adverse Reactions

- Local reactions (pain, redness, or swelling at the site of injection)
- Local reactions more common following 4th and 5th doses
- Reports of swelling of entire limb
- Extensive swelling after 4th dose NOT a contraindication to 5th dose
- Low-grade fever

DTP/DTaP Contraindications

- Severe allergic reaction to vaccine component or following a prior dose
- Encephalopathy not due to another identifiable cause occurring within 7 days after vaccination
- Progressive CNS disease

DTP/DTaP Precautions*

- Moderate or severe acute illness
- Temperature ≥105° F (40.5° C) or higher within 48 hours with no other identifiable cause
- Collapse or shock-like state (hypotonic hyporesponsive episode) within 48 hours
- Persistent, inconsolable crying lasting ≥3 hours, occurring within 48 hours
- Convulsions with or without fever occurring within 3 days