

# Childhood immunization: introduction

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# Introduction

- The ultimate goal is eradication or control of disease; the immediate goal is prevention of disease.
- Active vs. passive immunization
- Life-long vs. partial or waning immunity

**Table 1.1. Comparison of 20th Century Annual Morbidity and Current Morbidity: Vaccine-Preventable Diseases<sup>a</sup>**

<b>Disease</b>	<b>20th Century Annual Morbidity<sup>b</sup></b>	<b>2010 Reported Cases<sup>c</sup></b>	<b>Percent Decrease</b>
Smallpox	29 005	0	100
Diphtheria	21 053	0	100
Measles	530 217	63	>99
Mumps	162 344	2612	98
Pertussis	200 752	27 550	86
Polio (paralytic)	16 316	0	100
Rubella	47 745	5	>99
Congenital rubella syndrome	152	0	100
Tetanus	580	26	96
<i>Haemophilus influenzae</i>	20 000	246 <sup>d</sup>	99

<sup>a</sup>National Center for Immunization and Respiratory Diseases. Historical Comparisons of Vaccine-Preventable Disease Morbidity in the U.S. Atlanta, GA: Centers for Disease Control and Prevention

<sup>b</sup>Roush SW, Murphy TV, Vaccine-Preventable Disease Table Working Group. Historical comparisons of morbidity and mortality for vaccine-preventable diseases in the United States. *JAMA*. 2007;298(18):2155–2163

<sup>c</sup>Centers for Disease Control and Prevention. Notice to readers: final 2010 reports of nationally notifiable infectious diseases. *MMWR Morb Mortal Wkly Rep*. 2011;60(32):1088–1101

<sup>d</sup>23 type b and 223 unknown serotype (<5 years of age).



- Eradicated in 1980, case-fatality rate 30-50% according to type and age!



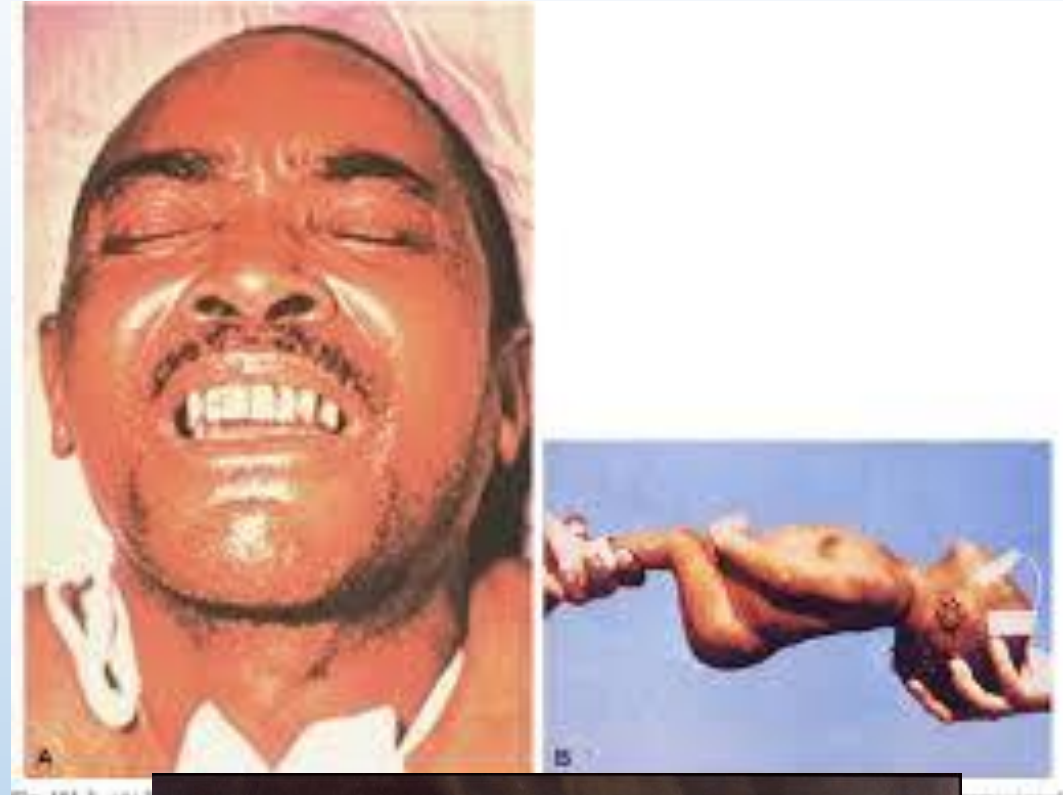
# Poliomyelitis!

- Rapid asymmetric acute flaccid paralysis (paralytic poliomyelitis), proximal muscles > distal, with areflexia. Cranial nerve (bulbar poliomyelitis) and paralysis of the diaphragm may lead to impaired respiration.



# Tetanus (Lockjaw)!

- Neurotoxin in a contaminated wound.
- Generalized tetanus (lockjaw): trismus and severe painful generalized muscular spasms. Autonomic dysfunction: diaphoresis, tachycardia, blood pressure, and arrhythmias.



# Pertussis (Whooping cough)

- catarrhal stage, paroxysmal stage, and convalescent stage (6 to 10 weeks).
- Complications: syncope, sleep disturbance, incontinence, rib fractures, pneumonia, conjunctival bleeding, hernia, hypoxia, seizures (2%), encephalopathy, and death.
- <6 months can be atypical: gasping, bradycardia, or apnea; absence of whoop.



# Diphtheria!

- Membranous nasopharyngitis or obstructive laryngotracheitis. Extensive neck swelling with cervical lymphadenitis (bull neck) is a sign of severe disease.
- Complications: upper airway obstruction; myocarditis with heart block; and cranial and peripheral neuropathies.
- Case fatality rates up to 10%, sometimes > 20% in older adults.





# Vaccines included in the national immunization program (NIP)

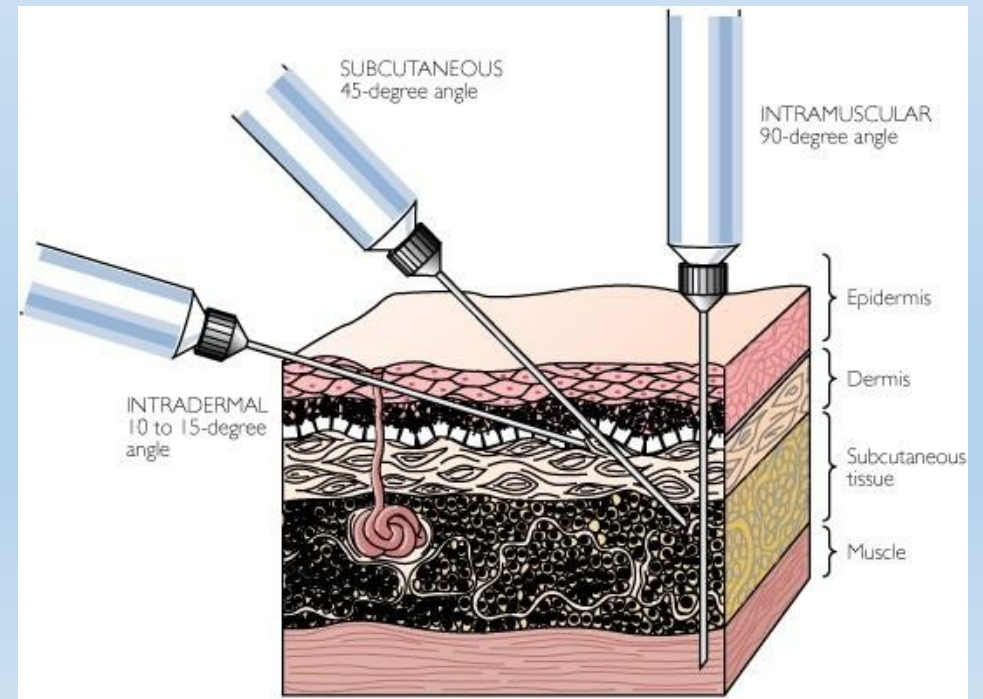
- Viral (6): Measles, mumps, rubella (MMR); poliovirus (IPV, OPV) hepatitis B virus, Rotavirus
- Bacterial (5): Haemophilus influenzae type b (Hib), Tuberculosis (BCG), Diphtheria, Tetanus, Pertussis (DTP, DTaP, Tdap, Td)
- Other vaccines in the American NIP: Hepatitis A, varicella, meningococcal, pneumococcal, human papilloma virus, influenza virus.
- Other vaccines for travelers or exposure: Typhoid, yellow fever, rabies

# Types of vaccines

- **Live-attenuated:** BCG, MMR, OPV, Rota, **Varicella**, (oral typhoid, yellow fever), **Nasal Influenza virus**
- **Inactivated:** DTaP (toxoids and inactivated components) (Tdap, Td, DTP), IPV, Hib (polysaccharide conjugate), **Hepatitis A (inactivated)**, **Meningococcal, pneumococcal** (polysaccharide conjugate or polysaccharide), **Influenza virus (inactivated)**
- **Genetically engineered** (recombinants antigens): Hepatitis B, **HPV**
- Live-attenuated vaccines are contraindicated in cases of cell-mediated immune defects and pregnancy. *OPV is the only vaccine contraindicated when household contains an immunocompromised member.*

# Administration

- Most: IM (Ant-lat thigh or deltoid). Exceptions:
- Intradermal (ID): BCG (or SC)
- SC: MMR, Varicella, Polysaccharide vaccines, IPV (or IM)
- Intranasal: Nasal influenza vaccine
- Oral: OPV, Rota



# Administration

- Combined vaccines, concurrent administration
- Catch up vaccines.
- Interval for live-vaccines administration after: Chemotherapy, high dose steroids, blood products.



# Possible side effects to all vaccines

- Local reactions to injectable vaccines
- Anaphylaxis to the vaccine or one of its components (contraindications for further similar doses)
- Syncope
- fever

# Not a contraindication!

- The followings are not contraindications to vaccine administration:

- Mild illness with or without fever
- Breast feeding
- Local rxns or fever after previous vaccine
- Preterm birth
- Penicillin allergy
- Concurrent antibiotics use
- Family history of seizure, controlled seizures

# Schedule of the NIP and UNRWA in Jordan

Time of vaccination	Vaccine (s)	Comments
Within the first month of life	BCG	Only 1 dose
2 months of age (60+ days)	(DTaP, IPV, Hib: الخماسي المحسن), HepB, RotaV	Not in NIP at this age: PCV 13
3 months (90+ days)	(DTaP, IPV, Hib), HepB, RotaV, OPV	
4 months (120+ days)	(DTaP, IPV, Hib), HepB, RotaV, OPV	Final doses of Hib, HepB and RotaV. Not in NIP at 6mo: FluV
9 months	Measles, OPV	Monovalent measles
12 months	MMR	Not in NIP : Varicella, HepA
18 months	MMR, OPV <sup>b</sup> , DTP <sup>b</sup>	Final MMR. <sup>b</sup> indicates booster
6 years, first grade	OPV <sup>b</sup> , Td	Reduced diphtheria vaccine
10 <sup>th</sup> grade	Td	Not in NIP: At 11 y: HPV, MCV4

# Vaccines: BCG

- **Bacillus Calmette–Guérin**
- Reduce disseminated and life-threatening manifestations of TB in young children (meningitis and miliary TB, 80% efficacy)
- Specific adverse events: 1%, localized abscess and lymphadenopathy, generally not serious. Osteitis, as long as several years after BCG. Disseminated (2 per 1 million). Anti-tuberculosis recommended for osteitis and disseminated.
- Live vaccine contraindications.



# Vaccines: HepB

- For infants born to HBsAg + mothers: HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth
- Efficacy 90-95%. Protection for 20 years or longer
- Adverse events and contraindications

# Vaccines: Hib

- At increased risk for invasive Hib: Splenic dysfunction, immunocompromized, younger than 5 years of age
- Efficacy 95-100%
- Adverse events and contraindications

# Vaccines: IPV/OPV

- OPV induces more immunity (intestinal and serum antibody response), herd immunity; but more side effects (vaccine associated poliomyelitis). Better to use in outbreaks.
- 3 serotypes
- Efficacy 99-100%
- OPV contraindications: Immunodeficiency including antibody disorders, household of immunocompromised child.

# Vaccines: DTaP

- Tetanus and Diphtheria booster every 10 years.
- Acellular vs. cellular pertussis (aP vs P)
- Side effects:
  - ❖ Local reactions include whole limb swelling.
  - ❖ Brachial neuritis
  - ❖ Febrile seizures within 48 hrs
  - ❖ Hypotonic hyporesponsive episode
  - ❖ Fever 40.5 or higher within 48 hrs
  - ❖ Prolonged (>3hrs) inconsolable crying within 48 hrs
  - ❖ Encephalopathy?



# Vaccines: DTaP

- Contraindications:
  - ❖ Encephalopathy within 7 days of previous dose (to pertussis vaccine)
  - ❖ Children less than 1 year with evolving neurological disorder (to pertussis vaccine)
  
- ❖ Efficacy: 98-100% after 5 doses

# Vaccines: Rota V

- Contraindications:
  - ❖ SCID
  - ❖ History of intussusception
- Precautions:
  - ❖ Severe illness including gastroenteritis
  - ❖ Other types of immunodeficiency
  - ❖ Chronic GI illness

# Vaccines: MMR

- Efficacy after 1 dose 95%, 2 doses 99%
- Live vaccine contraindications
- Side effects:
  - ❖ Arthralgia or arthritis (7-21 days after the vaccine)
  - ❖ Measles-like rash
  - ❖ Febrile seizures
  - ❖ Orchitis, parotitis (mumps component)
  - ❖ Thrombocytopenia (measles component)

# Thanks

