

CHILDHOOD IMMUNIZATION: INTRODUCTION

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Vaccination:

- The act of giving a vaccine (antigen)

Immunization:

- Induction of an immune response following exposure to an antigen

Active vs Passive immunity

ACTIVE	PASSIVE
Immunogenic antigen is given then the body forms its own protective antibodies.	Ready-made immune globulin (antibodies) from human or animal sources are given to the body.
Long term protection (Sometimes life long)	Temporary immunity that decreases with time (turnover of the administered immunoglobulin)
Examples: Natural: Infection Artificial: Vaccination	Examples: Natural: Mother's Ig to infant (transplacental/breast milk) effective for about 6 months. Artificial: Administration of antibodies (e.g: Hepatitis B IG, Varicella IG)



Smallpox

Eradicated in 1980

Poliomyelitis!

- Rapid **asymmetric acute flaccid paralysis** (paralytic poliomyelitis) caused by poliovirus
- Proximal muscles > distal
- Areflexia.
- Cranial nerve (bulbar poliomyelitis)
- Paralysis of the diaphragm may lead to impaired respiration.



Tetanus (Lockjaw)!

- Caused by Clostridium Tetanus
- Generalized tetanus (lockjaw): trismus and severe painful generalized muscular spasms.
- Autonomic dysfunction: diaphoresis, tachycardia, blood pressure, and arrhythmias.



Pertussis (Whooping cough)

- Bordetella Pertussis
- Complications: syncope, sleep disturbance, incontinence, rib fractures, pneumonia, conjunctival bleeding, hernia, hypoxia, seizures (2%), encephalopathy, and death.



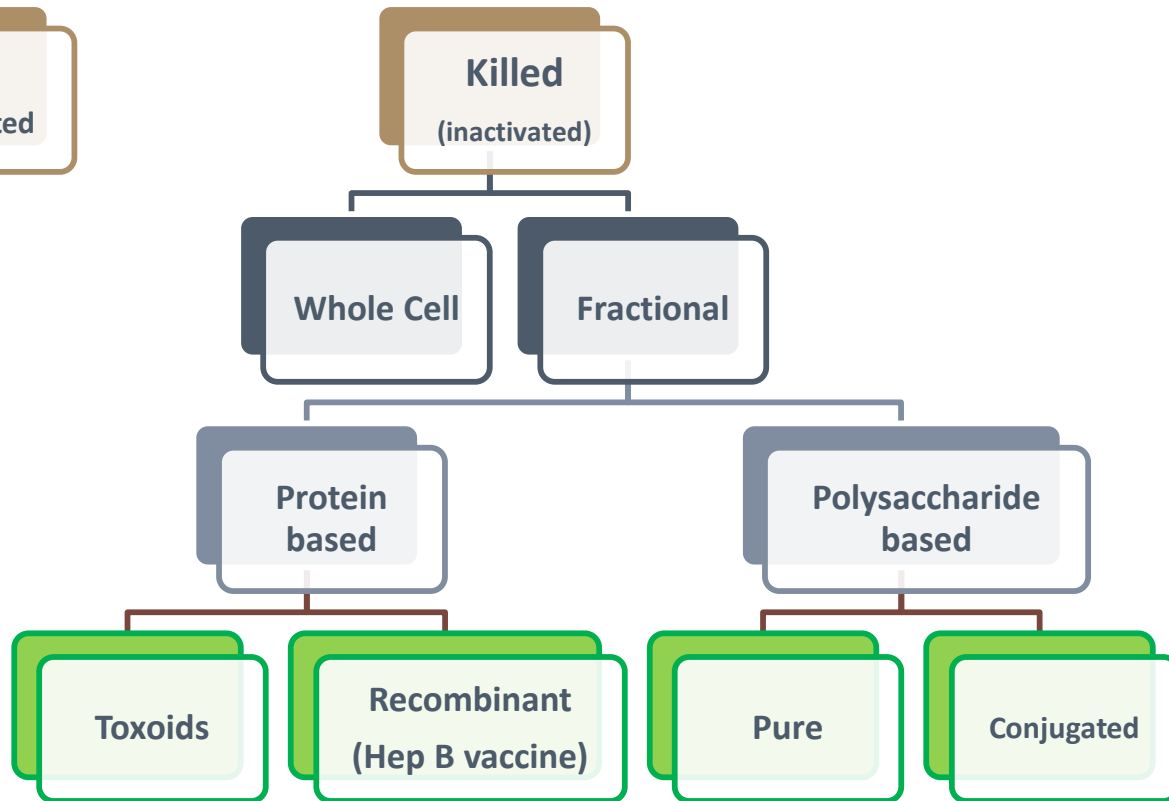
Diphtheria!

- Membranous nasopharyngitis caused by diphtheria toxin.
- Complications:
 - upper airway obstruction;
 - myocarditis with heart block;
 - cranial and peripheral neuropathies.
 - Extensive neck swelling with cervical lymphadenitis (bull neck) is a sign of severe disease.



Live attenuated	Inactivated vaccine
<p>Live organisms</p> <ul style="list-style-type: none"> ➤Lost ability to induce the disease ➤Retain capacity to grow but slowly and locally only 	<p>Killed organisms</p> <ul style="list-style-type: none"> ➤(by heat/chemicals [formaldehyde]).
<p>Can produce antigens continuously:</p> <ul style="list-style-type: none"> ➤More potent ➤1 Dose is sufficient ➤Longer immunity 	<p>Cannot keep producing antigens:</p> <ul style="list-style-type: none"> ➤Less potent ➤Need booster doses ➤Shorter immunity
<p>Induce humoral & cellular immunity</p>	<p>Induce humoral immunity only</p> <ul style="list-style-type: none"> ➤Antibody titers fall with time
<p>Risk of infection</p> <ul style="list-style-type: none"> ➤Can mutate back to its virulent form 	<p>No risk of infection</p>
<p>▪Not safe for immunocompromised people</p> <p>1-immunocompromised individuals.</p> <p>2-(steroids used)</p> <p>3-Pregnant women</p>	<p>Safe</p>

Types Of Vaccines



- **Live-attenuated:** BCG, MMR, OPV, Rota, Varicella, (oral typhoid, yellow fever), **Nasal Influenza virus vaccine.**

- **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** (recombinant antigens): Hepatitis B, **HPV**

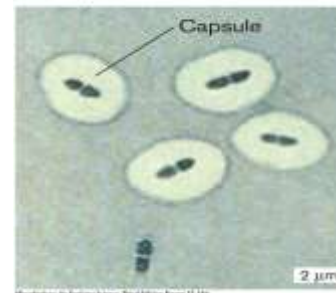
- **Live-attenuated vaccines are contraindicated** in cases of cell-mediated immune defects and pregnancy.

- **OPV is the only vaccine contraindicated** when household contains an immunocompromised member.

Pure polysaccharide vaccines → conjugated polysaccharide vaccines (with protein)

1. No T cell DEPENDENT immune response → can stimulate it
2. Not immunogenic in children younger than 2 years of age → become immunogenic
3. No booster response in adults → have a booster response

Images of polysaccharide *Streptococcus pneumoniae* and capsule



Examples For Each Type Of Vaccines

Live attenuated	Whole cell	Subunit (conjugated)	Subunit (recombinant)	Toxoids
<ul style="list-style-type: none"> • BCG (bacterial) • MMR (virus) • OPV (Virus) • Rota (Virus) • Varicella (Virus) • Yellow fever 	<ul style="list-style-type: none"> • Pertussis (bacterial) • IPV (Virus) • Flu (Virus) • HepA (Virus) 	<ul style="list-style-type: none"> • Hib (bacterial) • Pneumo (bacterial) • Meningo (bacterial) 	<ul style="list-style-type: none"> • HepB (Virus) 	<ul style="list-style-type: none"> • Tetanus (bacterial) • Diphtheria (bacterial)

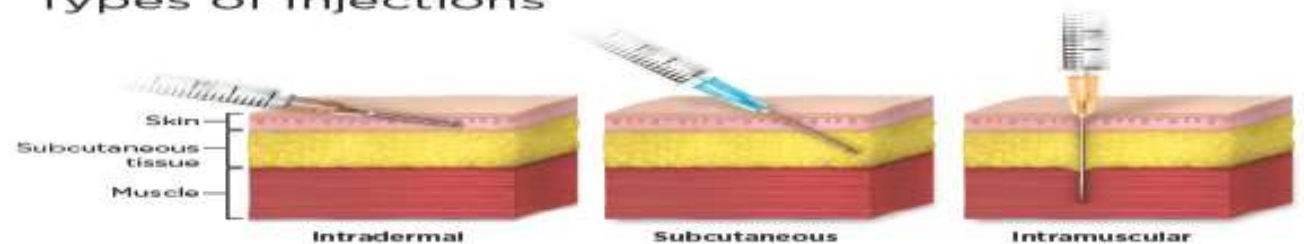
- Most: IM (Ant-lat thigh <2y or deltoid >3y).
 - Only IM : Hep A
- Intradermal (ID): BCG (or SC)
- SC: MMR, Varicella, Polysaccharide vaccines, IPV (or IM)
- Intranasal: Nasal influenza vaccine
- Oral: OPV, Rota

Immunization in Pregnancy

- **Influenza** Vaccine Each Influenza Season.
- **Tdap** With Each Pregnancy.

☐ **Vitamin A** enhanced the antibody response to measles vaccine (given with MMR)

Types of Injections



Possible side effects to all vaccines

- In general they occur early **within 24-48 hours of vaccination** and are **self-limited**.
- However, reactions following **live vaccines** (e.g. **MMR**) may be **delayed** and resemble a **mild version of the disease**.

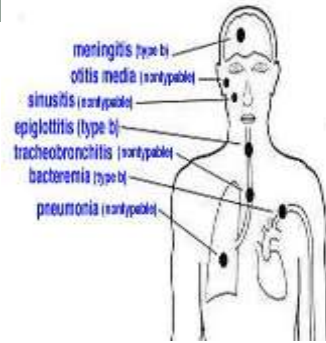
1. Local reactions to injectable vaccines
2. **Anaphylaxis** to the vaccine or one of its components (**contraindications for further similar doses**)
3. Syncope
4. Fever

Not a contraindication!

1. Mild illness with or without fever
2. Breast feeding
3. Local rxns or fever after previous vaccine
4. Preterm birth
5. Penicillin allergy
6. Concurrent antibiotics use
7. 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, HepA	Not in NIP : Varicella
18 months	MMR, OPV ^b , DTP ^b , , HepA	Final MMR. ^b indicates booster
6 years, first grade	OPV ^b , Td	Reduced diphtheria vaccine
10 th grade	Td	Not in NIP: At 11 y: HPV, MCV4



Vaccines: Hib

- Haemophilus influenzae type B (Hib) **was the most common cause of childhood bacterial meningitis**.
- It is given to individuals at increased risk for invasive Hib:
 1. Splenic dysfunction,
 2. immunocompromized
 3. younger than 5 years of age

Vaccines: Rota V

- Contraindications:
 - ❖ Severe Combined Immune Deficiency.
 - ❖ History of intussusception

Min age	6 wks
Max age- 1st dose	14 wks 6 days*
Max age- any dose	8 mon 0 days*

Vaccines: BCG

- **Bacillus Calmette–Guérin (the only bacterial live attenuated)**
- **meningitis and miliary TB, 80% efficacy**
- Specific adverse events: generally not serious
 - 1%, localized abscess and lymphadenopathy.
- Live vaccine contraindications.

Vaccines: IPV/OPV

- The IPV covers all the 3 serotypes of poliovirus while OPV covers serotypes 1 and 3.

IPV

- **Type of vaccine?**
 - Inactivated/whole cell
- **Route of administration?**
 - IM
- **To whom?**
 - Can be given to immunocompromised / contact with immunocompromised

OPV

- **Type of vaccine?**
 - Live attenuated
- **Route of administration?**
 - Oral
- **To whom?**
 - Can be given to immunocompromised / NOT contact with immunocompromised
- **Disadvantages?**
 - Vaccine associated paralytic polio

Side effects of the DTP vaccination

○ Mild (Common):

- **Fever, Redness, swelling, Soreness**
- more often **after the 4th and 5th doses**

○ Moderate Problems (Uncommon):

- **Seizure**
- Non-stop crying for 3 hours or more
- High fever

○ Severe Problems (Very Rare) :

- Serious allergic reaction
- Long-term **seizures**, coma, or lowered consciousness
- Permanent **brain damage**.

Absolute Contraindications:

1. Encephalopathy (e.g., coma, decreased level of consciousness; **prolonged seizures**) within 7 days of previous dose (to pertussis vaccine)
2. Anaphylactic reaction to a previous dose.

Relative contraindications:

1. **Progressive neurologic disorder (infantile spasms/ uncontrolled epilepsy/ progressive encephalopathy)**
2. **Temperature of 40.5° C or higher**
3. **Collapse or shock-like state**
4. **Seizure within 3 days**
5. **Persistent, inconsolable crying**

Vaccines not part of the Jordanian vaccination program

Pneumococcal vaccine

There are 2 types of pneumococcal vaccines against *Strep. pneumoniae*:

- A. **Pneumococcal conjugated vaccine(PCV13):** Given for children <2 years old and can be given for children older than 2 years?
1. Cystic fibrosis or chronic lung disease.
 2. Cochlear implants
 3. Patients with Splenectomy / Asplenia
 4. Immunocompromised patients (increased risk of infection)
 5. Nephrotic syndrome
 6. leaks of cerebrospinal fluid
 7. Sickle cell disease
- B. **Pneumococcal polysaccharide vaccine (PPV)/ Pneumovax:** Given to older children and adults.

Meningococcal vaccine

- What are the two types of meningococcal vaccine available in the US?:
 1. Tetravalent polysaccharide vaccine (MPSV4): For ages 2 years and up
 2. Tetravalent polysaccharide-protein conjugate vaccine (MCV4): Less than 2 years
- Both protect against serogroups A, C, Y, and W-135 of **Neisseria Meningitis**

Influenza vaccine

- Route of administration?
- IM → Killed
- Nasal spray → live attenuated

HUMAN MILK AND BREASTFEEDING RELATED ISSUES

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Types and Composition of Human Breast Milk

• Types Of Breast Milk:

1. **Colostrum or Early Milk:** is produced in the late stage of pregnancy till 4 days after delivery; and is rich in antibodies.

(highest protein, lowest fat and carbohydrate)

2. **Transitional Milk:** produced from day 4 — 10
(decreases protein, increases fat and carbohydrate)

3. **Mature milk:** is produced from approximately ten days after delivery up until the termination of the breastfeeding.

(lowest protein, highest fat carbohydrate)

- ❑ **Fore milk** Early milk — At the beginning of the feeding, got more lactose, proteins and water to satisfies the baby's thirst.
- ❑ **Hind milk** Late milk — at end of a feed and is richer in fat to satisfies the baby's hunger.

- Human milk = Contains Essential Fatty Acids, Enzyme Lipase, enough Vit A/B/C (predominantly Vit B in cow), Iron amount similar in cow milk but bitter absorption

- Breast feed benefits : **قراءة**

Fetal Protective Effect

- Diarrhea
- Type 1 diabetes mellitus
- UTI
- Allergy
- Obesity and overweight
- Infant mortality
- Septicemia
- Celiac disease

Maternal Benefits

- Decreased postpartum blood loss
- Rapid involution of the uterus
- Reduced risk of rheumatoid arthritis, hypertension, hyperlipidemia, cardiovascular disease, and diabetes
- Reduction in risk of breast and ovarian cancer

- How often will my newborn feed?
8-12 times per day
5-15 minutes per breast
- Indicators of successful feeding in babies: **قراءة**
 1. Frequent feedings 8-12 times daily.
 2. audible and visible swallowing
 3. sustained rhythmic suck
 4. relaxed arms and hands
 5. moist mouth regular soaked/heavy nappies, about 6-8 wet diapers in a 24 hour.
 6. Average daily weight gain of 20 -40g.
 7. Go to sleep and comfort after feeding.
- All breastfed infants should receive **400 IU** of **oral vitamin D drops** daily beginning during the first 2 months of life.
- administration of **IM Vit K** until after the first feeding is completed but within 6 h of birth

Absolute and Relative Contraindications to Breastfeeding Because of Maternal Health Conditions

1. HIV infection
2. TB infection (in first 2 weeks)
3. Varicella - zoster infection (avoided direct contact to lesion, give baby Ig)
4. Herpes simplex infection (avoided direct contact to lesion)
5. CMV infection (not contraindication)
6. Hepatitis B infection (give baby Ig and vaccine in first 12 h of birth, not contraindication)
7. Hepatitis C infection (not contraindication)
8. Alcohol intake (not contraindication)
9. Smoking (not contraindication)
10. Chemotherapy or radiopharmaceutical (contraindication)

Cow's Milk Protein Allergy CMPA

immune-mediated allergic response to proteins in milk

Therapeutic area	Symptoms		
Gastrointestinal	<ul style="list-style-type: none"> • Frequent regurgitation • Vomiting • Diarrhea • Constipation • Blood in stool without failure to thrive 	Respiratory	<ul style="list-style-type: none"> • Runny nose • Recurrent otitis media • Chronic cough • Broncho-constriction unrelated to infection
Dermatological	<ul style="list-style-type: none"> • Atopic dermatitis • Swelling of lips or eye lids • Urticaria unrelated to acute infections, drug intake, or other causes 	General	<ul style="list-style-type: none"> • Persistent distress • Colic (≥ 3 h/day wailing/irritable) over a period of >3 weeks

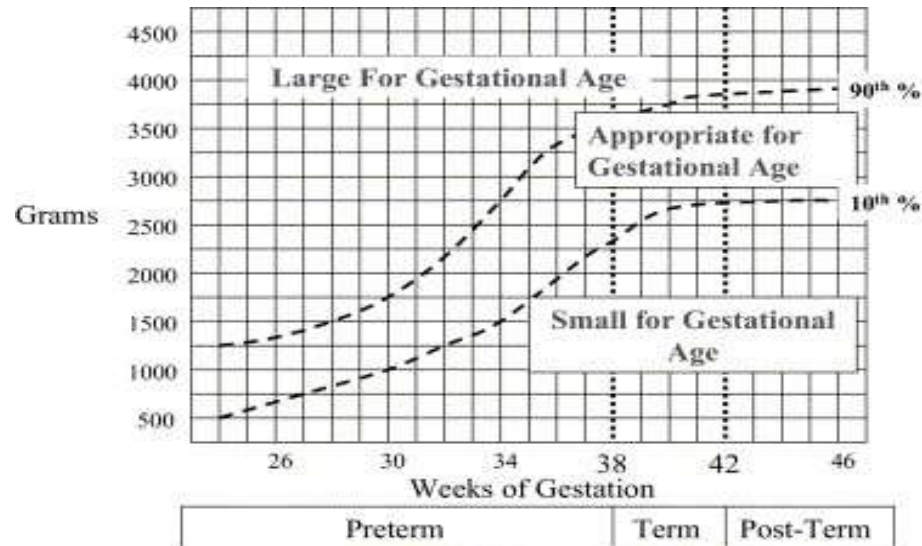
Gestational age

Table 11.1 Gestational age bands and their incidence.

Gestational age (weeks after LMP)	Terminology
>42 weeks	Post term
37–42 weeks	Term
<37 weeks	Preterm
34–36 weeks	Late preterm ^b
32–34 weeks	Moderately preterm ^b
28–32 weeks	Very preterm ^b
<28 weeks	Extreme preterm ^b
≤24 weeks	Threshold of viability

Macrosomia	• More than 4000 gm
Normal	• Between 2500 – 4000 gm
Low birth weight	• Less than 2500 gm • More than 1500 gm
Very low birth weight	• Less than 1500 gm. • More than 1000 gm.
Extremely low birth weight	• Less than 1000 gm.

Definitions AGA, SGA, and LGA



IntraUterine Growth Restriction (IUGR)

- A **fetus** with an estimated fetal weight (EFW) **<10%** of gestational age With Intrauterine abnormality
 - **Symmetric fetal growth restriction**
 - (head circumference, height, and weight all <10th percentile).
 - Is due to either decreased growth potential of the fetus (congenital infection or genetic disorder) **very early** in pregnancy.
 - **Asymmetric fetal growth restriction (more common).**
 - brain growth is usually normal.
 - Common etiologies include uteroplacental insufficiency, maternal malnutrition, and extrinsic conditions appearing **late** in pregnancy.
- Complications of IUGR:
 1. **Hypoxia and asphyxia**
 2. **Hypothermia.**
 3. **Metabolic: Hypoglycemia or Hyperglycemia, Hypocalcemia.**
 4. **Liver disease.** (e.g. Hypertriglyceridemia)
 5. **Hematologic disorders.** (e.g. Hyperviscosity and polycythemia)
 6. **Altered immunity.**