Principle of Immunization

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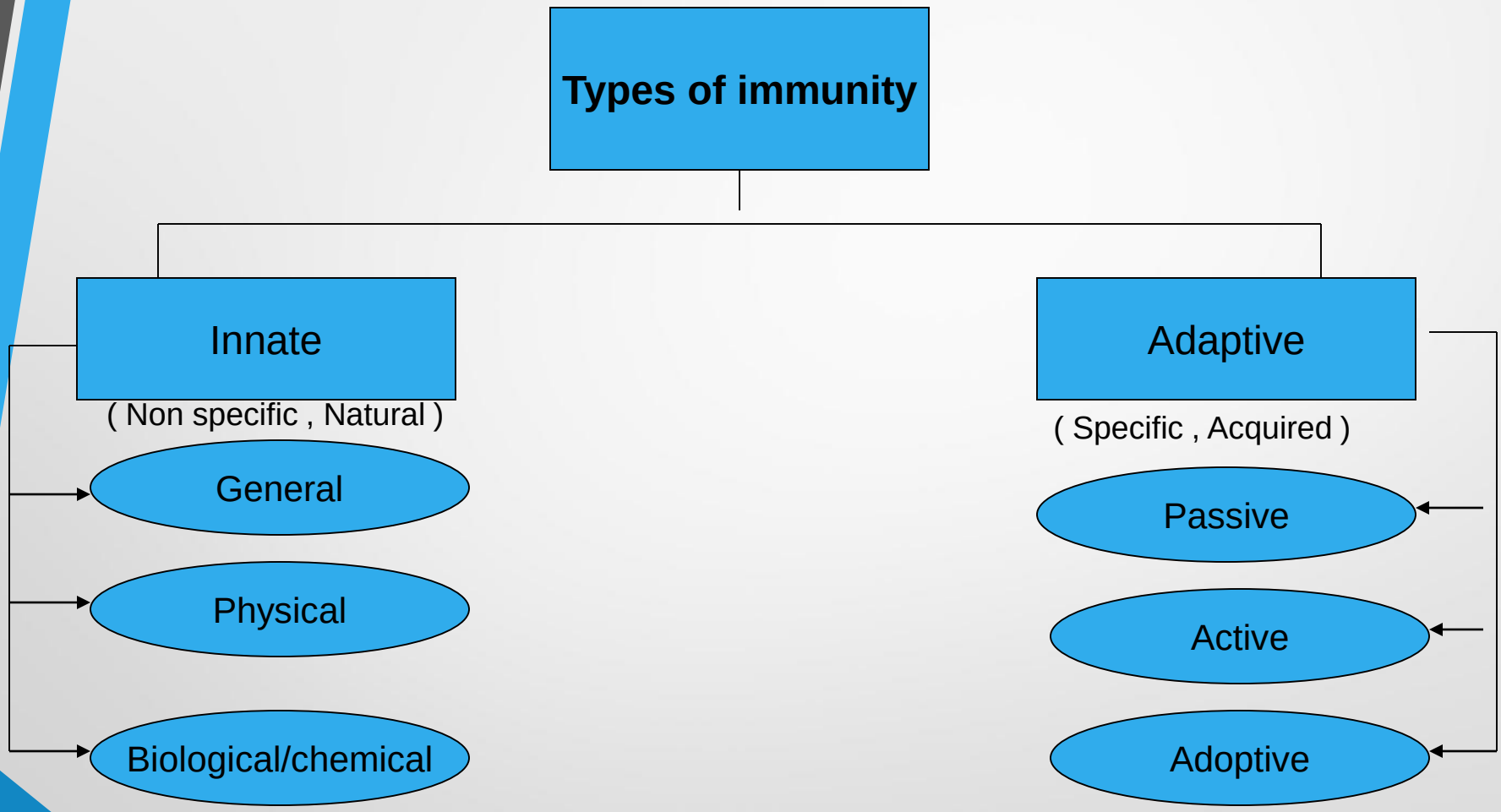
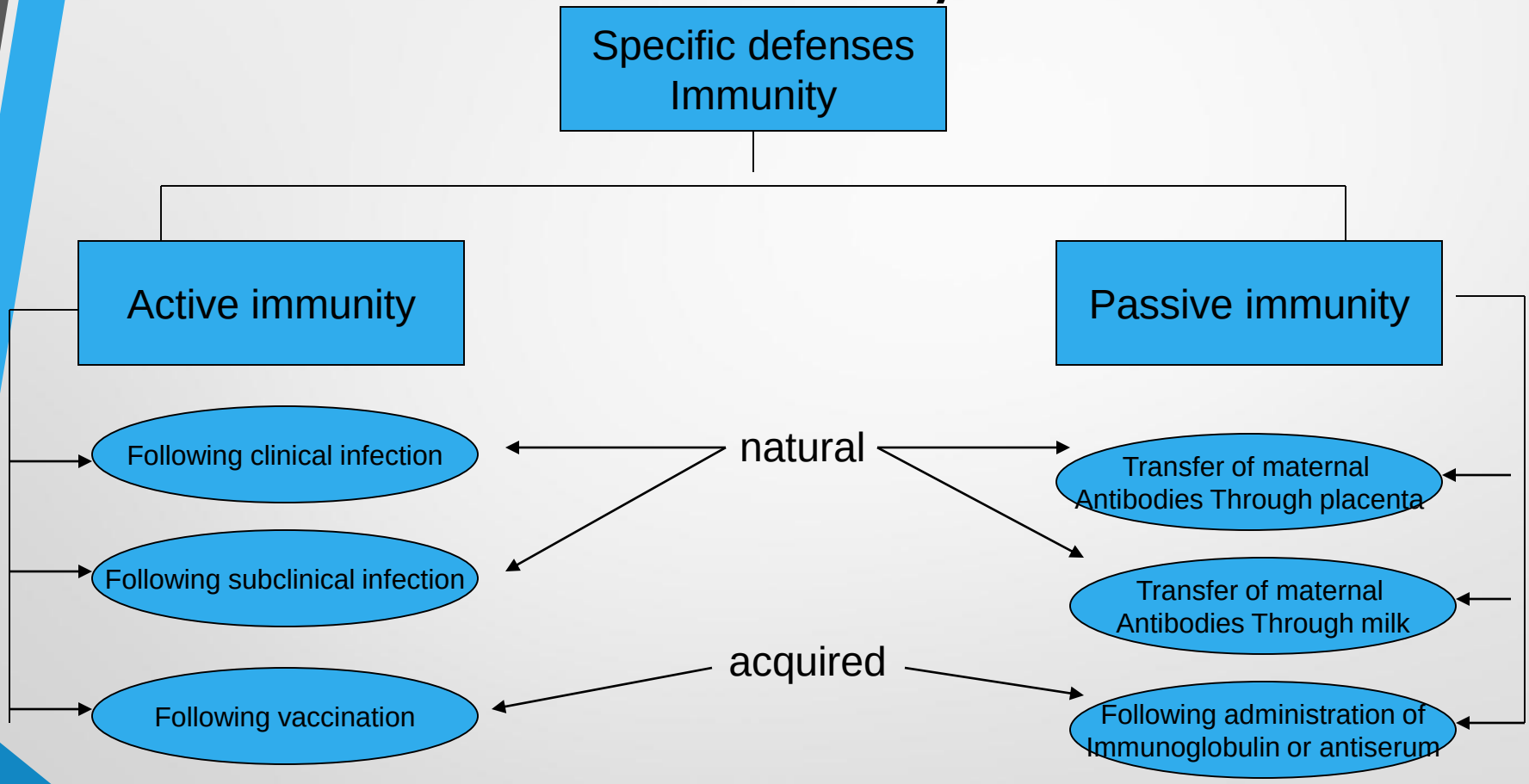
Agenda

- Types of immunity
- Principles of Vaccination
- Vaccination definition
- Types of vaccine
- Scheme of immunization
- Cold chain
- Adverse events
- Precautions


Types of immunity
Innate
(Non specific , Natural)
General
Physical
Biological/chemical
Adaptive
(Specific , Acquired)
Passive
Active
Adoptive

Immunity


Specific defenses
Immunity
Active immunity
Passive immunity
Following clinical infection
Following subclinical infection
Following vaccination
natural
acquired
Transfer of maternal
Antibodies Through placenta
Transfer of maternal
Antibodies Through milk
Following administration of
Immunoglobulin or antiserum

Active immunity

- Resistance developed in response to stimulus by an antigen (infecting agent or vaccine) and is characterized by the production of antibodies by the host.

Passive immunity

- Immunity conferred by an antibody produced in another host.
- It may be acquired naturally or artificially (through an antibody-containing preparation).

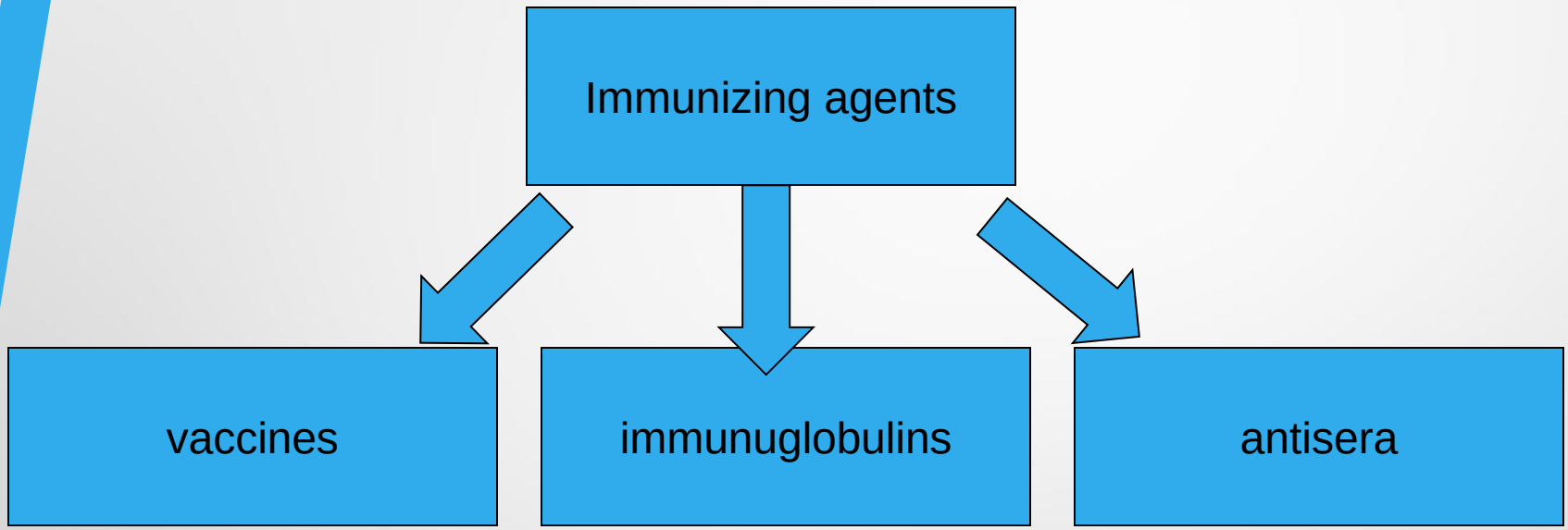
Principles of Vaccination

- The primary goal in vaccination is to provide protective immunity by inducing a memory response to an infectious microorganism using a non-toxic antigen preparation. It is important to produce immunity of the appropriate kind: antibody / or cellular immunity.
- Antibodies produced as a result of immunization are effective primarily against extracellular organisms and their products e.g., toxins. Passively administered antibodies have the same effect as induced antibodies.
- Cell-mediated immunity (T cells, macrophages) induced by vaccination is important particularly in preventing intracellular bacterial and viral infections and fungal infections.
- The ultimate goal of any immunization program is the eradication of the disease.

Principles of Vaccination

- This requires that the infection is limited only to humans, with no animal or environmental reservoir, and the absence of any subclinical or carrier state in humans.
- Achieving elimination requires a high level of herd immunity to prevent person to person spread.
- This requires considerable infrastructure support to ensure that all at-risk populations are targeted for immunization.
- This has been achieved for small pox, although we are close to the eradication of polio.

Immunizing agents



Immunoglobulins

- There are 5 major classes: IgM, IgA, IgG, IgE, IgD.
- Two types of immunoglobulin preparations are available for passive immunization:
  - Normal human immunoglobulin
  - Specific (hyper-immune) human immunoglobulin

Antisera or antitoxins

- These are materials prepared in animals or non human sources such as horses.

Immunoglobulin and antiserum (Passive immunity)

Human normal immunoglobulin	Human specific immunoglobulin	Non human Ig (antisera)
Hepatitis A Measles Rabies Tetanus Mumps	Hepatitis B Varicella Diphtheria	Diphtheria Tetanus Gas gangrene Botulism Rabies

Vaccination

- Vaccination is a method of giving antigen to stimulate the immune response through active immunization.
- A vaccine is an immuno-biological substance designed to produce specific protection against a given disease.
- A vaccine is “antigenic” but not “pathogenic”.

Types of vaccines

- Live vaccines
- Attenuated live vaccines
- Inactivated (killed vaccines)
- Toxoids
- Polysaccharide and polypeptide (cellular fraction) vaccines
- Surface antigen (recombinant) vaccines.

Live vaccines

- Live vaccines are made from live infectious agents without any amendment.
- The only live vaccine is small pox vaccine, made of live vaccinia cow-pox virus (not smallpox virus) which is not pathogenic but antigenic, giving cross immunity for smallpox.

Live attenuated (avirulent) vaccines

- Virulent pathogenic organisms are treated to become attenuated and avirulent but antigenic. They have lost their capacity to induce full-blown disease but retain their immunogenicity.
- Live attenuated vaccines should not be administered to persons with suppressed immune response due to:
  - Leukemia and lymphoma
  - Other malignancies
  - Receiving corticosteroids and anti-metabolic agents
  - Radiation
  - pregnancy

Inactivated (killed) vaccines

- Organisms are killed or inactivated by heat or chemicals but remain antigenic.
- They are usually safe but less effective than live attenuated vaccines.
- The only absolute contraindication to their administration is a severe local or general reaction to a previous dose.

Toxoids

- They are prepared by detoxifying the exotoxins of some bacteria rendering them antigenic but not pathogenic.
- Adjuvant (e.g. aluminum precipitation) is used to increase the potency of vaccine.
- The antibodies produces in the body as a consequence of toxoid administration neutralize the toxic activity produced during infection rather than act upon the organism itself.
- In general toxoids are highly efficacious and safe immunizing agents.

Polysaccharide and polypeptide (cellular fraction) vaccines

- They are prepared from extracted cellular fractions e.g. meningococcal vaccine from the polysaccharide antigen of the cell wall, the pneumococcal vaccine from the polysaccharide contained in the capsule of the organism, and hepatitis B polypeptide vaccine.

- Their efficacy and safety appear to be high.

Surface antigen (recombinant) vaccines.

- It is prepared by cloning HBsAg gene in yeast cells where it is expressed.
- HBsAg produced is then used for vaccine preparations.
- Their efficacy and safety also appear to be high.

Types of vaccines

Live vaccines	Live Attenuated vaccines	Killed Inactivated vaccines	Toxoids	Cellular fraction vaccines	Recombinant vaccines
•Small pox variola vaccine	•BCG •Typhoid oral •Plague •Oral polio •Yellow fever •Measles •Mumps •Rubella •Intranasal Influenza •Typhus	•Typhoid •Cholera •Pertussis •Plague •Rabies •Salk polio •Intra-muscular influenza •Japanise encephalitis	•Diphtheria •Tetanus	•Meningococcal polysaccharide vaccine •Pneumococcal polysaccharide vaccine •Hepatitis B polypeptide vaccine	•Hepatitis B vaccine

Routes of administration

- Deep subcutaneous or intramuscular route (most vaccines)
- Oral route (sabine vaccine, oral BCG vaccine)
- Intradermal route (BCG vaccine)
- Scarification (small pox vaccine)
- Intranasal route (live attenuated influenza vaccine)

Scheme of immunization

- Primary vaccination
  - One dose vaccines (BCG, smallpox, yellow fever)
  - Multiple dose vaccines (polio, DPT, hepatitis B)
- Booster vaccination

  To maintain immunity level after it declines after some time has elapsed (DT, MMR).

Periods of maintained immunity due to vaccines

- Short period (months): cholera vaccine
- Two years: TAB vaccine
- Three to five years: DPT vaccine
- Five or more years: BCG vaccine
- Ten years: yellow fever vaccine
- Solid immunity: measles, mumps, and rubella vaccines.

Levels of effectiveness

- Absolutely protective(100%): yellow fever vaccine
- Almost absolutely protective (99%): Smallpox, measles, mumps, rubella vaccines, and diphtheria and tetanus toxoids.
- Highly protective (80-95%): polio, BCG, Hepatitis B, and pertussis vaccines.
- Moderately protective (40-60%) TAB, cholera vaccine, and influenza killed vaccine.

The Cold Chain

- The "cold chain" is a system of storage and transport of vaccines at low temperature from the manufacturer to the actual vaccination site.
- The cold chain system is necessary because vaccine failure may occur due to failure to store and transport under strict temperature controls.

Cold chain

- Among the vaccines, polio is the most sensitive to heat, requiring storage at minus 20 degree C.
- Vaccines which must be stored in the freezer compartment are : polio and measles.
- Vaccines which must be stored in the COLD PART but never allowed to freeze are : typhoid, DPT, tetanus toxoid, DT, BCG and diluents

Adverse events

- No immune response is entirely free from the risk of adverse reactions or remote squeal. The adverse reactions that may occur may be grouped under the following heads:

1. *Reactions inherent to inoculation*
2. *Reactions due to faulty techniques*
3. *Reactions due to hypersensitivity*
4. *Neurological involvement*
5. *Provocative reactions*
6. Others

1. Reactions inherent to inoculation:

- These may be local general reactions. The local reactions may be pain, swelling, redness, tenderness and small nodule or sterile abscess.
- The general reactions may be: fever, malaise, headache and other constitutional symptoms.
- Most killed bacterial vaccines (e.g., typhoid) cause some local and general reactions.
- Diphtheria and tetanus toxoids and live polio vaccine cause little reaction.

2. Reactions due to faulty techniques:

Faulty techniques may relate to

- faulty production of vaccine (e.g. inadequate inactivation of the microbe, inadequate detoxication),
- improper immunization site or route,
- vaccine reconstituted with incorrect diluents,
- wrong amount of diluent used,
- drug substituted for vaccine or diluent,
- vaccine prepared incorrectly for use (e.g., an adsorbed vaccine not shaken properly before use),
- vaccine or diluent contaminated,
- vaccine stored incorrectly,
- contraindications ignored (e.g. a child who experienced a severe reaction after a previous dose of DPT vaccine is immunized with he same vaccine), reconstituted vaccine of one session of immunization used again at the subsequent session.

3. Reactions due to hypersensitivity:

- Administration of antisera may occasionally give rise to anaphylactic shock and serum sickness.
- Many viral vaccines contain traces of various antibiotics used in their preparation and some individuals may be sensitive to the antibiotic which it contains.
- Anaphylactic shock is a rare but dangerous complication of injection of antiserum.
- The symptoms may appear within a few minutes of injection or may be delayed up to 2 hours.
- Some viral vaccines prepared from embryonated eggs (e.g., influenza) may bring about generalized anaphylactic reactions.

4. Neurological involvement:

- Neurotic manifestations may be seen after the administration of serum or vaccine.
- The well-known examples are the post-vaccine encephalitis and encephalopathy following administration of anti -rabies and smallpox vaccines.

5. Provocative reactions:

- Occasionally following immunization there may occur a disease totally unconnected with the immunizing agent (e.g., provocative polio after DPT or DT administration against diphtheria).
- The mechanism seems to be that the individual is harboring the infectious agent and the administration of the vaccine shortens the incubation period and produces the disease.

6. *Others:*

- These may comprise damage to the fetus (e.g., with rubella vaccination); displacement in the age-distribution of a disease (e.g., a potential problem in mass vaccination against measles, rubella and mumps).

PRECAUTIONS TO BE TAKEN

- Before administration of the antiserum or antitoxin, it is necessary to test for sensitivity reaction. This can be done in 2 ways:

(a) instilling a drop of the preparation into the conjunctival sac. A sensitized person will develop pricking of the conjunctiva.

(b) a more reliable way of testing is by intradermal injection of 0.2 ml of antiserum diluted 1 : 10 with saline. A sensitized patient will develop a wheal and flare within 10 minutes at the site of injection. It should be borne in mind that these tests are not infallible.

The risk of adverse reactions can be reduced by:

- Proper sterilization of syringes and needles, by proper selection of the subject and the product.
- Measles and BCG vaccines should be reconstituted only with the diluent supplied by the manufacturer.
- Reconstituted vaccine should be discarded at the end of each immunization session, no other drug and substances should be stored beside vaccines.
- Training of immunization worker and their close supervision.

جدول التطعيمات الوطني
National Immunization Schedule

Visit	Vaccine	التطعيم	موعد الزيارة
At Birth	BCG - Hepatitis B		عند الولادة
2 Months	Hexavalent(IPV,Hib,DTP,Hepatitis B) PCV -RV		عمر شهرين
4 Months	Hexavalent(IPV,Hib,DTP,Hepatitis B) PCV -RV		عمر ٤ أشهر
6 Months	Hexavalent(IPV,Hib,DTP,Hepatitis B) PCV		عمر ٦ أشهر
9 Months	Measles-Meningococcal		عمر ٩ أشهر
12 Months	OPV-MMR-PCV-Meningococcal		عمر ١٢ شهر
18 Months	OPV-MMR-Hib-Varicella Hepatitis A-DTP		عمر ١٨ شهر
24 Months	Hepatitis A		عمر ٢٤ شهر
Vaccination on entry first class of primary school	OPV-DTP-MMR-Varicella		جرعات التطعيم عند دخول الصف الأول الابتدائي من المدارس

يعطى اللقاح الكتيري ابتداءا من ...

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THANK YOU