

Vaccines

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Vaccine

- An immunological preparation that provides specific protection against a given disease.
- Following vaccination, the immunogen stimulates the immune system of the body to produce active immunity in the form of protective antibody and/or immunocompetent T cell response.

Vaccination:- is a simple, safe, and effective way of protecting people against harmful diseases.

Edward Jenner is credited for the modern concept of vaccination

Types of vaccine

- ❖ Live Attenuated Vaccine
- ❖ Inactivated or Killed vaccine
- ❖ Toxoid vaccine
- ❖ Extracted or cellular fractions vaccine
- ❖ Subunit vaccine
- ❖ Combinations
- ❖ DNA vaccine
- ❖ Edible vaccine

Live Attenuated Vaccine

- Contain modified strains of pathogen that have been weakened but are able to multiply within the body and remain antigenic enough to induce a strong immune response
- Attenuation is achieved by passing the live organisms serially through a foreign host, such as chick embryo, tissue culture or live animals
- More potent immunizing agent compared to killed vaccines
- Most live vaccines are given in single dose format.
- Should not be administered in individuals with immunodeficiency diseases or any conditions that suppresses the immunity such as leukemia, corticosteroid drugs use, lymphoma, malignancies
- Risk of gaining the virulence

Eg:- BCG, Oral typhoid (Ty21a)

Inactivated or Killed vaccine

- It consists of organisms which are killed or inactivated by a chemical treatment or heat
- Generally safer but less efficacious than live vaccines
- Booster dose may be needed
- Adjuvants increase immunogenicity of the vaccine antigen

Eg:- Pertussis, Cholera, Plague

Characteristics of Live and killed Vaccine

Characteristics	Live Vaccine	Killed Vaccine
Number of doses	Single	Multiple
Need of adjuvant	No	Yes
Duration of immunity	Longer	Shorter
Immunoglobulins Produced	IgA and IgG	IgG
Mucosal immunity	Induced	Absent
Reverts back to virulent form	Possible	No
Interference by other microorganisms in host	Possible	No
Stability at room temperature	Low	High
Immunodeficiency and Pregnancy	Unsafe	Safe

Toxoid vaccine

- Exotoxins produced by certain bacteria can be detoxicated to form toxoid by treating with acidic pH, formalin or by prolonged storage
- Toxoid is a form of toxin that loses its virulence property but retains immunogenicity

eg: Diphtheria toxoid and Tetanus toxoid

Extracted or cellular fractions vaccine

- Vaccines prepared from extracted cellular fractions
- Meningococcal vaccine, Pneumococcal vaccine and *Haemophilus influenza* type b vaccine
- All are prepared from the capsular polysaccharide antigens of the respective organism

Subunit vaccine

- Only a particular component or subunit of the organism that best stimulate the immune system is used
- Eg. HBsAg is the immunogenic component of HBV

Combinations

- If more than one immunizing agents are included in a vaccine preparation, it is called combined vaccine
- Simplify administration
- Augment the immunogenicity of the immunogen

Eg: in DPT vaccine, pertussis component acts as adjuvant which increases the immunogenicity of both diphtheria toxoid and tetanus toxoid

DNA vaccine

- Small pieces of DNA containing genes from the pathogenic microorganism are injected into the host
- The gene of interest gets integrated with the host cell genome and starts transcribing the proteins against which the host cell mounts an immune response
- Several vaccine trials are going on based on DNA vaccines

Edible vaccine

- Orally active antigenic protein is isolated from the pathogen and is transferred to suitable plant bacteria, which are then used to infect a plant
- Antigens or antibodies expressed in plants
- Oral administration
- Cheaper
- Exhibit good genetic stability
- Still under experimental stage

Eg: Edible banana against Norwalk virus

others

- mRNA vaccine:
 - Uses messenger RNA(mRNA) which corresponds to certain protein rather than actual part of bacteria or virus
 - Example: Pfizer-bioNtech and Moderna COVID-19 vaccine
- Viral Vector vaccine:
 - utilize viruses to deliver genes that encode vaccine antigens into host cells
 - vector is a virus different from the one the vaccine is targeting (for example, an adenovirus)
 - Example: Astrazeneca, Johnson and Johnson/janssen vaccine for COVID-19

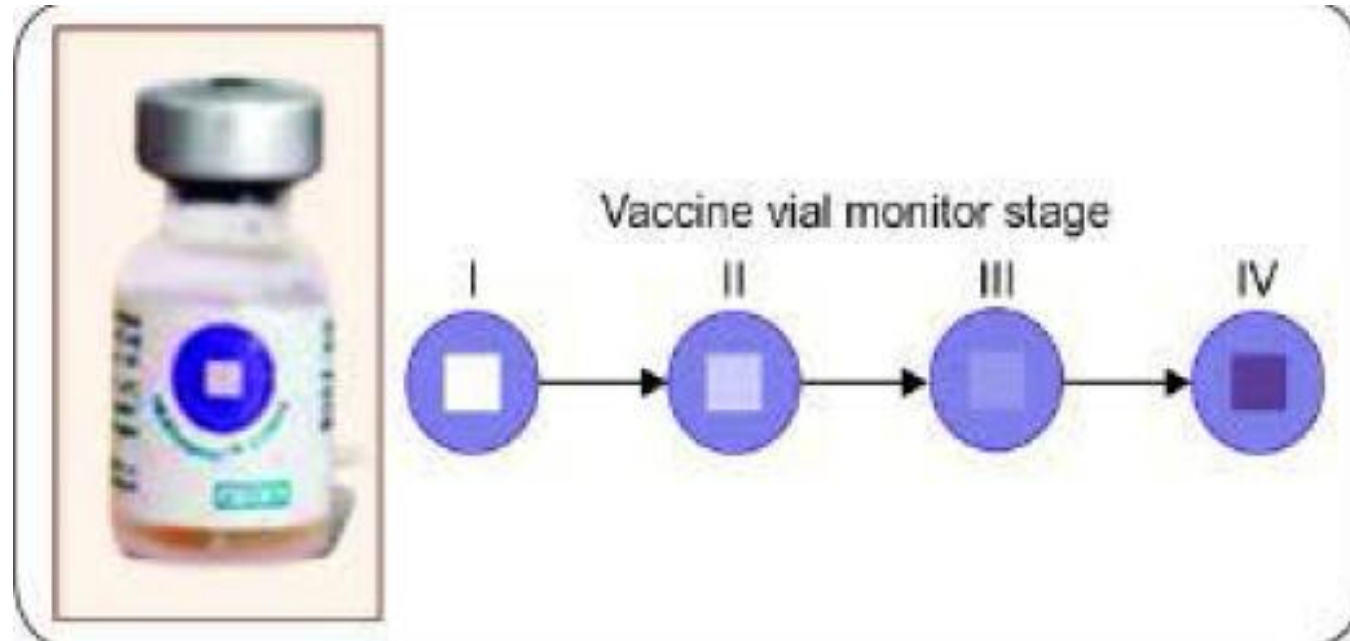
Cold chain

- Refers to a system of transport, storage and handling of vaccines starting at the manufacturer level and ending with the site of administration of the vaccine to the client
- Optimum temperature: +2°C to +8°C
- For frozen vaccines: -15°C
- Needs protection from light
- Freezer compartment: polio and measles
- Stored in Cold part but never allowed to freeze : DPT, BCG, Hepatitis B, *H.influenza* type b

Vaccine vial Monitor

- It is a tool to monitor the stability/potency of a vaccine and to check the efficiency of cold chain
- It is heat sensitive label lining the vaccine vial
- It contains an outer blue circle and an inner white square
- Changes its colour gradually from white towards blue with increase in time and temperature

Staging of vaccine vial monitor



	Inner square	Outer circle	Vaccine
Stage 1	White	Blue	Can be used
Stage 2	Light blue	Blue	Can be used
Stage 3	Blue	Blue	Discard
Stage 4	Dark blue	Blue	Discard

EPI Schedule of Nepal (2022)

S.N	Vaccine	Age of administration	Dose	Protect against
1.	Bacillus Calmette Guerin (BCG)	At birth	1	Tuberculosis
2.	Pentavalent vaccine (Diphtheria, Pertussis, Tetanus, Hep-B, Hib	6, 10 and 14 Wks	3	Diphtheria, Pertussis, Tetanus, Hep-B, Hib
3.	Oral polio vaccine (OPV)	6, 10 and 14 Wks	3	Polio
4.	Pneumococcal Conjugate Vaccine (PCV)	6, 10 wks and 9 months	3	Pneumococcal diseases
5.	Rotavirus Vaccine	6,10 wks	2	Rota virus diarrhea
6.	Fractional Injectable Polio vaccine	Children under 1yr: 14 weeks, 9months Children below 5yr(missed dose): 2doses separated by 4months	2	Polio
7.	MR (Measles- Rubella)	9 and 15 months	2	Measles and Rubella
8.	Japanese Encephalitis (JE)	12 months	1	Japanese Encephalitis
9	Typhoid conjugate vaccine	15 months	1	Typhoid

THANK YOU