Vaccination

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Learning objectives

- At the end of this presentation the students of 3rd shall be able to:
- Explain the importance of vaccination in the control of infectious diseases
- Describe the basic principles of vaccination
- List the main types of vaccine with examples
- Describe vaccines associated with adverse reactions
- Explain the difference between live attenuated and inactivated vaccines

Cont.

- Explain the role of vaccines in preventing disease.
- Differentiate between vaccination and immunization.
- Describe the strategies used from community medicine's perspective to promote vaccination in communities.
- Explain various programs of vaccination in Pakistan with particular reference to EPI.
- Describe the factors responsible for success and failure of vaccination programs in Pakistan.

Vaccine:

- A substance used to stimulate the production of antibodies and provide immunity against one or several diseases.
- Prepared from the causative agent of a disease, its products, or a synthetic substitute, treated to act as an antigen without inducing the disease.

Mechanism

1

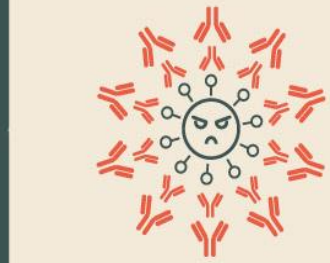
The **vaccine** introduces an **inactivated/weakened form of the virus/bacteria** into the body

2

The body's immune system **produces antibodies** to defend against the virus/bacteria

3

When the real active virus/bacteria enters the body, it is **recognized by the defense system which may eliminate it**



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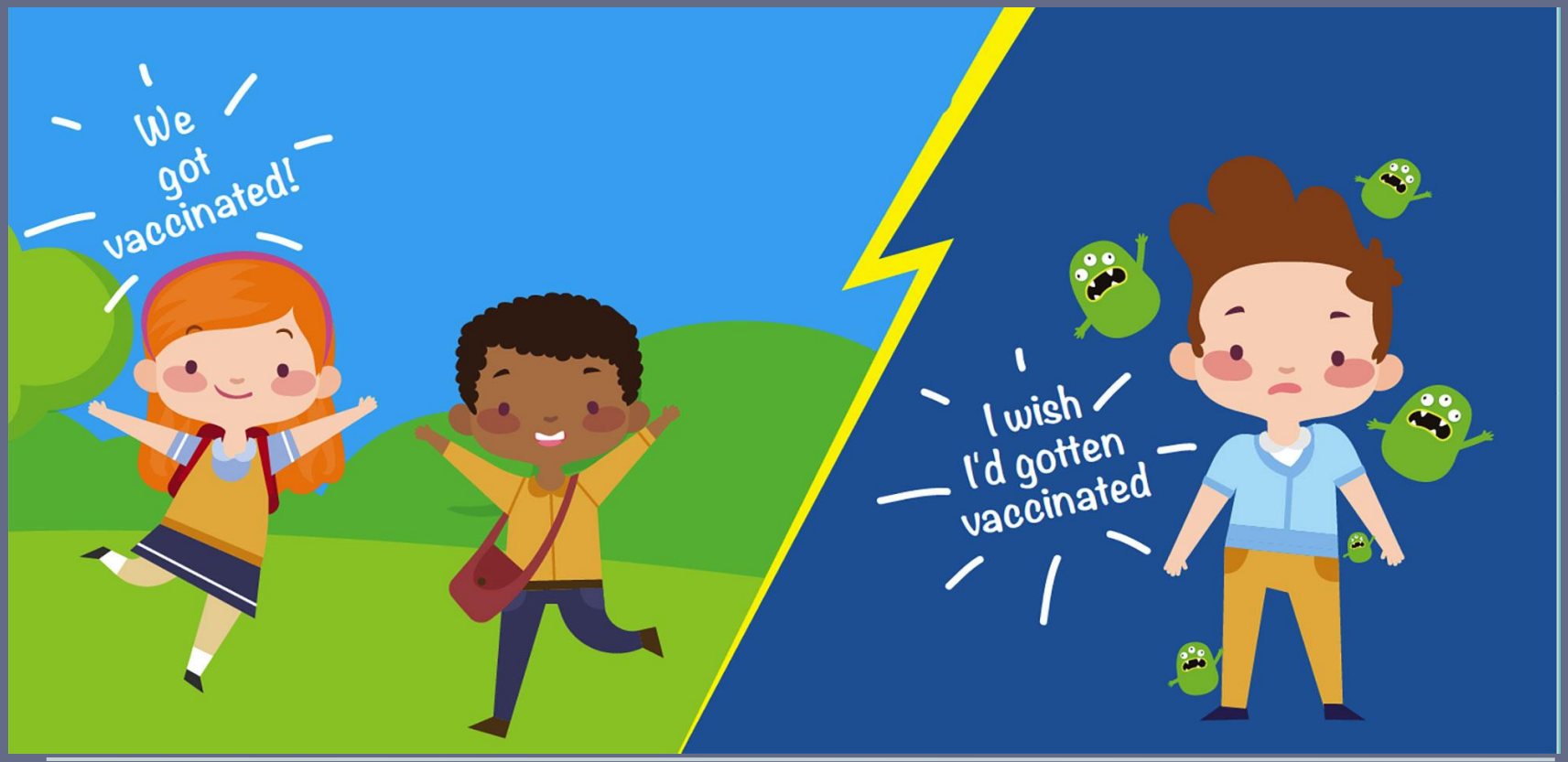
Vaccines enhance your body's natural defenses, without causing illness



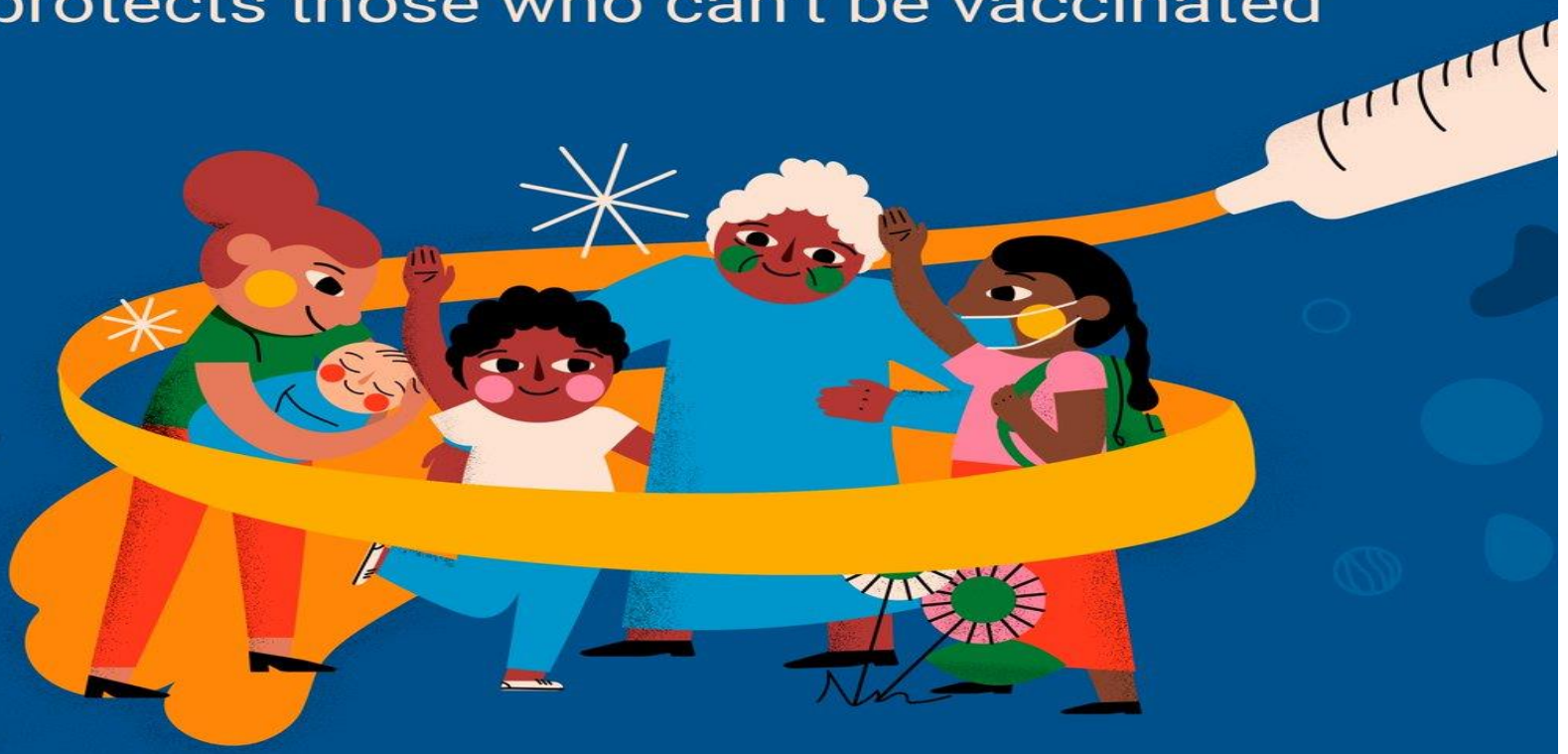
Importance of vaccination in the control of infectious diseases:

- Vaccination is one of the most **effective and cost efficient** medical technology, resulting in the **control, elimination or near elimination** of numerous infectious diseases e.g. (small pox eliminated/polio is near for elimination)
- Vaccines also protects from serious illness and death
- Prevent the outbreak of infectious diseases

- Saves between 2 - 3 million children's lives/year.
- Today vaccines are available to protect against diseases, such as diphtheria, tetanus, pertussis, measles etc.
- However, 1 in 5 children still miss out on routine life-saving immunization.

Vaccines protect individuals and communities.

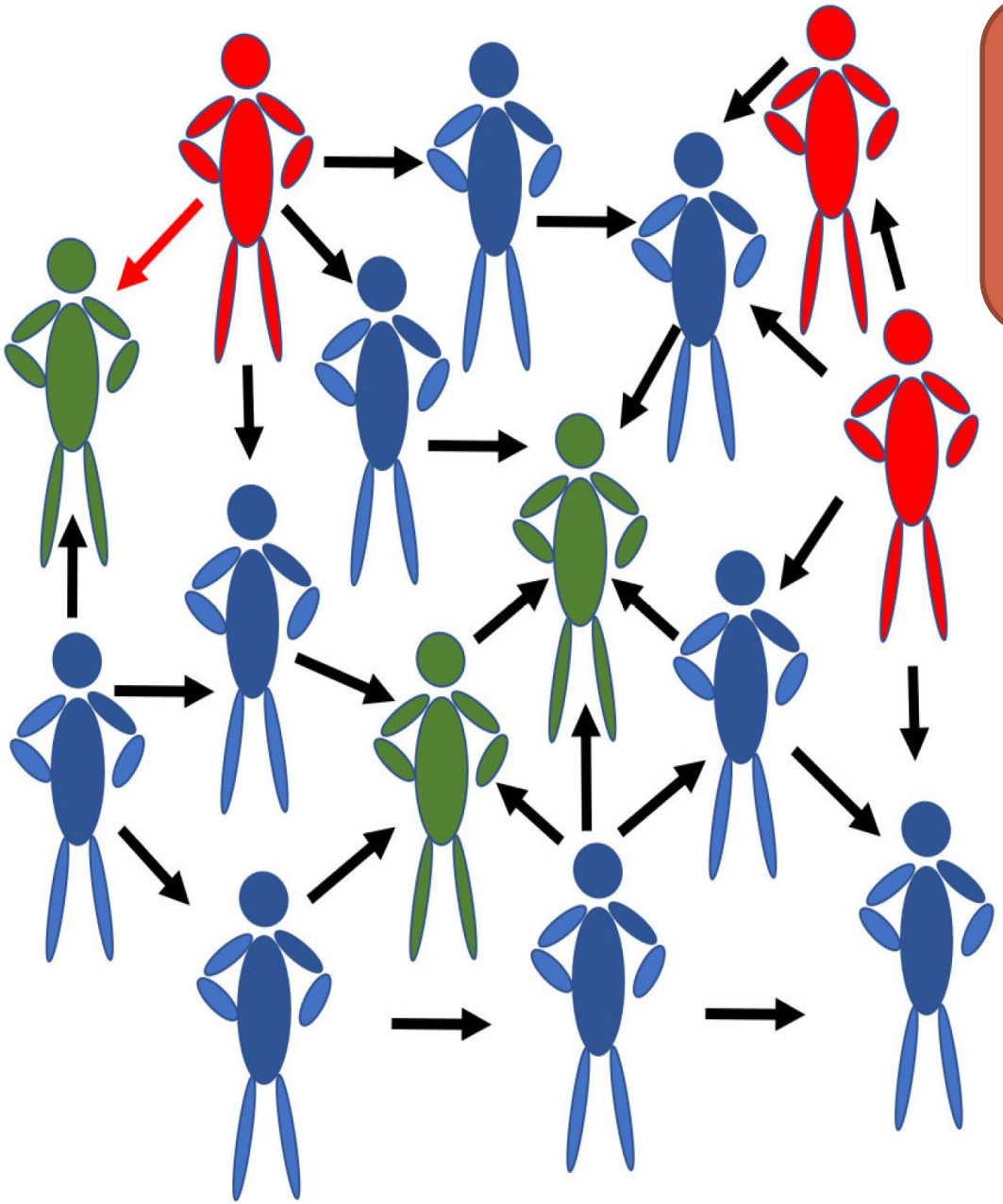
Vaccination not only protects you.
It protects those who can't be vaccinated



#VaccinesWork for All

World Health Organization

Herd immunity



COVID-19 POSITIVE

VACCINED OR IMMUNIZED

UNPROTECTED

NO VIRUS SPREADING

VIRUS SPREADING

Herd immunity by vaccination

- It is a form of immunity that occurs when the vaccination of a significant portion of a population (or herd) provides a measure of protection for individuals who cannot be vaccinated.
- These include too young children or too old or Immunocompromised individuals, (such as patients suffering from cancer/HIV).

- The proportion of the population which must be immunised in order to achieve herd immunity varies for each disease but the underlying idea is simple: (once enough people are protected, they help to protect vulnerable members of their communities by reducing the spread of the disease).
- E.g. Herd immunity for measles is about 95% of people to be vaccinated
- However, when immunisation rates fall, herd immunity breaks down leading to an increase in the number of new cases. For example, measles outbreaks Pakistan.

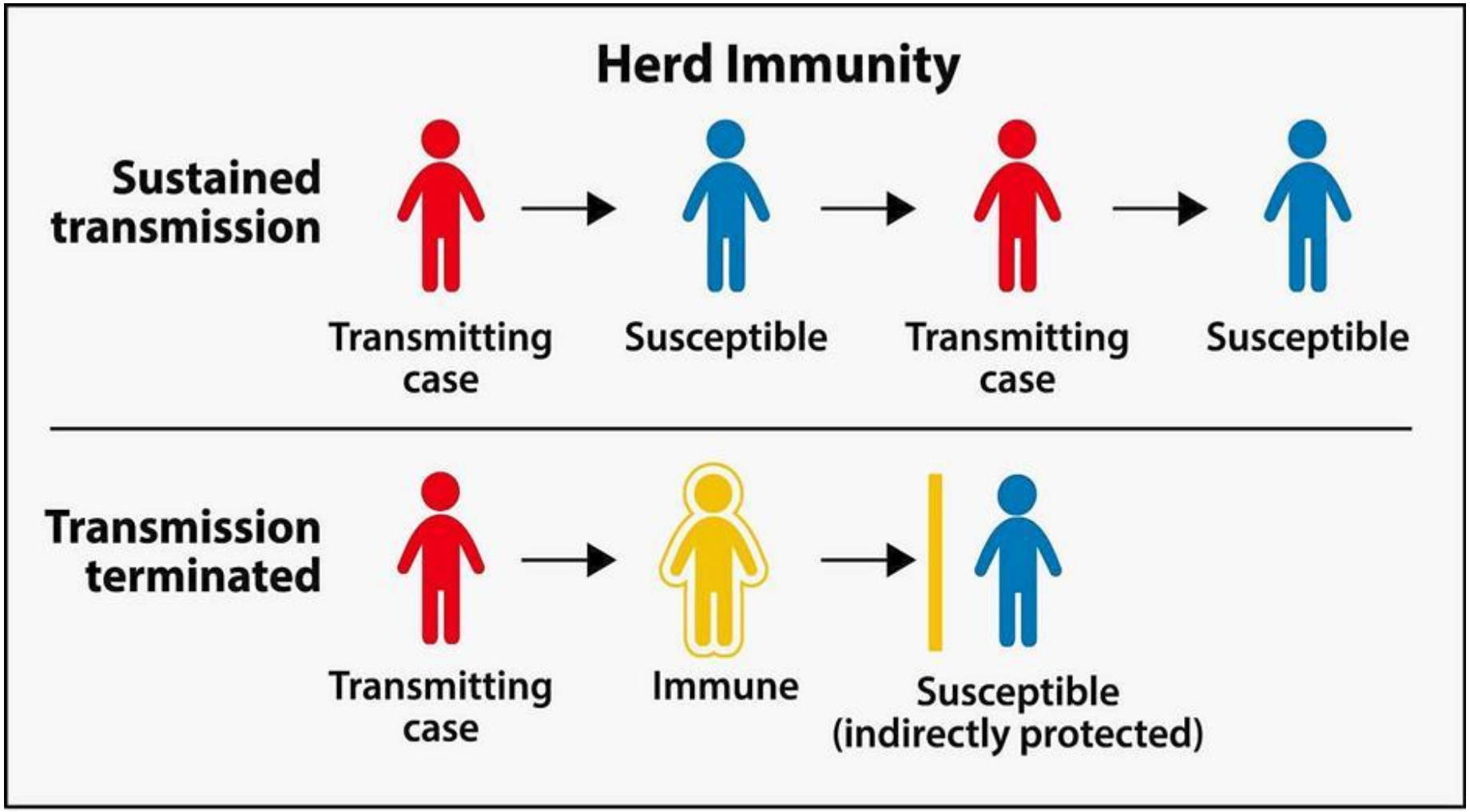
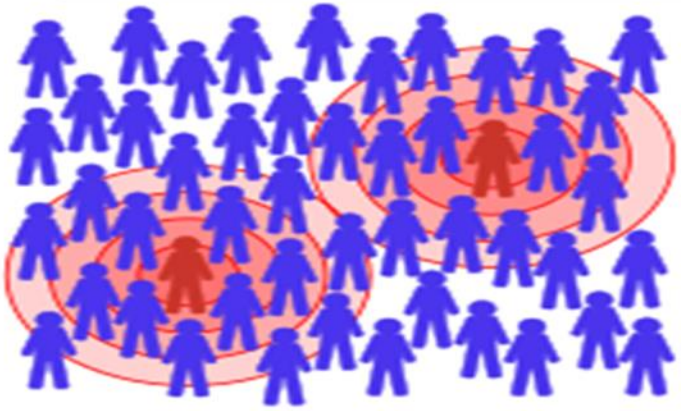


Figure - The principle underlying herd immunity is that the presence of enough immune persons in a community interrupts the transmisssion of an infectious agent, thereby providing indirect protection for unimmunized (or "susceptible") persons.

= not immunized, but still healthy

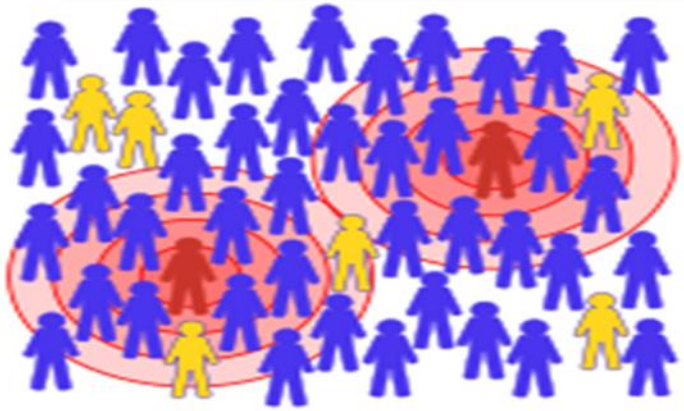
= immunized and healthy

= not immunized, sick, and contagious



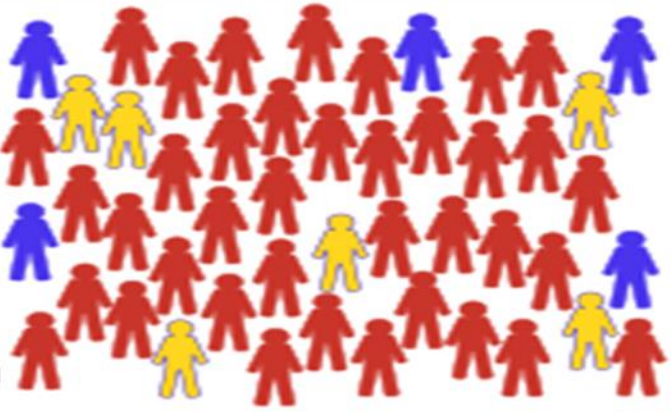
No one is immunized.

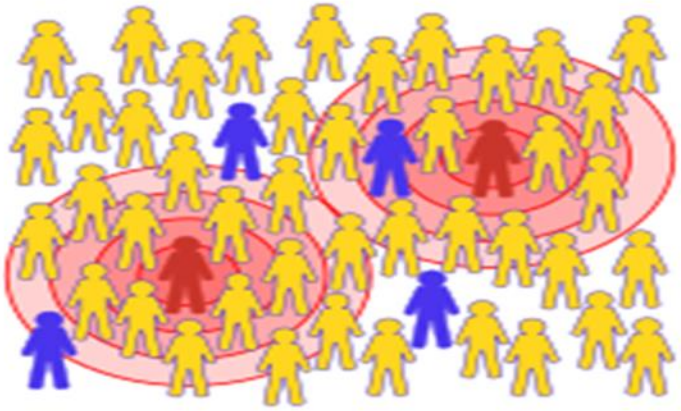
Contagious disease spreads through the population.



Some of the population gets immunized.

Contagious disease spreads through some of the population





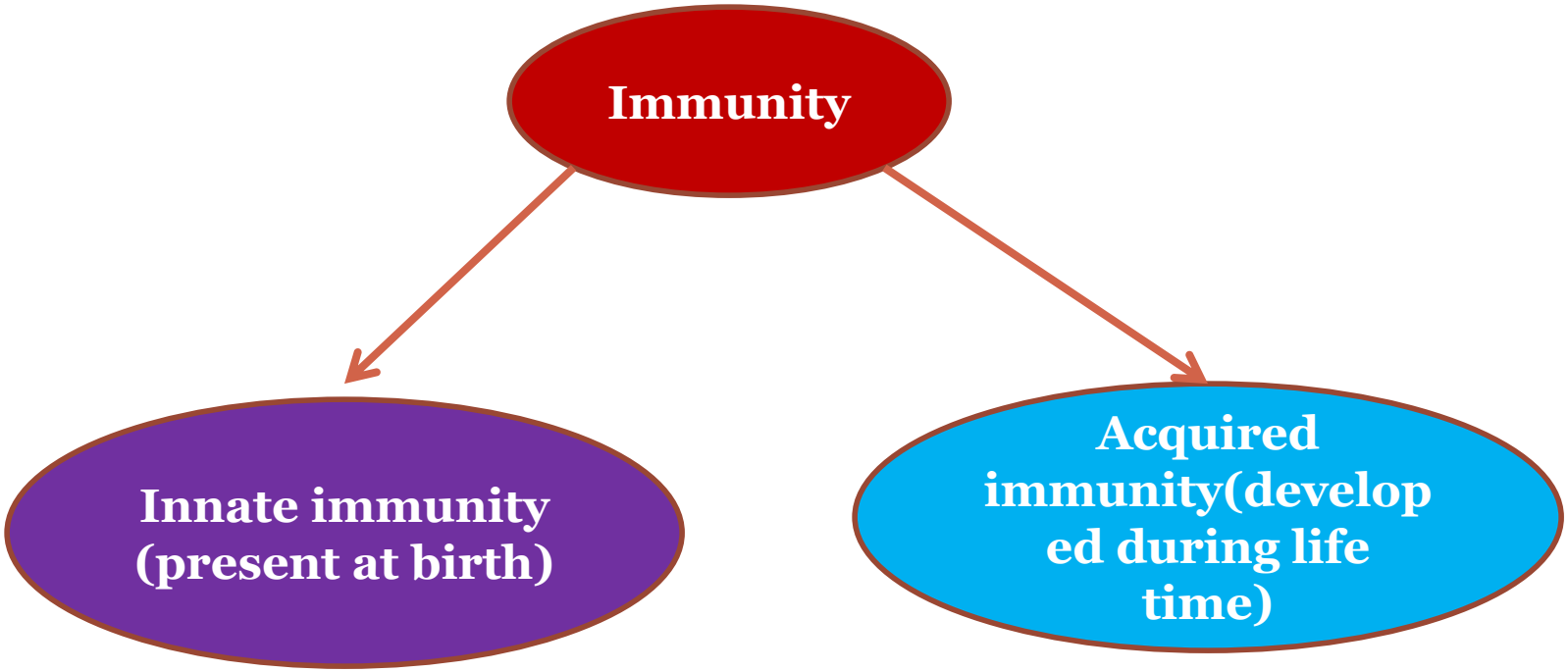
Most of the population gets immunized.

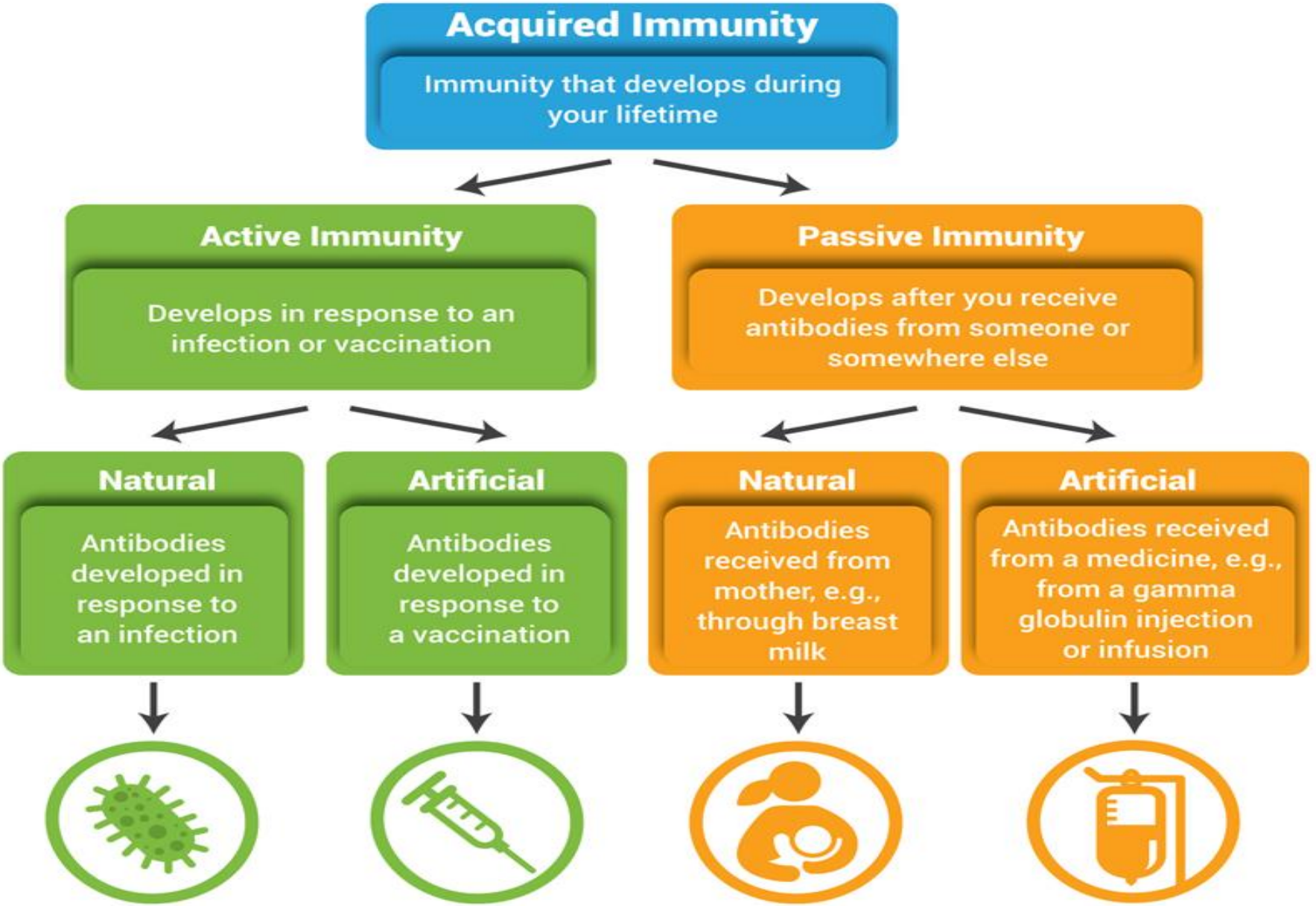
Spread of contagious disease is contained.

Basic principles of vaccination

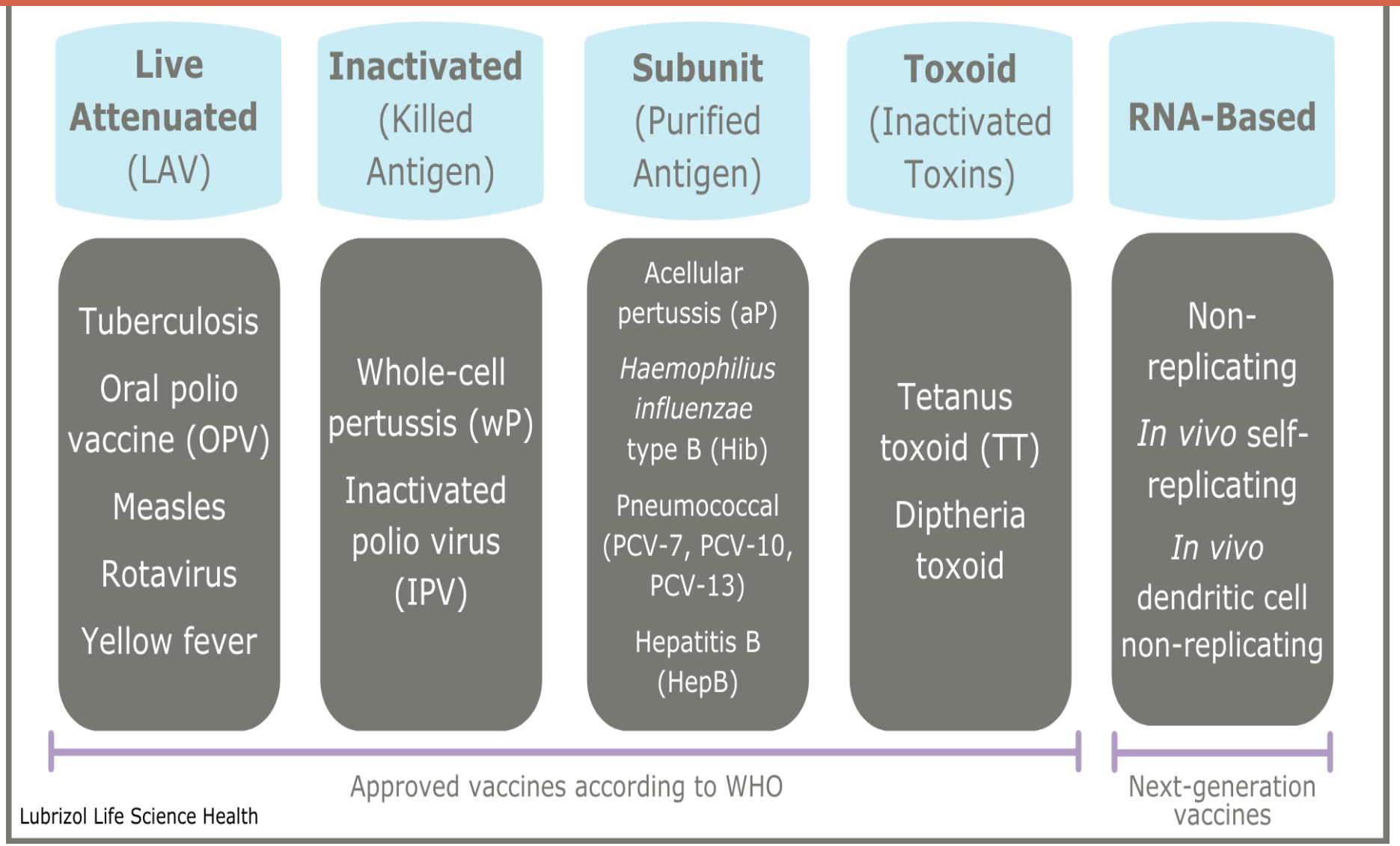
- Vaccines prevent the disease
- They contain the same germs that cause disease. (For example, measles vaccine contains measles virus, and Hib vaccine contains Hib bacteria.)
- It stimulates immune system to produce antibodies, exactly like it would if one is were exposed to the disease.
- Therefore after getting vaccinated, one develop immunity to that disease, without having to get the disease first.

- **Immunity** is the ability of the human body to tolerate the presence of material indigenous to the body ("self"), and to eliminate foreign ("no self") material.




Acquired Immunity
Immunity that develops during your lifetime
Active Immunity
Develops in response to an infection or vaccination
Passive Immunity
Develops after you receive antibodies from someone or somewhere else
Natural
Antibodies developed in response to an infection
Artificial
Antibodies developed in response to a vaccination
Natural
Antibodies received from mother, e.g., through breast milk
Artificial
Antibodies received from a medicine, e.g., from a gamma globulin injection or infusion

List of Types of vaccines



Lubrizol Life Science Health

COMMON COMPONENTS OF VACCINES

Active components

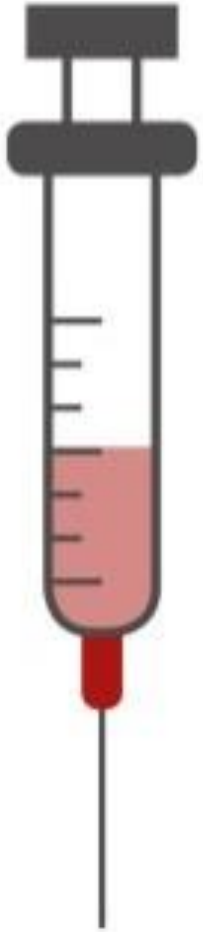
- Antigen
  - Virus, Bacteria, Toxin

Adjuvants

- Enhance immune response to vaccine
  - Aluminum

Antibiotics

- Prevent bacterial contamination
  - Neomycin, Gentamycin Polymycin B



Preservatives

- Prevent contamination e.g., repeated puncture of a multi-dose vaccine vial
  - Magnesium, Thimerosal

Stabilizers

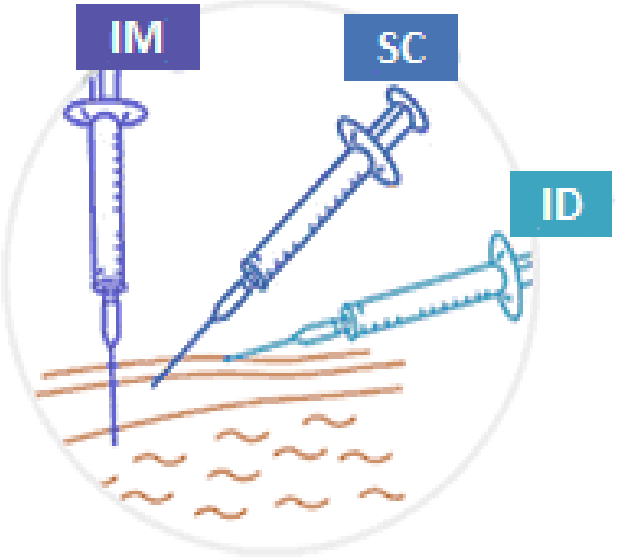
- Protect the vaccine from adverse conditions such as the freeze-drying process
  - Sugar : Lactose, Sucrose
  - Amino acid : Glycine
  - Protein : Gelatin, Albumin

Trace components

- Left over from vaccine production process
  - Formaldehyde

Routes of administration of different vaccines

- **Oral**
  - OPV
  - Rotavirus
- **Intramuscular (IM)**
  - DTwP, DTaP, DT, Td, TT
  - Hepatitis B
  - IPV
  - Hib
  - PCV-7
- **Subcutaneous (SC)**
  - Measles
  - Yellow fever
- **Intradermal (ID)**
  - BCG



1. Live attenuated vaccines

- Weakened form of the germ that causes a disease.
- Create a strong and long-lasting immune response.
- 1 or 2 doses of most live vaccines give a lifetime protection.
- **Limitations**
- Rarely can revert to original form and cause disease
- May harm Immunocompromised people
- Immunization errors (Reconstitution, cold chain)
- Usually not given in pregnancy

Examples:

- Oral Polio Vaccine (OPV)
- Measles
- Typhoid oral
- Measles, Mumps, Rubella (MMR)
- Yellow fever
- Hepatitis A
- Rota virus
- Intranasal influenza
- Typhus

Influenza vaccine

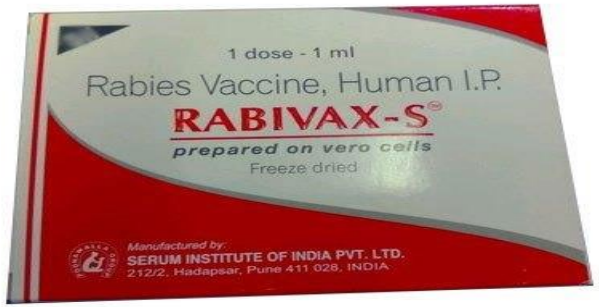
OPV

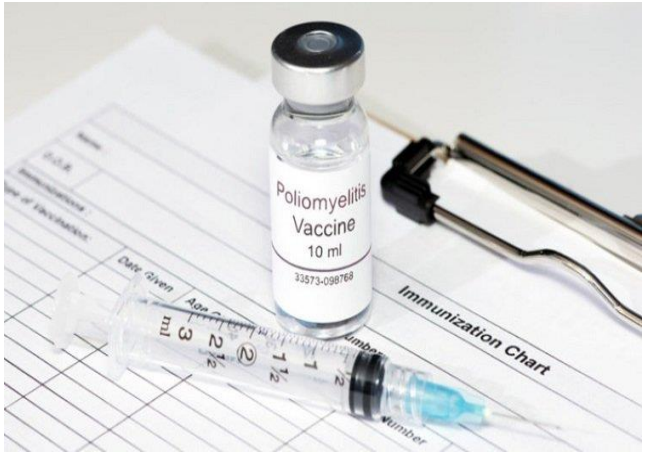
2. Inactivated /Killed vaccines

- Are the killed version of the germ that causes a disease.
- Usually do not provide immunity (protection) as strong as live attenuated vaccines.
- So several doses may be needed over time (booster shots) in order to get on-going immunity against diseases.
- These vaccines have no risk of inducing the disease as they do not contain live components.

Examples:

- Typhoid shot
- Flu shot
- Inactivated Polio vaccine (IPV)
- Rabies
- Pertussis
- Plague
- Cholera

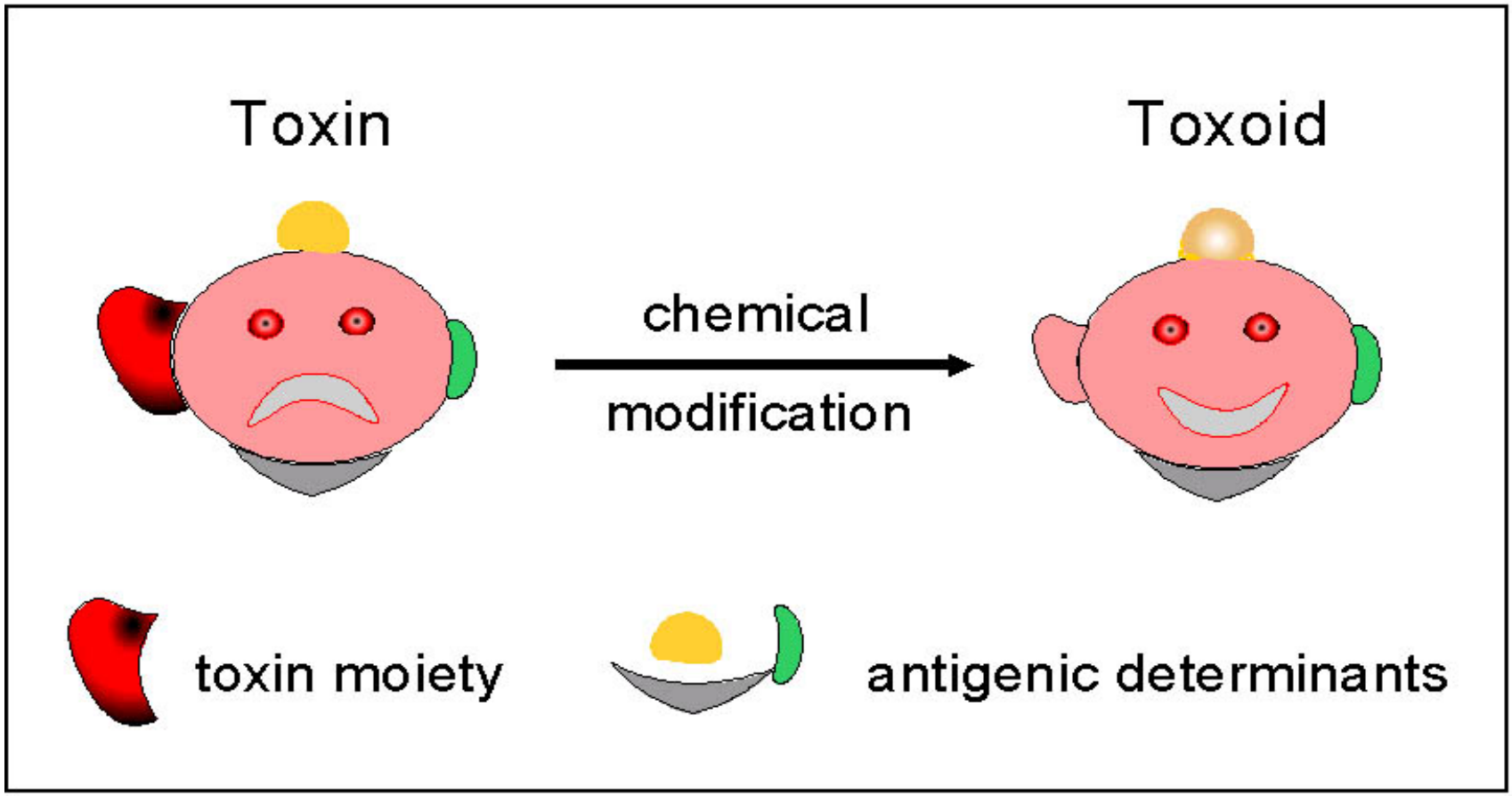




3. Toxoid Vaccines

- **Toxoid vaccines** use a **toxin** (harmful product) made by the germ that causes a disease.
- They create immunity to the parts of the germ that cause a disease instead of the germ itself.
- That means the immune response is targeted to the **toxin** instead of the whole germ.
- **Limitations:** Booster shots are needed.
- Examples: Diphtheria, Tetanus

Modification of Toxin to Toxoid



4. Subunit Vaccines

- Subunit vaccines/acellular vaccines contain purified pieces of pathogen instead of whole pathogen, which have been specially selected for their ability to stimulate immune cells.
- As these fragments are incapable of causing disease, subunit vaccines are considered very safe.
- **There are three types of subunit vaccines**

a. Protein based vaccines
b. Polysaccharide vaccines
c. Conjugate vaccines

a. Protein-based subunit /recombinant vaccines:

- Protein subunit vaccines contain specific isolated proteins from viral or bacterial pathogens;
- **Examples:** A cellular pertussis (aP), Hepatitis B

b. Polysaccharide vaccines:

- Polysaccharide vaccines contain chains of sugar molecules (polysaccharides) found in the cell walls of some bacteria.
- **Examples:** Pneumococcal, Meningococcal and Salmonella Typhi

c. Conjugate subunit vaccines

- Conjugate subunit vaccines bind a polysaccharide chain to a carrier protein to try and boost the immune response
- **Example:** Homophiles influenza type b (Hib) and Pneumococcal conjugate vaccines

Combination vaccines

- Combination vaccines consist of two
- or more vaccines in the same preparation.
- This approach has been used for over 50 years in many vaccines e.g. Pentavelant, Hexavalent and MMR.
- Combination products simplify vaccine administration
- Reduce the cost of stocking and administering
- Allow for the introduction of new vaccines without requiring additional health clinic visit and injections.

DNA and RNA vaccines

- A DNA vaccine is made from part of the virus' own genetic information.
- The vaccine uses that DNA or RNA to make the immune system think it's under attack, and that triggers the production of proteins directly in the cell.
- This activates the immune response, and in turn antibodies that fight the virus.
- Example: Zika, cytomegalovirus

Adverse effects of vaccines

- An **Adverse event following immunization (AEFI)** is any untoward medical occurrence which follows immunization.
- **Minor reactions:**
- Occur usually within a few hours of injection and resolve after short period of time and pose little danger.
- **Local** (pain, swelling or redness at the site of injection).
- **Systemic** (fever, malaise, muscle pain, headache).

Severe reactions

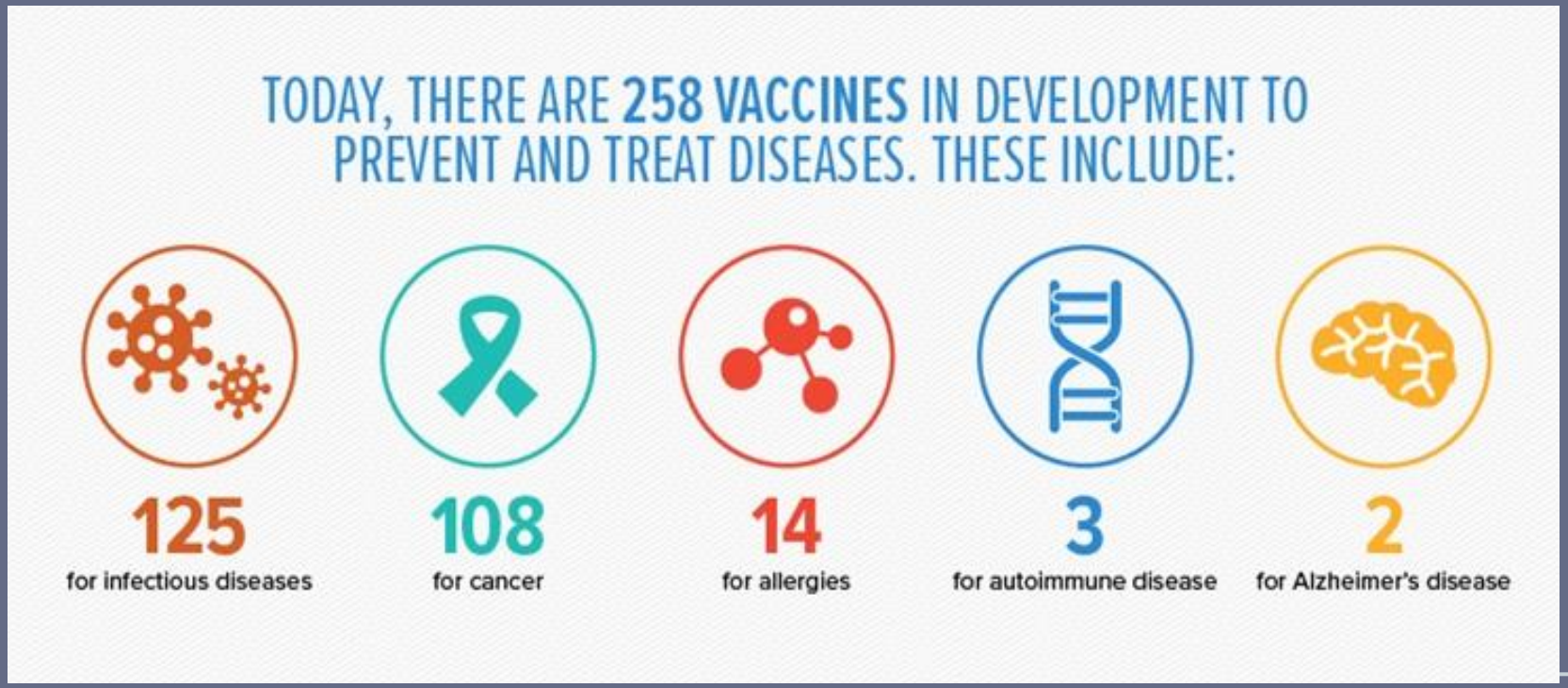
- **Anaphylaxis:** An acute, multi-system, allergic reaction
- Symptoms of anaphylaxis may include breathing difficulties, loss of consciousness, and a drop in blood pressure. Give adrenaline immediately.
- **Allergic reactions** caused by the body's reaction to a particular component in a vaccine.
- **Paralytic poliomyelitis** is a very rare event that occurs in about two to four in every million doses of oral polio vaccine (OPV)

Adverse effects due to impropriate vaccination procedures

Procedure	Potential adverse event
Incorrect storage	Local reaction
Incorrect injection site or technique	Local reaction
Non-sterile procedures	Local reaction
Contamination of vaccines or syringes	Toxic shock syndrome
Contraindications ignored	Anaphylaxis
Wrong diluents or substitution with another drug	Death

Describe difference between live attenuated and inactivated vaccines

	Features	Live Attenuated Vaccines	Killed Vaccines
1	Agent used	Live attenuated organism	Killed organism
2	Immune response	High	Low
3	Duration	Antibodies persists for long time	Short time
4	Booster Immunization	Booster not needed	Boosters needed frequently
5	Adjuvant	Not required	Required
7	Cost	Cheap	Costly
8	Safety	Chance of reversal	Safe
9	Production	Easy to produce	Difficult to produce



Role of vaccines in preventing disease.

- Disease prevention is the key to public health.
- It is always better to prevent a disease than to treat it.
- Vaccine-preventable diseases have a costly impact, resulting in doctor's visits, hospitalizations, and premature deaths.
- Sick children can also cause parents to lose time from work.
- Vaccines prevent disease in the people who receive them and protect those who come into contact with unvaccinated individuals.

- The immune system recognizes germs that enter the body as “foreign” invaders, or *antigens*, and produces protein substances called *antibodies* to fight them.
- A normal, healthy immune system has the ability to produce millions of these antibodies to defend against thousands of attacks every day, doing it so naturally that people are not even aware they are being attacked and defended so often

- Many antibodies disappear once they have destroyed the invading antigens, but the cells involved in antibody production remain and become **“memory cells.”**
- Memory cells remember the original antigen and then defend against it when the antigen attempts to re-infect a person, even after many decades. This protection is called immunity.
- Vaccines contain the same antigens or parts of antigens that cause diseases, but the antigens in vaccines are either killed or greatly weakened.

- When injected into the body vaccine antigens are not strong enough to produce the symptoms and signs of the disease but are strong enough for the immune system to produce antibodies against them.
- The memory cells that remain prevent re-infection when they encounter that disease in the future. Thus, through vaccination, children develop immunity without suffering from the actual diseases that vaccines prevent.

Available vaccines against different diseases

1. Cervical cancer
2. Cholera
3. COVID-19
4. Diphtheria
5. Hepatitis B
6. Influenza
7. Japanese encephalitis
8. Measles
9. Meningitis
10. Mumps
11. Pertussis
12. Pneumonia
13. Polio
14. Rabies
15. Rotavirus
16. Rubella
17. Tetanus
18. Typhoid
19. Varicella
20. Yellow fever

Some other vaccines are currently under development or being piloted, including those that protect against Ebola or malaria, but are not yet widely available globally.

Corona vaccines

1. Both AstraZeneca and Johnson & Johnson use the same platform for their vaccine, a virus known as an adenovirus.
2. Pfizer-BioNTech and Moderna vaccines, store the instructions in single-stranded RNA
3. Oxford and sputnik vaccines uses double-stranded DNA.
4. Sianofarm vaccine is an inactivated vaccine.

Vaccines developing & testing

- The most commonly used vaccines have been around for decades, with millions of people receiving them safely every year.
- As with all medicines, every vaccine must go through extensive testing to ensure it is safe before it can be introduced in a country.
- An experimental vaccine is first tested in animals to evaluate its safety and potential to prevent disease.

Vaccines Tested For Human Clinical Trials In 3 Phases:

- **1st Phase:** The vaccine is given to a small number of volunteers to assess its safety, confirm it generates an immune response, and determine the right dosage.
- **2nd Phase:** The vaccine is usually given hundreds of volunteers, who are closely monitored for any side effects, to further assess its ability to generate an immune response.

- Data are collected on disease outcomes, but usually not in large enough numbers to have a clear picture of the effect of the vaccine on disease.
- Participants in this phase have the same characteristics (age and sex)
- In this phase, some volunteers receive the vaccine and others do not, which allows comparisons to be made and conclusions drawn about the vaccine.

- **3rd Phase:** The vaccine is given to thousands of volunteers – some of whom receive the investigational vaccine, and some of whom do not, just like in phase II trials.
- Data from both groups is carefully compared to see if the vaccine is safe and effective against the disease it is designed to protect against.

Once the results of clinical trials are available:

- A series of steps is required before a vaccine may be introduced into a national immunization programme. Once the results of clinical trials are available, these include:

i. Reviews of efficacy

ii. Safety

iii. Manufacturing for regulatory and public health policy approvals

DIFFERENCE BETWEEN VACCINATION AND IMMUNIZATION

BYJU'S The Learning App

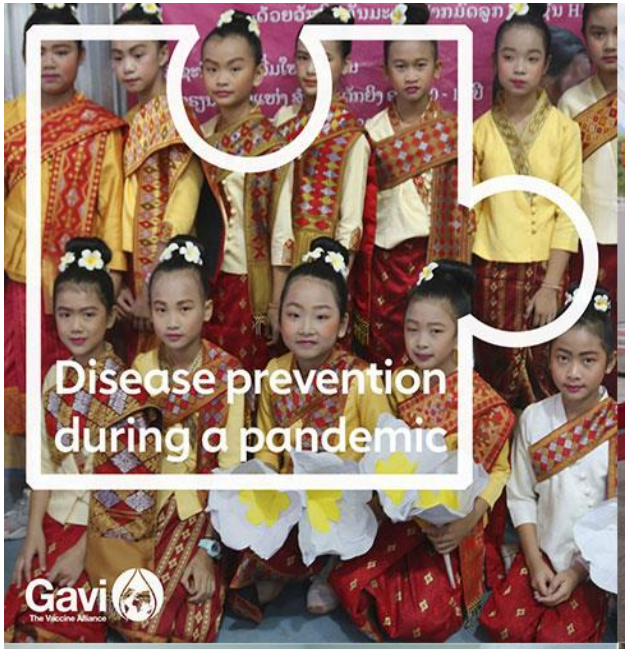
VACCINATION

VACCINATION IS THE ADMINISTRATION OF ANTIGENIC MATERIAL (A VACCINE) TO STIMULATE AN INDIVIDUAL'S IMMUNE SYSTEM TO DEVELOP ADAPTIVE IMMUNITY TO A PATHOGEN.

IMMUNIZATION

IMMUNIZATION IS THE PROCESS WHEREBY A PERSON IS MADE IMMUNE OR RESISTANT TO AN INFECTIOUS DISEASE, TYPICALLY BY THE ADMINISTRATION OF A VACCINE.

The strategies used from community medicine's perspective to promote vaccination in communities.


Disease prevention during a pandemic
Gavi
The Vaccine Alliance


Innovation
Gavi
The Vaccine Alliance


Leaving no one behind
Gavi
The Vaccine Alliance


Strengthening health systems
Gavi
The Vaccine Alliance


Youth empowerment
Gavi
The Vaccine Alliance


Vaccine storage
Gavi
The Vaccine Alliance

Maximize reach

i. Detect and reach the unreached

ii. Design services to reach all equitably

iii. Build capacity of vaccinators and managers

iv. Ensure vaccine quality and availability

v. Integrate immunization services

Mobilize people to:

i. Explain immunization benefits

ii. Motivate parents and caregivers for immunization

iii. Arrange clean outreach sites (school, community area)

iv. Inform community about health worker arriving time and place and arrange home visits

v. Register patients and control crowd

vi. Help to transport vaccines and health workers

vii. Engage community and religious leaders, teachers and traditional health practitioners

Manage the program

i. Secure political commitment and partnership

ii. Plan, budget and mobilize resources

iii. Ensure excellence in leadership

iv. Set program policy and guidance

Monitor program

i. Monitor program performance and disease occurrence

ii. Evaluate program through surveys and reviews

unicef | for every child

Expanded Program on Immunization
Government of Pakistan

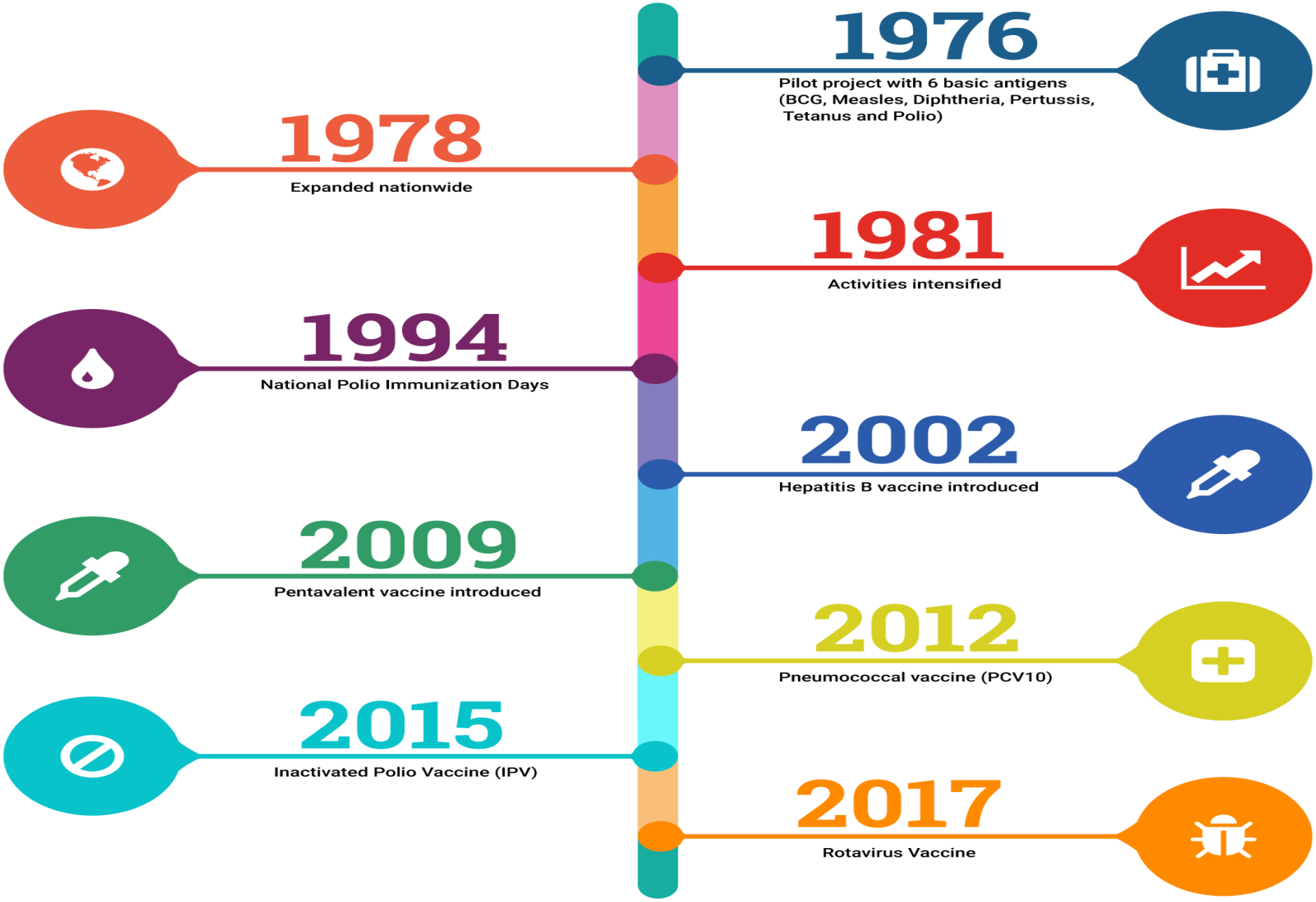
Teeku is your child's protector. Do you agree?

The objectives of the EPI are to:

- To provide safe, effective and cost-effective vaccination against vaccine preventable diseases
- To increase equitable coverage of immunization services against vaccine preventable diseases (VPD)
- To decrease VPD associated morbidity and mortality.
- To improve immunization services through expansion of service delivery and cold chain.

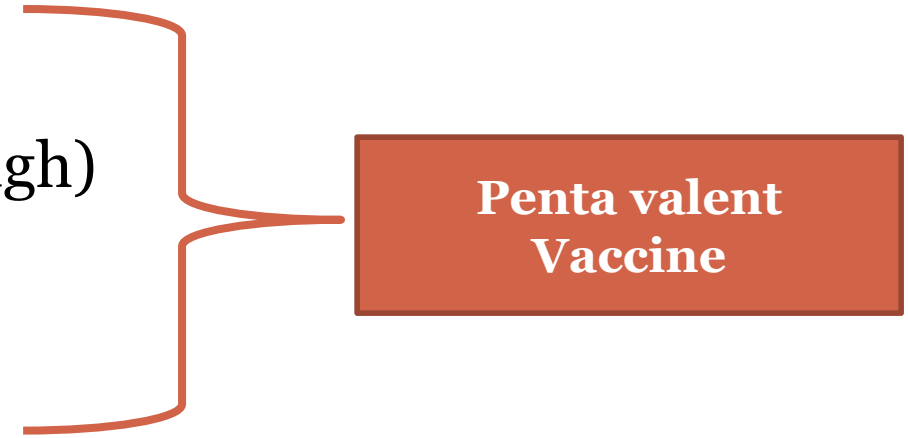
- The Pakistan EPI programme has adopted its goals and strategies in accordance with priorities set at the global and regional level.
- EPI was launched in Pakistan in 1978 to protect children by immunizing them against childhood tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus and measles.
- It also aims to protect mothers and new-born against tetanus.

- Later hepatitis B, haemophilis influenza type b (Hib) and pneumococcal vaccine (PCV10) were introduced in 2002, 2009 and 2012, respectively.
- Inactivated polio vaccine (IPV) was added in 2015.
- Rotavirus vaccine was introduced in 2017.
- A child needs only 5 visits during the first year and 1 visit during the 2nd year of life to complete the vaccination with 6 visits against 12 dreadful diseases.


1976
Pilot project with 6 basic antigens (BCG, Measles, Diphtheria, Pertussis, Tetanus and Polio)
1978
Expanded nationwide
1981
Activities intensified
1994
National Polio Immunization Days
2002
Hepatitis B vaccine introduced
2009
Pentavalent vaccine introduced
2012
Pneumococcal vaccine (PCV10)
2015
Inactivated Polio Vaccine (IPV)
2017
Rotavirus Vaccine

Diseases covered by EPI

1. Poliomyelitis
2. Childhood Tuberculosis
3. Neonatal Tetanus
4. Diphtheria
5. Pertussis (Whooping Cough)
6. Hepatitis-B
7. Hib Pneumonia
8. Measles
9. Rota virus diarrhoea
10. Rubella
11. Mumps
12. thyphoid



AGE	VACCINE	DOSE	FORM	ROUTE	Sstorage temperature
BIRTH	BCG	0.05 ml	Powered	Intra Dermal right deltoid	+ 2 to +8 ° C
	Hep B	0.5 ml	Liquid	Intra Muscular anterolateral aspect of left thigh	+2 to +8 °C
	OPV- 0	2 drops	Liquid	Oral	- 15 to - 25 °C at federal level + 2 to + 8 ° C at district level
6 WEEKS	PENTA 1	0.5 ml	Liquid	Intra Muscular at anterolateral aspect right thigh	+ 2 to + 8 °C
	OPV 1	2 drops	Liquid	Oral	
	PCV 1	0.5 ml	Liquid	Intra Muscular at anterolateral aspect right thigh	+ 2 to + 8 °C
	ROTA 1	1.0 ml	Liquid	Oral	+2 to +8 °C
10 WEEKS	PENTA 2	0.5 ml	Liquid	Intra Muscular	
	OPV 2	2 drops	Liquid	Oral	
	PCV 2	0.5 ml	Liquid	Intra Muscular	
	ROTA 2	1 ml	Liquid	Oral	

AGE	VACCINE	DOSE	FORM	ROUTE	Storage temperature
14 WEEKS	PENTA 3	0.5 ml	Liquid	Intra Muscular	
	OPV 3	2 drops	Liquid	Oral	
	PCV 3	0.5 ml	Liquid	Intra Muscular	
	IPV1	0.5 ml	Liquid	Intra Muscular at anterolateral aspect of left thigh	+2 to +8 °C
9 MONTH	MR1	0.5 ml	Powdered	Sub Cutaneous	+2 to +8 °C
	IPV2	0.5ml	Liquid		
	Typhoid(typhar)	0.5ml	liquid	Intra muscular	+2 to +8 °C
15 MONTH	MR 2	0.5 ml	Powdered	Sub Cutaneous	+2 to +8 °C

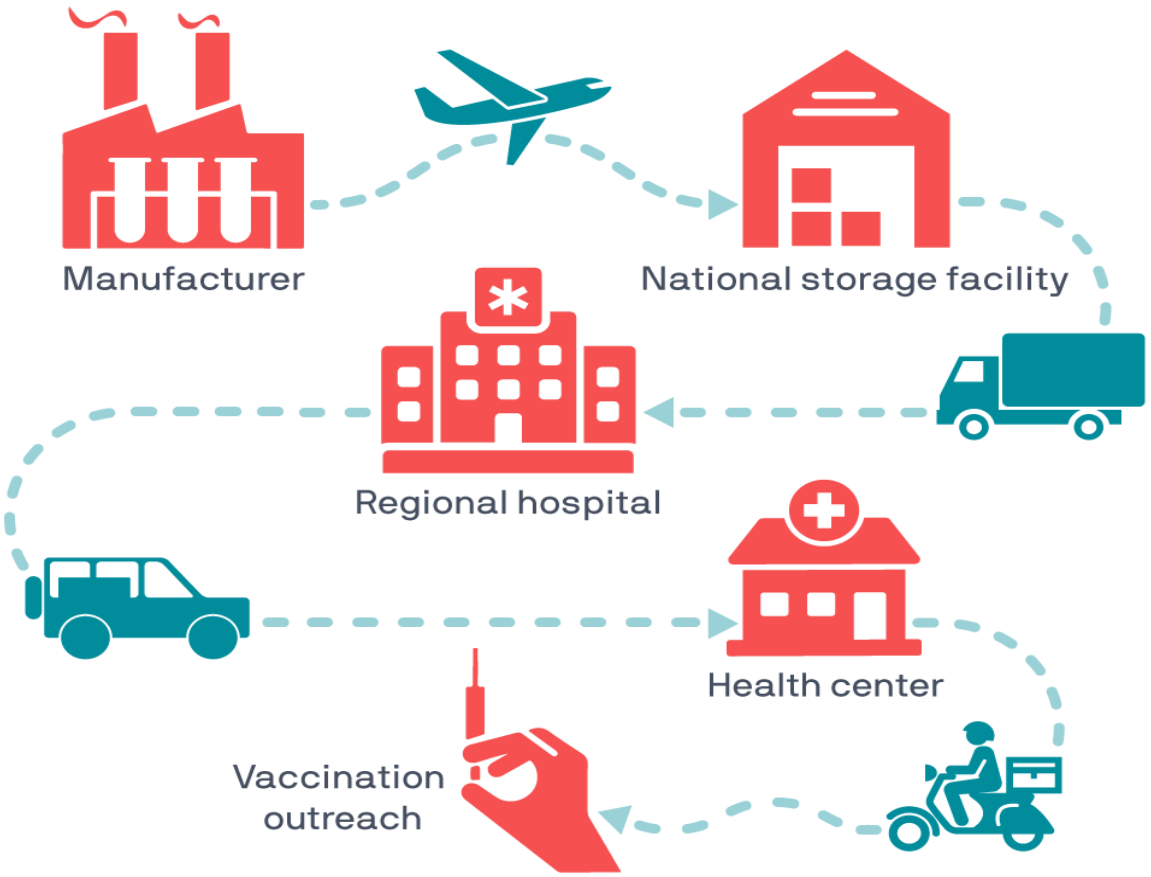
for women of childbearing age

Dose	When to give	Expected duration of protection
TT 1	at first contact or as early as possible in pregnancy	none
TT 2	at least 4 weeks after TT 1	1 - 3 years
TT 3	at least 6 months after TT 2	5 years
TT 4	at least one year after TT 3 or during subsequent pregnancy	10 years
TT 5	at least one year after TT 4 or during subsequent pregnancy	All childbearing years

Cold Chain

- Vaccines are sensitive biological products that may become less effective or destroyed, when exposed to temperatures outside the recommended range.
- **Cold chain** refers to the process used to maintain optimal conditions during the transport, storage, and handling of vaccines.
- Starting at the manufacturer and ending with the administration of the vaccine to the client.
- The optimum temperature for refrigerated vaccines is between +2°C and +8°C.

Cold chain

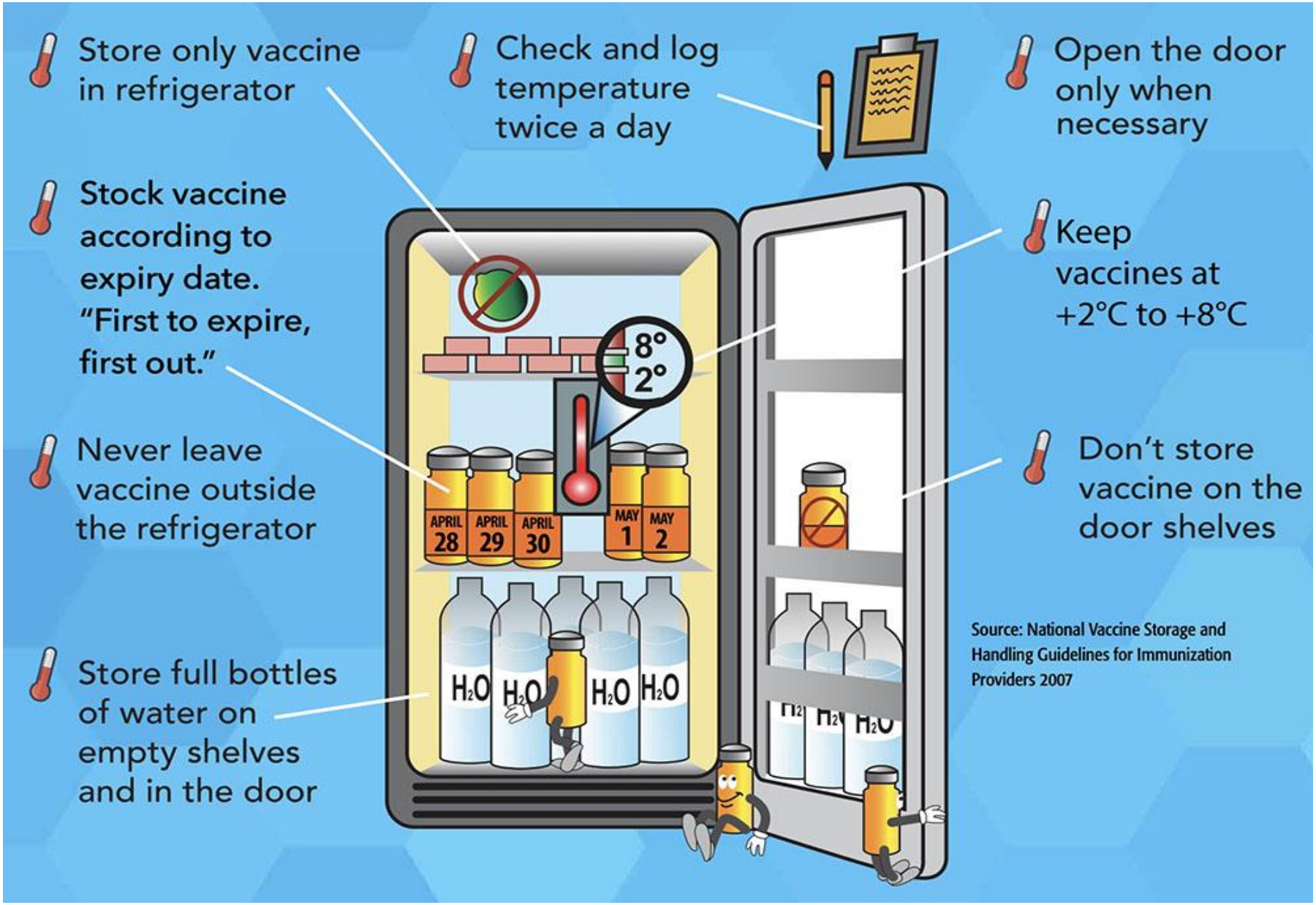

Manufacturer
National storage facility
Regional hospital
Health center
Vaccination outreach

Temperature monitoring devices

1. Cold Rooms and Freezer Rooms
2. Refrigerators and Freezers
3. Cold Boxes and Vaccine Carriers
4. Electronic freeze indicators
5. Cold Chain Monitor
6. Vaccine Vial Monitor

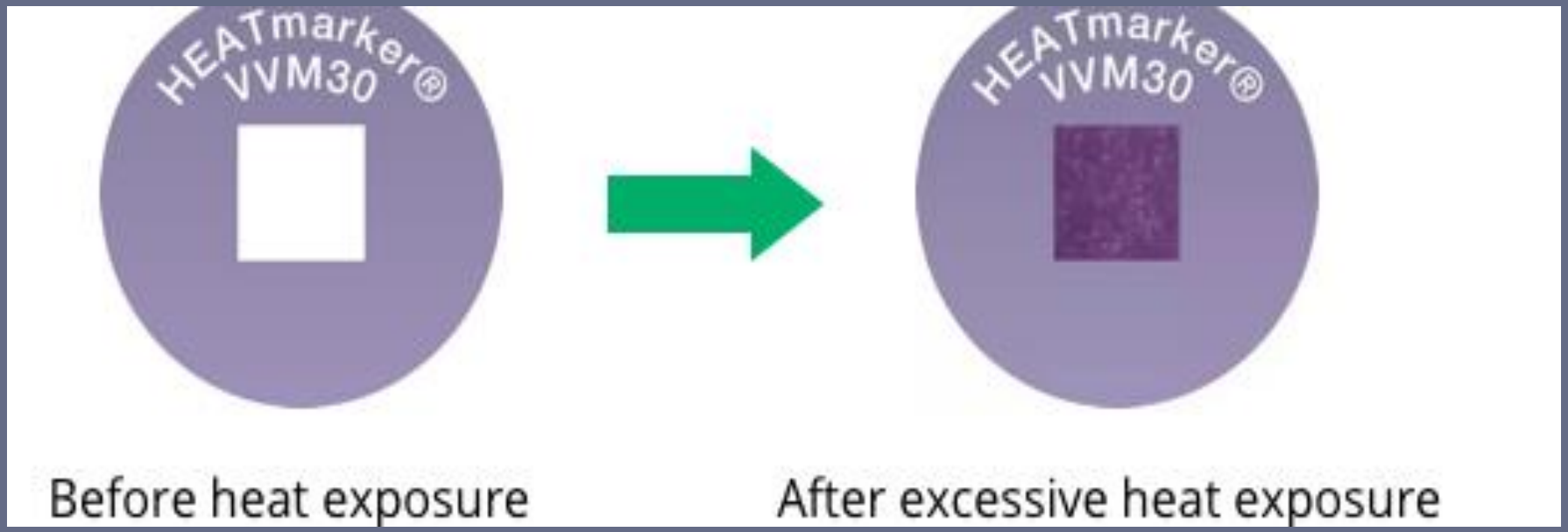
Cold room

Cold boxes


Store only vaccine in refrigerator
Check and log temperature twice a day
Open the door only when necessary
Stock vaccine according to expiry date. "First to expire, first out."
Keep vaccines at +2°C to +8°C
Never leave vaccine outside the refrigerator
Don't store vaccine on the door shelves
Store full bottles of water on empty shelves and in the door
8°
2°
APRIL 28
APRIL 29
APRIL 30
MAY 1
MAY 2
H2O
Source: National Vaccine Storage and Handling Guidelines for Immunization Providers 2007

Three main elements combine to ensure proper vaccine transport, storage, and handling.

- Trained personnel
- Transport and storage equipment
- Efficient management procedures



Vaccine Vail Monitor (VVM)

- Vaccine Vail Monitor (VVM) is a thermo chromic label on vials containing vaccines.
- It gives visual indication of whether the vaccines has been kept at a temperature which preserves its potency.
- The vials were designed in response to problem of delivering vaccines to developing countries where.

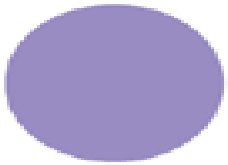
i. Cold chain is difficult to preserve.
ii. Vaccines became inactive and denatured by exposure to ambient temperature.

- If the square becomes the same colour as the circle or becomes darker than the circle, then the vaccine contained in the vial is damaged and the vial should be discarded.
- The vaccine vial monitor is intended for use on vaccines which may travel outside of the cold chain, but its use on certain vaccines has had an especially notable impact.
- Hep B, Oral Polio vaccine (OPV)

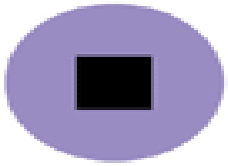
How to read a VVM

Inner square is lighter than outer circle.
If the expiry date has not been passed, USE the vaccine.

At a later time, inner square is lighter than outer circle. ***If the expiry date has not been passed, USE the vaccine.***



Discard point:
Inner square matches colour of outer circle.
DO NOT use the vaccine.
Inform your supervisor.



Beyond the discard point:
Inner square darker than outer circle.
DO NOT use the vaccine.
Inform your supervisor.

Factors Responsible for Success and Failure of Vaccination Programs in Pakistan.

- Immunization is one of the most successful public health initiatives in recent times. It is, therefore, worrying to learn the level of under-vaccination in Pakistan.
- Diseases that have been successfully eliminated through the aid of vaccination in other countries have not been eliminated in Pakistan.
- The reasons for this vary and show the uniqueness of the **economic, healthcare and environmental** landscape of Pakistan, through which public health programs need to be implemented.

- Pakistan is not achieving the targets is worrying from both Global perspective and national healthcare system of Pakistan.
- EPI has in Pakistan, has encountered many problems since its inception.
- **These includes**

i. Logistical obstacles
ii. Parental and female awareness and education
iii. Influence of religious community leaders
iv. Conflict and war

v. Reduced funding and technical assistance

vi. Poor capacity of human resources has contributed, it includes:

- Poor worker motivation
- Political interference
- Underutilization of available human resources
- Worker fatigue due to polio and other regularly conducted campaigns have reduced the time available for EPI

- Obstacles in procurement of vaccines and other required items
- Lack of proper cold chain
- Poor maintenance of equipment
- Inability to pay transportation and/or other costs
- Lack of available time during immunization hours
- Poor or disrespectful treatment from health workers during service contacts

Recommendations

- EPI needs drastic changes to improve its performance.
- Interprovincial coordination and collaboration needs to be strengthened.
- Situational analysis should be carried out in each Provinces, including **coverage, mapping of difficult-to-reach populations & fixed service points.**
- The available human resources, logistics, funding, and demand aspects of program should be enhanced.

- EPI implementation plan for each district should address .
- The responsibility for planning should be delegated to the union council (UC) and district-level staff under the direction of the provincial EPI manager this ensures ownership of the program
- Use local knowledge, and help to make more realistic estimates of eligible children.

- Integrate program MCH and IMNCI
- Integrate with primary health care and private sector
- The province should develop a plan to expand to outreach and hard-to-reach areas, especially in high-risk districts.
- Vaccine vial monitors and other cold chain monitoring tools should be introduced
- Vaccine procurement capacity and cold chain equipment maintenance as well as back-up power systems need improvements.

- Leadership and good management should be fostered through appropriate training.
- Regular training of managers
- Funding for training courses to be offered regularly in each province
- Supervision and monitoring should be restructured
- Monitoring, evaluation, and surveillance system of the EPI needs to be strengthened


THANK
YOU