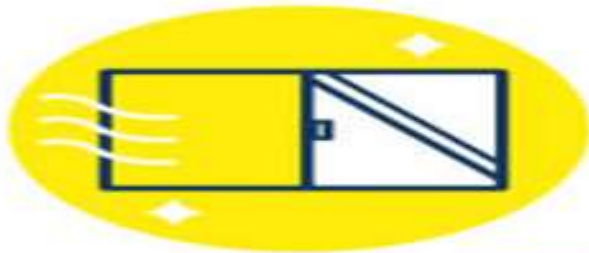
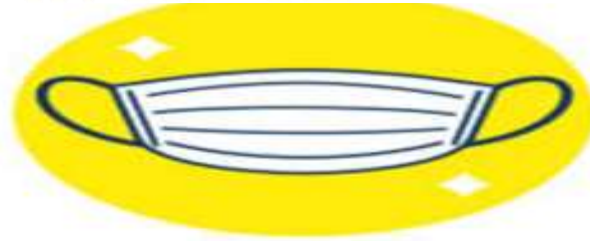


PRINCIPLES OF COMMUNICABLE DISEASES

EPIDEMIOLOGY L-4/24-25



Infection control and prevention measures



Objectives

- Identify the principles and components of cold chain**
- Designate the principles of passive immunity**

- Recognize the principles of prevention of infectious diseases.**

- Describe the key elements for control of infectious diseases(cases, contact, reservoir, and community)**
- Define and compare between disease eradication and elimination**

cold chain

The cold chain is a set of rules and procedures that ensure the proper storage and distribution of vaccines to health services from the national to the local level.

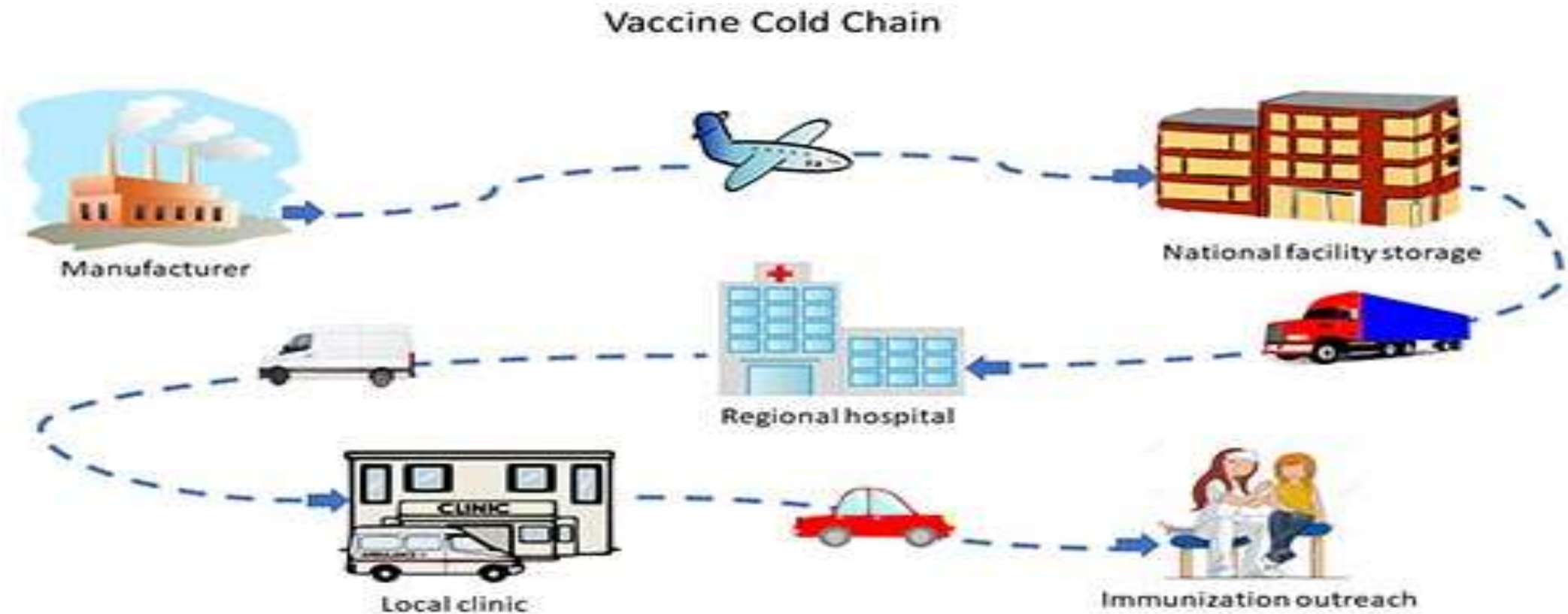
The cold chain is interconnected with refrigeration equipment that allows vaccines to be stored at recommended temperatures to maintain their potency.

Mapping the vaccine cold chain

What happens when a vaccine leaves the manufacturer?
It's anything but simple, especially when the vaccine requires ultra-cold temperatures.



A cold chain is a temperature-controlled supply chain that includes all vaccine-related equipment and procedures. The cold chain begins with the cold storage unit at the manufacturing plant, extends to the transport and delivery of the vaccine and correct storage at the provider facility, and ends with administration of the vaccine to the patient.

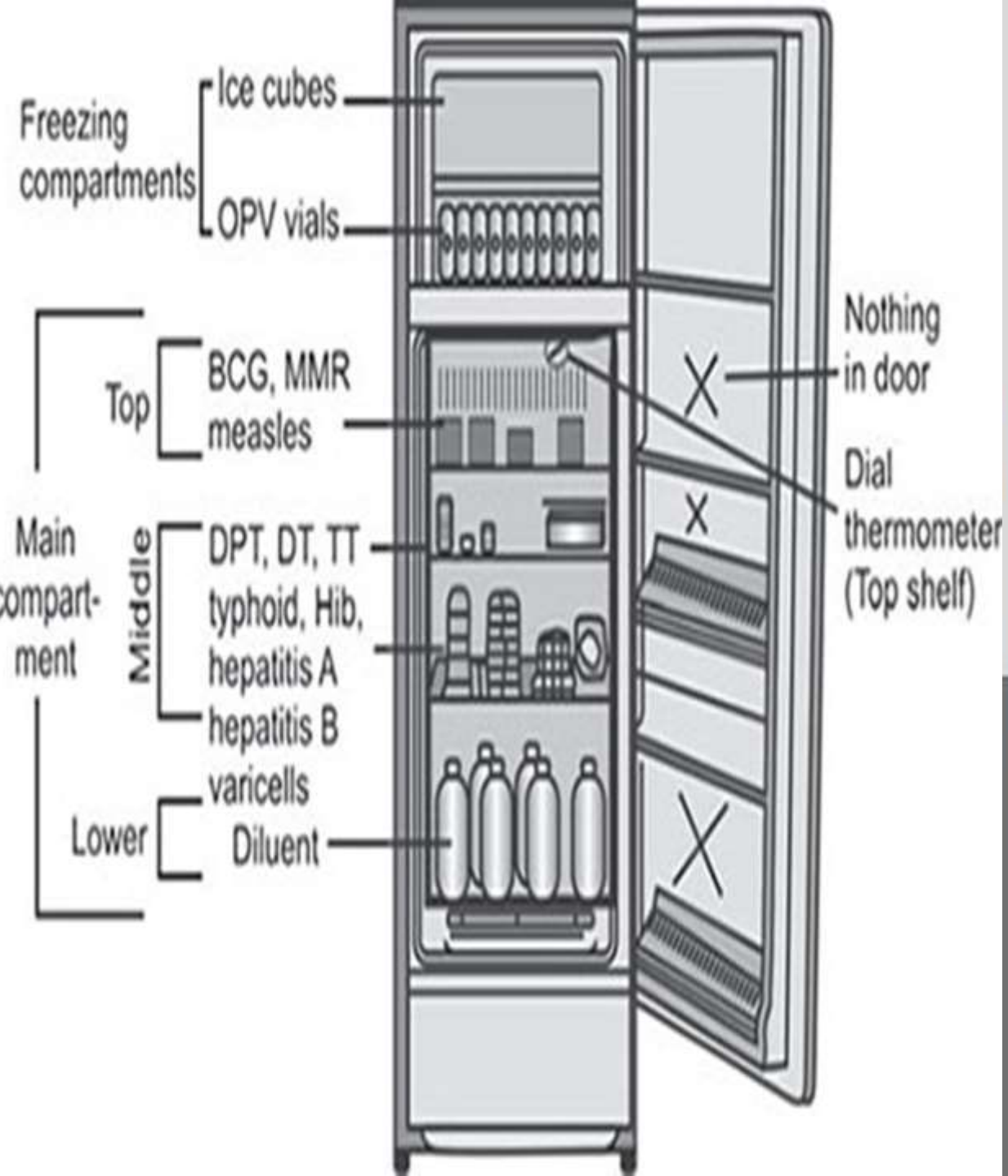


What are the 3 main components of cold chain?

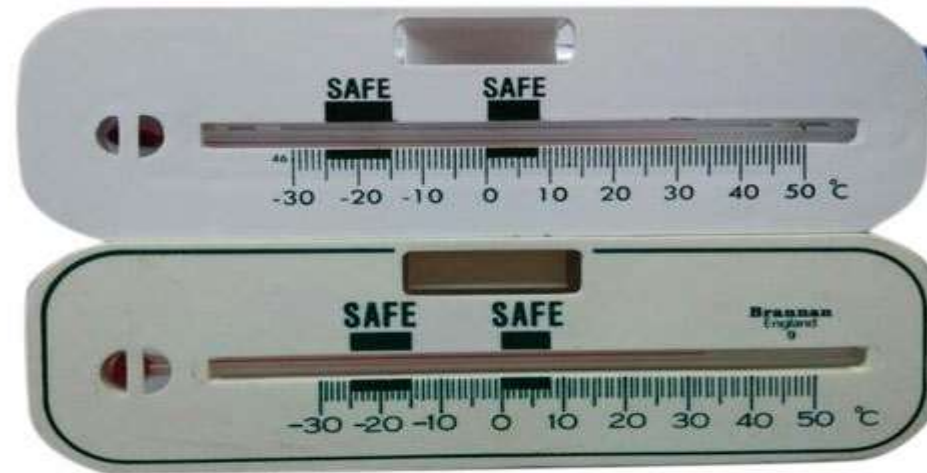
The cold chain has three main components:

- ✓ **Equipment:** to store and transport vaccine and monitor temperature
- ✓ **Trained personnel :**to manage vaccine storage and distribution (vaccine and cold-chain handler at each cold-chain point)
- ✓ **Efficient management procedures:** to ensure correct utilization of equipment and ensure vaccines are stored and transported safely.

All three elements must combine to ensure safe vaccine transport and storage



- **Maintaining the cold chain ensures that vaccines are transported and stored according to the manufacturer's recommended temp range +2C to +8C until point of administration**
- **Polio vaccine is the most sensitive vaccine to heat.**



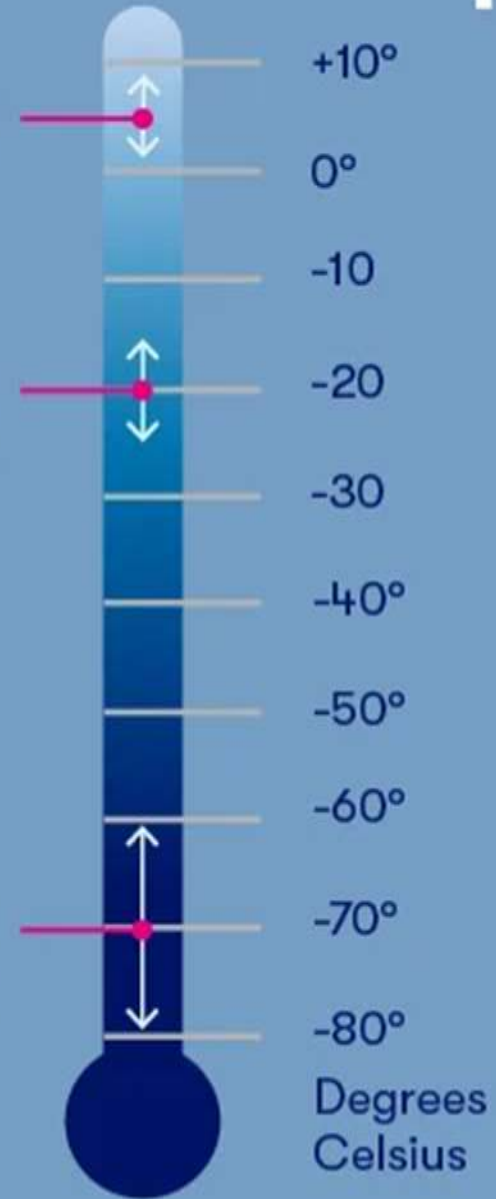
VACCINE TEMPERATURE RANGE



Majority of Vaccines
2° - 8°C

Vaccines for [redacted] chickenpox,
shingles, measles, mumps, and rubella
ll need -25° - -15°C

One of the COVID-19
vaccines, needs even
-80° - -60°C



Vaccines sensitive to heat

BCG (after reconstitution)
OPV
Measles
DPT
BCG (before reconstitution)
Haemophilus influenzae type B
Tetanus and diphtheria toxoid (Td)
Tetanus toxoid
Hepatitis B

Most



Least

Vaccines sensitive to freezing

Hepatitis B
DPT
DTaP
Td
TT

Most



Least

Note: These vaccines become much more heat sensitive after they have been reconstituted with diluent.

These vaccines are not damaged by freezing are:

Bacillus Calmette- Guérin(BCG)

Measles

Measles, mumps, rubella

Oral poliovirus

Rabies

Rotavirus

Rubella



Freeze sensitivity

Range	Vaccine
Most sensitive	HepB
	Hib liquid
	DTP, DTP-HepB, DTP-HepB+Hib, YF
	DT
	Td
Least sensitive	TT, Hib lyophilized

Light Sensitive

Sensitive to strong light, sunlight, ultraviolet, fluorescents (neon)

{most sensitive} BCG

MMR

Varicella

Meningococcal C Conjugate

Most DTaP containing vaccines



Vaccines should always be stored in their original packaging until point of use to protect them from light.

Vaccine vial monitors

Every vial is shipped with a temperature-sensitive label, that health workers monitor during vaccination sessions.



SAFE

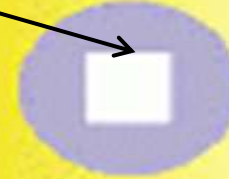
If the inner square is lighter than the outer ring and the expiration date is valid, the vaccine is usable

SPOILED

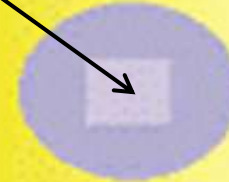
If the inner square matches or is darker than the outer ring, the vaccine must be discarded.

The Vaccine Vial Monitor says...

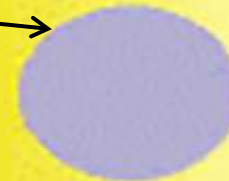
If the expiry date is not passed,



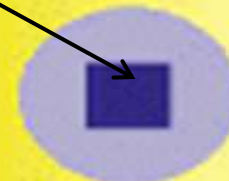
USE the vaccine



USE the vaccine
FIRST



DO NOT USE
the vaccine



DO NOT USE
the vaccine

THE SHAKE TEST

DPT, hepatitis B and tetanus toxoid vaccines can all be damaged by freezing. By shaking two vials, side-by-side, one that might have been frozen and one that has never been frozen, health workers can determine if a vaccine has spoiled.



**Fig. 4.10: Shake Test Passed -
Vaccine usable**

Control Vial

Test Vial



**Fig. 4.11: Shake Test Failed -
Do not use Vaccine**

Control Vial

Test Vial



WHAT DAMAGES THE VACCINES?

- 1. Any defect in the cold chain.**
- 2. Out date expiry.**
- 3. Using skin antiseptic at the site of injection (e.g. BCG).**
- 4. Using the reconstituted vaccine (MMR, measles, BCG) after the recommended period (6 hours).**
- 5. Exposure of the vaccine to unacceptable temperature during the immunization session.**
- 6. Exposure of the vaccine to direct sunlight.**

PASSIVE IMMUNIZATION

(SEROPROPHYLAXIS)

Passive immunization needed for rapid, but temporary protection of susceptible, either after exposure to infection or before expected exposure (occasionally).

The duration of immunity induced is short and variable (1-6 weeks).

Passive immunization has a limited value in the mass control of disease, it is recommended for non-immune persons under special circumstances.

Three types of preparations are available for passive immunity

A. normal human immunoglobulin

B. specific [hyper immune] human immunoglobulin

C. antisera or antitoxins

APPLICATION OF IMMUNOGLOBULIN:

1-After exposure ; associated with either

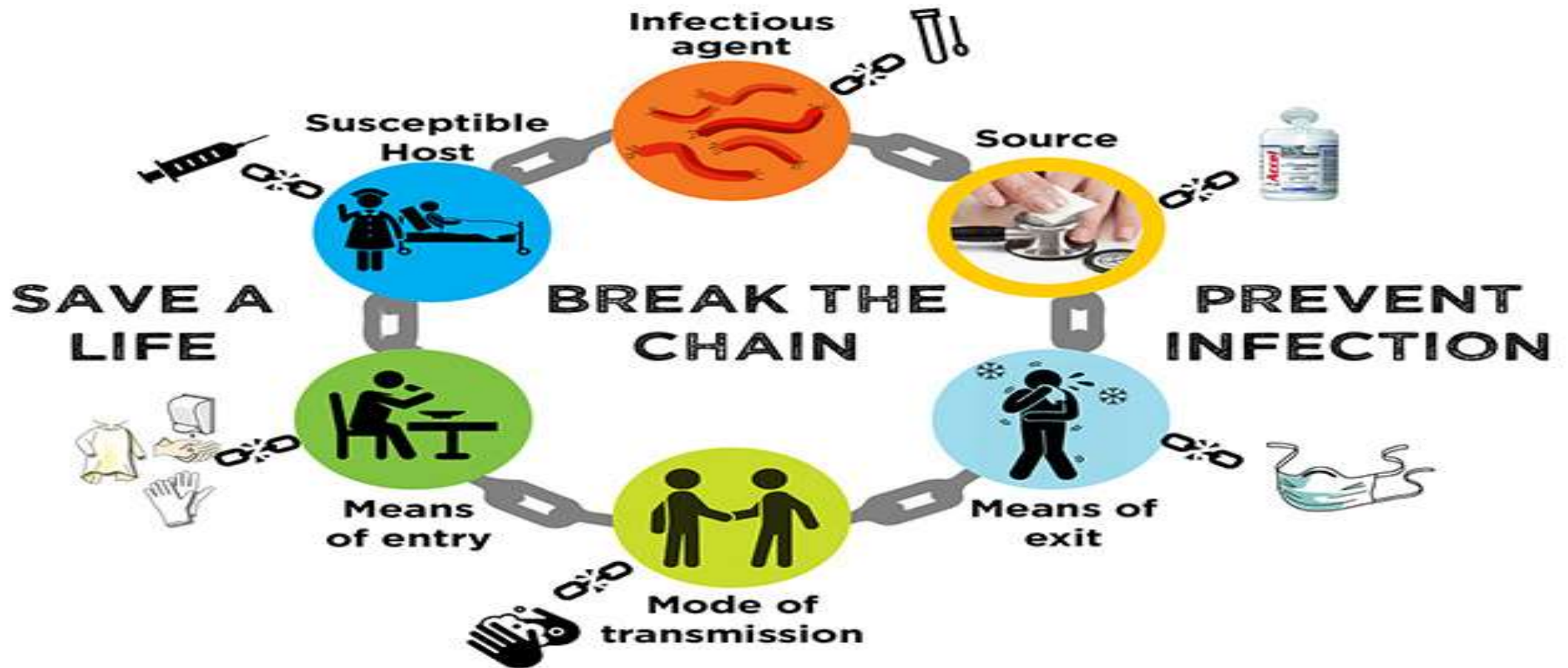
- * **Sero prevention**; when given early in incubation period
- * **Sero attenuation**; when given later in incubation period.
- * **Not effective; if given late in incubation.**

2-Before expected exposure; travelers from free to endemic areas can be given seroprophylaxis for expected infection; hepatitis A.

► **Specific immunoglobulin's are available for Sero-prophylaxis; antiviral (mumps, hepatitis A,B, measles, rubella, rabies. antitoxic (diphtheria & tetanus), and antipertussis (for exposed susceptible infants).**

□ **Serotherapy: tetanus ,diphtheria and rabies have specific antitoxin immunoglobulin that can be used for both prophylaxis & therapy in bigger doses. But there is no antiviral Serotherapy.**

prevention & control of infectious diseases



**Infection Prevention is
everyone's responsibility**



PREVENTION of INFECTIOUS DISEASES

Primary prevention means preventing the occurrence of infectious diseases, and so having no cases.

There are many aspects to communicable disease prevention and control, all with the aim of preventing the spread of communicable diseases in the population.

The work usually involves different types of preventive activities with the aim of:

- **Reducing the risk of an individual coming into contact with an infectious agent**
- **Preventing individuals who have been exposed to infection from becoming ill**
- **Preventing an infected individual from passing on the infection to others.**

Determinants of prevention

Successful prevention depends upon:

- **A knowledge of causation**
- **Dynamics of transmission**
- **Identification of risk factors and risk groups**
- **Availability of prophylactic or early detection and treatment measures**

- **An organization for applying these measures to appropriate persons or groups**
- **Continuous evaluation of and development of procedures applied**

Primary prevention can be achieved by general & specific measures.

1-General preventive measures:

- a- Sanitation of the environment: clean, pollution free.**
- b- Clean, proper behavior and habits of the public through health education.**
- c- Health promotion of the public, with adequate nutrition, to raise the general body resistance.**

2- Specific preventative:

- a-Immunization; active & seroprophylaxis**
- b- Chemoprophylaxis.**

Control of Infectious Diseases

Control refers to the activities conducted to bring a disease or a health problem to a very low level till it becomes no longer a public health problem.

**The term disease control describes ongoing operations aimed
at Reducing:**

- **The incidence of disease**
- **The duration of disease and as a result the risk of transmission**
- **The effects of infection, including both the physical and psychosocial complications**
- **The financial burden to the community.**

Control means the measures to be taken for existing infectious diseases, with following objectives:

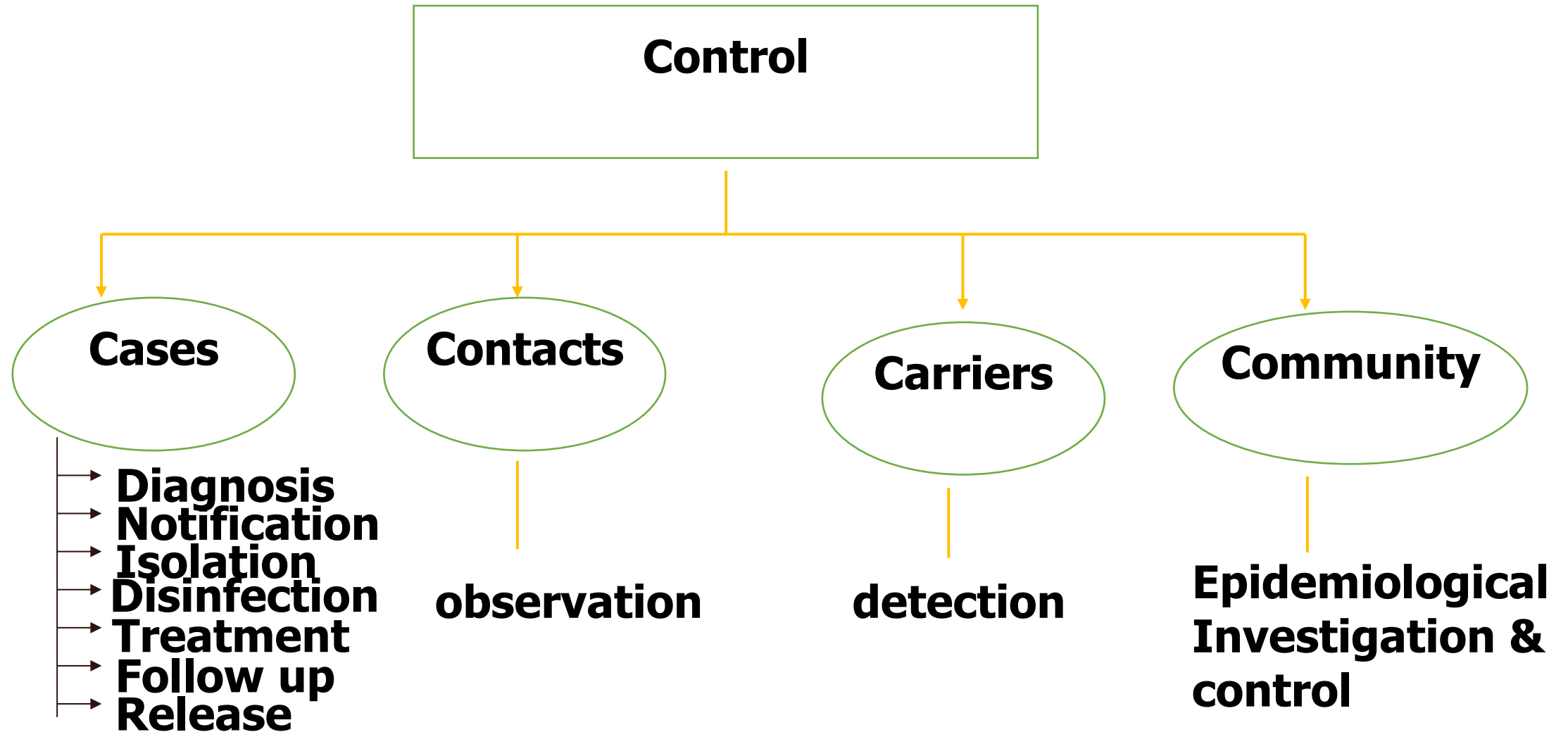
1-Case finding [detect cases]

2-Management of cases, and protecting them against hazards and sequelae of disease.

3-Protecting susceptible contacts and other groups who may be exposed to infection

4-Preventing or minimizing spread of disease in the involved community

Control of infectious diseases (the 4 "C"s)



1- Control of cases

a- Case – finding clinical diagnosis, and laboratory confirmation if necessary.

b- Notification: cases, of definite or suspected diagnosis, must be notified to the local health authority . This will depend on nature of disease.

Value of notification:

- 🌐 **To take prevention & control measures for the cases, and contacts and the community if necessary.**
- 🌐 **To help tracing source and channels of infection, in outbreak or epidemic.**
- 🌐 **To collect significant statistical data.**

C-Isolation

isolation is the act of separating a sick individual with a contagious disease from healthy individuals without that contagious disease in order to protect the general public from exposure of a contagious disease.

Isolation is defined as “separation**” , for the period of communicability of infected persons or animals from others in such places under such conditions , as to prevent or limit the direct or indirect transmission of the infectious agent from those infected to those who are susceptible ,or who may spread the agent to others”.**

- **Isolation is a routine procedure in hospitals and healthcare facilities.**
- **Isolation is usually voluntary, but in a public health emergency, officials have the authority to isolate people who are sick.**

Isolation of patients is indicated for infectious disease having the following epidemiological features:

1-High morbidity and mortality

2-High infectivity

3-No significant extra human reservoir

4-Infectious cases easily recognizable

5-Chronic carriers are not a significant part of the reservoir.

The infectious case must be isolated, either at home or hospital or special places, according to the nature of disease& home condition, period of isolation varies according to nature of disease.

It is usually for the period of communicability .

Value of Isolation

- **To stop activity and movement of the case in the community, thus prevent spread of infection.**
- **To protect the case against the risk of secondary infection, when exposed to contacts & visitors.**

Categories of isolation:

- ❖ **There are seven isolation categories (Strict Isolation, Respiratory Isolation, Protective Isolation, Enteric Precautions, Wound and Skin Precautions, Discharge Precautions, and Blood Precautions)**

d-Disinfection: is the process of destroying pathogenic organisms outside the body, by direct exposure to chemical or physical agents.

Types of disinfection are :

- 1- Prophylactic**
- 2-Concurrent**
- 3-Terminal**

Prophylactic Disinfection

As preventive measure to prevent the onset of disease such as chlorination of water, scrubbing and washing hands of health care providers, sterilization of instruments before using for surgery.

Concurrent disinfection: is carried out during the course of disease for:

- **Excreta and discharge, any object or material used in nursing, soiled articles & fomites.**

Terminal disinfection: disinfection for the last time, after transferring the case to hospital, or cure or death.

e-Treatment:

- **Specific therapy for bacterial disease, chemotherapy& antitoxins.**
- **Nursing and proper feeding**
- **Symptomatic treatment**
- **Prevention & control of sequelae and complications [2nd bacterial infection, dehydration...]**

f-Release:

The case can leave isolation, and return to school or work if:

- **Clinical recovery { becoming clinically free}**
- **Satisfactory general condition**
- **Becoming bacteriologically free, in diseases having **convalescent carriers****

2-Control of Contacts

A contact is the person who has been in association with the case at any time during the i.p and until discovered and isolated.

□ Forms of Contacts: house holds including family contacts; work, school.

Contact tracing is the process of identifying people who may have been exposed to an infected person ("contacts") and subsequent collection of further data to assess transmission

By tracing the contacts of infected individuals, testing them for infection, and isolating or treating the infected, this public health tool aims to reduce infections in the population.

In addition to infection control, contact tracing serves as a means to identify high-risk and medically vulnerable populations who might be exposed to infection and facilitate appropriate medical care

The local health center is responsible for control of contacts of notified cases.

1-Enlistment: special [contact list] is filled for names& personal data.

2-Examination: for case-finding if any; general condition, body temp, & any manifestations.

3-No exposure to isolated cases.

4-Surveillance, segregation ,quarantine or isolation according to disease

a-Surveillance

in most infectious diseases, contacts are put under supervision, every day for the incubation period of the disease, for case-finding, meanwhile, they go to work& school.

Personal SURVEILLANCE the practice of close medical or, other supervision of contacts to permit quick recognition of infection or illness but without restricting their movements.

b-Segregation: Contacts of the following diseases are excluded from school or work (not isolated)

- **Diseases having contact carriers e.g. Typhoid & diphtheria. Food handlers & school personnel contacts are excluded from work, and bacteriologically examined until prove not to be carriers.**
- **Diseases which are highly infectious in the early days, measles, susceptible contacts are excluded from school, and so will not be at school, otherwise spread infection, if get diseased.**

C-quarantine

A quarantine is used to separate and restrict the movement of persons; it is a 'state of obligatory isolation'

- ❑ Quarantine is for people who are not sick, but may have been exposed.**
- ❑ This is often used in connection to disease and illness, such as those who may possibly have been exposed to a communicable disease.**
- ❑ Quarantined people may stay at home or another location so they don't spread disease to healthy people.**
- ❑ Quarantine can be voluntary, but in a public health emergency, officials have the authority to quarantine people who have been exposed to an infectious disease.**

Quarantined individuals will be sheltered, fed, and cared for at home, in a selected emergency facility, or in a specialized hospital, depending on the disease and the available resources.

They will also be among the first to receive all available medical interventions to prevent and control disease, including:

- **Vaccination.**
- **Antibiotics.**
- **Early and rapid diagnostic testing and symptom monitoring.**
- **Early treatment if symptoms appear.**

QUARANTINE



- healthy person
- exposed
- staying at home + away from others

VERSUS

ISOLATION



- known case
- sick (even mild symptoms)
- staying at home + away from others

c-Isolation

Contacts of cholera [non endemic areas], pneumonic plague& pneumonic anthrax are isolated each for a certain period of time; since these diseases are serious, and so if any of the contacts is diseased, he will be isolation, and not exposed to others to infection.

5- Specific protection: By immunization or chemoprophylaxis, if available.

3-Community Control Measures

Sporadic cases of endemic infectious diseases can be readily controlled by control measures for cases & contacts, but if epidemic or outbreak appears or threatens to occur, prevention & control measures are needed to protect the at risk community.

Community Control Measures Include

a-Case finding and control of cases & contacts.

b-Epidemiologic investigation, to trace source & channels of infection.

c-Extreme control measures, been taken, if necessary e.g. closing schools and public places .

ERADICATION of INFECTIOUS DISEASE

Eradication literally means to "tear out by roots".

Eradication is defined as the permanent reduction to zero of the worldwide incidence of infection.

It involves eliminating an infectious agent worldwide by termination of all modes of transmission of infection , so there are zero cases globally — although it may still be kept in secure medical laboratories. Not all infectious diseases are eradicable.

- The concept of eradication is a global one. (complete removal).**
- Smallpox is the only disease that has been eradicated to date is smallpox.**

ELIMINATION of INFECTIOUS DISEASE

Elimination is defined as the reduction to zero of the incidence of infection in a specified geographic area.

Termination of all modes of transmission to a reduction of the incidence of the disease to the zero in a confined or specific geographic locality as a result of deliberate efforts yet, continued intervention methods are required. Ex, measles, poliomyelitis, and neonatal tetanus.

It means that existing endemic disease so controlled to reach the level of 'no reported cases'. This is usually by protection of at risk group or population, while the causative agent not necessarily eliminated.

WHAT IS DISEASE ELIMINATION?

ELIMINATION AND ERADICATION HAVE TWO VERY DIFFERENT MEANINGS

ELIMINATION



REGIONAL/LOCAL

DISEASE MAY BE ELSEWHERE IN POPULATION

ERADICATION



WORLDWIDE

DISEASE IN LABS ONLY, NOT IN POPULATION

BALTIMORE
CITY HEALTH
DEPARTMENT

000
@Bmore_Healthy

Coronavirus.BaltimoreCity.gov

Consideration of Definitions of Disease Control, Elimination, Eradication

	Definition
Disease Control	↓ in incidence, prevalence of infection and sequelae; ongoing measures required
Elimination	Cessation of transmission, undesirable manifestations prevented entirely
Eradication	↓ in incidence of infection, disease to zero

ANY QUESTION?

Break the Chain of Infection

BREAK THE CHAIN!

- ✓ Immunizations
- ✓ Treatment of underlying disease
- ✓ Health insurance
- ✓ Patient education



BREAK THE CHAIN!

- ✓ Diagnosis and treatment
- ✓ Antimicrobial stewardship

BREAK THE CHAIN!

- ✓ Cleaning, disinfection, sterilization
- ✓ Infection prevention policies
- ✓ Pest control

References

1-Park K. Principles Of Epidemiology and Epidemiologic Methods In: Textbook of Preventive and Social Medicine. 25th ed. Jabalpur; M/s Banarasidas Bhanot Publishers; 2019. p 100- 108

2-Kadri AM. General Epidemiology of Infectious Diseases and its Prevention and Control In: IAPSM's Textbook of Community Medicine. 2nd ed. New Delhi; Jaypee Brothers Medical Publishers; 2021.p 223-234