# Principles of Communicable Diseases EpidemiologyL-4/25-26


Prof Dr Najlaa Fawzi

## Objectives

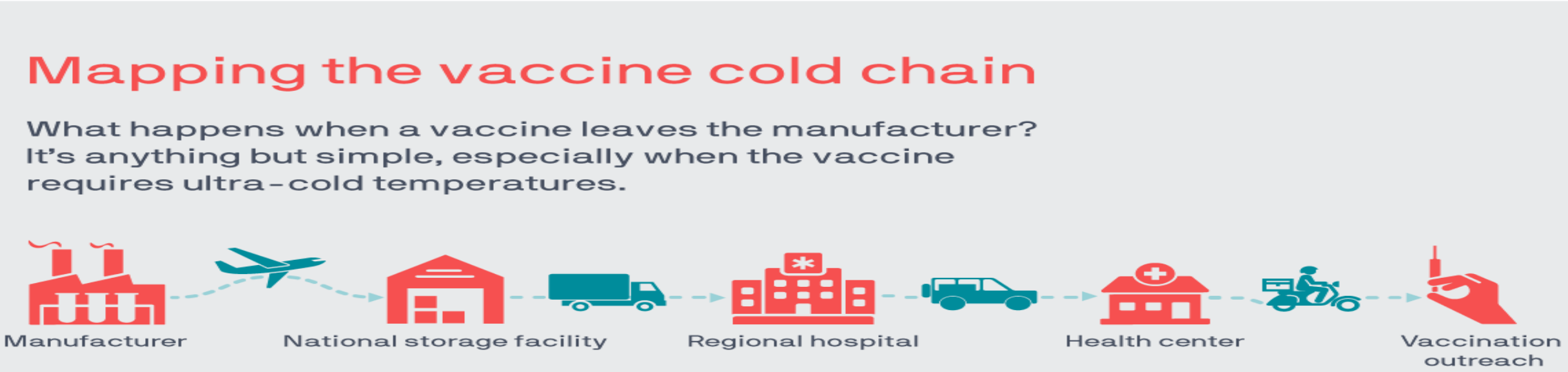
-Identify the principles and components of cold chain
- Designate the principles of passive immunity

-Recognize the principles of prevention of infectious diseases.

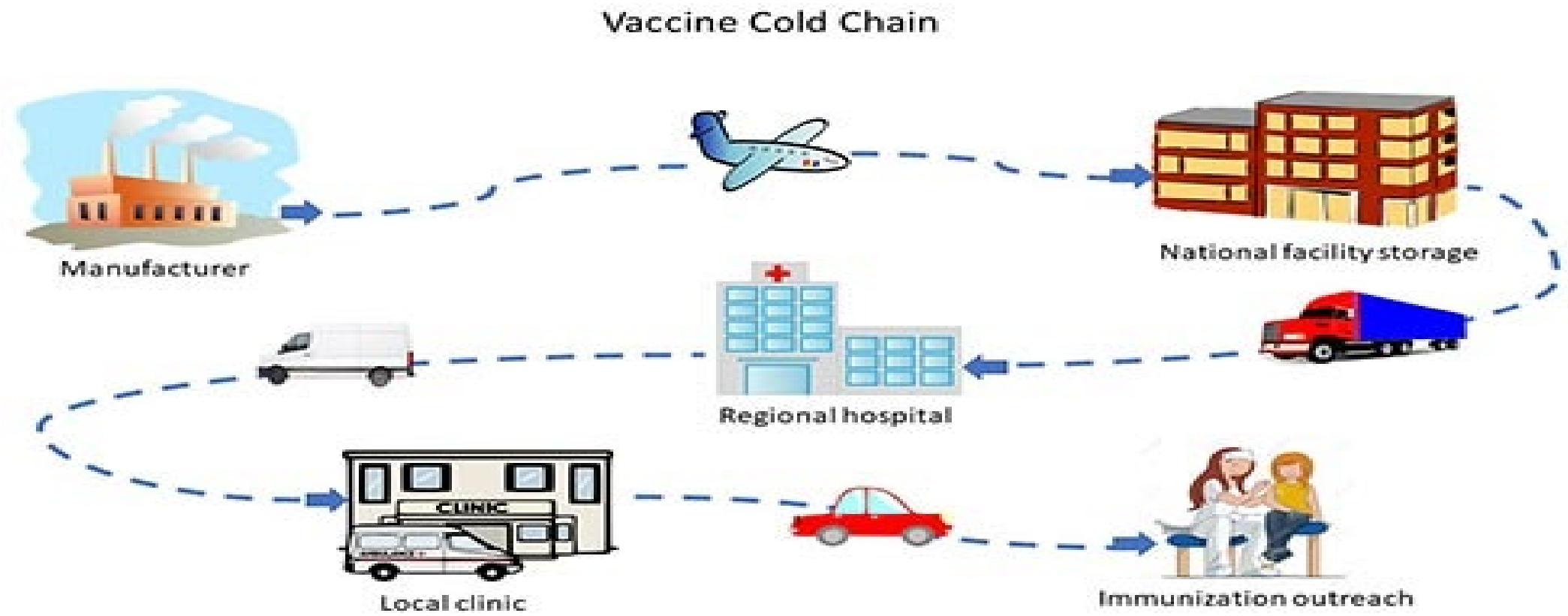
-Describe the key elements for control of infectious diseases(cases, contact, reservoir, and community)
- Define and compare between disease eradication and elimination

# 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.**



**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.**



# Importance of cold chain

1. Obtaining the vaccines from the manufacturers
2. Storing and transporting the vaccines
3. Maintaining the supply of vaccines
4. Having information about essential equipments, supply of electricity etc
5. Keeping the vaccine at low temperature
6. Protecting the vaccine from sunlight exposure
7. Maintaining the potency of vaccines.

## What are the 3 main components of cold chain?

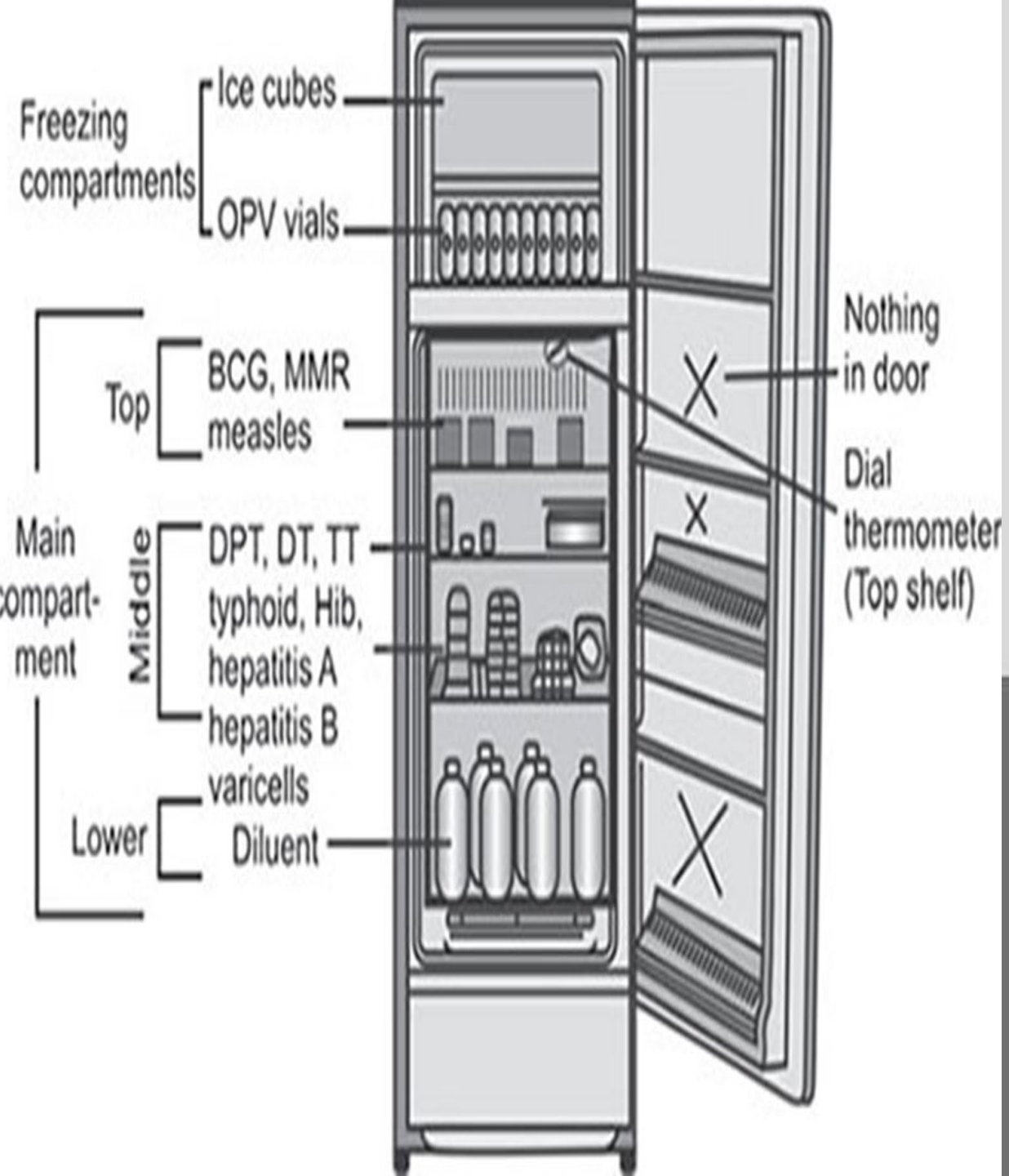
**The cold chain has three main components:**

- ✓ **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.

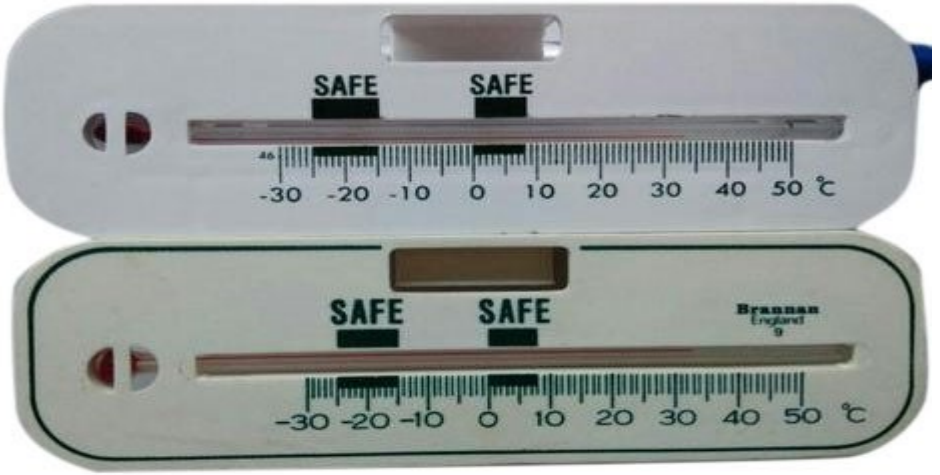
**All three elements must combine to ensure safe vaccine transport and storage**


Freezing compartments
Ice cubes
OPV vials
Top
BCG, MMR measles
Main compart-ment
Middle
DPT, DT, TT typhoid, Hib, hepatitis A hepatitis B varicells
Lower
Diluent
Nothing in door
Dial thermometer (Top shelf)


STOP
STOP

- **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.**



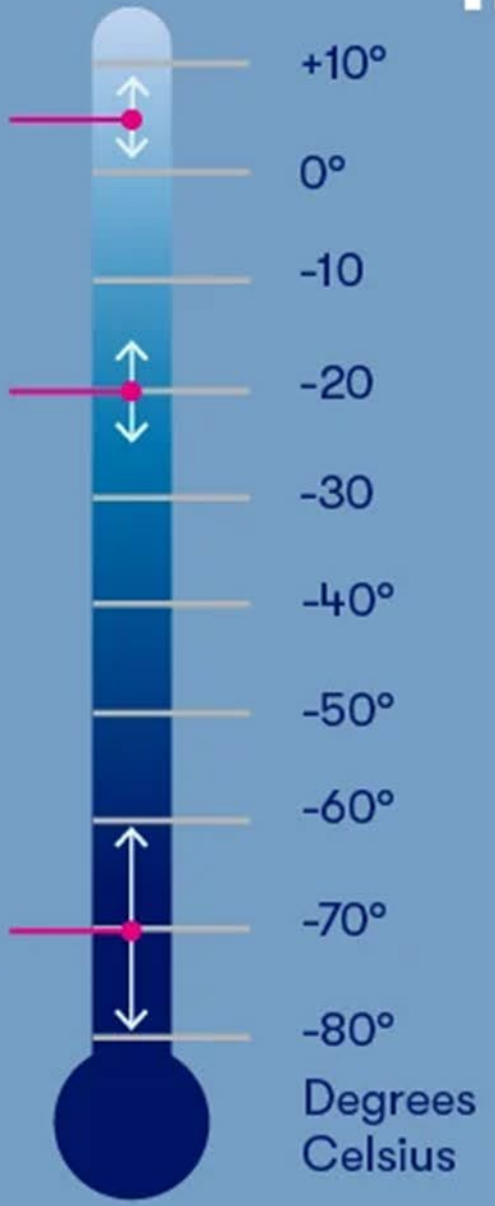
# VACCINE TEMPERATURE RANGE

REEFER RUNNER
IDENTEC SOLUTIONS


Majority of Vaccines
2° - 8°C

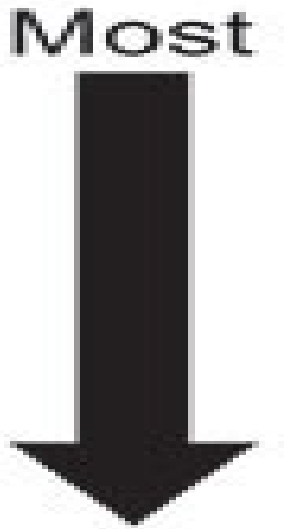
Vaccines for [redacted] chickenpox, shingles, measles, mumps, and rubella
ll need -25° - -15°C

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




BECAUSE IT WORKS

## 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

## Vaccines sensitive to freezing


Hepatitis B
DPT
DTaP
Td
TT

**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

**VVMs are small indicators that adhere to vaccine vials and change color as the vaccine is exposed to cumulative heat, letting health workers know whether the vaccine has exceeded a pre-set limit beyond which the vaccine should not be used.**

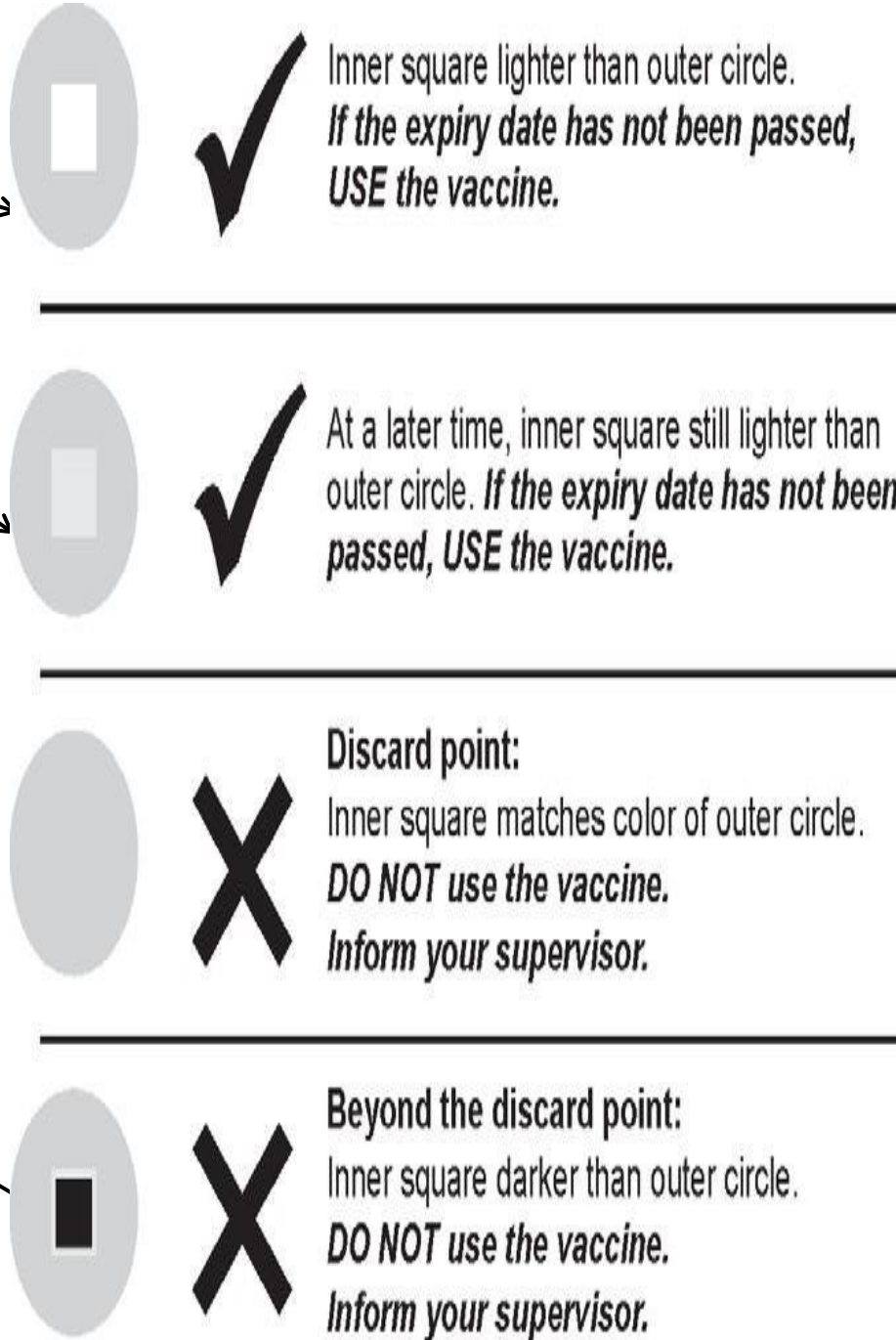
Vaccine vial monitors

**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 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.**

# 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.**

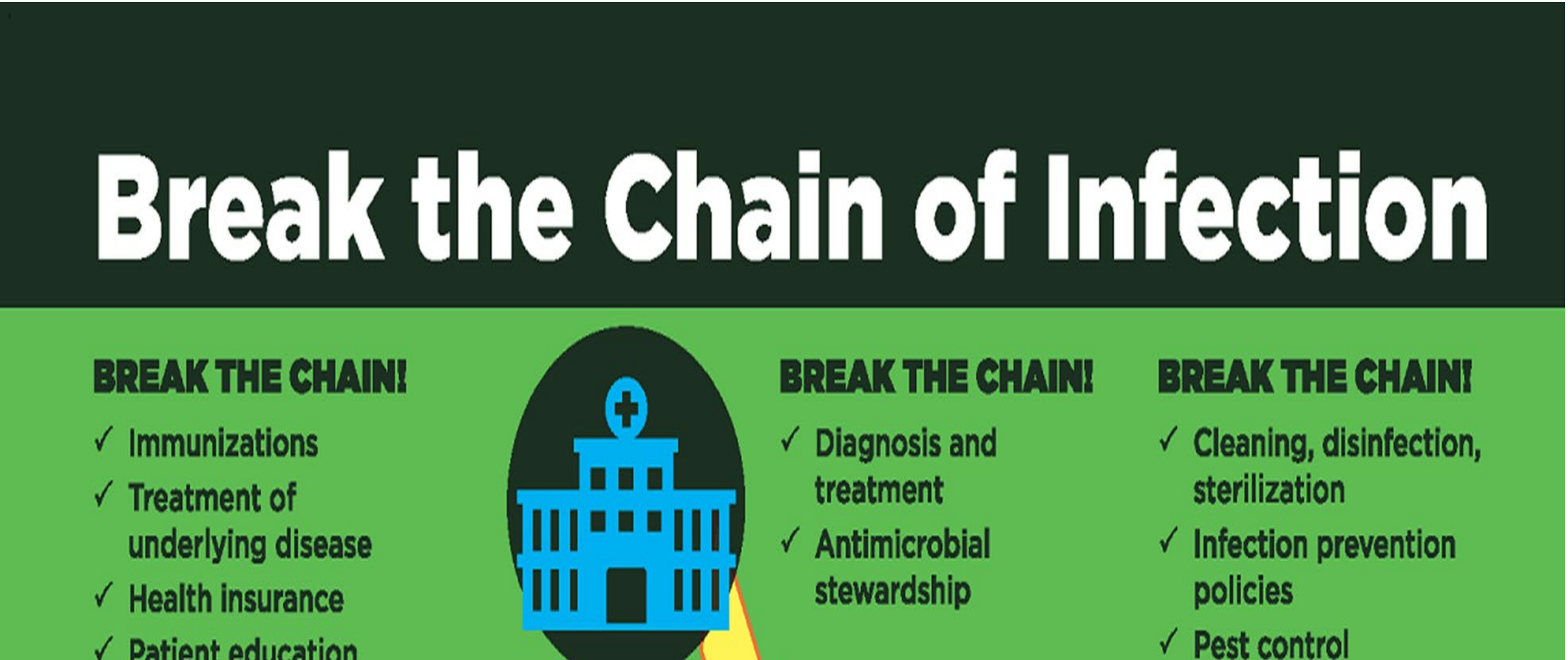
* **Not effective; if given late in incubation.**

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

➨ **Specific immunoglobulins 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



# 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:**

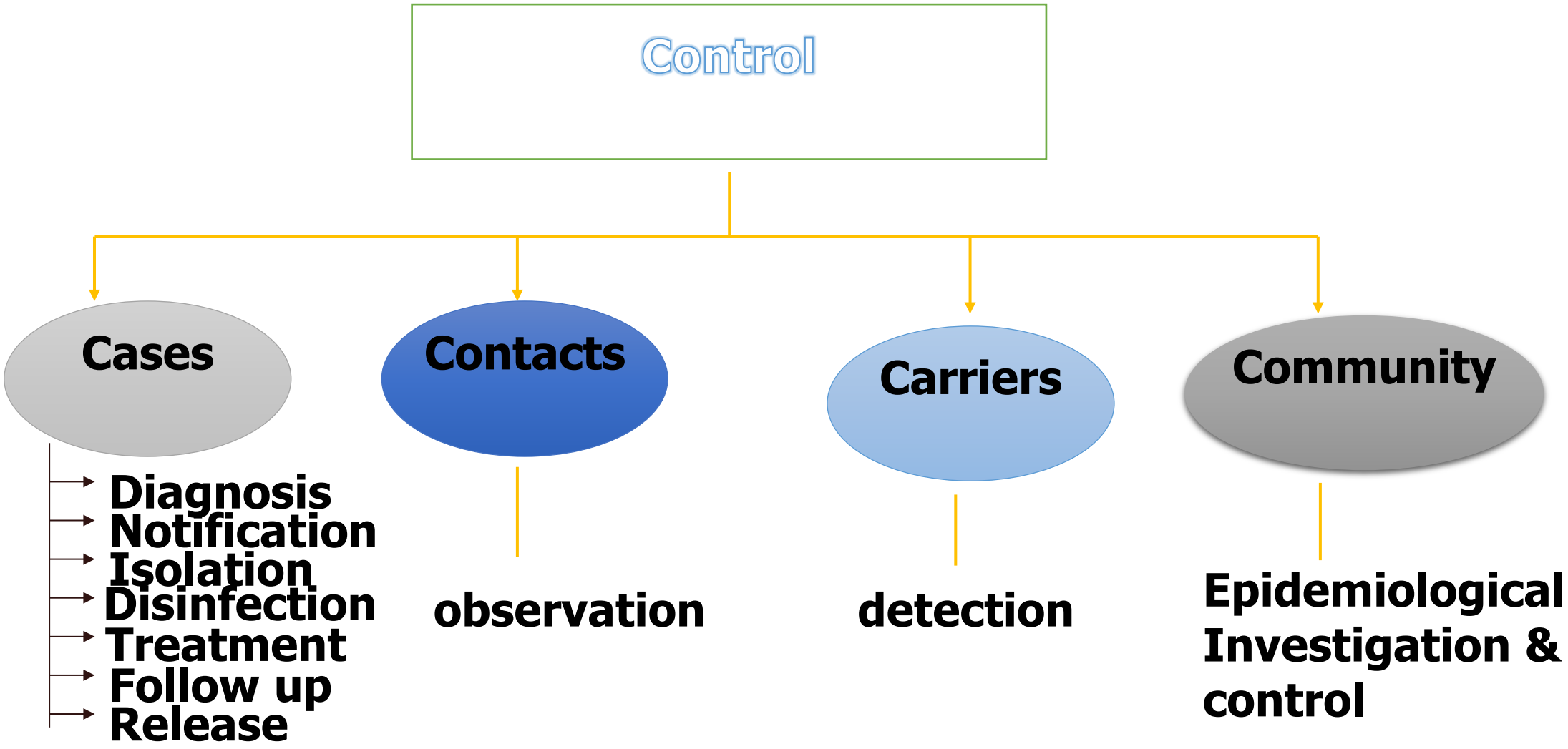
**1-Case finding [ detect cases]**

**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)



## Control measures are taken for:

a-Reservoirs of infection: man [cases, carriers] and animals.
b-Contacts [home, school, work…].
c-The community.

## A-Control of Reservoirs

**1-Animal reservoirs:** for infectious diseases having animal reservoirs

a-Eradication, if practically applicable, rodents, and stray dogs & cats.

b-Control of animals (sanitary environment, adequate feeding, veterinary care, vaccinations, sanitation of slaughtering houses).

c-Protection of man against occupational infection and transmission of infection.

# 2-Human Reservoirs : control of cases and carriers

**I-Control of carriers: may be difficult to control, since the majority is unnoticed, and only a small percent may come to notice: convalescent& contact carriers of diagnosed cases.**

**Carriers can be detected on laboratory examination on: --- Control of some infectious diseases:**

**1- Examining convalescent & contacts of diagnosed cases.**

**2- Epidemiologic study to trace the reservoirs of infection.**

**3-Pre employment & periodic examination of certain occupational groups**

# II- 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 .**

## Period of isolation:

**The period of isolation depends mainly on:**

**1- Time of recovery of case**

**2- Satisfactory general condition of the case.**

**3- Cessation of infectivity in disease having a convalescent carriers through bacteriological examination for: stool, throat and nose swabs (three consecutive successive negative results), or after arbitrary period of time of potential risk in viral disease.**

# 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.**

**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 application of disinfective measures as soon as possible after discharge of infectious material from body of an infected person
- During illness
- Responsibility of nursing
- Example: Disinfection of urine, faeces, vomit, contaminated linen, clothes, hands, dressings, gloves, aprons

**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 (name, age, sex, occupation, address, work)
2. Examination
3. Prevent contact with the case for benefit of both.
4. Put contacts under surveillance, segregation or isolation

5. Laboratory examination in diseases having Incubatory and contact carriers.

6. Excluded from work and examined until giving three consecutive negative results
(Examination: food handler and school children for diphtheria.

7. Specific protection by immunization and chemoprophylaxis (contacts of meningococcal meningitis→ oral Rifampicin, cholera→ oral tetracycline)

## a-Surveillance

in most infectious diseases, contacts are put under supervision, every day for the incubation period of the disease, for case-finding, mean while, 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 bacteriologic ally 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.**
- **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.**

# QUARANTINE

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

VERSUS

# ISOLATION

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

pennsylvania
DEPARTMENT OF HEALTH

## d-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.**

# 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.**

**1-Applied prevention: measures of primary prevention are applied in relation to the particular disease under control**

**--- Adequate ventilation& spacing of confined places in respiratory infections, especially meningococcal meningitis.**

**---- Super chlorination of water supply and sanitary disposal of wastes in food borne infections.**

**---- Health education of the at- risk group or pop, for encountered disease, especially personal precautions.**

**---- Specific prevention; mass active immunization or chemoprophylaxis of at risk- group, if available for the encountered disease.**

## 2-Control measures:

a-Case finding and control of cases & contacts.

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

c-Drastic control measures, been taken, if necessary, e.g. closing schools.

# 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 POPULARION

### ERADICATION

WORLDWIDE

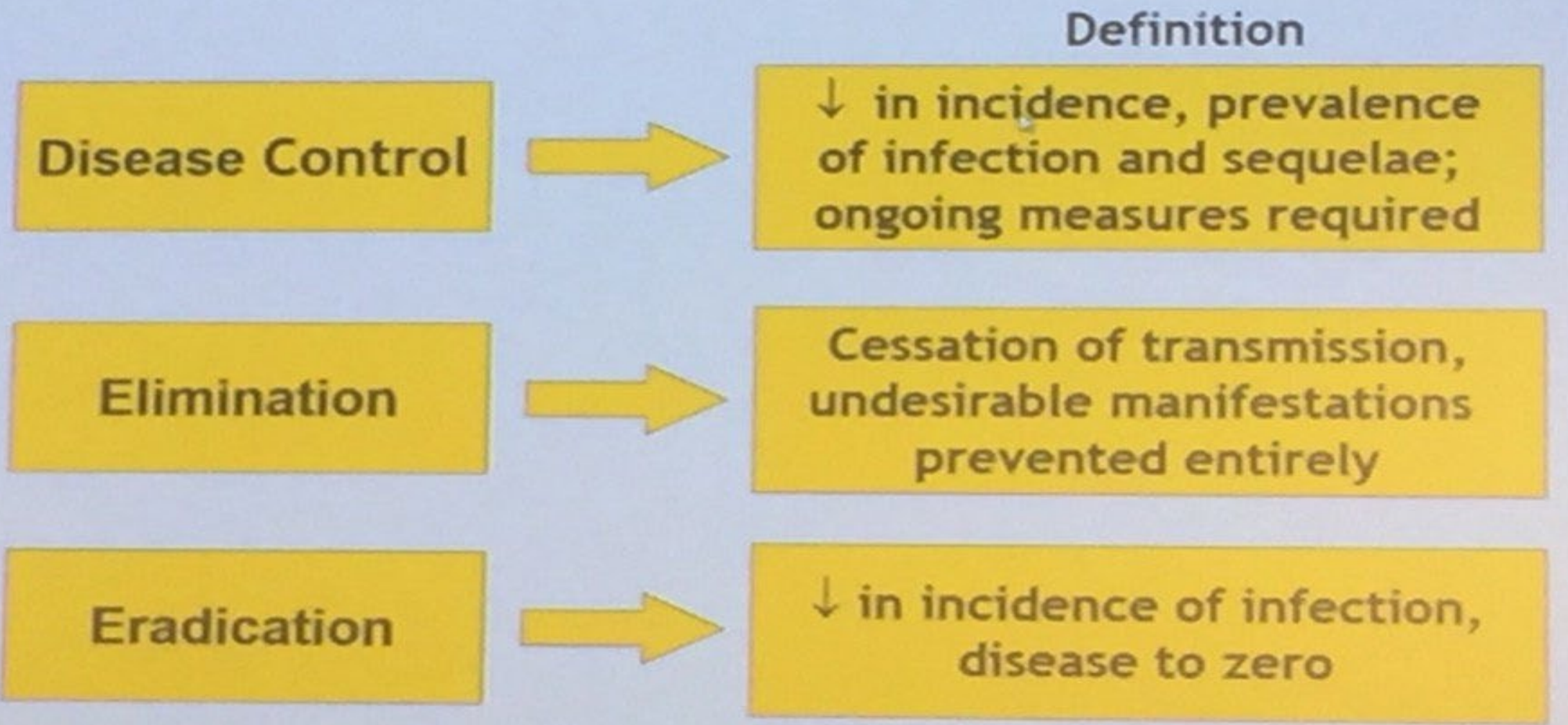
DISEASE IN LABS ONLY, NOT IN POPULATION

BALTIMORE CITY HEALTH DEPARTMENT

@Bmore_Healthy

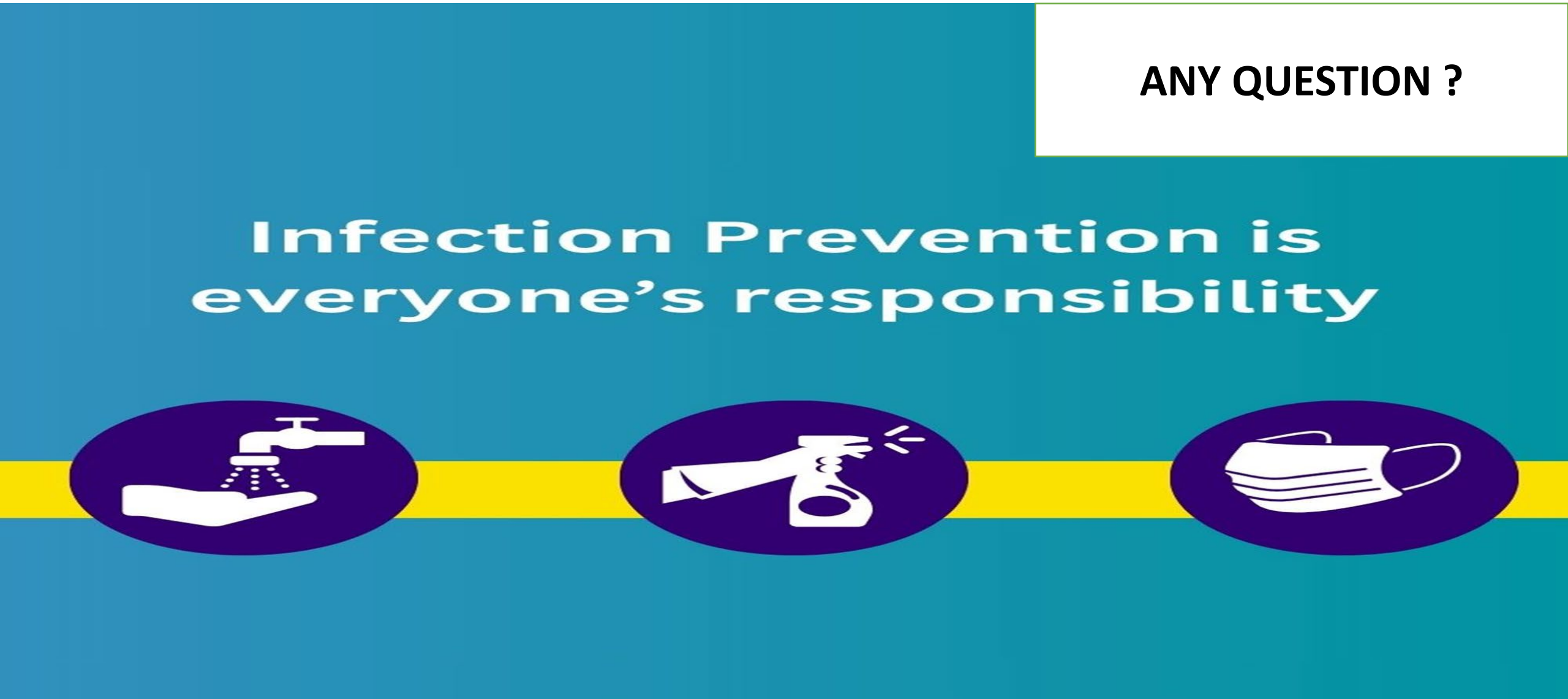
Coronavirus.BaltimoreCity.gov

# Consideration of Definitions of Disease Control, Elimination, Eradication




Dowdle WR. *Bull World Health Organ* 1998;76(Suppl 2):22-25.

**ANY QUESTION ?**



## 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