

# *Infection Control*

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# *Learning Objectives*

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At the end of this lecture the students will be able to:

1. Define the basic definitions related to infectious diseases epidemiology
2. Review the role of susceptible host for successful parasitism
3. Describe the modes of transmission of disease

4. List and explain the various classifications of communicable diseases with special reference to the scope and purpose of the **International Classification of Diseases (ICD - 10)**
5. Enlist the common infectious diseases affecting the population of Pakistan as per National institute of Health Pakistan.
6. Explain the role of personal hygiene & PPE in infection control.

# ***Objective - 1***

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***Define the basic definitions related to infectious diseases epidemiology***

# *Infection*

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Invasion of a host body tissues by disease causing organisms & their multiplication, and reaction of host tissues to these organisms and their toxins.

E.g. viruses, prions, bacteria, worms, arthropods, fungi, protists parasites.



# ***Contamination:***

It is an accidental introduction of infectious material like bacteria, yeast, mould, fungi, virus, prions, protozoa or their toxins and by-products of food, water etc.

## **Food Contaminant**

***Something that should not be in a food and makes it unfit for human consumption.***

### **Biological Contaminant**

***Viruses***   
***Bacteria***   
***Parasites***   
***Insects***   
***Other organisms or microorganisms***

### **Physical Contaminant**

***Plastic***  
***Steel wool***   
***Glass***  
***Metal***  
***Other foreign objects***

### **Chemical Contaminant**

***Pesticides***   
***Herbicides***  
***Rodenticides***  
***Arsenic***  
***Mercury***   
***Other toxins***

# Pollution

The presence of offensive, but not necessarily infectious matter in environment.

## TYPES OF POLLUTION



1 Air pollution



2 Water pollution



3 Soil pollution



3 Noise pollution

# ***Infestation:***

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The diseases is caused by mites, ticks, lice and worms.

- i. *External Infestation:*** The parasite lives on the surface of the host e.g. mites, ticks, head lice and bed bugs.
- ii. *Internal Infestation:*** The parasites live within the host and includes worms



***External infestation -  
head lice***

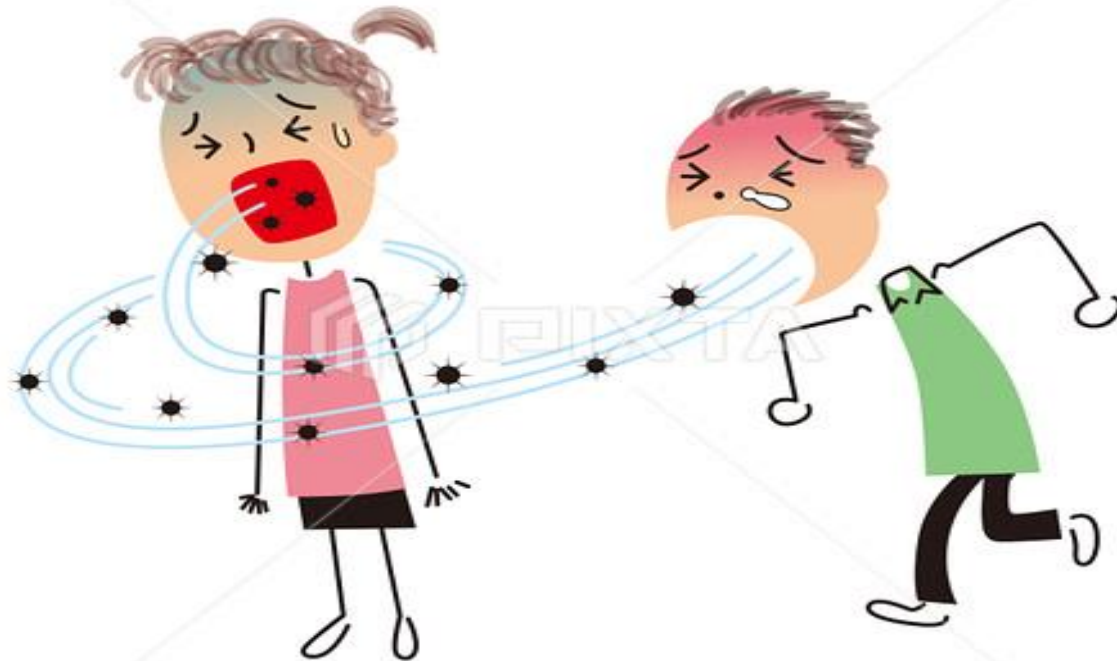


***Internal infestation –  
intestinal worms***



***Infectious diseases:*** Diseases and disorders caused by micro organisms — e.g. Bacteria viruses, fungi or parasites.

***Contagious diseases:*** Infectious diseases that can spread rapidly from person to person through direct contact



## ***Host: there are 3 types***

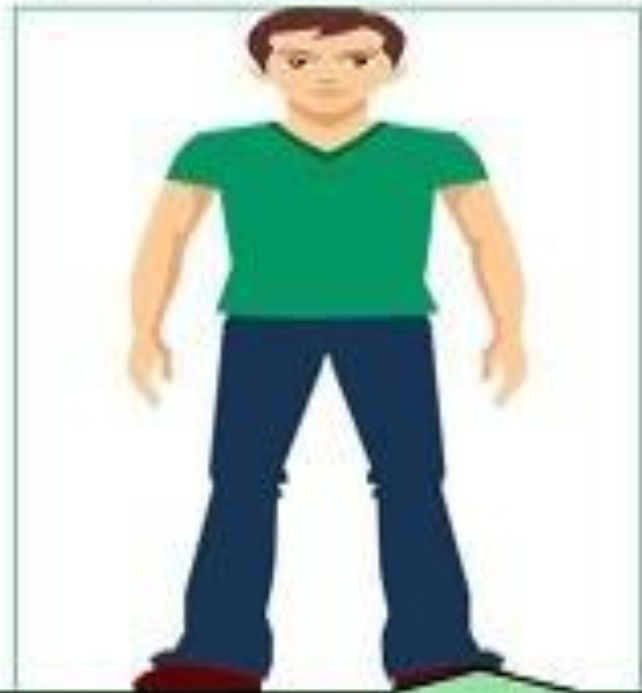
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- The organism from which a parasite obtains its nutrition and/or shelter.
  - a. *Definite or primary host:*** In which the parasite reaches maturity and may reproduce sexually.
  - b. *An intermediate host:*** It acts as vector of parasite to mature.
  - c. *Reservoir host:*** Can harbor a pathogen indefinitely with no ill effects.

# HOSTS OF PLASMODIUM PARASITE



DEFINITIVE  
HOST



INTERMEDIATE  
HOST

***Susceptible person:*** Susceptible or non-immune person is one who has little resistance against a particular organism and who, if exposed to this organism, is likely to contract disease.

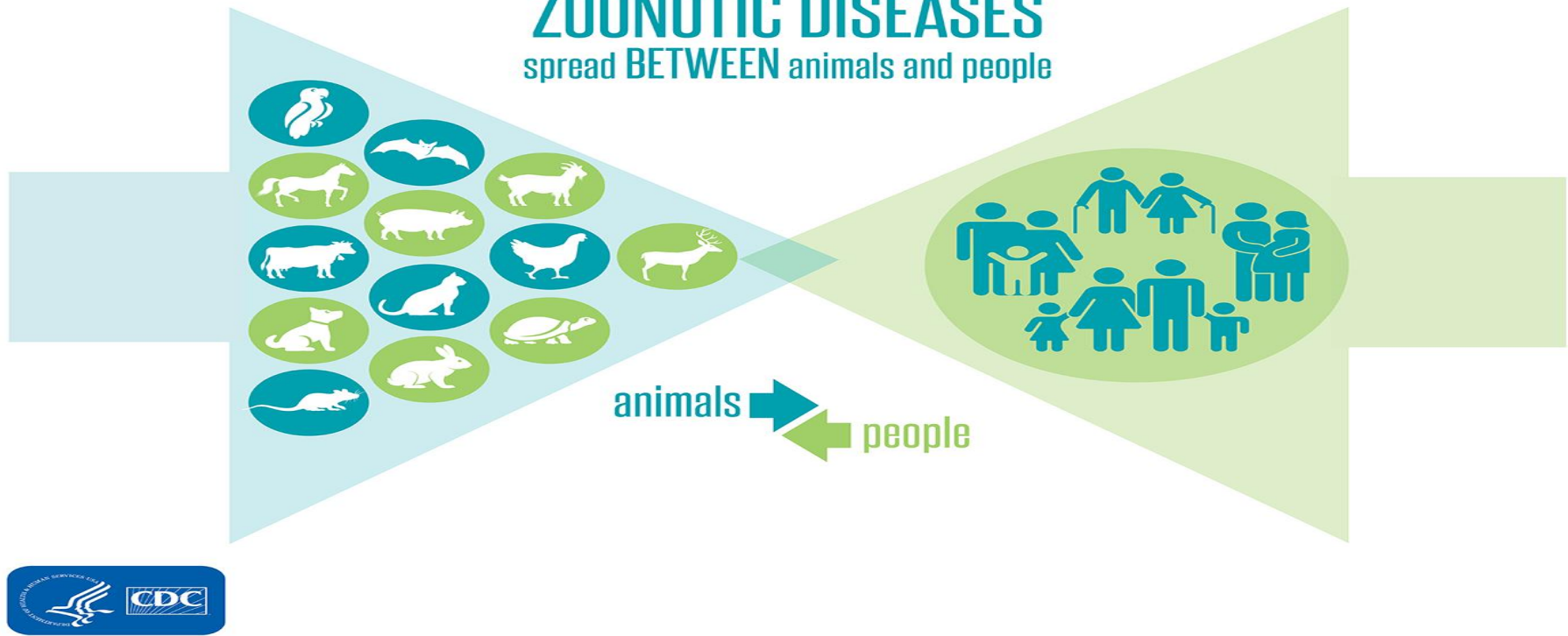
***Immune Person:*** A person who possesses a power to resist infection.

- ***Sporadic disease:*** The disease occurring occasionally, or in scattered instances. E.g. tetanus, rabies.
- ***Outbreak:*** A disease that occurs in greater numbers than expected in a community or region or during a season.
- ***Endemic:*** Disease that is always present in a community in low frequency. E.g. Malaria, Chicken pox, AIDs

- ***Epidemic:*** Disease spreading rapidly & extensively, affecting many individuals in a population at the same time. E.g. influenza, Avian influenza, Cholera, Ebola, Plague, Influenza, Zika etc.
- ***Pandemic:*** A widespread disease affects a whole region, a continent, or whole world. E.g. AIDS in Africa, SARS, Covid 19

# ZOOONOTIC DISEASES

spread BETWEEN animals and people



Diseases and infections that are naturally transmitted between vertebrate animals and humans.(WHO). A zoonotic agent may be a bacterium, virus, fungus etc.



**Contact person:** An individual that has lived in close association with another and has thereby been exposed to infection with a disease with which that other is affected.

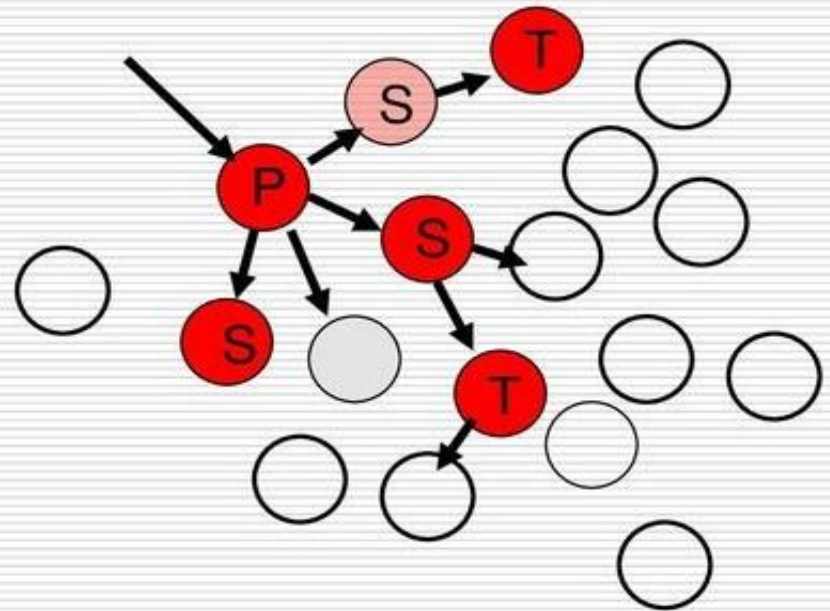
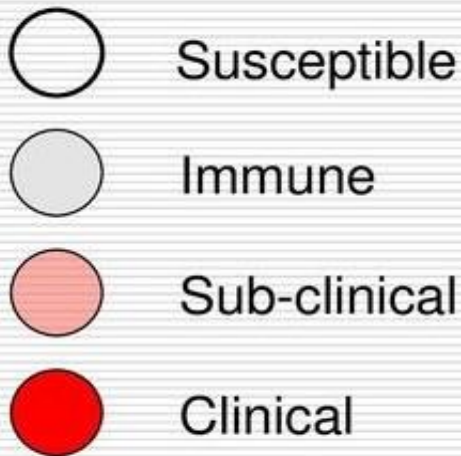
**Fomite:** Nonliving agents like clothing or bedding, knob, pencil etc, that are capable of absorbing and transmitting the infecting organism of the disease.



F O M I T E S

# Cases

- ❖ Index – the first case identified
- ❖ Primary – the case that brings the infection into a population
- ❖ Secondary – infected by a primary case
- ❖ Tertiary – infected by a secondary case



- **Carriers:** Persons who harbors microorganisms of a disease & excretes them without suffering from symptoms. 3 types
  - i. **Incubatory carriers:** Persons infected with microorganism but in an early stage that clinical manifestations are not apparent.
  - ii. **Convalescent carriers:** Persons who have recovered from symptoms of infectious diseases but are still capable of transmitting it, e.g. typhoid, dysentery.
  - iii. **Healthy carriers:** Persons who have contracted infectious disease but shows no symptoms and can transmit it to others.

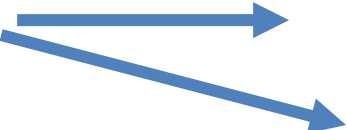
# ***Disease Vectors:***

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Are usually arthropods that transfers infectious agent from one host to another. e.g. dogs transmit rabies virus/mosquito transmits malaria to humans.

Vectors are found in every habitat worldwide,

Prevalent in tropics, warm/moist regions.

**Vectors may be**  **a. Biological**  
**b. Mechanical**



***Biological vectors:*** Usually arthropods in which infecting organism develops before becoming infective to recipient individual and are responsible for serious blood-borne diseases. E.g. malaria, viral encephalitis.

Flies may carry diseases such as hepatitis A, typhoid, amebic dysentery and polio by contaminating food or water



***b. Mechanical vectors:*** Arthropod vectors that transmits infective organisms from one host to another but are not essential to life cycle of the parasites e.g. housefly.

# ***Timelines for Infection and disease***

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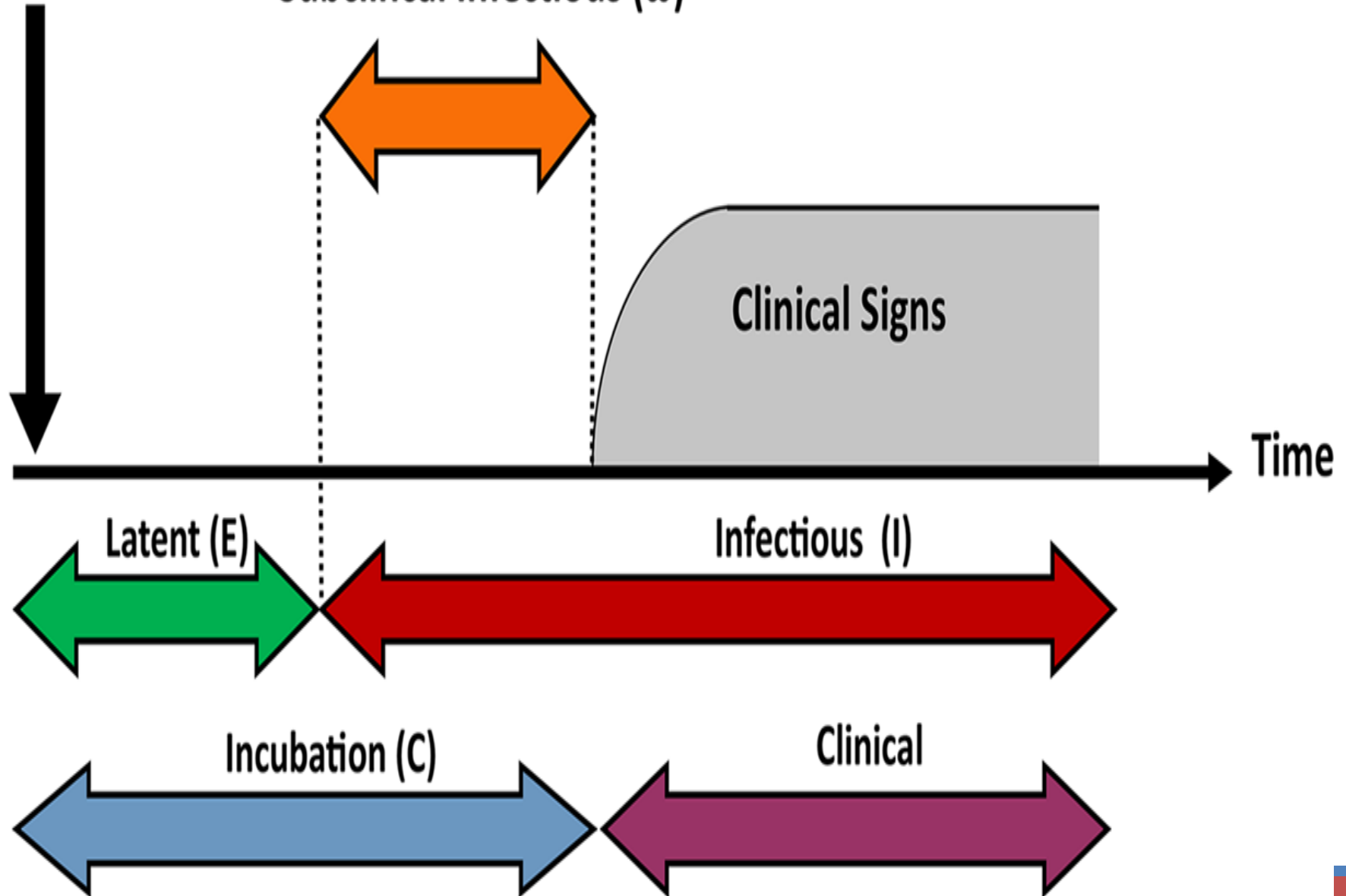
***Latent period:*** Time interval between exposure and infection.

***Incubation period:*** Time between exposure and to the development of clinical disease

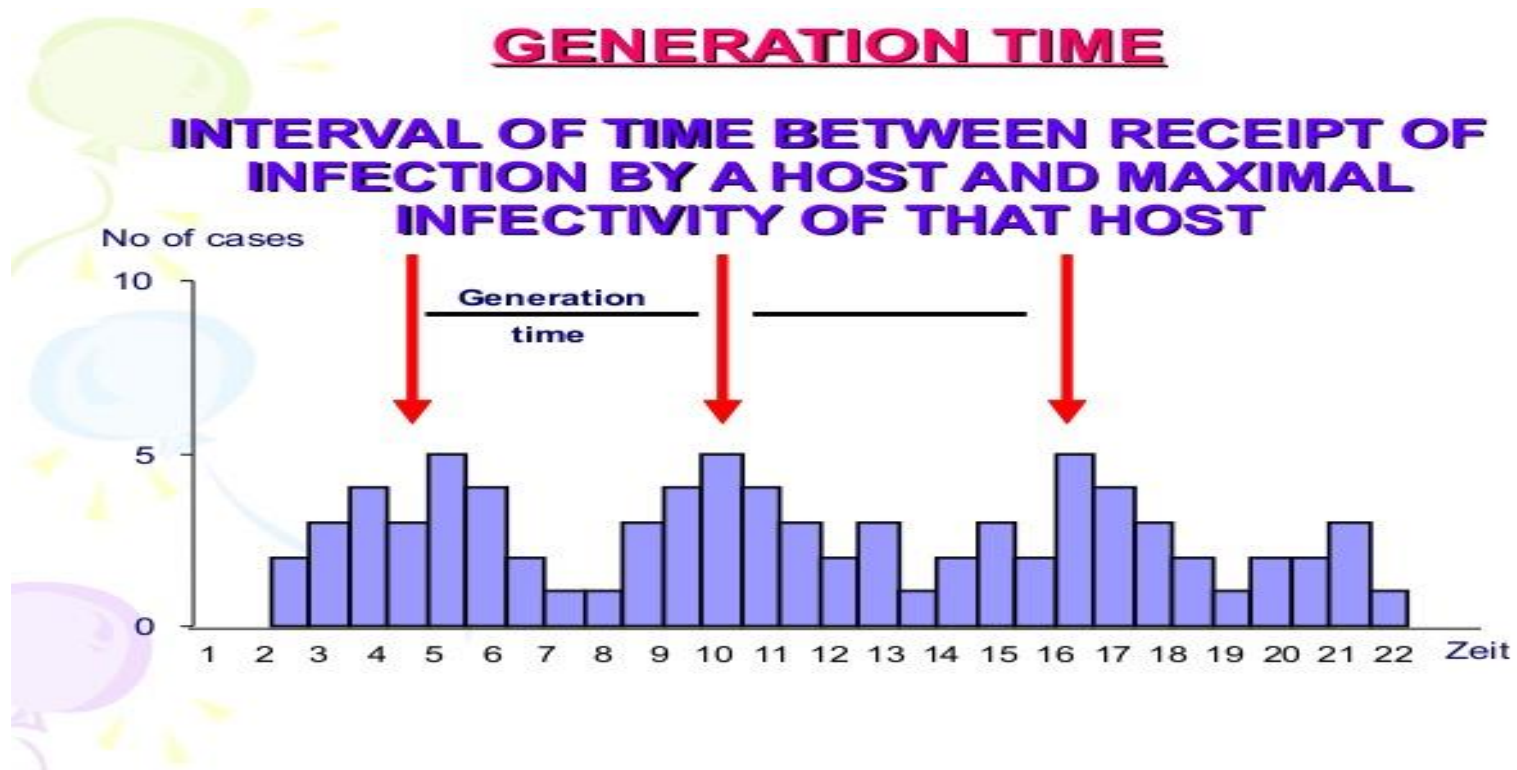
***Infectious period:*** Time during which a host can infect another host.

Infection

Subclinical Infectious ( $\omega$ )



**Generation time:** When one person transmits an infection to another, then the time that elapses between onset of symptoms in the **Primary case** and onset of symptoms of the **Secondary case**





***Cross infection:*** A cross infection occurs when harmful microorganisms like bacteria and viruses transfer to a patient by way of another person or medical tools and equipment

***Noso - comial (hospital-acquired infections):***

Infections that are not present in patient at the time of admission but developed later during the stay in hospital.

***Opportunistic infection:*** An infectious organism that normally does not harm its host but can cause disease when the host's resistance is low. E.g. *Candida albicans* - causes oral and genital tract infections.

***Iatrogenic disease:*** It is an adverse effect or complication resulting from medical treatment or advice, including that of psychologists, therapists, pharmacists, nurses, physicians and dentists etc.

## Examples

- medical error
- wrong prescription, (due to illegible handwriting)
- negligence
- faulty procedures, techniques, information, or methods
- failure in life support instruments
- prescription drug interaction
- adverse effects of prescription drugs
- over-use of drugs leading to antibiotic resistance in bacteria
- nosocomial infection (hospital-acquired infections)
- blood transfusion

# ***Disease Surveillance:***

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It is an information-based activity involving

- Identification
- Collection
- Analysis and Interpretation
- Monitoring the large amount of data.

***Disease Control:*** Reducing the number of, new infections, number of people currently infected and number of people who become sick or die from a disease in local settings.

***Disease Eradication:*** Reduction of worldwide incidence of a disease to zero as a result of deliberate efforts, intervention measures are no longer needed. e.g. smallpox.

***Disease Elimination:*** The specific infectious agent no longer exists in nature or in the laboratory. Example none.

***Emerging infectious diseases:*** Infections that have recently appeared within a population or those whose incidence or geographic range is rapidly increasing or threatens to increase in the future.

May be caused by previously undetected infectious agents.

E.g. SARS, 0157-H7 (E coli), H5N1, Dengue

## ***Objective – 2***

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***Role Of Susceptible Host For Successful  
Parasitism***

**Parasitism** is a close relationship between species, where one organism, the **parasite**, lives on or inside another organism, the host, causing it some harm, and is adapted structurally to this way of life.

In Parasitism, parasites are much smaller than their hosts, do not kill them, and often live in or on them for an extended period.

Parasites of animals are highly specialized, and reproduce at a faster rate than their hosts.

Classic examples include interactions between vertebrate hosts and tapeworms, flukes, the malaria-causing *Plasmodium* species, and fleas.



# *Four stages are required for successful parasitism*

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1. Portal of entry
2. Site of living in the body
3. Portal of exit
4. Survival in extreme environment

## ***Objective – 3***

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***Mode of transmission of disease***

# Mode of transmission

There are two main modes of transmission

## 1. Direct transmission

- **Direct contact**
- **Droplet infection**
- **Contact with soil**
- **Inoculation into skin or mucosa**
- **Trans-placental (vertical)**

## 2. Indirect transmission

- **Vehicle-borne**
- **Vector-borne:**
  - i. Mechanical**
  - ii. Biological**
- **Air-borne**
- **Fomite-born**

# ***1: Direct Transmission of Communicable Diseases:***

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- In this, the pathogens are transmitted from an infected person to a healthy person directly without an intermediate agent. E.g.
  - a. Direct contact with an infected person** i.e. hand shake, kissing, sexual act, e.g. contagious diseases like chickenpox, smallpox, measles, ringworm, gonorrhoea syphilis etc.

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- b. Droplet infection** by coughing, sneezing and spitting e.g., pneumonia, diphtheria, influenza, tuberculosis etc.
  - c. Contact with soil**, e.g. Bacterial cysts of tetanus.
  - d. Animal bites** e.g. Rabies viruses.
  - e. Tran placental transmission.** The viruses of German measles and AIDS; and bacteria of syphilis can be transmitted from the maternal blood into foetal blood through placenta.

## ***2. Indirect transmission***

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Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. It may be:

***A; Mechanical transmission:*** When a vector simply carries pathogenic microorganisms on their body and transfers them to food. E.g. flies and cockroaches.

***i. Vehicle borne transmission***

- The agents multiplies or develops in vehicle & transmits through agencies like water, vegetables, fruits, milk, milk products, ice, blood, serum, tissue etc. E.g. Diarrhea, Typhoid, Cholera, Polio, Hepatitis A, Brucellosis, Etc.

***ii. Vector borne – Already discussed***

- iii. Air borne.** Transmission is carried in air in form of droplets and dust e.g. tuberculosis, influenza, chicken pox, measles, viruses, spores of fungi etc.
- iv. Fomite borne.** These are inanimate substances other than water or food contaminated by the infectious discharge, e.g. diphtheria, typhoid bacillary dysentery, hepatitis A, eye and skin infections.



## ***Objective 4***

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# ***The International Classification of Diseases (ICD)***

List and explain the various classifications of communicable diseases with special reference to the scope and purpose of the International Classification Of Diseases (ICD - 10)

# ***Infection Control***

***Basic definitions of infectious disease  
epidemiology***

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# ***Ways of classifying communicable diseases***

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- 1. Clinical classification** is based on the main clinical manifestations (symptoms and signs) of the disease.
- 2. Epidemiologic classification** is based on the main mode of transmission of the disease.
- 3. Classification according to nature of Pathogen**

# *Ways of classifying communicable diseases*

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## *1 - Clinical classification*

This classification is based on the main clinical manifestations of the disease.

1. Communicable diseases
2. Non communicable diseases

## ***2 - Epidemiologic classification***

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This classification is based on the main mode of transmission of the infectious agent.

1. Food and Waterborne diseases
2. Zoonotic Diseases
3. Sexually transmitted diseases
4. Airborne diseases
5. Vector-borne diseases

## ***3 - Classification according to the nature of the pathogen***

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1. Viral diseases
2. Rickettsial diseases
3. Mycoplasmal diseases
4. Chlamydial diseases
5. Bacterial diseases
6. Spirochaetal diseases
7. Protozoan diseases
8. Helminthic diseases
9. Fungal diseases.

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**ICD-10** is the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (**ICD**), a medical classification list by the World Health Organization (WHO).

The WHO owns, develops and publishes ICD codes, and National Governments and other regulating bodies adopt the system.

# *Benefits of ICD-10*

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- ICD-10 code sets will enhance the quality of data for:
  - i. Tracking public health conditions
  - ii. Improved data for epidemiological research
  - iii. Measuring outcomes and care provided to patients
  - iv. Making clinical decisions
  - v. Identifying fraud and abuse
  - vi. Designing payment systems/processing claims



## ***ICD - 9***

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The ICD is originally designed as a health care classification system, providing a system of diagnostic codes for classifying diseases.

The ninth revision of an international classification of diseases accepted and used throughout the world for the coding of mortality and morbidity statistics and the indexing of hospital records.

# *Examples*

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1. Intestinal infectious diseases (001–009) - 001 Cholera
2. Tuberculosis (010–018) - 011.0 Tuberculosis of lung
3. Zoonotic bacterial diseases (020–027)
4. Other bacterial diseases (030–041) - 032 Diphtheria
5. Human immunodeficiency virus (HIV) infection (042–044) –  
042
6. Mycoses (110–118) - 112 Candidacies

# ***Objective 5***

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***Common infectious diseases national  
institute of health Pakistan.***

1	Tuberculosis	17	Diphtheria
2	Hemorrhagic Fevers CCHF	18	Bacterial Meningitis
3	Hepatitis B & C	19	Viral Meningitis
4	Malaria	20	Coetaneous Leishmaniasis
5	Poliomyelitis and AFP	21	Gonorrhea
6	Dengue, DHF & DHS	22	Nosocomial Infections
7	Severe Acute Respiratory Infections	23	Encephalitis
8	Cholera	24	Plague
9	Diarrhea	25	Mumps
10	HIV/AIDS	26	Botulism
11	Enteric Fever	27	Congenital Rubella Syndrome
12	Neonatal Tetanus	28	Syphilis
23	Rabies	29	Brucellosis
14	Meningococcal Meningitis	30	Visceral Leishmaniasis
15	Hepatitis A & E	31	Anthrax
16	Pertussis		

# ***Objective 6***

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***Explain the role of personal hygiene &  
PPE in infection control.***

# ***Role of Personal hygiene in Control of Infection***

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Personal hygiene are **the behaviors that must be practiced in daily life, starting from morning to sleep time to protect health.**

To protect health, body, hair, mouth and teeth must be cleaned regularly and clothes must be washed frequently.

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Hygiene practices reduce the risk of transmission by killing the germs and microbes that carry the disease.

Soaps, sanitizers and other hygiene products contain ingredients and chemicals that, while harmless to humans, kill these microorganisms.

# Common Hygiene Practices

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## Hand washing

Regular hand washing is one of the most effective ways to prevent the spread of infectious diseases.

Washing hands correctly with warm water and soap for at least 20 seconds or using an alcohol based sanitizer.



## 40 - 60 Second Hand Wash Procedure

**1**



Wet hands

**2**



Palm to palm

**3**



Back of hands

**4**



between fingers

**5**



Back of fingers

**6**



Base of thumbs  
& wrists

**7**



Fingernails

**8**



Rinse & dry

# *Dental Hygiene*

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Mouth is home to millions of organisms such as bacteria, blood, saliva and oral debris.

Without brushing teeth regularly, infections can be caused by diseases of the teeth, gums and mouth.

Brush teeth at least twice a day but brushing after every meal is even better.

# Protect yourself and your family

Cover your cough and sneeze



**1** **COVER** your mouth and nose with a tissue when you cough or sneeze.



**2** Put your used tissue in the rubbish **BIN**.



**3** If you don't have a tissue, cough or sneeze into your upper sleeve or elbow, **NOT YOUR HANDS**.



**4** **WASH** your hands with soap and running water. Dry your hands thoroughly with a disposable paper towel.

Stay germ free and healthy

A Victorian Government initiative



# *Washing the Body*

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For good personal hygiene, washing the body is just as important as hand washing.

It is recommended that everyone have either a shower or a bath at least once a day.

While washing body, use soap and warm water to effectively clean skin.

While washing body, bacteria is removed from the skin, which prevents infection and the spread of diseases.

# *Practice Physical Distancing*

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Physical distancing reduces the opportunity for contact with those microorganisms, if they are moving through the community undetected.



# *Personal protective Equipment (PPE).*

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PPE is equipment that will protect the user against health or safety risks at work.

The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter.

It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses.



## Minimum PPE for general patient triage



Face shield /  
Goggles / eye-visors

Surgical mask /  
N95 respirator

Isolation gown  
(AAMI level 1)



Disposable gloves  
as indicated#  
#For example,  
when presence of  
skin lesions or  
contact with blood  
and body fluids

## Recommended PPE for suspected / confirmed novel coronavirus cases

Face shield / Goggles /  
Cap

N95 respirator

Isolation gown  
(AAMI level 3)



Disposable gloves



***Thank you***