



TRAINING MANUAL FOR PARTICIPANTS

COMMUNICABLE DISEASES

&

INFECTION PREVENTION CONTROL

IN PRIMARY HEALTHCARE SETTINGS



Khyber Pakhtunkhwa – Human Capital Investment Project (KP-HCIP) Health Department

Activity: Communicable Diseases and Infection Prevention & Control in Primary Healthcare Settings

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Acknowledgement

This Training Manual on Communicable Diseases and Infection Prevention in primary healthcare settings has been developed with the support of the Department of Health (DOH), Khyber Pakhtunkhwa and in collaboration with multiple technical and implementing partners. It serves as a comprehensive resource aimed at equipping public health professionals and primary healthcare workers with essential knowledge and practical skills to identify, report and manage communicable diseases effectively at both the community and facility levels.

We are especially grateful to the World Bank for its financial and technical assistance through the Human Capital Investment Project (HCIP), which made the development of this manual possible.

Special thanks are due to the Communicable Disease Control Cell, the Public Health Directorate and the Technical Working Group on Disease Surveillance and Response, whose dedication and technical inputs have ensured the relevance and quality of this manual. We also recognize the invaluable contributions of subject matter experts, district health teams, academic institutions and implementing partners, who participated in the manual's development through consultations, reviews and field validation.

We offer our sincere appreciation to all those who supported this initiative, including those whose contributions may have been inadvertently omitted. Their collective effort reflects a shared commitment to strengthening the capacity of the healthcare workforce in disease prevention and control across Khyber Pakhtunkhwa.

- **Aerosol-Generating Procedures (AGPs)**
Medical procedures such as intubation or suctioning that can generate airborne particles, increasing the risk of infection transmission.
- **Airborne Precautions**
Infection control measures used to prevent the spread of diseases transmitted via airborne particles (e.g., using N95 masks, negative pressure rooms).
- **Biohazard**
Any biological material (including body fluids) that poses a threat to human health, especially in healthcare or laboratory settings.
- **Brucellosis**
A zoonotic bacterial infection transmitted from animals (e.g., livestock) to humans through direct contact or consumption of unpasteurized milk.
- **Case Surveillance**
The continuous monitoring of disease occurrence through systematic data collection and reporting.
- **Cohorting**
Grouping patients with the same infection together in a shared space to prevent cross-infection with uninfected individuals.
- **Communicable Disease Surveillance System**
A structured system (e.g., IDSR, DHIS-2, DEWS) used to collect, analyze and interpret disease-related data for timely response.
- **DHIS-2 (District Health Information Software 2)**
An open-source, web-based platform used for health data reporting and visualization in Pakistan, including communicable disease tracking.
- **DEWS (Disease Early Warning System)**
A sentinel surveillance system designed to detect early signs of disease outbreaks for prompt response.
- **Direct Transmission**
The immediate transfer of infectious agents through contact with infected individuals (e.g., person-to-person, droplet spread).

- **eDEWS (Electronic Disease Early Warning System)**
A digital version of DEWS that uses real-time reporting tools to identify disease trends and potential outbreaks.
- **Environmental cleaning**
The regular disinfection of surfaces and equipment to prevent indirect transmission of pathogens in healthcare settings.
- **Fever of Unknown Origin (FUO)**
A clinical condition where a patient experiences persistent fever with no identifiable source after standard investigation.
- **Gowning and gloving**
The act of donning gowns and gloves as part of PPE to protect against contact with blood, body fluids, or contaminated surfaces.
- **Hand Hygiene**
A foundational infection control measure involving handwashing or use of alcohol-based hand rubs to remove transient microorganisms.
- **Healthcare-Associated Infections (HAIs)**
Infections acquired in hospitals or healthcare facilities that were not present at the time of patient admission.
- **IPC (Infection Prevention and Control)**
A set of evidence-based practices and procedures designed to reduce the risk of infection in healthcare settings.
- **Integrated Disease Surveillance and Response (IDSR)**
A WHO-recommended strategy to strengthen surveillance and response capacities at all health system levels.
- **Isolation Room**
A dedicated hospital room used to care for patients with highly infectious diseases, often equipped with airflow control.
- **Mode of Transmission**
The mechanism through which a pathogen moves from a source to a susceptible host (e.g., contact, airborne, vector-borne).

- **N95 Respirator**
A type of PPE that filters at least 95% of airborne particles, recommended for protection against airborne diseases like TB.
- **Nosocomial Infection**
A hospital-acquired infection that develops after 48 hours of admission or within 30 days of receiving healthcare.
- **Outbreak Investigation**
The systematic examination of a disease outbreak to identify the cause, source and appropriate control measures.
- **PEI (Polio Eradication Initiative)**
A program targeting the elimination of polio through vaccination, surveillance and public health campaigns.
- **PPE (Personal Protective Equipment)**
Items such as gloves, gowns, masks, respirators and face shields used to prevent infection exposure.
- **Sharps Injury**
Accidental punctures or cuts from needles or other sharp medical instruments, posing a risk of blood borne infections.
- **Standard Precautions**
Minimum infection prevention measures applied to all patient care, regardless of suspected or confirmed infection status.
- **Surveillance Threshold**
A predefined number or rate of disease cases that signals the need for public health action or investigation.
- **Vector-Borne Diseases**
Diseases transmitted by arthropods such as mosquitoes, ticks, or fleas (e.g., malaria, dengue, leishmaniasis).
- **Zoonotic Disease**
Diseases that can be naturally transmitted from animals to humans (e.g., rabies, anthrax, brucellosis).

List of Acronyms:

Acronym	Full Form
AGPs	Aerosol-Generating Procedures
AIDS	Acquired Immunodeficiency Syndrome
AMR	Antimicrobial Resistance
ANC	Ante Natal Clinic
BCG	Bacillus Calmette–Guerin (vaccine)
CDC	Centers for Disease Control and Prevention
CD	Communicable Disease
CDCC	Communicable Disease Control Cell
COVID-19	Coronavirus Disease 2019
DEWS	Disease Early Warning System
DHIS-2	District Health Information Software, Version 2
DOH	Department of Health
DOTS	Directly Observed Treatment, Short-course
EPI	Expanded Program on Immunization
FUO	Fever of Unknown Origin
HAIs	Healthcare-Associated Infections
HCIP	Human Capital Investment Project
HIV	Human Immunodeficiency Virus
IDSR	Integrated Disease Surveillance and Response
IEC	Information, Education and Communication
IPC	Infection Prevention and Control
KP	Khyber Pakhtunkhwa
MERS	Middle East Respiratory Syndrome
MIYCN	Maternal, Infant and Young Child Nutrition
MOH	Ministry of Health
MRSA	Methicillin-Resistant <i>Staphylococcus aureus</i>
N95	NIOSH-Certified Mask that Filters $\geq 95\%$ of Airborne Particles
NGO	Non-Governmental Organization

NPI	Non-Pharmaceutical Interventions
OPD	Outpatient Department
PEI	Polio Eradication Initiative
PHC	Primary Healthcare
PHO	Public Health Officer
PPE	Personal Protective Equipment
RRT	Rapid Response Team
SARS	Severe Acute Respiratory Syndrome
SOP	Standard Operating Procedure
TB	Tuberculosis
TWG	Technical Working Group
VBDs	Vector-Borne Diseases
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Message from the Health Minister, Khyber Pakhtunkhwa

I am pleased to announce the launch of Communicable Diseases and Prevention Training Manual, developed to build the capacity of public health professionals and primary healthcare workers across Khyber Pakhtunkhwa under the World Bank-supported Human Capital Investment Project (KP-HCIP).



This manual is a timely and vital resource, reflecting our government's ongoing commitment to strengthening disease surveillance, early detection, prevention and control of communicable diseases. These efforts are critical to safeguarding public health, reducing disease burden and achieving Universal Health Coverage (UHC) in alignment with the Sustainable Development Goals (SDGs).

Communicable diseases—whether endemic, epidemic, or emerging—pose ongoing challenges to our communities, health systems and national development. This training manual equips frontline workers with the technical knowledge, practical skills and evidence-based protocols needed to respond effectively to common and priority communicable diseases. It emphasizes key areas such as infection prevention and control (IPC), personal protective equipment (PPE) use, surveillance systems (e.g., IDSR, DHIS-2, eDEWS), environmental hygiene and risk communication. Through this manual, healthcare workers will be empowered to identify, report, contain and prevent disease outbreaks, while improving community awareness and resilience.

I express my deep appreciation to the World Bank Pakistan for their invaluable financial and technical support. I also commend the collaborative work of the Department of Health Khyber Pakhtunkhwa, the Technical Working Group and our many stakeholders and partners who contributed their expertise to this important resource. I strongly encourage all health officers, clinicians, surveillance teams and community health workers to apply this manual in their daily work. With dedication and collective effort, we can reduce the spread of preventable diseases and protect the health and future of every citizen in Khyber Pakhtunkhwa.

Mr. Khaleeq ur Rehman

Health Minister, Khyber Pakhtunkhwa, Pakistan

Message from the Secretary of Health, Khyber Pakhtunkhwa

As we move forward in strengthening healthcare systems across Khyber Pakhtunkhwa through the Human Capital Investment Project (HCIP), it gives me great pleasure to present the Communicable Diseases and Prevention Training Manual, developed for our primary healthcare providers and public health professionals with the technical and financial support of the World Bank.



This manual is a critical contribution to our efforts to reduce the burden of communicable diseases, which continue to challenge the health and well-being of our communities. From routine infections to potential outbreaks, these diseases demand a coordinated, timely and well-informed response at all levels of the health system.

The manual provides practical guidance and standardized approaches for surveillance, diagnosis, reporting, case management and infection prevention and control (IPC). It also includes instruction on the proper use of personal protective equipment (PPE), safe environmental cleaning practices and the use of data systems such as DHIS-2, eDEWS and IDSR. Most importantly, it empowers healthcare workers to serve as educators and first responders within their communities, especially in resource-limited settings.

I encourage all healthcare workers—particularly those serving in rural and high-risk areas—to study, apply and cascade this knowledge within their teams and communities. Your role is essential in detecting early warning signs, managing outbreaks and preventing the spread of infectious diseases.

Let us continue working together with dedication, vigilance and shared purpose to protect the health of our people. With strong leadership at the frontline and continued investment in health workforce development, we can move closer to a health-secure and resilient Khyber Pakhtunkhwa.

Mr. Shahidullah Khan

Secretary of Health, Khyber Pakhtunkhwa, Pakistan

Message from the Director General Health Services, Khyber Pakhtunkhwa

As we continue our efforts to achieve Universal Health Coverage (UHC) in Khyber Pakhtunkhwa, strengthening our response to communicable diseases remains a top public health priority. Protecting communities from preventable infections is fundamental to improving the health, productivity and resilience of our population.

In this regard, I am pleased to announce the development of the Communicable Diseases and Prevention Training Manual, designed for primary healthcare workers and public health professionals across the province under the World Bank-supported Human Capital Investment Project (HCIP). This resource aims to provide essential, evidence-based knowledge and tools to enhance the prevention, early detection, surveillance and response to infectious diseases across all levels of the health system.

The manual highlights the importance of infection prevention and control (IPC), correct and safe use of personal protective equipment (PPE), environmental hygiene, case definitions and surveillance mechanisms such as IDSR, eDEWS, DHIS-2 and EPI systems. It also addresses the challenges faced in resource-constrained settings, offering practical solutions and guidance for frontline health workers to apply in real-world contexts.

We are deeply grateful to World Bank Pakistan for their continued technical and financial support in the development of this crucial training resource. I also acknowledge the hard work of the Department of Health KP, dedicated technical experts and stakeholders from across the public health sector whose contributions have made this manual possible.

I strongly urge all health professionals, surveillance officers and community health workers to utilize this manual as a core reference in their practice. By applying the knowledge and strategies it contains, we can significantly improve our province's ability to prevent outbreaks, save lives and build a healthier, disease-resilient Khyber Pakhtunkhwa.

Dr. Shahid Yunis

Director General Health Services, Khyber Pakhtunkhwa, Pakistan

Message from Director Public Health, Khyber Pakhtunkhwa

I am pleased to present the Communicable Diseases and Infection Prevention Training Manual, a key resource developed under the World Bank-supported Human Capital Investment Project (KP-HCIP). This manual is designed to strengthen the capacity of our primary healthcare workers and public health professionals in the effective prevention and control of communicable diseases in Khyber Pakhtunkhwa.

Our province continues to face significant public health challenges, particularly in the realm of infectious diseases that contribute to preventable morbidity and mortality—especially among vulnerable populations such as children, mothers and the elderly. Outbreaks of diseases such as measles, tuberculosis, hepatitis, dengue and diarrheal infections strain our health system and underscore the need for a trained, responsive and well-equipped health workforce.

This training manual provides a comprehensive framework for identifying, preventing and managing communicable diseases. It emphasizes practical approaches to surveillance, outbreak investigation, case detection, infection prevention and control (IPC) and the use of personal protective equipment (PPE). It also highlights the role of environmental hygiene, health promotion and community engagement in breaking the chain of transmission.

Particularly important is the manual's relevance to resource-constrained settings, offering realistic and scalable strategies that can be implemented by healthcare workers across all levels of the system. By empowering frontline workers with the right knowledge and skills, we can reduce disease transmission and improve public health outcomes across the province.

I extend my sincere appreciation to the World Bank Pakistan for its continued support and to all stakeholders—technical teams, partners and field experts—who contributed to the development of this critical training resource. Your efforts are instrumental in our fight against communicable diseases and our commitment to achieving health equity and resilience in Khyber Pakhtunkhwa.

Dr. Muhammad Bilal Khan

Project Director, KP-HCIP, Pakistan

Message from Deputy Project Director, (KP-HCIP)

As the Deputy Project Director of the Khyber Pakhtunkhwa Human Capital Investment Project (KP-HCIP), I am pleased to introduce the Communicable Diseases and Prevention Training Manual, a significant step in our journey to build a stronger, more resilient healthcare system across the province.

Through KP-HCIP, we are committed to improving foundational health services by enhancing the capacity of the Primary Health Care (PHC) system, which serves as the cornerstone of health access for the people of Khyber Pakhtunkhwa. One of the most urgent public health challenges we face is the persistent burden of communicable diseases, which continue to impact individual health, disrupt communities and place a heavy load on healthcare infrastructure.

This training manual is specifically designed to empower our healthcare workers with the knowledge, tools and practices needed to address communicable diseases proactively. It covers critical areas such as disease surveillance, infection prevention and control (IPC), personal protective equipment (PPE), case identification, outbreak management and community engagement. These competencies are essential for achieving early detection, timely response and effective containment of infectious diseases—especially in resource-limited settings.

By equipping our frontline workers with evidence-based strategies and field-relevant skills, we can reduce transmission, improve case outcomes and ultimately contribute to a healthier population. The manual supports our broader vision of building health system resilience and accelerating progress toward Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs). I extend my sincere appreciation to World Bank Pakistan for its unwavering technical and financial support and to the Department of Health, technical consultants and partner organizations who collaborated in development of this manual.

Dr. Sumaira Saeed

Deputy Project Director, KP-HCIP, Pakistan

Introduction to the Manual

Communicable diseases remain a major public health concern in Pakistan, including in Khyber Pakhtunkhwa (KP), where they continue to account for a significant burden of morbidity, mortality and economic loss. Despite progress in health sector reforms and disease-specific initiatives, outbreaks of preventable diseases such as tuberculosis, hepatitis, measles, typhoid, dengue and cholera continue to occur, especially in underserved and resource-constrained communities. These challenges are further compounded by rapid urbanization, inadequate sanitation, limited access to clean water and weak disease surveillance systems.

This Communicable Diseases and Prevention Training Manual has been developed as part of the Human Capital Investment Project (HCIP) to provide primary healthcare workers, public health staff and surveillance personnel with the essential knowledge and skills needed to prevent, detect and respond to communicable diseases effectively. It focuses on evidence-based strategies, aligning with national health policies, the Essential Health Services Package (EHSP) and international standards including the International Health Regulations (IHR, 2005).

The manual emphasizes a preventive, community-centered approach, recognizing that early detection, proper case management and effective public health interventions can drastically reduce disease transmission and save lives. It is especially relevant in the first line of care delivery, where primary healthcare workers are responsible for recognizing early signs of outbreaks, implementing infection prevention and control (IPC) practices and educating communities about protective behaviors.

Key components of the manual include:

- Understanding modes of transmission (direct and indirect)
- Use and selection of Personal Protective Equipment (PPE)
- Environmental cleaning and disinfection protocols
- Disease surveillance and reporting systems (e.g., DHIS-2, eDEWS, IDSR)
- Outbreak response and risk communication
- Implementation of IPC strategies in resource-limited settings

This resource is designed to serve not only as a training tool but also as a practical guide that health workers can refer to during routine and emergency situations. It encourages intersectoral collaboration, rapid reporting and community involvement as key pillars in controlling the spread of communicable diseases.

By building the capacity of frontline healthcare providers, this manual aims to reduce the incidence of preventable diseases, strengthen health system resilience and ultimately contribute to a healthier, safer Khyber Pakhtunkhwa.

Target audience:

The Communicable Diseases and Prevention Training Manual is intended for a wide range of healthcare providers and public health personnel working across primary, secondary and community health levels in Khyber Pakhtunkhwa. These individuals form the frontline defense against infectious disease threats and play a pivotal role in surveillance, prevention, outbreak response and community education.

The target audience includes:

- **Medical Officers (MOs)**

Lead the diagnosis, treatment and case management of communicable diseases and supervise infection prevention and control (IPC) activities at health facilities.

- **Lady Health Visitors (LHVs)**

Deliver maternal and child health services, identify early signs of communicable diseases, provide counseling on hygiene and IPC and serve as referral points.

- **Medical and Health Technicians**

Support disease screening, specimen collection, patient monitoring and basic IPC practices within outpatient and inpatient settings.

- **Sanitary Inspectors and Environmental Health Staff**

Monitor sanitation and hygiene, manage waste and water safety and mitigate environmental risk factors contributing to disease transmission.

- **Community Health Workers (CHWs)**

Serve at the household and village level to raise awareness, conduct health promotion, refer suspected cases and support outbreak response and data reporting.

- **Lady Health Workers (LHWs)**

Provide doorstep-level services focused on disease prevention, maternal-child care, immunization support and community education.

- **Vaccinators**

Administer routine and emergency immunization, support outbreak containment (e.g., measles, polio), maintain cold chain systems and report Adverse Events Following Immunization (AEFIs).

- **District Surveillance Officers (DSOs) and Surveillance Focal Persons**

Coordinate surveillance activities, maintain IDSR/eDEWS reporting, analyze disease trends and lead outbreak investigations.

- **Nutritionists and Public Health Professionals**

Address nutrition-related vulnerabilities in communicable diseases, especially during outbreaks and contribute to integrated disease control strategies.

- **Support Staff (Cleaners, Waste Handlers, Ward Assistants, Drivers, etc.)**

Essential in maintaining a safe, hygienic environment through proper environmental cleaning, biomedical waste disposal, disinfection, PPE handling and safe patient transport—especially during infectious disease outbreaks.

These cadres form the backbone of communicable disease prevention and control efforts. Their active participation and coordination at facility and community levels are essential for reducing transmission, strengthening the health system and ensuring timely public health response.

Training Manual Contents:

Each module in the manual is divided into sessions and activities, each with clear objectives to guide the learning process. Every session includes a defined aim, a list of necessary materials and equipment, an estimated time frame and step-by-step instructions for execution. Some activities may require preparatory work ahead of the training session. To enhance learning, the sessions are supported by handouts, PowerPoint presentations, case studies and classroom exercises, all of which are designed to facilitate engagement and reinforce key concepts.

MODULE ONE

BASICS OF COMMUNICABLE DISEASES



SESSION 1.1

INTRODUCTION TO EPIDEMIOLOGY AND PATTERNS OF DISEASE OCCURRENCE

Introduction

Communicable diseases are illnesses that can spread from one person to another, from animals to humans, or through the environment. These diseases are caused by harmful microorganisms such as bacteria, viruses, fungi, or parasites.

In areas like Khyber Pakhtunkhwa, where healthcare systems face challenges such as limited resources, overcrowding and poor sanitation, understanding how these diseases spread is crucial. Healthcare workers at the primary level play a key role in stopping the spread before it turns into an outbreak or epidemic.

This chapter is designed to give you the foundational knowledge needed to recognize, report and respond to communicable diseases effectively.

Learning Objectives

By the end of this session, participants will be able to:

- Define epidemiology and describe its importance in communicable disease control.
- Identify the components of the epidemiologic triad and how diseases spread.
- Distinguish between endemic, epidemic, sporadic and pandemic diseases.
- Explain the concept of communicable and contagious diseases.

1. What is Epidemiology?

Epidemiology is the study of the distribution (who, where, when) and determinants (why and how) of health-related events in a population — and the application of this study to prevent and control health problems.

In simple words, epidemiology helps us understand:

An epidemiologist looks at:

- **Who** is getting sick
- **When** they get sick
- **Where** the disease is spreading
- **Why** people are getting infected
- **How** we can break the chain of infection

I keep six honest serving-men
(They taught me all I knew);

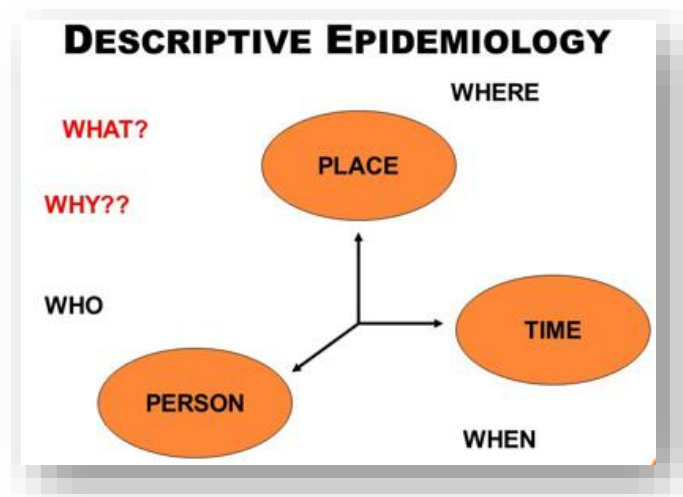
Their names are **What** and **Why** and **When**
And **How** and **Where** and **Who**.

—Rudyard Kipling (1865–1936)



For example, during a measles outbreak in a village, an epidemiologist would look at the vaccination records, age group of the patients and living conditions to find the cause and control the spread.

Epidemiology is the backbone of public health, guiding actions for disease prevention, outbreak investigation and policy-making.



2. Application of Epidemiology in Communicable Diseases

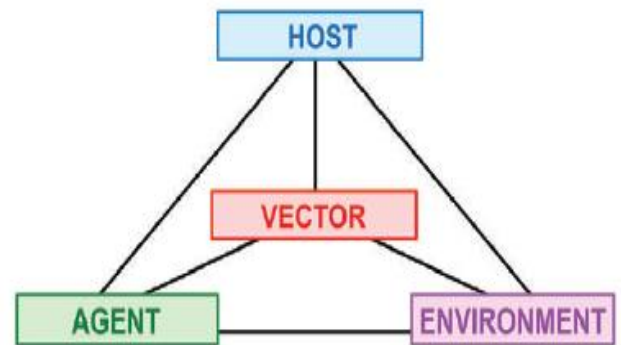
Epidemiology is used to:

- Detect and investigate disease outbreaks
- Identify risk factors for infection
- Guide control measures (e.g., vaccination, quarantine)
- Evaluate health programs and interventions
- Support evidence-based decision-making

For example, during a cholera outbreak, epidemiologists collect data about who got sick, where they live, what they ate or drank and how the disease spreads — helping control the situation quickly.

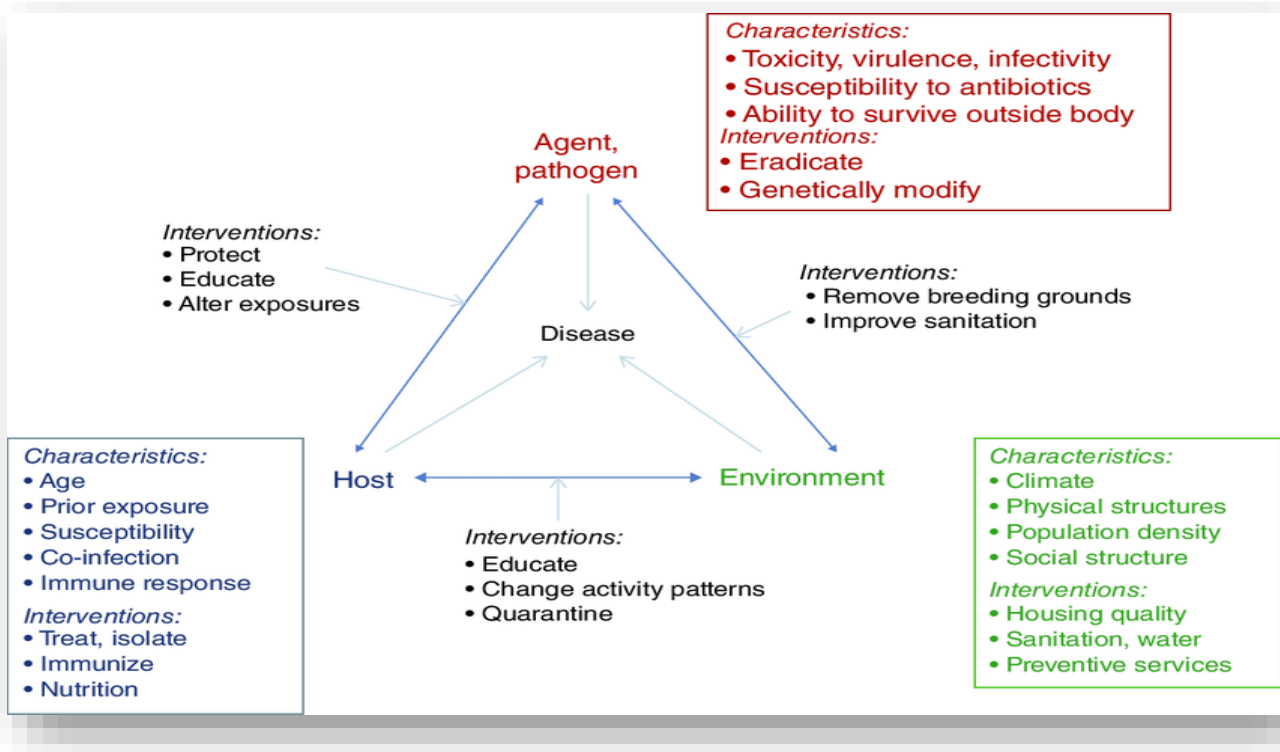
3. The Epidemiologic Triad

Communicable diseases occur when three key factors interact — known as the epidemiologic triad:



For example, during a measles outbreak, an epidemiologist would look at the vaccination records, age group of the patients and living conditions to find the cause and control the spread.

Component	Description	Example
Agent	The microorganism that causes disease (bacteria, virus, parasite, fungus).	<i>Mycobacterium tuberculosis</i> causing TB
Host	The human or animal that can be infected.	People with weak immunity are more susceptible
Environment	External factors that affect the agent and host.	Poor sanitation, stagnant water, overcrowding



If any part of this triad is broken (for example, improving sanitation or immunization), the disease chain can be interrupted.

4. Types and Patterns of Disease Occurrence

Epidemiology classifies disease occurrence into patterns based on how frequently and widely they appear:

Epidemic

The unusual occurrence in a community or region of disease, specific health related behavior clearly in excess of expected occurrence e.g. Dengue fever, smoking or other related events like traffic accidents. Outbreaks and epidemics are used interchangeably; outbreak term is often used for local epidemics like food poisoning.

Endemic

It refers to the constant presence of a disease or infectious agent within a given geographic area or population group, without importation from outside. For instance, common cold or endemic goiter.

An endemic disease, when conditions are favorable may turn into an epidemic e.g. hepatitis A, typhoid fever.

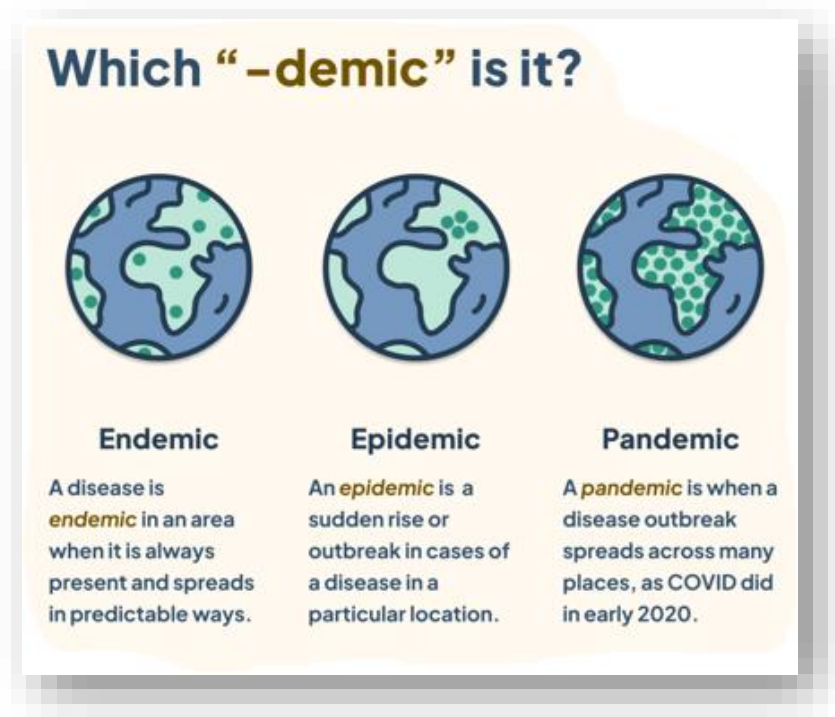
Sporadic

The word sporadic means scattered bout. The cases occur irregularly, haphazardly from time to time and generally infrequent. Many zoonotic diseases are characterized by sporadic to man.

Pandemic

An epidemic usually affecting a large proportion of the population and occurring over a wide geographic area such as a section of a nation, the entire nation, a continent or the world, e.g. influenza pandemics of 1918 and 1957, cholera in 1962 and COVID-19.

Term	Definition	Example
Endemic	Constantly present in a region or population.	Malaria in some tropical areas
Epidemic	Sudden increase in cases above the expected level.	Measles outbreak in a district
Pandemic	Epidemic that spreads across countries or continents.	COVID-19 pandemic
Sporadic	Occurs occasionally and irregularly.	Tetanus cases in rural areas



5. Communicable vs. Contagious Diseases

A disease that is transmitted through direct contact, for example scabies, trachoma, STDs and leprosy is called contagious disease

While an illness due to a specific infectious agent or its toxic products capable of being directly or indirectly transmitted from man to man, animal to animal, animal to human or from the environment (through air, dust, soil, water, food etc.) to man or animal is called communicable disease.

Communicable Disease	Contagious Disease
Caused by infectious agents and can be transmitted directly or indirectly.	Easily spread from person to person through direct contact.
Example: Malaria (via mosquito vector)	Example: Measles, Influenza

All contagious diseases are communicable, but not all communicable diseases are contagious.

6. Nosocomial, Opportunistic and Iatrogenic Infections

Nosocomial

Nosocomial (hospital acquired) infection is an infection originating in an individual while in a hospital or other health care facility. The individual can be a patient, attendant of the patient or health care worker. These infections are contracted in hospitals by individuals who were free of that infection before entry into the hospital. The signs and symptoms of the disease usually appear after discharge of the patients from the hospital or the attendants leave the hospital; this is due to longer incubation period. Common Nosocomial infections are infection of surgical wounds, Hepatitis B infection and urinary tract infections. Micro-organisms involved in Nosocomial infections are different.

Opportunist infection

In this type of infection, an organism takes the opportunity to infect a person when the immune system of the person weakens. E.g. Herpes simplex, Cytomegalovirus, Toxoplasma, M. tuberculosis, Pneumocystis Carinii, etc. Opportunistic infections are very common in AIDS.

Iatrogenic

Any unwanted or adverse consequence of a preventive, diagnostic or therapeutic regimen or procedure, that causes impairment, handicap, disability or death resulting either from a physician's professional negligence or unintentional activity. E.g. if a surgeon leave a towel in the abdomen after laparotomy or episodes related to drug therapy, immunization or diagnostic procedures, e.g. reactions to penicillin and immunizing agents, aplastic anemia following that use of chloramphenicol, blood transfusion etc. Iatrogenic infections can prolong stay in the hospital. These are all preventable. In short, iatrogenic disease is a hazard of health care.

7. Key Takeaways

- Epidemiology helps identify and control health problems in communities.
- The epidemiologic triad explains how agent, host and environment interact.
- Diseases can be sporadic, endemic, epidemic, or pandemic.
- Strengthening public health measures can break the chain of transmission.

Reflection Questions

1. What is the main goal of epidemiology in public health?
2. How can breaking the epidemiologic triad help prevent disease?
3. Give one example each of an endemic, epidemic and pandemic disease.

SESSION 1.2

MEASURES OF DISEASE FREQUENCY AND DYNAMICS OF INFECTION

Learning Objectives

By the end of this session, participants will be able to:

- Define and differentiate between incidence and prevalence.
- Explain attack rate, secondary attack rate and case fatality rate.
- Understand the iceberg phenomenon of disease.
- Recognize how index, primary and secondary cases contribute to disease spread.
- Relate these measures to real-life examples from their community practice.

1. Introduction

In public health, we must understand how many people are sick and how quickly a disease is spreading.

These measures help PHC workers to:

- Detect outbreaks early.
- Evaluate effectiveness of control measures.
- Allocate resources efficiently.
- Plan community health interventions.

Two key measures are incidence and prevalence.

2. Measures of Morbidity (Incidence, Prevalence and Attack Rate)

A. Incidence:

Incidence measures the number of new cases of a disease in a population during a specific period. It shows the risk of developing a disease.

$$\text{Incidence Risk} = \frac{\text{Number of new cases of disease in a specified period of time}}{\text{Number of disease-free persons at the beginning of that time period}}$$

Example:

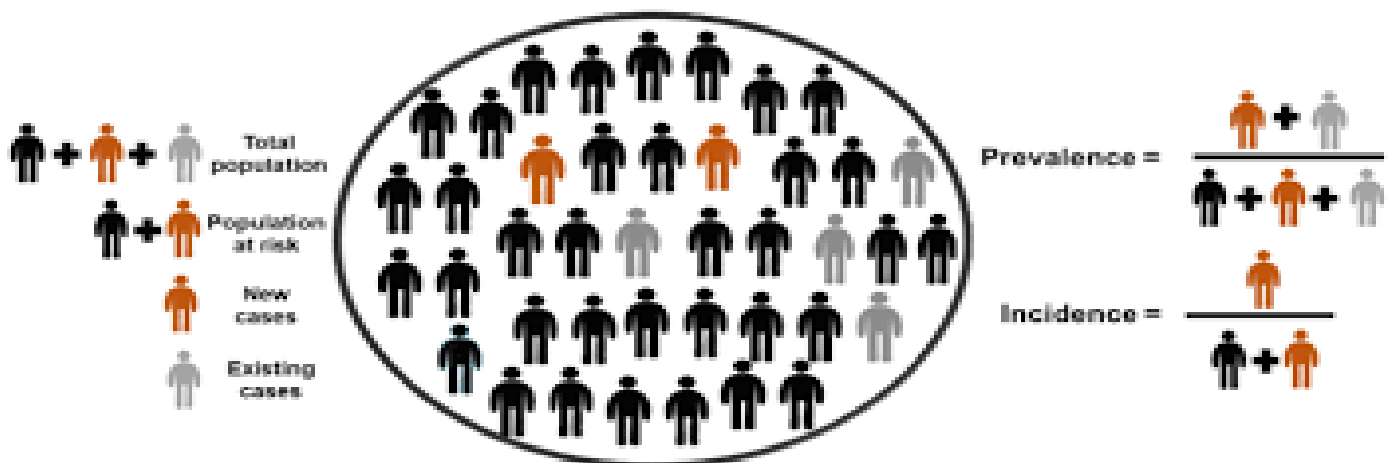
If 40 new cases of hepatitis A occur in a population of 10,000 during one year: Calculate incidence for hepatitis A in given population.

Use in PHC:

- Helpful in detecting sudden increases (possible epidemic).
- Used to monitor effectiveness of interventions (e.g., vaccination).

B. Prevalence

Prevalence measures the total number of people (new + old cases) with a disease in a population at a particular point or period. It shows the burden of disease in the community.



$$\text{Point Prevalence} = \frac{\text{Number of cases in a defined population at one point in time}}{\text{Number of persons in a defined population at the same point in time}}$$

Example:

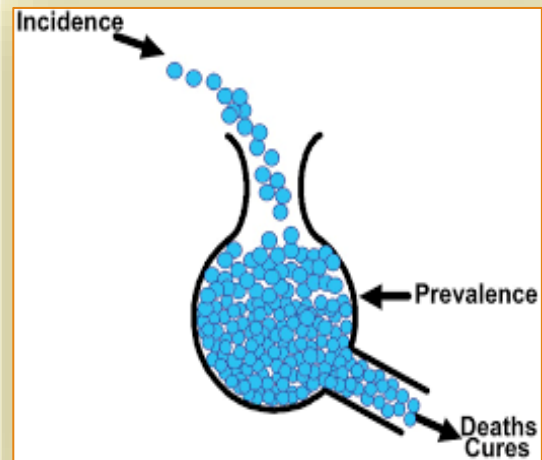
If 200 people in a population of 10,000 are living with TB (old + new cases):

$$\text{Prevalence} = 200 / 10,000 \times 100 = 2\%$$

Use in PHC:

- Assesses chronic diseases (e.g., TB, HIV, diabetes).
- Helps in planning long-term care and treatment services.

Comparing Incidence and Prevalence



Feature	Incidence	Prevalence
Definition	Number of <i>new</i> cases	Number of <i>all existing</i> cases
Time Factor	Over a period of time	At a particular time or period
Indicates	Risk of developing disease	Burden of disease
Useful for	Acute diseases, outbreaks	Chronic or long-term diseases
Example	New cholera cases this month	All TB cases in the district this year

C. Attack Rates

A person who acquires the disease from an exposure (e.g., from a contaminated food) is called a primary case. A person who acquires the disease from exposure to a primary case is called a secondary case.

A case which is notified and is brought to the attention of the authorities is called Index case.

There are two types of attack rates commonly used;

i. Primary Attack Rate (PAR)

Primary attack rate refers to the number of primary cases out of the total exposed persons.

It is given by the formula;

$$\text{PAR} = \frac{\text{Number of primary cases}}{\text{Total number of susceptible exposed}} \times 100$$

PAR concept is mainly practiced in diseases like food poisoning.

For example: there were total 60 persons who attended a party and ate a single common food, out of the total 10 developed gastro-enteritis, so the PAR will be;

$$\text{PAR} = 10 / 60 \times 100 = 16.6 \%$$

ii. Secondary Attack Rate

The secondary attack rate is therefore defined as the attack rate in susceptible people who have been exposed to a primary case.

It is given by the formula;

$$\text{SAR} = \frac{\text{Number of persons exposed to a primary case developing the disease}}{\text{Total number of exposed/ susceptible contact}} \times 100$$

For example: in a household 10 children were exposed to a primary case of measles of which 6 suffered from measles, so in this case the SAR will be;

$$\text{SAR} = 6/10 \times 100 = 60 \%$$

Importance: It is a good measure of person-to-person spread of disease after the disease has been introduced into a population and it can be thought of as a ripple moving out from the primary case. SAR is usually high in air borne diseases. We often calculate the secondary attack rate in family members of the index case.

Summary Table (Incidence, Prevalence, Attack Rates)

Term	Definition	Purpose / Use	Example
Incidence	The number of new cases of a disease in a population during a specific time period.	Shows the risk of developing a disease.	50 new TB cases in a district in one year.
Prevalence	The total number of existing (old + new) cases in a population at a given time.	Shows the burden of disease in a community.	300 people currently living with diabetes.
Attack Rate	The proportion of people who become ill among those exposed to a risk during an outbreak.	Used in epidemic investigations.	30 out of 100 people who ate contaminated food became sick (30% attack rate).
Secondary Attack Rate	The proportion of contacts of an initial (index) case who become infected.	Measures person-to-person transmission.	2 out of 5 family members of a measles case get infected (40% secondary attack rate).

Measures of Disease Frequency

Age/sex specific mortality rate =	$\frac{\text{number of deaths in year in specific age/sex group}}{\text{mid-year population of age or sex group}} \times 1000$
Birth rate =	$\frac{\text{number of births in a year}}{\text{mid-year population}} \times 1000$
Fertility rate =	$\frac{\text{number of live births in year}}{\text{mid-year population of women aged 15-44}} \times 1000$
Infant mortality rate =	$\frac{\text{number of deaths in year <1 year of age}}{\text{number of live births in year}} \times 1000$
Perinatal mortality rate =	$\frac{\text{number of stillbirths + deaths <7 days in a year}}{\text{total number of births (live + still) in a year}} \times 1000$
Neonatal mortality rate =	$\frac{\text{number of deaths in year < 28 days of age}}{\text{number of live births in a year}}$
Case fatality rate (%) =	$\frac{\text{number of deaths in year (from specific disease)}}{\text{number of cases of that disease in a year}} \times 100$
Proportional mortality rate due to TB =	$\frac{\text{total number of deaths due to TB}}{\text{total number of deaths due to all causes}} \times 100$

3: Measures of Mortality

Measurement of different mortality rates is important in assessing the severity of a disease.

- i. ***Crude death rate*** (annual mortality from all causes/1000 population)

$$\text{CDR} = \frac{\text{Number of deaths from all causes in one year} \times 1000}{\text{No of all persond in the popultation in mid – year}}$$

Since population changes over time, only mid-year population is considered.

- ii. ***Age Specific Mortality Rate***

Annual mortality rate from all causes in children under 10 years age =

$$\text{ASMR} = \frac{\text{No of children dying form all cause in 1 year under age of 10 years} \times 1000}{\text{No of all children under age of 10 years in mid – year}}$$

- iii. ***Cause Specific Mortality Rate***

Annual mortality rate from lung cancer =

$$\text{CSMR} = \frac{\text{No of persons dying from lung caner in one year} \times 100}{\text{No of persons in the population in mid – year}}$$

- iv. ***Proportionate Mortality Rate***

Proportionate mortality rate from cancers in Pakistan in 2017

$$\text{PMR} = \frac{\text{No of persons died of cancers in Pakis tan in 2017} \times 100}{\text{Total no of deaths from all causes in Pakis tan in 2017}}$$

Assume that in a population total 20 people die of cancer out of total 80 deaths from all causes in one year so the proportionate mortality rate will be,

Proportionate mortality rate from cancer = $20/80 \times 100 = 25\%$.

v. Case Fatality Rate

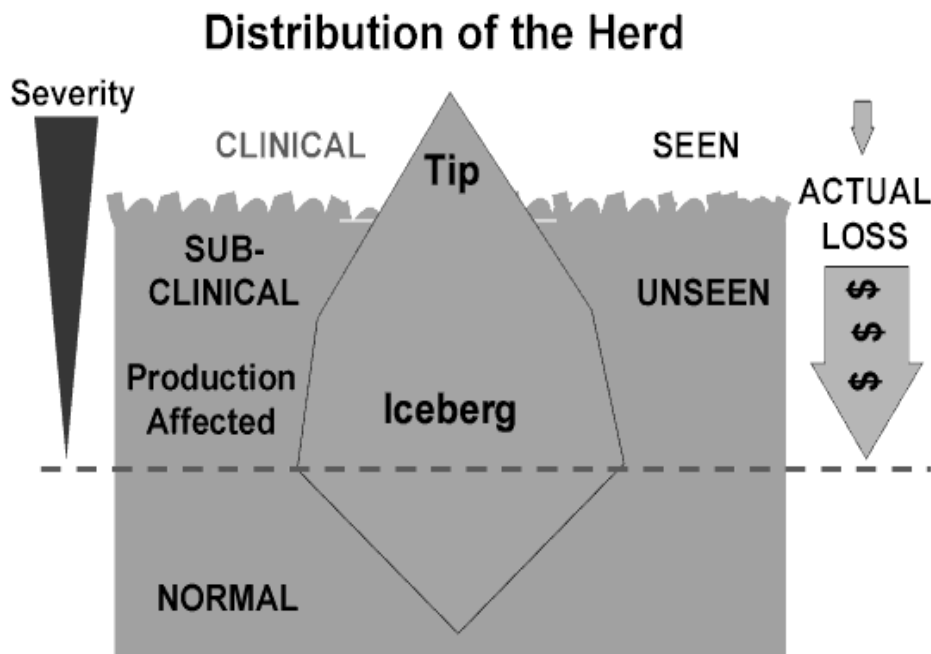
$$\text{CFR} = \frac{\text{No of persons dying of a disease during a specified period after its diagnosis}}{\text{Total no of cases of that specified disease}}$$

E.g. total 10 cases of Rabies are diagnosed, out of these 9 dies so the case fatality rate would be =
 $9/10 \times 100 = 90\%$.

4. The Iceberg Phenomenon of Disease

Iceberg means an ice rock suspended in water. Usually a small tip of the iceberg is visible above the surface of water while the major bulk is invisible under the surface of water.

Certain diseases especially the chronic diseases behave like an iceberg. Only small proportion of cases is visible to the physician (clinical/apparent cases) in the form of signs and symptoms. Major bulk of the disease is inapparent/subclinical cases behave like submerged portion of the iceberg. These cases are without signs and symptoms.



Example:

In Hepatitis A, most infections in children are mild and go undiagnosed, forming the “submerged part” of the iceberg.

Why it matters:

Understanding the iceberg helps in planning surveillance and control — because unseen cases continue to spread infection.

5. Understanding Index, Primary and Secondary Cases

Term	Definition	Example
Index Case	The first case that comes to the attention of health authorities.	First reported case of cholera in a village.
Primary Case	The person who first brings the infection into a population.	The traveler who brought the infection home.
Secondary Case	A person infected by the primary or index case.	Family members who get sick after exposure to the traveler.

Note: The index case may or may not be the same as the primary case — the index is simply the first detected.

5. Dynamics of Infection Spread

The spread of disease depends on several interacting factors:

- ***Source of infection:*** where the agent lives and multiplies (e.g., humans, animals, environment).
- ***Mode of transmission:*** direct or indirect.
- ***Susceptible population:*** individuals who lack immunity.
- ***Environment:*** conditions that favor survival of the pathogen (e.g., poor sanitation, humidity).

6. Example Activity – Community Data Analysis

Scenario:

During Eid holidays, 40 people attended a family feast. Two days later, 16 reported severe diarrhea.

- Total exposed = 40
- Number sick = 16

Calculate:

Attack Rate = $(16 \div 40) \times 100 = 40\%$

Discussion:

What does this tell us about the outbreak?

Which foods or drinks might have been the source?

(Participants can do this as a quick group exercise.)

7. Key Takeaways

- Incidence shows *new* cases; prevalence shows *existing* cases.
- Attack rates are essential in outbreak investigations.
- The iceberg model reminds us that many cases go undetected.
- Knowing the index and secondary cases helps trace transmission chains.
- Measuring disease frequency supports early action and prevention.

SESSION 1.3

UNDERSTANDING VIRULENCE AND DISEASE TRANSMISSION

Introduction:

Effective prevention and control of communicable diseases require a clear understanding of how infections occur and spread within communities. Every infectious disease follows a predictable pattern — from the entry of a pathogen into a host to its transmission to others.

This session introduces the key concepts of infection, such as infectivity, pathogenicity and virulence and explains how these characteristics influence disease outcomes. Participants will also explore the chain of infection and the various modes of disease transmission, supported by real-world examples from primary healthcare settings.

By understanding these principles, Primary Health Care (PHC) workers can identify critical points where interventions can “break the chain” — stopping infections before they spread. The session combines theory with practical group exercises to help participants apply these concepts to their day-to-day work in communities and health facilities.

Learning Objectives

By the end of this session, participants will be able to:

- Define key terms including infection, infectivity, pathogenicity and virulence.
- Explain the chain of infection and its components.
- Describe modes of disease transmission with relevant examples.
- Identify ways to break the chain of infection in primary healthcare settings.

1. Basic Concepts

Term	Definition	Example
Infection	Entry and multiplication of an infectious agent in the host.	<i>Mycobacterium tuberculosis</i> infecting the lungs.
Infectivity	Ability of an organism to invade and multiply in the host.	Measles virus is highly infectious.
Pathogenicity	Ability of an agent to cause disease after infection.	Poliovirus causes paralysis in a small proportion of those infected.
Virulence	The degree of severity of the disease produced.	Rabies virus is highly virulent and almost always fatal.
Toxigenic	Ability of an organism to produce toxins.	<i>Corynebacterium diphtheriae</i> produces diphtheria toxin.
Immunogenicity	Ability of an agent to trigger an immune response.	Measles virus provides long-term immunity after infection.

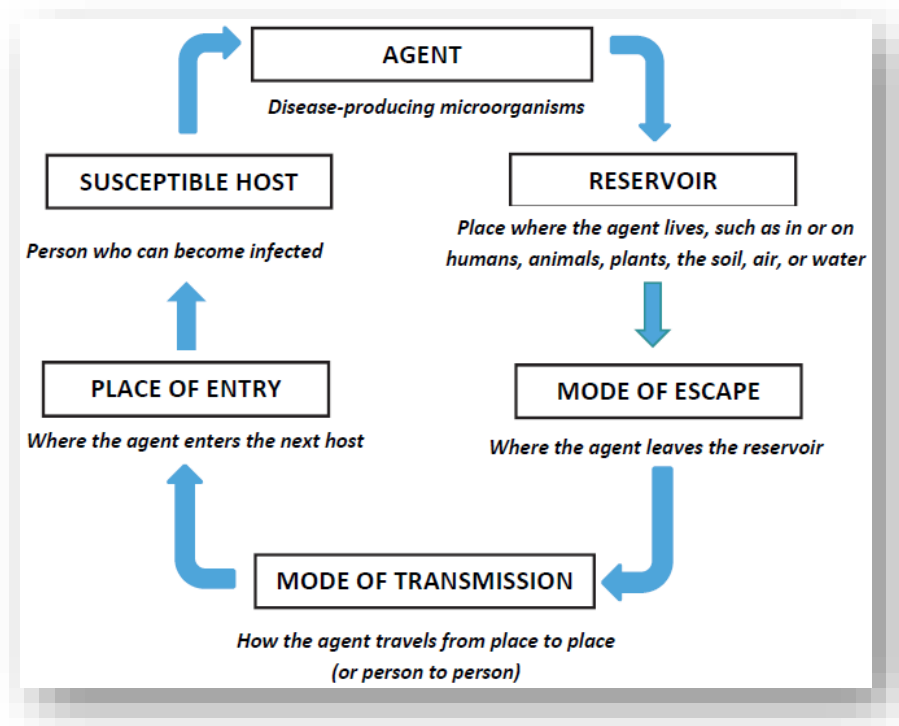
Remember:

All virulent organisms are pathogenic, but not all pathogenic organisms are equally virulent.

2. The Chain of Infection

The chain of infection describes how diseases spread from one host to another.

Breaking any link in the chain can stop transmission.

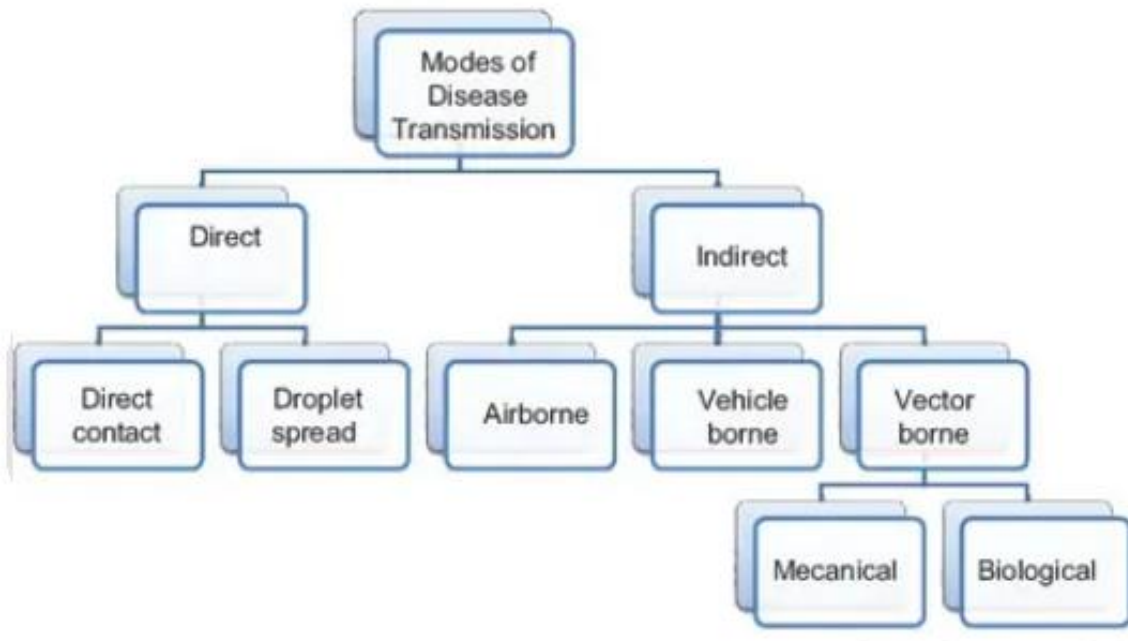


Link in the Chain	Description	Control Measure
1. Infectious Agent	Microbe that causes disease (virus, bacteria, parasite, fungus).	Identify and treat carriers early.
2. Reservoir	Place where the agent lives and multiplies (humans, animals, environment).	Disinfection, pest control.
3. Portal of Exit	Path by which the agent leaves the reservoir.	Coughing, sneezing, blood, feces.
4. Mode of Transmission	How the agent moves from one host to another.	Direct contact, air, water, vector.
5. Portal of Entry	Path by which the agent enters the new host.	Respiratory tract, skin breaks.
6. Susceptible Host	Person who can become infected.	Immunization, nutrition, PPE use.

1. Modes of Disease Transmission

Mode of transmission is how the agent travels from person to person, this usually occurs via HCWs' hands, contaminated equipment, instruments, devices and the environment (including air and water).

It can be classified as;



A. Direct Transmission

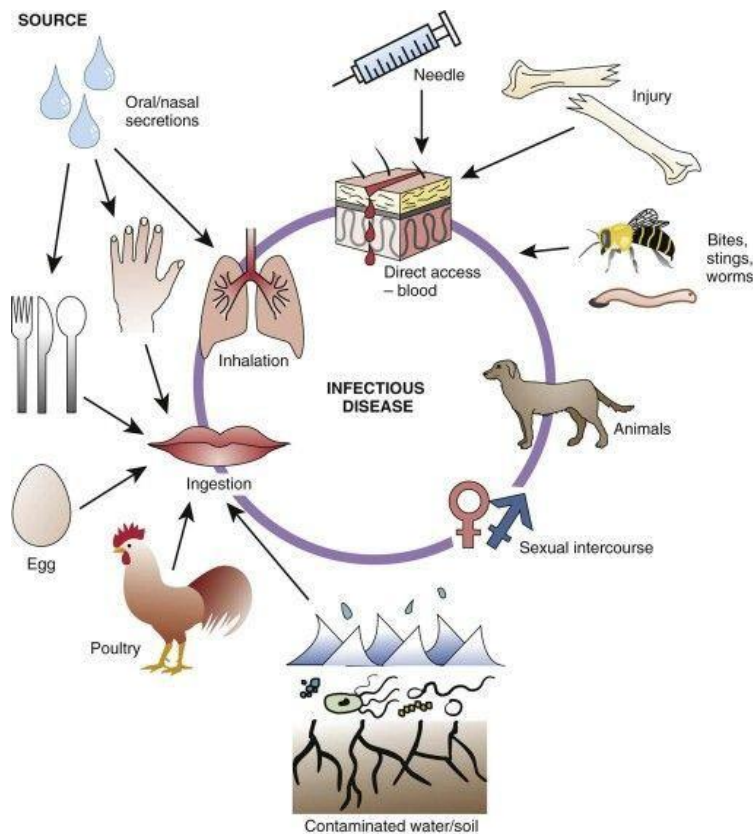
Occurs when the infectious agent passes **immediately** from an infected person to a susceptible one.

Type	Example	Prevention
Direct contact (touching, kissing, sexual contact)	STIs, skin infections	Use of PPE, safe sex practices
Droplet spread (coughing, sneezing)	Influenza, COVID-19	Masks, respiratory hygiene, distancing
Transplacental (mother to fetus)	HIV, syphilis	ANC screening, ART treatment

B. Indirect Transmission

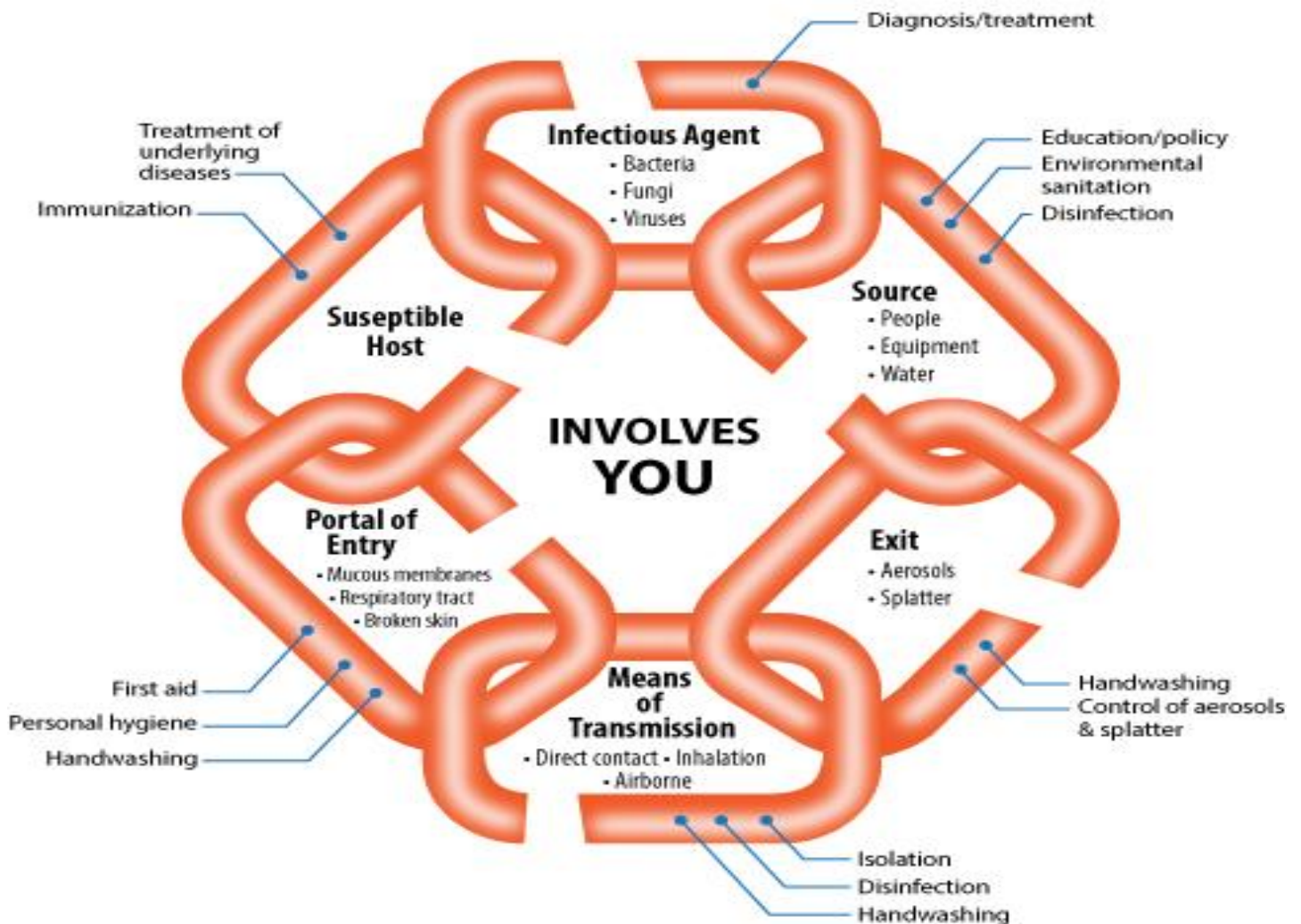
Involves an **intermediate object or vector**.

Type	Example	Prevention
Airborne (dust, droplet nuclei)	TB, measles	Ventilation, N95 masks
Vehicle-borne (food, water, utensils)	Cholera, hepatitis A	Safe food & water, hand hygiene
Vector-borne (mosquitoes, flies, ticks)	Malaria, dengue, typhoid (flies)	Insecticide use, bed nets, vector control
Fomite-borne (contaminated objects)	COVID-19 via surfaces	Regular cleaning & disinfection
Iatrogenic / nosocomial	Hospital-acquired infections	Adherence to IPC protocols



5. Breaking the Chain of Infection – Role of PHC Workers

Step	Example of Action
Control the agent	Treat infections promptly, disinfect equipment.
Eliminate reservoirs	Ensure safe waste disposal, clean water storage.
Block exit portals	Cover mouth when coughing, use masks.
Interrupt transmission	Promote hand washing, safe injection practices.
Protect entry portals	Use gloves, ensure wound care.
Protect the host	Immunization, nutritional support, health education.



7. Practical Activity – Chain of Infection Mapping

Group Work:

Participants identify the links of infection for tuberculosis or cholera or Dengue Fever and discuss:

- How does the infection spread in their community?
- What actions can break the chain at each step?

8. Key Takeaways

- Virulence is the severity of disease, while infectivity is the ability to spread.
- The chain of infection explains how diseases move from source to host.
- Transmission may be direct or indirect.
- Breaking the chain through preventive actions is the foundation of IPC at the PHC level.

SESSION 1.4

DISEASE SURVEILLANCE SYSTEMS IN KHYBER PAKHTUNKHWA (KPK)

Learning Objectives

By the end of this session, participants will be able to:

- Define disease surveillance and describe its main purposes.
- Identify the types and components of a surveillance system.
- Explain the Integrated Disease Surveillance and Response (IDSR) and DEWS systems in Pakistan.
- Understand the roles and responsibilities of PHC workers in disease reporting.
- Recognize the importance of timely reporting in outbreak detection and response.

1. What is Disease Surveillance?

Surveillance is the systematic and continuous collection, analysis, interpretation and dissemination of health data for planning, implementation and evaluation of public health practice.

In simple words, it means keeping an eye on diseases in the community to detect early warning signs and prevent outbreaks.

Remember:

Surveillance is not just data collection — it's data for action.

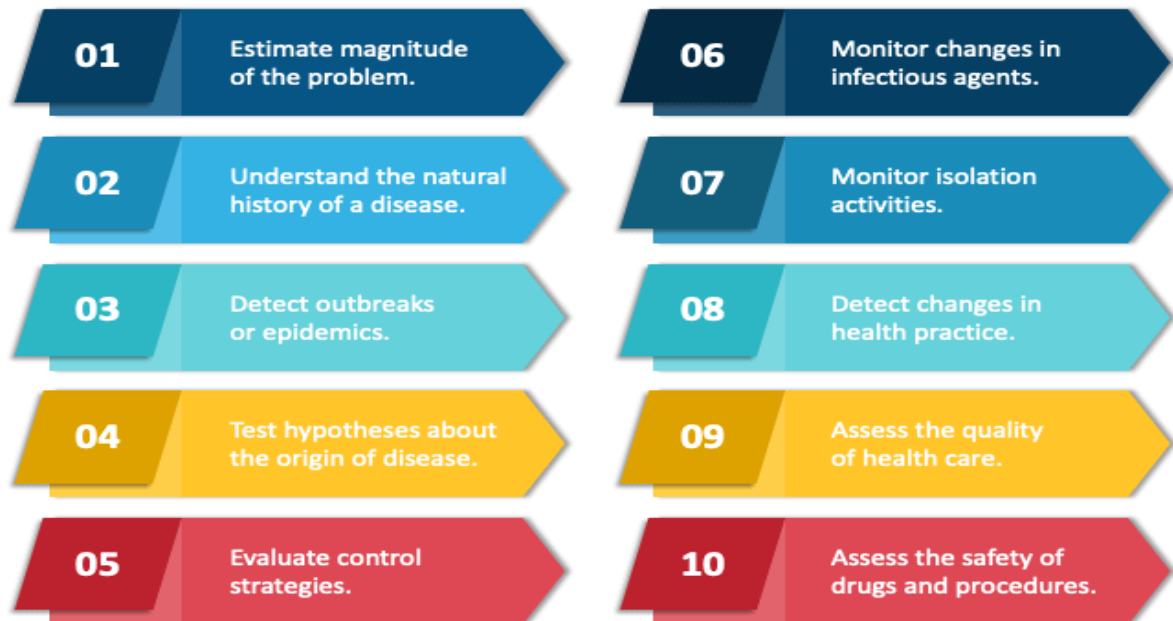
2. Objectives of Surveillance

- Detect and monitor trends in disease occurrence.
- Identify outbreaks early and guide timely response.
- Evaluate the effectiveness of control programs.
- Provide evidence for decision-making and policy formulation.
- Strengthen coordination among health facilities and authorities.



PUBLIC HEALTH SURVEILLANCE

Objectives of Public Health Surveillance



3. Components of a Surveillance System

Component	Description
Data Collection	Routine and systematic gathering of disease-related data from health facilities and communities.
Data Analysis	Summarizing and interpreting data to identify unusual patterns or increases in cases.
Information Dissemination	Sharing findings with relevant stakeholders for timely action.
Public Health Response	Implementing control measures such as vaccination, isolation, or investigation.
Evaluation	Reviewing system performance and identifying areas for improvement.

4. Types of Surveillance

Type	Description	Example
Passive Surveillance	Routine data collected from health facilities without active search for cases.	Monthly reporting through DHIS-2.
Active Surveillance	Health workers actively search for cases or verify reports.	Field visits during a suspected cholera outbreak.
Sentinel Surveillance	Selected facilities monitor specific diseases to detect trends.	Influenza monitoring in sentinel hospitals.
Event-based Surveillance	Rapid collection of information on unusual events or rumors.	Reports of sudden deaths or unexplained illness clusters.

5. Disease Surveillance in Pakistan and KPK

Pakistan operates several coordinated surveillance systems managed by federal and provincial health departments.

a. Integrated Disease Surveillance and Response (IDSR)

- Developed according to WHO guidelines.
- Aims to integrate multiple disease surveillance systems under one framework.
- Includes priority communicable diseases such as malaria, TB, dengue, measles and cholera.
- Strengthens data collection, analysis and rapid response at district and facility levels.

b. Disease Early Warning System (DEWS)

- Initially established for early detection of outbreaks during emergencies and disasters.
- Uses weekly data from sentinel sites and PHC facilities.
- Provides alerts and outbreak verification through Rapid Response Teams (RRTs).
- Managed by the Department of Health (DoH) KPK in collaboration with WHO.

c. DHIS-2 (District Health Information Software)

- Electronic reporting platform used across KPK.
- Collects monthly data on diseases, maternal and child health indicators and facility performance.
- Helps monitor trends and plan preventive actions.



LIST OF NOTIFIABLE DISEASES

(Case Definition, Alert and Outbreak Thresholds)

Integrated Disease Surveillance and Response System



S. No	Disease / Condition	Case Definition	Alert Threshold	Outbreak Threshold	Reporting Timeline
1	Acute Flaccid Paralysis	Any child under 15 years of age with recent onset of floppy weakness of any cause including Guillian- Barre Syndrome or any person of any age with a paralytic illness. In whom poliomyelitis is suspected	1 suspected case	1 case with lab - confirmed wild poliovirus in stool sample.	Within 24 hours
2	Suspected Pertussis	Any person with a cough lasting at least 2 weeks with one of the following : Paroxysms of coughing; Inspiratory "whoop"; Post- tussive vomiting AND without other apparent cause	1 suspected case	5 cases in 1 locality 1 lab confirmed	Within 7 days
3	Neonatal Tetanus (NNT)	Suspected Case: Any neonatal death between 3 and 28 days of age in which the cause of death is unknown OR any neonate reported as having suffered from neonatal tetanus between 3 and 28 days of age and not investigated. Confirmed case: Any neonate with normal ability to suck and cry during the first 2 days of life, and who between 3 and 28 days of age cannot suck normally and becomes stiff or has convulsions or both. Hospital-reported cases are considered confirmed.	1 case requires investigation for safe birth practices and immunization.	1 confirmed cases from a single location. outbreak	Within 7 days
4	Probable Diphtheria	A probable case is any person with upper respiratory tract illness characterized by an adherent membrane on the tonsils, pharynx and/or nose and any one of the following: laryngitis, pharyngitis or tonsillitis.	1 suspected case probable case	1 confirmed case who has been laboratory confirmed by culture or linked epidemiologically to a laboratory confirmed case	Within 24 hours
5	Suspected Measles	Any person with fever and maculopapular rash and one of the following: cough, coryza or conjunctivitis OR Any person in whom a clinician suspects measles infection.	1 suspected case	Cluster of 5 or more clinical cases in a single location over a 30 day time period with at least 1 lab confirmed case.	Within 24 hours
6	Viral Meningitis	Is in Inflammation (Swelling) of the Protective Membrane and covering the brain and spinal cord.	NA	NA	1 week
7	Bacterial Meningitis (unspecified, not Meningococcal)	Bacterial meningitis affects the membranes that cover the brain and spinal cord. It is a medical emergency.	NA	NA	1 week
8	Suspected Meningococcal Meningitis	Any person having sudden onset of fever ($>38^{\circ}\text{C}$ axillary and on or more of the following: -Neck stiffness -Altered consciousness -Other meningeal sign or petechial or purpurial rash -In infants under one year of age, suspect meningitis when fever is accompanied by bulging fontanelle.	3 or more suspected cases in one location or one confirmed cases of N. Meningitidis	2 or more lab confirmed cases from a single location.	Within 24 hours
9	Congenital Rubella Syndrome	An infant $<$ year of age who does not meet the criteria for a probable or confirmed cases but who has one or more clinical manifestation of CRS.	1 probable case	One lab confirmed case	1 week
10	Mumps	Acute onset of unilateral or bilateral tender, self-limited swelling of parotid or other salivary gland, lasting two or more days and without other apparent cause.	NA	1 lab confirmed or linked by time & place	1 week
11	Covid-19	Acute Onset of any three or more of following signs of symptoms sore throat, fever, dry cough general weakness, fatigue headache, myalgia coryza.	1 suspected case	One lab confirmed case	Immediate
12	Severe Acute Respiratory Syndrome (SARI)	Any person with acute respiratory infection with history of fever of $\geq 38^{\circ}\text{C}$ and cough with onset within last 10 days and requires hospitalization.	1 SARS case	1 lab confirmed or cluster of cases epidemiological linkage	Immediate



LIST OF NOTIFIABLE DISEASES

(Case Definition, Alert and Outbreak Thresholds)

Integrated Disease Surveillance and Response System



S. No	Disease / Condition		Case Definition	Alert Threshold	Outbreak Threshold	Reporting Timeline
13	Influenza	Seasonal Influenza	Any person with sudden onset of fever > 38°C and sore throat or cough in the absence of another known cause.	1 suspected case is an alert and requires an immediate investigation	1 lab confirmed case	Within 24 hours
		Pandemic Influenza (H1N1)	Any person with clinical compatible illness or who died of an unexplained acute respiratory illness who is considered to be epidemiologically linked to a probable or confirmed case	NA	NA	Within 24 hours
		Avian Human Influenza, A (H5N1)	Any person who has been in contact with suspected avian influenza case, or living in area where birds/ chickens have died or were sick in last 2 weeks, or living in endemic area,	NA	NA	Within 24 hours
14	Avian/Human Influenza, A (H5N1)		presenting with Respiratory tract illness characterized by fever (Temp > 38°C) and one or more of the following: Cough, Sore throat, Shortness of breath	NA	NA	Within 24 hours
15	Pneumonia		Children < 5 Years: Any child presenting with cough or difficulty breathing and any one of the following: fast breathing (Less than 2 months: >60 breaths/min: 2 months to 12 months:>50 breaths/min: 12 months to 5 years:>40 breaths/min), & Lower Chest Wall Indrawing	2 times the mean number of cases of the previous 3 weeks for a given location	Cluster of cases in a single location above the alert threshold	Within 7 days
16	Tuberculosis		Lab based surveillance	1 Case	Clustering of cases	Within 24 h
17	Acute Diarrhea (non-Cholera)		Any person with acute Diarrhea (Passage of 3 or more loose stools in the past 24 hours) with or without dehydration, and which is not due to bloody Diarrhea or suspected Cholera.	2 times the mean number of cases of the previous 3 weeks for a given location	Cluster of cases in a single location above the alert threshold	Within 7 days
18	Bloody Diarrhea		Any person having acute Diarrhea with visible blood in the stool	3 or more cases in one location	Cluster of 6 or more cases in one location.	Within 7 days
19	AWD Suspected Cholera		Non endemic areas; Any person aged 2 years or more with severe dehydration or death from acute watery Diarrhea. During Outbreak; Acute watery diarrhea with or without vomiting in a patient aged 5 years or more	1 AWD Case	1 lab confirmed cholera case, or a cluster of 6 or more AWD in a single locality	Within 24 hours
20	Acute Viral Hepatitis/ Acute Jaundice Syndrome (Hep. A&E primarily)		Any person having acute onset of jaundice yellow coloration of skin and sclera, dark urine) and severe illness (fatigue, nausea, vomiting, and abdominal pain) and absence of any known precipitating factors.	3 or more cases in one location.	Cluster of 6 or more cases in one location.	Within 24 hours
21	Acute Viral Hepatitis/ Acute Jaundice Syndrome (Hep. B,C&D primarily)		A suspected case that meets the clinical case definition and is laboratory confirmed i.e. IgM anti HAV antibody positive OR A case compatible with clinical description who has an epidemiological link to a confirmed case of Hepatitis A (i.e. household or sexual contact with an infected person during the 15-50 days before the onset symptoms	3 or more cases in one location.	Cluster of 6 or more cases in one location.	Within 24 hours
22	Suspected Typhoid Fever		Any person with acute illness and fever of at least 38°C for 3 or more days with abdominal cramps; Diarrhea or constipation or tenderness progressing to prostration and relative bradycardia.	3 or more linked cases	Cluster of 6 or more cases in one location with one lab-confirmed case	Within 7 days
23	Suspected Dengue Fever (DF)	Dengue Fever	Any person having acute onset of fever (>38°C) for 2- 10 days with at least two of the following manifestations: Severe headache, retro-orbital pain, and myalgia/arthralgia.	1 probable case is an Alert.	Cluster of 6 or more cases in one location + 1 lab confirmed DF case	Within 24 hours
		Dengue Hemorrhagic Fever	A probable or confirmed case of Dengue in whom hemorrhage tendencies is evidenced by;Petechie, Ecchymosis or purpura Bleeding mucosa, GIT, injection sites Or Hematemesis or Melaena	1 Suspected case	One lab confirmed case	Within 24 hours



LIST OF NOTIFIABLE DISEASES (Case Definition, Alert and Outbreak Thresholds) Integrated Disease Surveillance and Response System



S. No	Disease / Condition	Case Definition	Alert Threshold	Outbreak Threshold	Reporting Timeline
24	Suspected Malaria	Any person having had recent fever ($>38^{\circ}\text{C}$ in the last 48 hours) with or without other symptoms (chills, Headache, body aches, nausea, vomiting, Diarrhea), in whom other causes of fever have been excluded. NB severe malaria may also include signs and symptoms related to organ failure.	Cases more than 50 % of the mean of the number of cases in previous three years.	In endemic area, slide positivity rate above 50 % or falciparum rate above 40%; In non- endemic area, evidence of indigenous transmission of falciparum.	Within 7days
25	Visceral Leishmaniosis	A person with clinical symptoms of Prolonged irregular fever, splenomegaly and weight loss where fever lasts more than 2 weeks and does not respond to anti-malarial drugs	1 suspected case	1 Confirmed case	Within 24 hours
26	Cutaneous Leishmaniosis	Any person having skin lesions on the face neck, arms, and legs (exposed body parts), which began as nodules and turned into skin ulcers, eventually healing but leaving a depressed scar.	1 case outside Endemic area, 3 cases in endemic area.	Cluster of 6 or More cases in one location.	Within 24 hours
27	Chikungunya	Any person with acute onset of measured fever $>38.5^{\circ}\text{C}$ and severe arthralgia /arthritis not explained by other medical condition.	NA	NA	1 week
28	HIV/AIDS	Lab based surveillance	1 Case	1 Lab Confirmed case	Within 24 hours
29	Gonorrhea	Demonstration of gram-negative intracellular diplococci in urethral smear obtained from male or an endo-cervical smear obtained from a female.	NA	NA	1 week
30	Syphilis	A case with one or more ulcerative lesions (e.g. chancre) or localized or diffuse mucocutaneous lesions (e.g. rash such as non-pruritic macular, maculopapular, papular, or pustular lesions) , often with generalized lymphadenopathy with or without other symptoms like mucous patches, condyloma lata, and alopecia	NA	NA	1 week
32	Scabies	Any person having skin infection characterized by rash or lesions and intense itching especially at night. Lesions prominent around finger webs, wrists, elbows, axillaries, beltline, thighs, external genitalia, nipples, abdomen and lower portion of buttocks. In infants, head, neck palm and soles of infants may be involved.	2 times the mean number of cases of the previous 3 weeks for a given location	Cluster of cases in a single location above the alert threshold	Within 24 hours
33	Snake bite	Snake bites occur when a snake bites the skin. They are medical emergencies if the snake is venomous.	NA	NA	1 week
34	Nosocomial infection	Nosocomial' or 'healthcare associated infections' (HCAI) appear in a patient under medical care in the hospital or other health care facility which was absent at the time of admission	NA	NA	1 week
35	Encephalitis	Encephalitis is inflammation of the active tissues of the brain caused by an infection or an autoimmune response. The inflammation causes the brain to swell, which can lead to headache, stiff neck, sensitivity to light, mental confusion and seizures.	NA	NA	1 week
36	Botulism	Ingestion of Botulinum toxin results in illness of variable severity. Common Symptoms are diplopia, blurred vision, and bulbar weakness. Symmetric paralysis may progress rapidly.	NA	NA	1 week
37	Leprosy	A Person having one or more of the following symptoms. Hypo pigmented or reddish skin lesion(s) with definite loss of sensation & damage to peripheral nerves, as demonstrated by loss of sensation & mobility to hand, feet or face.	NA	NA	1 week
28	Brucellosis	An acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache and arthralgia & Routine workup of other common febrile illness is negative and is epidemiologically linked to suspected or confirmed animal cases or contaminated food of animal origin.	NA	NA	1 week
39	Rabies/Dog Bite	Any case with acute onset of neurological syndrome (encephalitis) dominated by any or more of the following symptoms; excitability, aerophobia, paralysis, hydrophobia, delirium, convulsions, or hyperactivity (furious rabies or paralytic syndromes (dumb rabies) that progresses towards respiratory failure, coma and death with history of bites or scratches or contact with saliva from a suspected animal during last 30 to 90 days.	NA	NA	1 week
40	Salmonellosis	Salmonella, or salmonellosis, is an infection with Salmonella bacteria that causes diarrhea, fever and stomach pains	NA	NA	1 week
41	CCHF	Patient with sudden onset of illness with high grade fever (38.5°C) for >3 days and <10 days especially in CCHF endemic areas and among those in contact with a confirmed patient or handling animals and raw animal products and when fever does not respond to antibiotics or anti-malarial treatment.	1 CCHF Case	1 lab confirmed case, if CCHF, 6 or more cases in one location + 1 lab confirmed case, if DHF.	Within 24 hours
42	Anthrax	Skin lesion evolving over 1 to 6 days from a papular through a vesicular stage, to a depressed black eschar/scab invariably accompanied by oedema AND Has an epidemiological link to a suspected or confirmed Anthrax animal case or contaminated animal product?	1 Case	1 Lab Confirmed case	Within 24 hours

6. Priority Notifiable Diseases in KPK

Health facilities are required to report immediately any suspected or confirmed cases of certain diseases.

Examples include:

Category	Diseases / Conditions
Vaccine-Preventable	Polio, Measles, Diphtheria, Pertussis
Vector-Borne	Malaria, Dengue, Leishmaniasis
Waterborne	Cholera, Typhoid, Hepatitis A & E
Respiratory	COVID-19, Tuberculosis, Influenza
Other Epidemic-Prone	Meningitis, Crimean-Congo Hemorrhagic Fever (CCHF)

7. Roles and Responsibilities of PHC Workers

Responsibility	Description
Case Detection	Identify suspected or confirmed cases based on standard case definitions.
Data Recording	Use standard registers and reporting forms accurately.
Reporting	Submit timely reports through DHIS-2 or directly to CDCC or EPI cell.
Outbreak Notification	Immediately report any unusual increase in cases or deaths to supervisors.
Community Awareness	Educate the public about preventive measures.
Collaboration	Work with RRTs, EPI teams and district health authorities.

Reporting Timelines:

- ***Immediate (within 24 hours):*** Epidemic-prone diseases like cholera, measles, or CCHF.
- ***Weekly:*** Routine notifiable diseases (through DEWS).
- ***Monthly:*** General health indicators (through DHIS-2).

8. Local Laws, Policies and Regulations

Disease surveillance and reporting in KPK are guided by:

1. Pakistan Public Health (Surveillance and Response) Act 2018
2. Khyber Pakhtunkhwa Public Health Act 2017
3. National Institute of Health (NIH) Notification Guidelines
4. Integrated Disease Surveillance and Response (IDSR) Strategy 2020–2025
5. Department of Health KPK – Communicable Disease Control Cell (CDCC) Protocols

These laws mandate timely disease notification and empower health authorities to act quickly to prevent epidemics.

Key Message:

Timely reporting by frontline PHC workers saves lives and prevents community-wide outbreaks.

09. Key Takeaways

- Surveillance is continuous observation of diseases for action.
- PHC workers are the first line of defense in early detection and reporting.
- IDSR, DEWS and DHIS-2 are the main systems used in KPK.
- Timely and accurate reporting ensures rapid outbreak response.
- Local public health laws provide a legal framework for mandatory disease notification.

MODULE TWO

COMMUNICABLE DISEASES



Introduction:

Communicable diseases are illnesses caused by infectious agents that can be transmitted from one person, animal, or object to another. Understanding how these diseases spread is essential for their prevention and control. The traditional epidemiologic triad model explains that infectious diseases result from the interaction of three key factors — agent, host and environment. Transmission occurs when the infectious agent leaves its reservoir or host through a portal of exit, is carried by a mode of transmission and enters through a portal of entry to infect a susceptible host.

Each component of this chain plays a vital role in determining whether infection occurs and how rapidly a disease can spread within a community. The risk of transmission depends not only on the nature of the infectious agent but also on host factors such as immunity and environmental conditions that facilitate or hinder spread. An infectious agent may be transmitted from its natural reservoir to a susceptible host in different ways, broadly categorized as direct or indirect modes of transmission.

In this section, communicable diseases are classified based on their mode of transmission, providing a clearer understanding of how infections spread and the strategies needed for effective prevention and control.

Communicable Disease Classification by Modes of Disease Transmission:

Mode of transmission is how the agent travels from person to person, this usually occurs via HCWs' hands, contaminated equipment, instruments, devices and the environment (including air and water). It can be classified as;

Table 2.1: Classification of Communicable Diseases

Main Category	Sub-category	Description
Direct Transmission	<i>Direct Contact</i>	Transmission through physical contact with an infected person.
	<i>Droplet Spread</i>	Transmission through large droplets expelled during coughing, sneezing, or talking that travel short distances.
	<i>Vertical Transmission</i>	Transmission of infectious agents from mother to baby
Indirect Transmission	<i>Airborne</i>	Transmission through fine particles or droplet nuclei that remain suspended in the air and can be inhaled.
	<i>Vehicle-borne</i>	Transmission through contaminated inanimate objects (vehicles) such as food, water, or fomites.
	<i>Vector-borne</i>	Transmission through vectors (insects or animals) that carry infectious agents.

SESSION 2.1: DIRECT TRANSMISSION

SUB-SESSION 2.1.1: CONTACT TRANSMISSION

Session Objectives

By the end of this session, participants will be able to:

1. Define contact transmission and explain how it contributes to the spread of communicable diseases.
2. Differentiate between **direct** and **indirect** contact transmission.
3. Identify common diseases transmitted through contact in the context of Khyber Pakhtunkhwa (KP).

1. Introduction

Contact transmission is one of the most common modes through which infectious diseases spread within communities, households and healthcare settings. It refers to the immediate or indirect transfer of infectious agents from one person to another — either by direct physical contact or through contaminated objects (fomites).

In resource-limited settings such as KP, contact transmission plays a major role in outbreaks of skin infections, gastrointestinal diseases and sexually transmitted infections (STIs). Overcrowding, limited sanitation and inadequate infection prevention practices increase the risk of disease spread among patients and healthcare workers alike.

2. Overview of Direct Transmission

Definition:

Direct transmission is the immediate spread of an infectious agent from an infected person to a susceptible individual without any intermediate object or vector.

Mechanisms include:

- Skin-to-skin contact
- Mucosal contact (mouth, eyes, genital areas)
- Sexual contact
- Vertical (mother-to-child) transmission

Key Feature:

Requires close physical proximity and immediate transfer of infectious material (blood, secretions, or excretions).

3. Subtypes of Contact Transmission

A. Direct Contact Transmission (Person-to-Person)

Definition and Mechanism:

Direct contact transmission involves the immediate transfer of pathogens through physical touch between an infected and a susceptible person. This can occur through touching, kissing, sexual activity, or maternal contact during childbirth and breastfeeding.

Common Routes of Direct Contact:

Form of Contact	Mechanism of Transmission	Examples of Diseases
Skin-to-skin contact	Pathogens transfer via infected skin, wounds, or lesions.	Scabies, Impetigo, Cellulitis
Kissing/oral contact	Viruses spread through saliva and mucous membranes.	Herpes simplex (HSV-1, HSV-2), Cytomegalovirus, Epstein-Barr Virus
Sexual contact	Exchange of bodily fluids and mucosal contact.	HIV, Syphilis, Gonorrhea, Chlamydia, HPV
Vertical transmission	Mother-to-child contact during delivery or breastfeeding.	HIV, Herpes simplex, Hepatitis B

B. Indirect Contact Transmission

Definition:

Indirect contact transmission occurs when pathogens are transferred via contaminated surfaces or objects (fomites) rather than direct person-to-person contact.

Mechanism:

1. Infected person contaminates a surface or object.
2. Pathogens survive on the fomite for a period of time.
3. A susceptible person touches the object and then touches their mouth, nose, eyes, or skin, leading to infection.

Key Points:

- **Common fomites:** Door handles, bed rails, stethoscopes, mobile phones, medical instruments, toys, clothes.
- **Persistence:**
 - *Norovirus* – survives up to 2 weeks on hard surfaces.
 - *MRSA* – survives for hours to days.
 - *C. difficile* spores – survive for weeks to months, resistant to disinfectants.

4. Summary Table

Transmission Subtype	Definition	Typical Examples	Infection Control Focus
Direct Contact	Immediate person-to-person physical contact	Scabies, Herpes, STIs, Impetigo	Isolation, treatment, behavioral change
Indirect Contact	Transfer via contaminated surfaces or objects	MRSA, Norovirus, <i>C. difficile</i>	Hand hygiene, disinfection, PPE use

5. Common Contact-Transmitted Diseases in Khyber Pakhtunkhwa

Disease	Mode of Contact Transmission	Public Health Context (KP)
HIV/AIDS	Sexual contact, blood exposure	Stigma and limited testing contribute to underreporting, especially in rural areas.
Scabies	Prolonged skin-to-skin contact	Common in overcrowded households, refugee camps and schools.
Herpes Simplex Virus	Mucosal or sexual contact	Often asymptomatic but highly contagious; awareness is low.
Impetigo	Skin contact among children	Common in hot, humid climates and low-hygiene environments.

SESSION 2.1: DIRECT TRANSMISSION

SUB-SESSION 2.1.2: DROPLET TRANSMISSION

Session Objectives

By the end of this session, participants will be able to:

1. Define droplet transmission and explain how it differs from airborne and contact transmission.
2. Identify common diseases spread through droplet transmission.
3. Describe epidemiological relevance and key factors increasing droplet transmission.
4. Apply infection prevention and control (IPC) measures to prevent droplet-transmitted infections in community and clinical settings.
5. Recognize high-risk environments and groups vulnerable to droplet-borne infections in the KP context.

1. Introduction

Droplet transmission is a major route for the spread of respiratory communicable diseases that are commonly seen in both community and healthcare settings in Pakistan. It occurs when infectious respiratory droplets are expelled by an infected individual and come into direct contact with the mucosal surfaces (eyes, nose, mouth) of another person within close proximity — generally 1–2 meters.

In Khyber Pakhtunkhwa (KP), droplet-borne diseases such as influenza, pertussis, COVID-19, mumps, diphtheria and meningococcal meningitis continue to cause periodic outbreaks, especially in schools, health centers, refugee camps and crowded homes. Limited ventilation, overcrowding and inadequate respiratory hygiene make these infections highly transmissible.

2. Definition

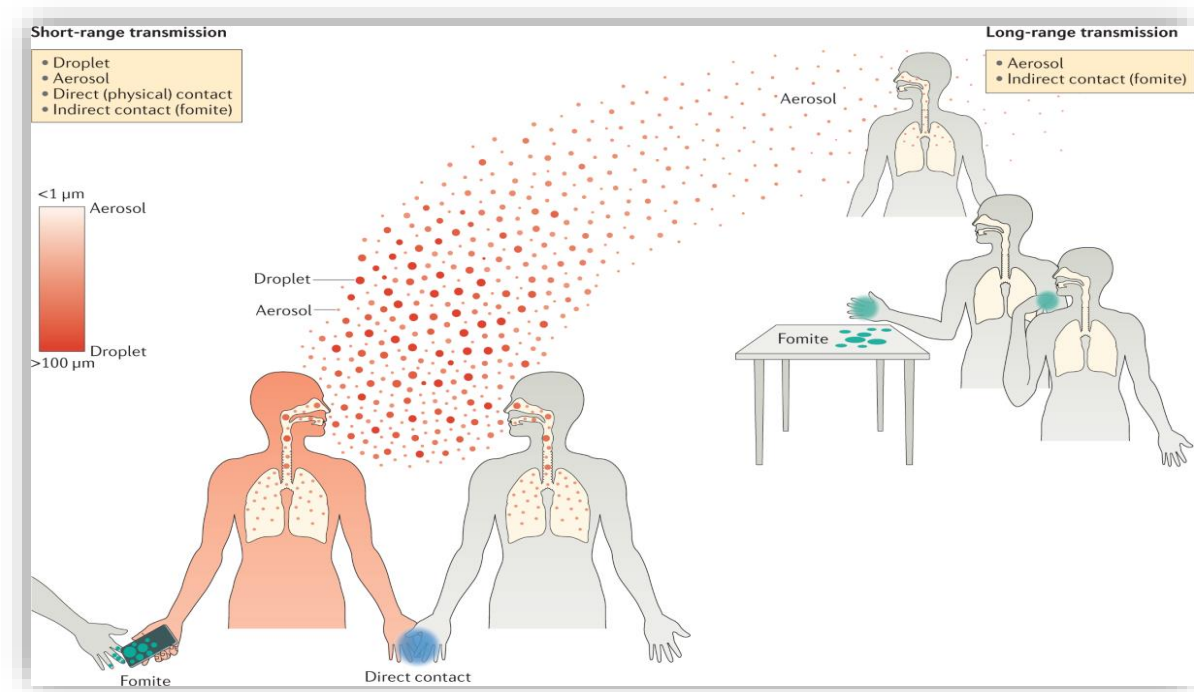
“Droplet transmission occurs when respiratory droplets carrying pathogens are propelled a short distance directly onto the mucosal surfaces of a susceptible individual.”

— *WHO IPC Guidelines, 2021*

Key Concept:

Respiratory droplets (>5 microns in diameter) are expelled when an infected person coughs, sneezes, talks, sings, or breathes heavily. These droplets travel short distances (up to 1–2 meters) and quickly settle either:

- On another person’s mucosal surfaces (causing infection), or
- On nearby surfaces, where they can be picked up via indirect contact.



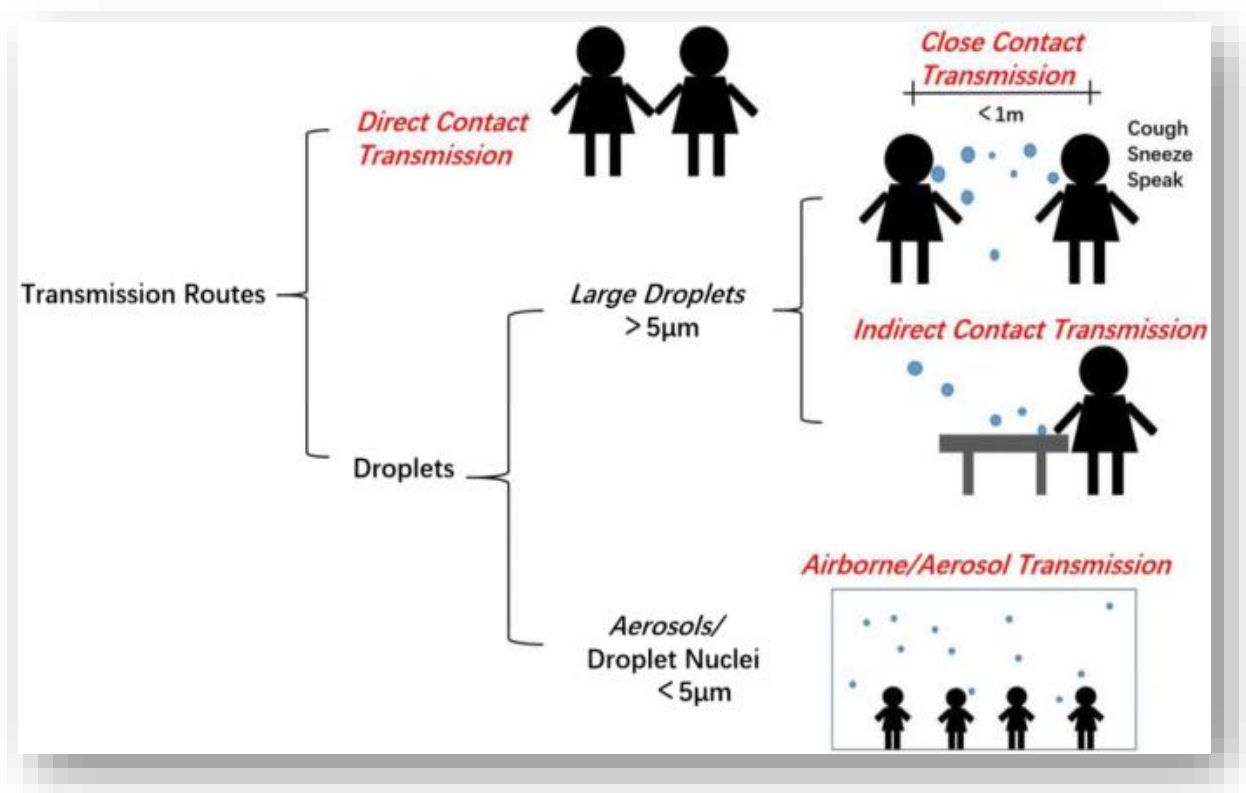
3. Mechanism of Droplet Transmission

Generation:

- Droplets are released during coughing, sneezing, talking, or medical procedures such as suctioning or intubation.

Routes of Spread:

- **Direct spread:** When droplets directly reach mucosal surfaces of a nearby person.
- **Indirect spread:** When droplets contaminate surfaces or objects (fomites), which are later touched by another person before handwashing.



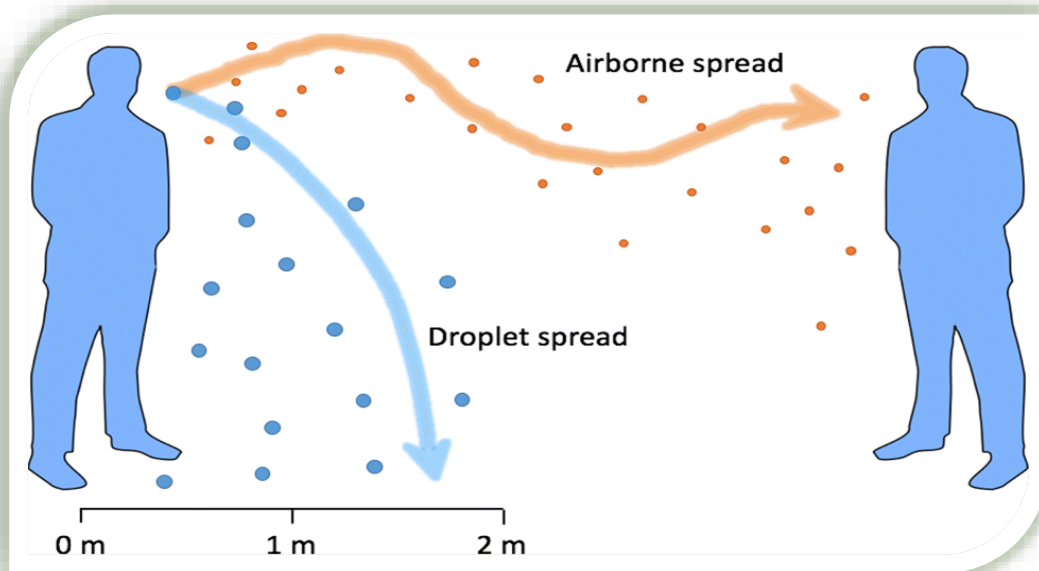
Important:

Droplets differ from aerosols (airborne particles) because they are too heavy to stay suspended in the air for long and fall to the ground within seconds.

4. Droplet vs. Airborne Transmission

Feature	Droplet Transmission	Airborne Transmission
Particle size	$>5\ \mu\text{m}$	$\leq 5\ \mu\text{m}$
Travel distance	Usually $\leq 1\text{--}2$ meters	Can travel >6 meters
Duration in air	Seconds to minutes	Hours
Typical control measures	Surgical mask, physical distancing	N95/FFP2 mask, negative pressure ventilation
Examples	Influenza, COVID-19, Mumps, Diphtheria	Tuberculosis, Measles, Chickenpox

Some infections (e.g., SARS-CoV-2, influenza) may have both droplet and airborne transmission components depending on the environment and duration of exposure.



5. Examples of Droplet-Transmitted Diseases

Disease		Pathogen	Transmission Context
Influenza	Influenza virus	Coughing, sneezing in close contact	
COVID-19	SARS-CoV-2	Talking, coughing, sneezing, aerosol generation in clinical settings	
Pertussis (Whooping cough)	<i>Bordetella pertussis</i>	Close-range coughing, especially among unvaccinated children	
Mumps	Mumps virus	Droplets from saliva and respiratory secretions	
Meningococcal meningitis	<i>Neisseria meningitidis</i>	Spread through droplets in crowded living spaces	
Diphtheria	<i>Corynebacterium diphtheriae</i>	Droplet spread during coughing or talking	
Rubella	Rubella virus	Droplet spread from infected individuals, especially dangerous during pregnancy	

6. Epidemiological Relevance

- **Outbreak Settings:**

Schools, daycares, religious gatherings, healthcare facilities, prisons and refugee camps.

- **High-Risk Groups:**

- Infants and young children
- Elderly and immunocompromised individuals
- Healthcare workers exposed to patients without adequate PPE

- **Seasonal Trends:**

Respiratory droplet infections (e.g., influenza) peak during colder months when people spend more time indoors and ventilation is poor.

7. Factors Increasing Droplet Transmission Risk

Risk Factor	Explanation
Overcrowding and close proximity	Increases likelihood of droplet contact within 1–2 meters.
Poor ventilation	Accumulation of infectious droplets in closed environments.
Inadequate respiratory hygiene	Coughing or sneezing without covering the mouth or nose.
Lack of mask use	Especially during outbreaks or in healthcare facilities.
Healthcare procedures	Aerosol-generating procedures (suctioning, intubation) increase exposure risk.

8. Prevention and Control of Droplet Transmission

At Healthcare Facility Level

- Maintain 1–2-meter distance between patients.
- Use surgical masks for staff and patients with respiratory symptoms.
- Ensure hand hygiene before and after patient contact.
- Clean and disinfect frequently touched surfaces (e.g., beds, doorknobs, equipment).
- Implement respiratory hygiene protocols (cover coughs and sneezes).
- Ventilate examination and waiting areas regularly.

At Community Level

- Educate families on cough etiquette and mask-wearing.
- Discourage attendance at gatherings when ill.
- Encourage vaccination against influenza, pertussis, diphtheria and COVID-19.
- Promote early consultation at PHC centers for respiratory symptoms.

SESSION 2.1: DIRECT TRANSMISSION

SUB-SESSION 2.1.3: VERTICAL TRANSMISSION

Session Objectives

By the end of this session, participants will be able to:

1. Define *vertical transmission* and explain the different routes of vertical transmission – during pregnancy, delivery and breastfeeding.
2. Identify common infections transmitted vertically and their health impacts.
3. Recognize the risk factors that increase the likelihood of vertical transmission.
4. Describe practical prevention and control measures at the primary health care (PHC) level.

1. Introduction

Vertical transmission, also known as mother-to-child transmission, is an important route by which infectious diseases are passed from a mother to her baby. This can happen before birth (in utero), during childbirth (intrapartum), or after birth (postnatal) through breastfeeding.

According to the *World Health Organization (WHO)*,

“Vertical transmission is the transmission of infection from mother to child during the prenatal period, delivery, or postpartum via breastfeeding.”

In many developing regions, including parts of Khyber Pakhtunkhwa (KP), vertical transmission contributes significantly to infant mortality, congenital disorders and chronic infections. It is often associated with limited access to antenatal care, lack of maternal immunization and inadequate infection prevention practices during delivery.

For primary healthcare workers, understanding vertical transmission is essential to prevent avoidable infections, educate mothers and strengthen maternal and child health services.

2. Routes of Vertical Transmission

Vertical transmission can occur in three main ways: during pregnancy, at birth, or through breastfeeding. Each route carries specific risks for the mother and the child.

A. In Utero (Transplacental Transmission)

In this form, the infectious agent crosses the placenta and infects the fetus during pregnancy. The infection may occur when the mother contracts a disease such as rubella, toxoplasmosis, or cytomegalovirus during pregnancy.

This can lead to congenital infections, miscarriage, stillbirth, or birth defects. For example, if a mother contracts rubella early in pregnancy, her baby may develop Congenital Rubella Syndrome (CRS), which can cause cataracts, heart defects, or hearing loss.

B. Intrapartum Transmission (During Labor and Delivery)

Intrapartum transmission happens when the baby is exposed to infected blood, vaginal secretions, or other body fluids while passing through the birth canal. This route is common for infections such as HIV, Hepatitis B, Herpes Simplex Virus and Group B Streptococcus.

The risk increases if the mother's infection is not treated, or if the labor is prolonged or complicated. Safe delivery practices and proper infection control are essential to reduce this risk.

C. Postpartum Transmission (Through Breastfeeding)

After birth, certain infections can be transmitted to the baby through breast milk. The most common example is HIV, but other infections such as Cytomegalovirus (CMV) and Human T-cell Lymphotropic Virus (HTLV) can also be transmitted. While breastfeeding has many health benefits, mothers with certain infections need medical advice on whether and how to safely breastfeed. For example, HIV-positive mothers who are on antiretroviral therapy (ART) are often advised to continue exclusive breastfeeding while maintaining treatment, as this reduces transmission risk and provides essential nutrition.

3. Common Infections Transmitted Vertically

Several infections can be transmitted from mother to child. These may cause serious health problems ranging from mild illness to lifelong disability. Primary healthcare workers should recognize these diseases early and refer affected mothers and babies for treatment and follow-up.

Infection	Transmission Route	Possible Outcomes in Baby
HIV (Human Immunodeficiency Virus)	In utero, during delivery, or breastfeeding	Perinatal HIV infection, poor growth, weakened immune system
Syphilis (Treponema pallidum)	Transplacental	Stillbirth, skin rash, bone deformities, congenital syphilis
Rubella (German Measles)	Transplacental	Congenital Rubella Syndrome (CRS): cataracts, hearing loss, heart defects
Toxoplasmosis (Toxoplasma gondii)	Transplacental	Hydrocephalus, brain and eye damage
Cytomegalovirus (CMV)	Transplacental or during delivery	Hearing loss, developmental delay, small head size
Hepatitis B (HBV)	During delivery (maternal blood)	Chronic liver infection, risk of liver cancer in adulthood
Herpes Simplex Virus (HSV-1, HSV-2)	During delivery	Severe neonatal infection, brain inflammation
Zika Virus	Transplacental	Microcephaly and neurological problems
COVID-19 (SARS-CoV-2)	Rare, under study	Usually mild or asymptomatic in newborns

4. Health Impact and Significance

Vertical transmission has serious clinical and public health implications. Babies infected before or during birth may suffer from congenital abnormalities, premature birth, or early death. Others may appear healthy but later develop chronic infections, such as HIV or Hepatitis B, that require lifelong treatment.

For mothers, pregnancy can make infections more severe due to reduced immunity. Conditions like malaria or hepatitis E are more dangerous during pregnancy. Treating these infections promptly is vital to protect both mother and baby.

In Khyber Pakhtunkhwa, factors such as limited antenatal screening, home deliveries and low immunization coverage increase the risk of vertical transmission. Strengthening maternal health services can help reduce these infections significantly.

5. Timing of Transmission and Risk Factors

The timing of transmission influences the type and severity of infection in the baby. Certain factors make vertical transmission more likely, such as untreated maternal infection, poor infection control during delivery, or lack of prophylaxis after birth.

Timing	Description	Key Risk Factors
In Utero	Infection crosses the placenta before birth	Early pregnancy infection, maternal viremia, placental inflammation
During Delivery	Baby exposed to infected fluids in the birth canal	High maternal viral load, prolonged labor, premature rupture of membranes
Postnatal (Breastfeeding)	Transmission through infected breast milk	No ART in HIV-positive mother, cracked nipples, mastitis, delayed vaccination

6. Case Study: Rubella Outbreak in Khyber Pakhtunkhwa

In a rural district of KP, several infants were born with hearing loss and eye cataracts. On investigation, many of their mothers reported a rash and fever during early pregnancy, consistent with rubella infection. None of them had been vaccinated before pregnancy.

Health authorities confirmed an outbreak of Congenital Rubella Syndrome (CRS). The root cause was low vaccination coverage and missed antenatal visits. As a response, a rubella vaccination campaign was launched for women of childbearing age, antenatal screening was strengthened and CRS surveillance was added to the district's health information system.

This example highlights the importance of maternal vaccination, early antenatal care and community education in preventing vertical transmission.

Perinatal Transmission

7.



Prevention and Control at Primary Health Care Level

Primary healthcare workers are the first point of contact for pregnant women and families. They play a central role in preventing vertical transmission by providing screening, counseling and preventive care.

Antenatal Care

- Screen all pregnant women for HIV, syphilis and hepatitis B early in pregnancy.
- Promote and ensure maternal immunizations such as rubella and tetanus.
- Educate mothers about avoiding infections like toxoplasmosis by washing hands, avoiding raw meat and wearing gloves while gardening.
- Encourage early antenatal visits and follow-up.

Delivery and Postnatal Care

- Promote institutional deliveries where infection control is ensured.
- Use clean and sterile practices during labor and delivery.
- For hepatitis B–positive mothers, ensure that the newborn receives HBV vaccine and HBIG within 12 hours of birth.
- Encourage exclusive breastfeeding unless medically contraindicated and ensure mothers on ART continue treatment.
- Provide routine immunization for infants and counsel mothers on safe infant feeding practices.

8. Key Takeaways

- Vertical transmission occurs when infections pass from mother to baby before, during, or after birth.
- Common infections include HIV, Hepatitis B, Syphilis, Rubella and Herpes Simplex Virus.
- These infections can cause serious complications like congenital defects, chronic illness, or infant death.
- Prevention through antenatal screening, safe delivery practices and maternal immunization is the most effective approach.
- Primary healthcare workers are essential in identifying risk factors early and educating mothers and families.

SESSION 2.2: INDIRECT TRANSMISSION

SUB SESSION 2.2.1A: AIRBORNE DISEASES

Learning Objectives

By the end of this session, participants will be able to:

1. Define airborne diseases and explain how airborne transmission occurs.
2. Identify key characteristics and environmental factors that promote airborne spread.
3. Recognize major examples of airborne diseases and their public health importance.
4. Describe preventive and control strategies at both individual and community levels.
5. Apply infection prevention and control (IPC) measures in primary health care settings.

1. Introduction

Airborne diseases are among the most infectious illnesses known to humanity. These infections can spread rapidly through the air, especially in closed, poorly ventilated and crowded environments such as clinics, schools and public transport. Understanding how they spread and how to prevent them is crucial for all primary healthcare workers (PHCWs), as they are often the first point of contact for affected individuals.

2. Definition

Airborne diseases are infections caused by pathogens (bacteria, viruses, or fungi) that are transmitted through airborne particles. These particles, also called droplet nuclei (less than 5 microns in size), can:

- Remain suspended in air for long periods.
- Travel long distances on air currents.
- Be inhaled deep into the lungs by another person.

3. Mechanism of Airborne Transmission

Airborne transmission occurs through a series of steps from the infected source to a new host.

Stage	Explanation
Source	The infected person releases respiratory droplets while coughing, sneezing, talking, or breathing.
Droplet Nuclei Formation	Larger droplets ($>5\text{ }\mu\text{m}$) fall to the ground, while smaller droplets dry up and form droplet nuclei ($<5\text{ }\mu\text{m}$).
Suspension & Travel	Droplet nuclei remain suspended in air and can travel long distances depending on ventilation and airflow.
Host Exposure	Another person inhales the contaminated air, allowing pathogens to enter their respiratory tract and cause infection.

4. Step-by-Step Mechanism (Simplified)

1. *Release of Pathogens* – An infected person emits droplets containing microorganisms.
2. *Evaporation* – Larger droplets shrink into smaller droplet nuclei.
3. *Suspension* – These tiny particles remain floating in air for minutes or hours.
4. *Inhalation* – A nearby person breathes them in.
5. *Infection* – The pathogen settles in the lungs and begins multiplying, leading to disease.

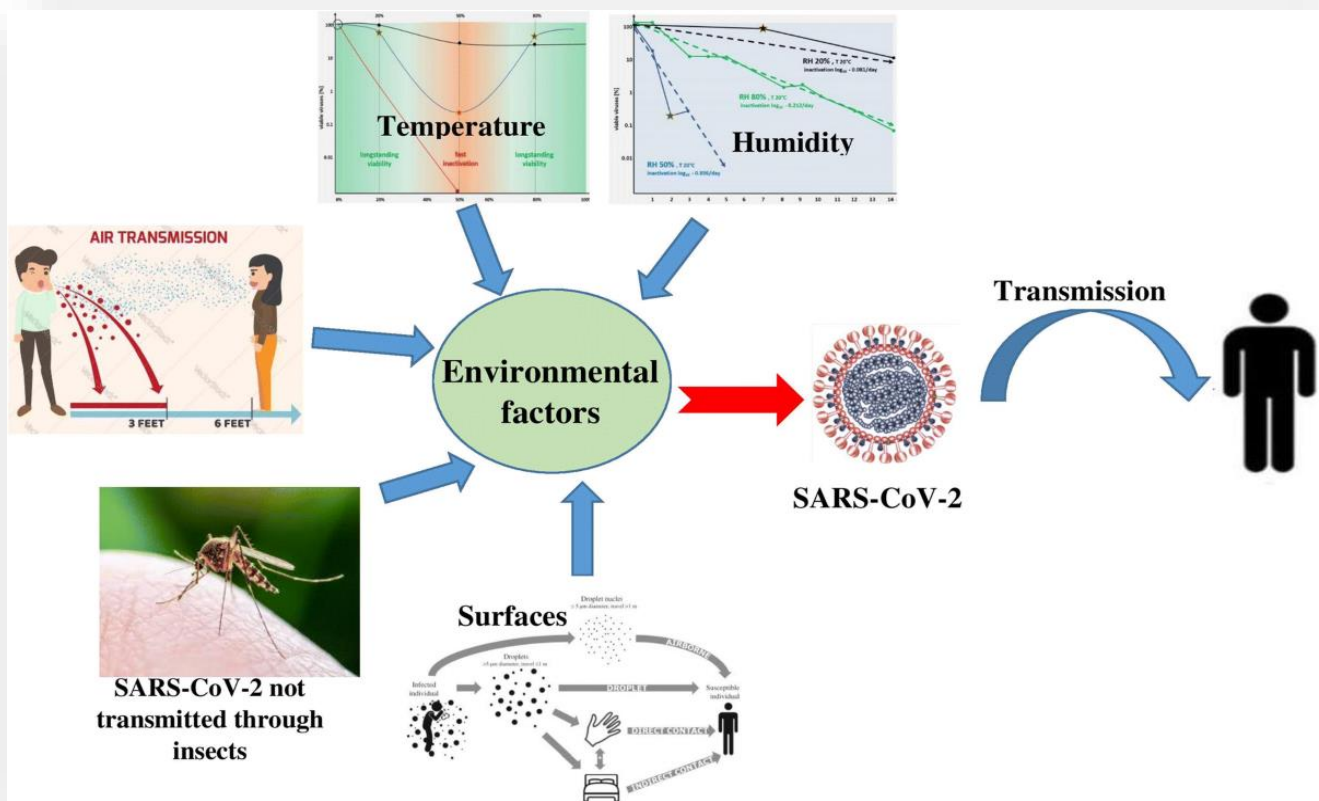
5. Characteristics of Airborne Particles

Feature	Public Health Implication
Size <5 microns	Easily inhaled deep into the lungs.
Light and dry	Stay suspended in air for prolonged periods.
Travel distance $>1\text{--}2$ meters	Can spread infection beyond close contact.
Low infectious dose	Even a few organisms may cause illness.

6. Environmental Factors Affecting Transmission

Environmental conditions can greatly influence the spread of airborne infections:

Factor	Effect on Transmission
Ventilation	Poor ventilation increases accumulation of infectious particles.
Humidity	Low humidity helps droplets evaporate faster, forming droplet nuclei.
Airflow Direction	Air currents can carry particles from one area to another.
Crowding	More people = more chances for exposure.
Exposure Duration	Longer exposure = higher risk of infection.



7. Aerosol-Generating Procedures (Healthcare Settings)

Some medical procedures produce fine aerosols, increasing airborne risk. These include:

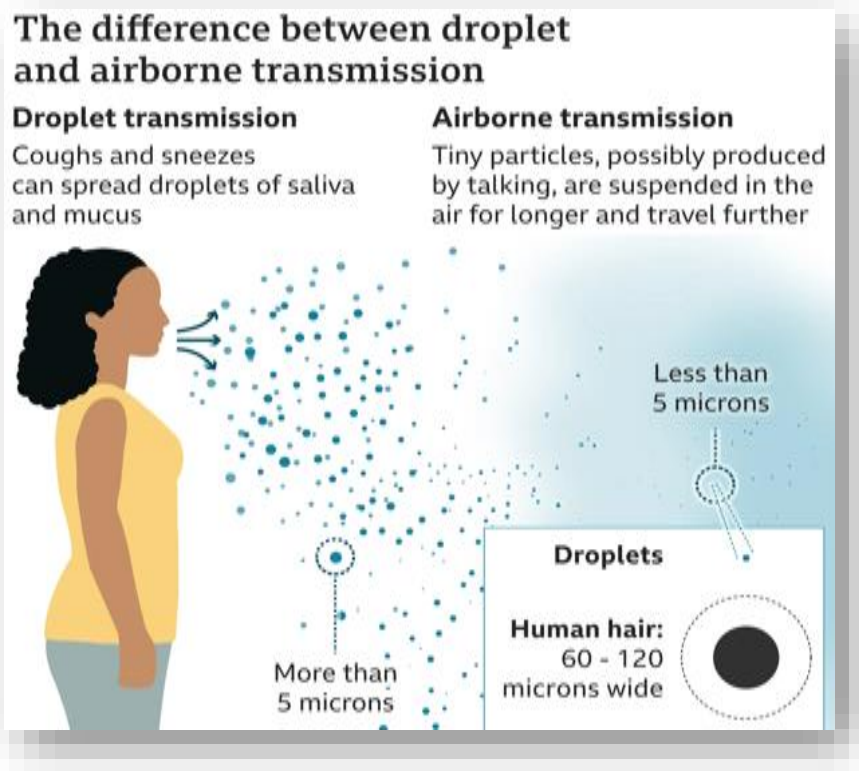
- Endotracheal intubation or extubation
- Nebulizer therapy
- Bronchoscopy
- Open suctioning
- Cardiopulmonary Resuscitation (CPR)

Precaution:

Use **N95 respirators**, ensure **negative-pressure rooms** and limit personnel presence during these procedures.

8. Difference Between Droplet and Airborne Transmission

Feature	Droplet Transmission	Airborne Transmission
Particle size	>5 µm	<5 µm
Travel distance	<1 meter	>1 meter
Air suspension	Falls quickly	Stays suspended for long periods
Example diseases	Influenza, COVID-19 (partial)	TB, Measles, Varicella, COVID-19 (aerosols)



9. At-Risk Populations and High-Risk Settings

At-Risk Populations

- Healthcare workers (especially in ICUs and TB clinics)
- Children and elderly persons
- Immunocompromised individuals (HIV, cancer, transplant)
- Residents of overcrowded housing
- Workers in enclosed environments (prisons, mines, factories)

High-Risk Settings

- Hospitals and health facilities
- Schools and daycare centers
- Prisons and refugee camps
- Poorly ventilated buildings
- Public transport
- Elderly care homes

10. Public Health Impact

Airborne diseases pose major public health challenges:

- Rapid and widespread community transmission.
- Overburdening of health systems during epidemics (e.g., COVID-19).
- High mortality rates among vulnerable groups.
- Need for urgent isolation and outbreak control measures.

11. Public Health Strategies

Strategy	Rationale
Use of N95/FFP2 masks	Filters out particles smaller than 5 µm.
Isolation rooms (negative pressure)	Prevents contaminated air from spreading.
Improved ventilation (natural or mechanical)	Dilutes airborne pathogens.
Vaccination programs	Reduces number of infectious individuals.
Outbreak investigation	Identifies and controls sources quickly.

12. Surveillance and Response

Effective control depends on:

- Early case detection (symptom screening, laboratory testing).
- Contact tracing and follow-up to prevent secondary infections.
- Rapid response teams for outbreak investigation.
- Reporting and data mapping through surveillance systems such as IDSR or eDEWS.

13. Summary Table: Public Health Priority Diseases (Airborne)

Disease	Vaccine Available	High Transmission Risk	Severe Outcomes Possible	Isolation Needed
TB	Yes (BCG, partial)	Yes	Yes	Yes
Measles	Yes	Very High	Yes	Yes
Chickenpox	Yes	High	Yes (in adults)	Yes
COVID-19	Yes	High	Yes	Yes
Influenza	Yes	High (seasonal)	Yes	Sometimes
Diphtheria	Yes	Moderate	Yes	Yes
Hantavirus	No	Low	Yes	No
Aspergillosis	No	Low	Yes	No

14. Global and Local Examples

Region	Example	Key Points
Global	COVID-19 pandemic	Airborne spread in enclosed spaces; need for ventilation and masks.
Pakistan	Measles outbreaks	Linked to low vaccination coverage.
South Asia	TB	High MDR-TB burden.
Americas	Hantavirus	Spread via rodent droppings and urine aerosols.

15. Key Takeaways for PHC Workers

- Airborne diseases can spread rapidly even without close contact.
- Proper ventilation, masks and vaccination are essential.
- Early recognition and isolation prevent outbreaks.
- Educate the community about cough etiquette and vaccination.
- Always use PPE during aerosol-generating procedures.
- Participate actively in surveillance and reporting.

SESSION 2.2: INDIRECT TRANSMISSION

SUB SESSION 2.2.1B: MAJOR AIRBORNE DISEASES

1. Tuberculosis (TB)

Causative Agent: *Mycobacterium tuberculosis*

Transmission: Inhalation of droplet nuclei from infected individuals.

Symptoms: Persistent cough (>2 weeks), fever, night sweats, weight loss, blood in sputum.

Diagnosis: Sputum smear microscopy, GeneXpert, chest X-ray.

Epidemiology:

- High prevalence in South Asia and Sub-Saharan Africa.
- Associated with HIV and overcrowding.

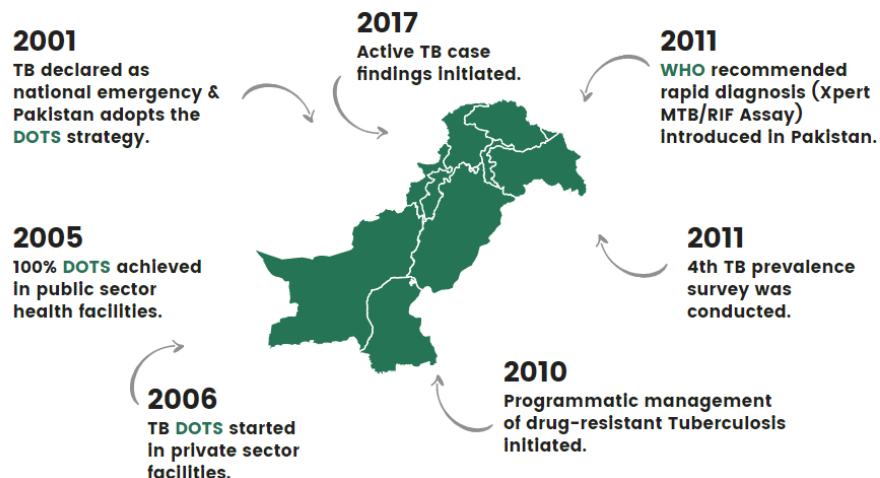
Public Health Importance:

- Long infectious period, drug-resistant forms (MDR-TB).

Prevention:

- BCG vaccination, early diagnosis, DOTS strategy, proper ventilation in clinics.

Milestones - TB Control Program (Pakistan)





Global TB situation (Global TB report 2020)

- 1 TB remains the top infectious killer worldwide. One of the top 10 causes of death.
- 2 10 million people fell ill with TB in 2019.
- 3 About 7.1 million TB patients were reported to National TB Control Programs.
- 4 About 2.9 million people with TB were missing and not reported to National TB Control Programs.
- 5 TB-related deaths dropped from 1.5 million in 2018 to 1.4 million in 2019.
- 6 An estimated 63 million lives were saved through TB diagnosis and treatment between 2000 and 2019. TB deaths fell by 38% in the same period

- 7 In 2019, the 30 high TB burden countries 87% of new TB cases. Eight countries accounted for two thirds of the global total TB burden India, China, Indonesia, Philippines, **Pakistan**, Nigeria, Bangladesh & South Africa.
- 8 Drug-resistant TB continues to be a public health threat.
- 9 There were about 500,000 new cases of rifampicin-resistant TB and 206,030 cases were notified.
- 10 25% of diagnosed **DR-TB** Patients had access and received treatment.
- 11 "57% diagnosed **DR-TB** patients were treated successfully".



Global TB situation(Global TB report 2020) **The situation of TB in Pakistan**

- 1** Tuberculosis is one of the major public health problems in Pakistan.
 - 2** Pakistan ranks 5th in Drug-susceptible and Drug-resistant TB among 30 high-burden countries.
 - 3** 570,000 persons developed active tuberculosis in Pakistan in 2019.
 - 4** 328,000 (58%) cases were notified and treated.
 - 5** 242,000 (42%) cases were missed and/or not reported to National TB Control Program in 2019.
 - 6** 93% patients were successfully treated.
-
- 8** 25000 people fell ill with drug-resistant TB.
 - 9** Only 3004 (12%) were put on treatment.
 - 10** 64% are successfully treated.
 - 11** 5100 people (less than 2.4 %) living with **HIV** fell ill with TB.
 - 12** 44000 people died of TB in 2019.

“WHO Strategies and Targets (1994 onward)”



DOT

1994–2005

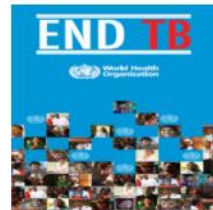
70% case detection rate
85% treatment success rate



STOP TB

2006–2015

Halt and began to reverse the
incidence of TB by 2015 (MDG)
Prevalence & death: by 50% STP



END TB

2015–2035

10 TB cases per 100,000 population

Sustainable Development Goals (The 2030 Agenda) Sustainable Development Goal 3



Ensure healthy lives and promote well-being for all at all ages

“By 2030, end the epidemics of **AIDS, Tuberculosis, Malaria, and neglected tropical diseases, and combat Hepatitis, Water-borne diseases, and other communicable diseases.”**

2. Measles

Causative Agent: Measles virus (*Paramyxoviridae* family)

Transmission: Highly contagious; airborne through coughs/sneezes.

Symptoms: Fever, cough, coryza, conjunctivitis, Koplik spots, rash.

Epidemiology:

- R_0 (basic reproductive number) 12–18 (very high).
- Outbreaks in areas with low vaccination coverage.

Public Health Importance:

- Major cause of child mortality in unvaccinated populations.

Prevention:

- Two-dose MMR vaccination, vitamin A supplementation.



Measles

IT ISN'T
JUST A
LITTLE
RASH



Measles can be dangerous,
especially for babies and
young children.



MEASLES SYMPTOMS TYPICALLY INCLUDE

- High fever (may spike to more than 104° F)
- Cough
- Runny nose
- Red, watery eyes
- Rash breaks out 3-5 days after symptoms begin



3. Chickenpox (Varicella)

Causative Agent: Varicella-zoster virus (VZV)

Transmission: Airborne and direct contact with lesions.

Symptoms: Itchy vesicular rash, fever, malaise.

Epidemiology:

- Mostly affects children; severe in adults and pregnant women.

Prevention:

- Varicella vaccine, post-exposure prophylaxis for high-risk contacts.

Chickenpox
Caused by the Varicella-Zoster Virus (VZV), Chickenpox is a contagious disease that commonly affects children, teens and young adults.

Risk Groups

- Individuals taking steroid medications for another disease/condition
- Pregnant Women
- Newborns and infants whose mothers have not had chickenpox or its vaccine
- Immunocompromised Individuals

Symptoms

- Fever
- Loss of appetite
- Headache and Tiredness
- Itchy red rash, fluid filled blisters and scabbed lesions

Transmission

- Person to person by direct contact
- Sneezing or coughing
- Contact with the clothing or bed linen of an infected person

Prevention
The chickenpox vaccine is the most effective way to prevent infection
Note: The vaccine is not approved for pregnant women, immunocompromised individuals and people who are allergic to gelatin or the antibiotic neomycin

Punjab Healthcare Commission
Office # 1&2, 4th Floor, Shaheen Complex,
38- Abbot Road, Lahore, Pakistan
042-99206371-78
www.phc.org.pk info@phc.org.pk
/PunjabHealthcareCommission /PHC_punjab

4. COVID-19

Causative Agent: SARS-CoV-2

Transmission: Airborne and droplet spread.

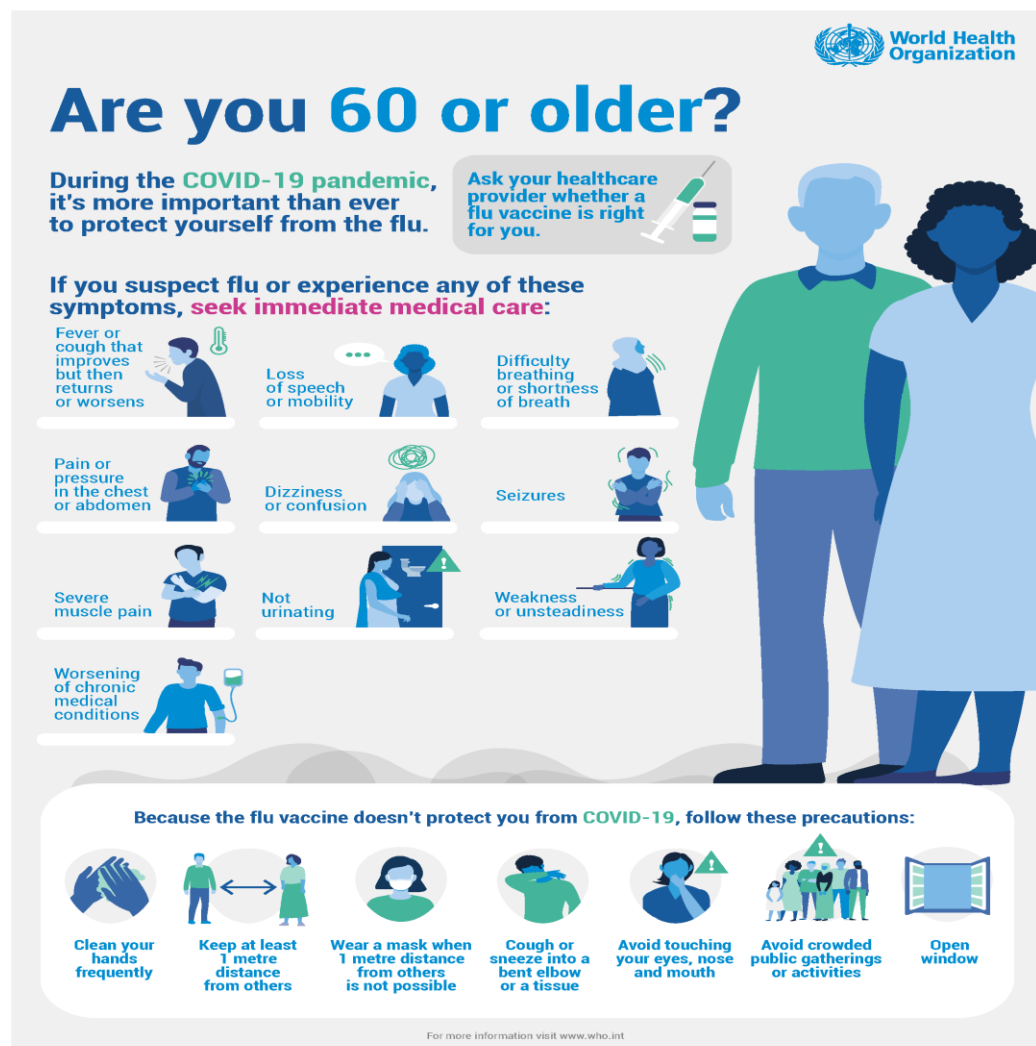
Symptoms: Fever, cough, fatigue, loss of smell/taste, difficulty breathing.

Epidemiology:

- Declared global pandemic (2020).
- High transmission in crowded, poorly ventilated areas.

Prevention:

- Vaccination, mask use, ventilation, isolation, hand hygiene.



5. Influenza (Flu)

Causative Agent: Influenza viruses A and B

Transmission: Airborne droplets and aerosols.

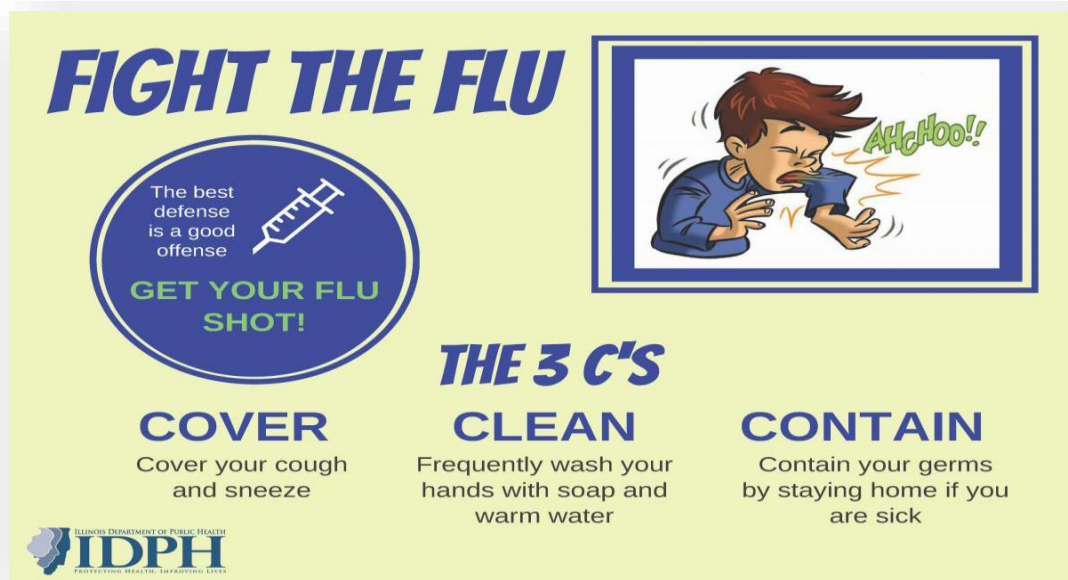
Symptoms: Sudden fever, cough, sore throat, muscle pain.

Public Health Importance:

- Seasonal epidemics cause up to 650,000 deaths annually.

Prevention:

- Annual vaccination, antivirals, public health campaigns.



6. Diphtheria

Causative Agent: *Corynebacterium diphtheriae*

Transmission: Droplets from infected throat/nose.

Symptoms: Sore throat, low-grade fever, thick gray membrane on tonsils.

Epidemiology:


- Re-emerging where vaccination is low.

Prevention:

- DPT vaccination, case isolation, contact prophylaxis.

WHAT IS DIPHTHERIA?

Diphtheria is a potentially life threatening bacterial disease and is caused by toxin producing strains of *Corynebacterium diphtheriae*, primarily affecting the respiratory tract. It is transmitted via respiratory droplets from infected individuals while coughing, sneezing or talking without a mask.



Alert: There has been a recent surge in diphtheria cases in the province of Sindh.

SIGNS & SYMPTOMS

Fever Sore throat Prominent neck swelling Generalized weakness

Grayish white membrane in the nose, tonsils and/or throat that bleeds on touch

COMPLICATIONS:

It can affect the heart, lungs, kidneys and nerves.

MANAGEMENT:

Visit nearby healthcare facility to get

- Early identification
- Diagnosis is clinical and also by culture and toxin detection from throat swab
- Isolation of the patient as soon as possible for droplet precautions (respiratory diphtheria)
- Prompt administration of antitoxin
- Antibiotics
- Prophylaxis for close contacts

PREVENTION:

- Primary series of three doses of pentavalent vaccine (DTP + Hep B + Hib) at 6, 10 and 14 weeks of age should be completed
- Catch up immunization is recommended for those who have not completed primary vaccination
- Antibiotic prophylaxis of close contacts
- Healthcare workers at risk of exposure to diphtheria are encouraged to get Tdap vaccine shot every ten years

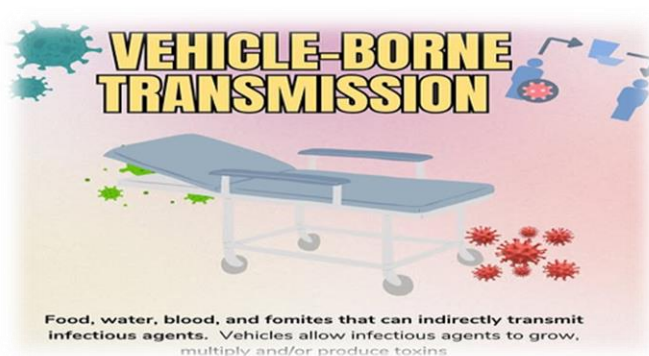
SESSION 2.2: INDIRECT TRANSMISSION

SUB SESSION 2.2.2: VEHICLE-BORNE TRANSMISSION

Session Objectives

By the end of this session, participants will be able to:

1. Explain the concept of vehicle-borne transmission and its role in spreading infectious diseases.
2. Identify common vehicles (water, food, blood, instruments) that can transmit diseases.
3. Describe how contamination, survival and transmission of pathogens occur through vehicles.
4. Recognize the major waterborne diseases, their symptoms, diagnosis and public-health significance.
5. Understand environmental and behavioral factors contributing to waterborne disease transmission.



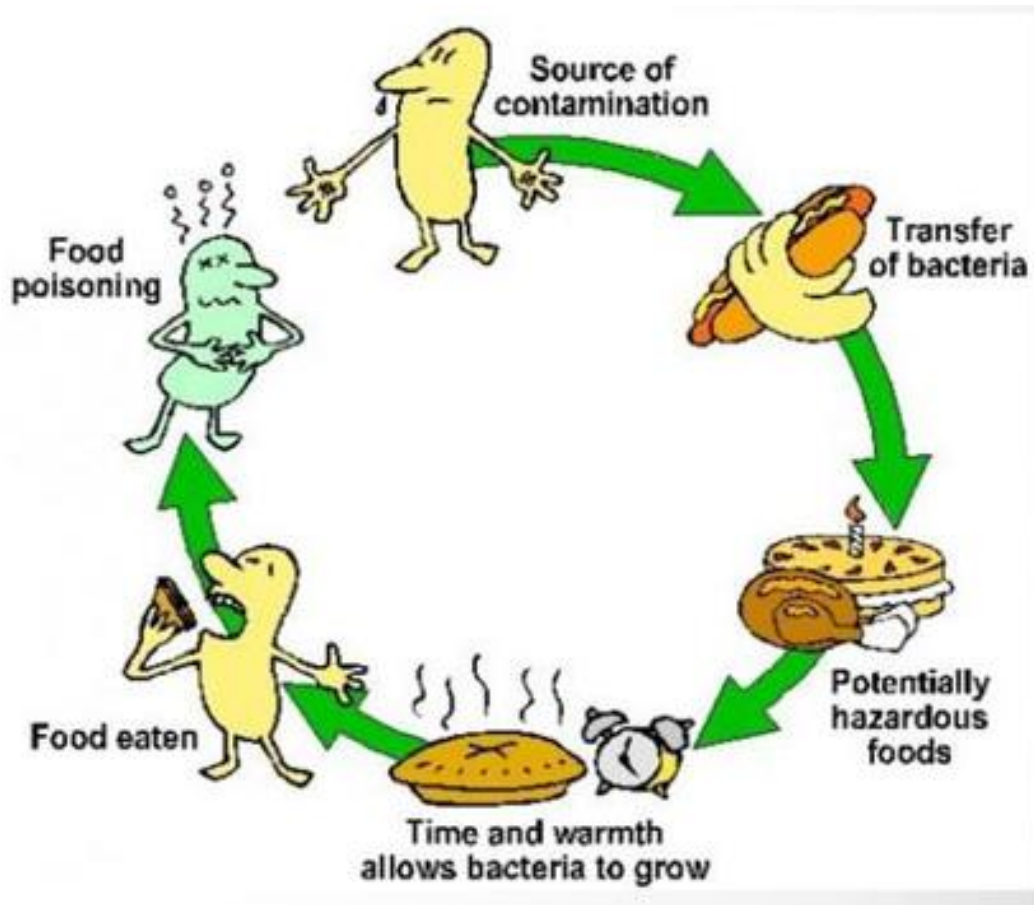
1. Introduction to Vehicle Borne Diseases

Infectious diseases spread through various routes. Among them, vehicle-borne and waterborne transmission are among the most common in resource-limited settings like KP, especially where sanitation and hygiene infrastructure are inadequate.

Vehicle-borne transmission involves pathogens carried through contaminated vehicles such as food, water, blood, or medical instruments. Waterborne transmission, a major subtype, occurs when people consume or come in contact with contaminated water containing infectious microorganisms.

2. Understanding Vehicle-Borne Transmission

Vehicle-borne transmission is an indirect mode of disease transmission where pathogens are carried from an infected source to a susceptible host through a contaminated inanimate medium known as a *vehicle*. A vehicle can be any substance or object—such as food, water, blood, or a medical instrument—that delivers pathogens into the body by ingestion, injection, inhalation, or contact with mucous membranes or broken skin.



3. Common Types of Vehicles

Type of Vehicle	Examples	Common Diseases
Water	Contaminated drinking or bathing water	Cholera, Hepatitis A & E, Typhoid fever
Food	Undercooked meat, unwashed vegetables, unpasteurized milk	Salmonellosis, E. coli infection, Botulism
Blood and Blood Products	Transfusions, organ transplants	HIV, Hepatitis B/C, Syphilis
Medical Equipment	Needles, catheters, surgical tools	Sepsis, Hepatitis, Prion diseases
Air (via water aerosols)	Contaminated air-conditioning or humidifiers	Legionnaires' disease

4. Mechanism of Vehicle-Borne Transmission

Vehicle-borne transmission usually occurs in four key stages:

Stage 1: Contamination of the Vehicle

Vehicles become contaminated through contact with infectious agents.

Examples:

- Food contaminated by feces during preparation.
- Blood products contaminated due to unsafe transfusion.
- Water contaminated with sewage after flooding.

Stage 2: Survival and Multiplication of Pathogens

Some vehicles act as passive carriers (e.g., hepatitis A in water), while others allow microbes to grow.

- Improperly canned foods enable *Clostridium botulinum* to multiply and produce deadly toxins.
- Standing water tanks allow *Legionella* bacteria to grow.

Stage 3: Transmission to the Host

The contaminated vehicle reaches the host by:

- Ingestion (food, water)
- Injection (contaminated syringes)
- Implantation (during surgery)
- Mucosal contact (contaminated instruments)

Stage 4: Infection

Once inside the host, pathogens overcome natural defenses, multiply and cause disease. The likelihood of infection depends on the infectious dose, host immunity and virulence of the pathogen.



5. Real-World Case Studies

- Haiti Cholera Outbreak (2010): Contaminated river water caused over 800,000 cases after the introduction of *Vibrio cholerae*.
- South Africa Listeriosis (2017–18): Contaminated processed meat caused the world's largest recorded foodborne outbreak.
- Flint Water Crisis (USA, 2014–16): Poor water treatment led to *Legionella* infections and lead poisoning.

These examples demonstrate how contamination at the source can lead to widespread disease when control measures are weak.

6. Public Health Challenges

Vehicle-borne transmission remains a challenge due to:

- Poor water and food quality control.
- Inadequate laboratory capacity for detecting pathogens.
- Weak surveillance and outbreak response systems.
- Behavioral resistance to hygiene and sanitation practices.
- Unsafe medical or transfusion practices in low-resource facilities.

Primary healthcare workers play a key role in recognizing early warning signs, reporting cases and promoting safe practices at community level.

A: WATERBORNE TRANSMISSION

1. Definition

Waterborne diseases are illnesses caused by microorganisms transmitted through contaminated water, usually by the fecal-oral route. Fecal matter from infected humans or animals contaminates water used for drinking, cooking, or washing, allowing pathogens to enter new hosts.

Waterborne infections often cause diarrhea, vomiting and dehydration, but can also affect the liver (e.g., hepatitis A/E), nervous system (e.g., polio), or other organs.



2. Step-by-Step Mechanism of Waterborne Transmission

Description	Example
Contamination of water source by feces, sewage, or animal waste	River contaminated by open defecation
Pathogen survival in water	Hepatitis A virus survives for weeks
Human contact or consumption	Drinking or cooking with contaminated water
Entry into human body	Pathogens enter through mouth or skin
Disease development	Diarrhea, vomiting, or fever
Pathogen shedding	Infected person excretes pathogens in stool
Amplification	Contamination spreads through shared sources

Most waterborne diseases are preventable through safe water, sanitation, hygiene (WASH) and vaccination

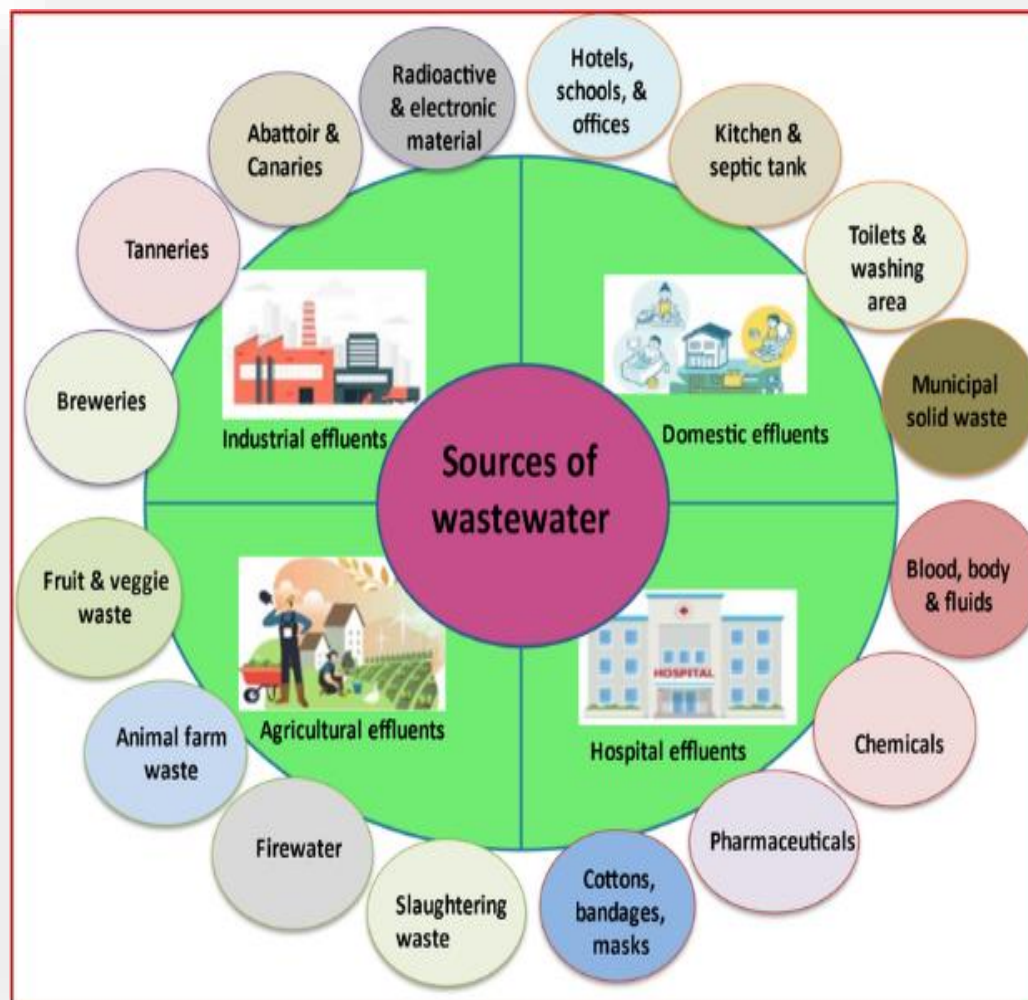
3. Major Waterborne Diseases

Disease	Causative Agent	Main Transmission Route	Prevention & Control Measures
Cholera	<i>Vibrio cholerae</i>	Fecal contamination of water or food	Safe drinking water, oral rehydration therapy (ORS), cholera vaccine, sanitation and hygiene improvement
Typhoid Fever	<i>Salmonella Typhi</i>	Fecal contamination of food or water	Typhoid conjugate vaccine, safe water, proper handwashing, food hygiene
Hepatitis A & E	<i>Hepatitis A virus, Hepatitis E virus</i>	Fecal-oral route via contaminated food or water	Safe food and water, improved sanitation, Hepatitis A vaccination
Giardiasis	<i>Giardia lamblia</i>	Ingestion of cysts in contaminated water or food	Boiling or filtering drinking water, personal hygiene, sanitation
Amoebiasis	<i>Entamoeba histolytica</i>	Fecal-oral route (contaminated water/food)	Safe water and sanitation, prompt treatment, food hygiene
Cryptosporidiosis	<i>Cryptosporidium spp.</i>	Contaminated water, swimming pools	Boiling or filtering water, hygiene education, avoiding unsafe swimming water
Poliomyelitis	<i>Poliovirus</i>	Fecal-oral transmission via contaminated water	Oral Polio Vaccine (OPV) and Inactivated Polio Vaccine (IPV), sanitation, hygiene

4. Environmental and Behavioral Factors

The spread of waterborne diseases is driven by environmental, infrastructural and behavioral conditions.

- Poor sanitation: Open defecation and poor waste disposal contaminate water.
- Unsafe water sources: Open wells, rivers and unprotected springs.
- Inadequate water treatment: Lack of chlorination or filtration.
- Flooding and climate change: Increase contamination during rainy seasons.
- Poor hygiene: Lack of handwashing after defecation or before eating.
- Overcrowded settlements: Shared contaminated sources (refugee camps, urban slums).



5. Public Health Relevance

- Global burden: Over 2 billion people consume fecally contaminated water (WHO).
- Child mortality: Diarrheal diseases remain a leading cause of death among children under five.
- Economic cost: Healthcare expenses and loss of productivity due to waterborne illness cost billions annually.
- Resilience gap: Limited investment in rural water and sanitation perpetuates transmission cycles.

6. Prevention and Control Strategies

At the Individual Level

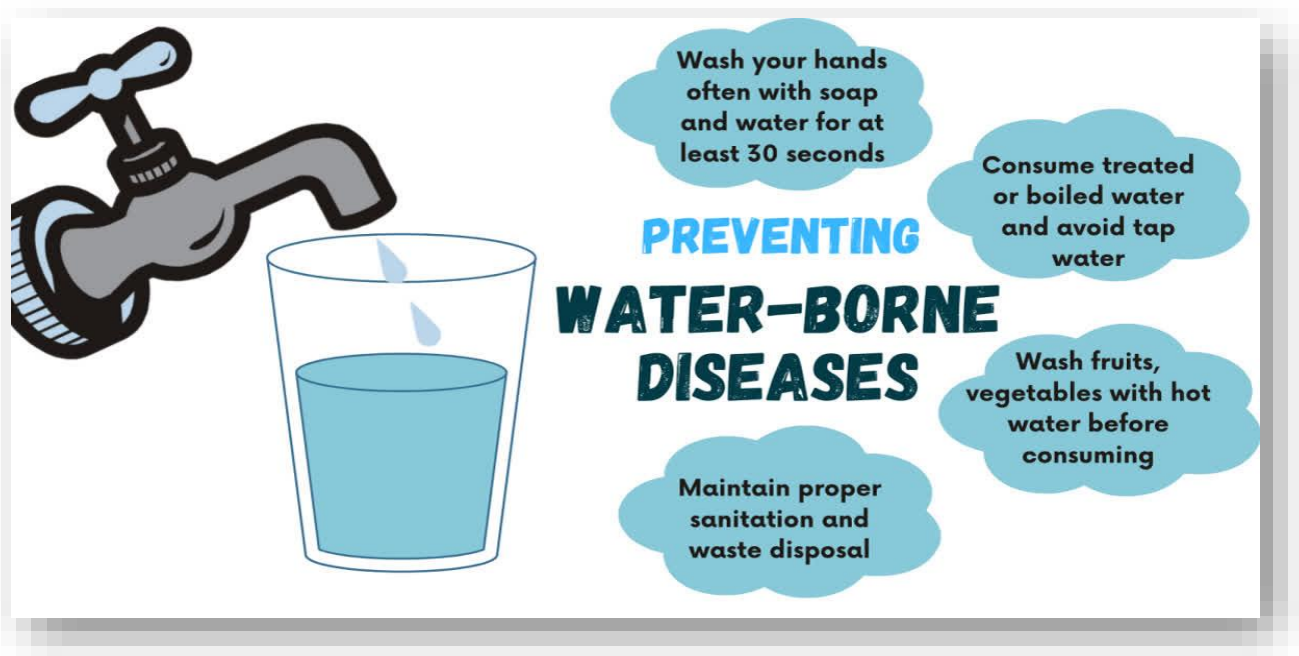
- Drink only boiled or treated water.
- Practice handwashing with soap after toilet use and before meals.
- Avoid raw or undercooked food and unpasteurized milk.

At the Household Level

- Use safe water storage containers with covers.
- Dispose of waste safely (pit latrines, septic tanks).
- Treat household water with chlorine tablets or solar disinfection.

At the Community Level

- Promote Community-Led Total Sanitation (CLTS) to end open defecation.
- Conduct water quality monitoring (chlorine residual testing).
- Ensure regular health education sessions on hygiene and sanitation.



At the System Level

- Strengthen WASH infrastructure (piped water, waste treatment).
- Maintain disease surveillance and outbreak response systems.
- Build capacity of laboratories for water testing and microbial culture.
- Ensure intersectoral coordination (health, water, local government).

7. Case Example: Cholera Outbreak in Flood-Affected KP District

After monsoon floods, water sources were contaminated by sewage overflow. Over 100 patients presented with severe watery diarrhea within one week. Field investigation identified contaminated wells as the source.

Response actions included:

- Emergency chlorination of water sources.
- Distribution of ORS and antibiotics.
- Community awareness campaigns on boiling water.

- Strengthened surveillance for new cases.

This case underscores how environmental factors and infrastructure breakdown can trigger outbreaks in vulnerable communities.

8. Role of Primary Healthcare Workers

PHC workers are the first line of defense. Their roles include:

- Early recognition and reporting of diarrheal outbreaks.
- Providing treatment and rehydration (ORS, zinc, antibiotics).
- Conducting health education on hygiene and sanitation.
- Supporting community-based surveillance and contact tracing.
- Coordinating with local authorities for safe water supply and environmental cleanup.

9. Key Takeaways

- Vehicle-borne and waterborne diseases share a common preventable pathway: contamination and ingestion.
- Improving sanitation, hygiene and safe water practices can break the transmission cycle.
- Community participation is critical for sustained prevention.
- PHC workers must combine clinical care with public health vigilance.
- Early detection and rapid response save lives and prevent large outbreaks.

B. FOODBORNE DISEASES

Session Objectives

By the end of this session, participants will be able to:

1. Define foodborne diseases and explain how they occur.
2. Identify major causes and examples of foodborne infections and intoxications.
3. Describe the chain of transmission and contributing factors.
4. Explain methods to prevent and control foodborne diseases at community and facility levels.
5. Recognize the role of primary healthcare workers in detection, reporting and community education.

1. Introduction

Foodborne diseases (FBDs) are infections or intoxications caused by consuming food contaminated with harmful microorganisms or their toxins. These diseases are a major public health concern worldwide and in Pakistan, especially in areas with poor food safety practices, inadequate hygiene and limited cold-chain facilities.

According to the World Health Organization (WHO), one in every ten people globally falls ill each year due to unsafe food, with children under five years being most affected. Foodborne diseases can cause acute illnesses such as diarrhea and vomiting, or long-term complications like liver disease, kidney damage, or malnutrition.

2. Definition

Foodborne disease:

An illness caused by eating food contaminated with microorganisms (bacteria, viruses, parasites) or harmful chemicals/toxins. WHO Definition (2023): “Foodborne diseases are infections or intoxications caused by agents that enter the body through the ingestion of food.”

3. Modes of Food Contamination

Food may become contaminated at any stage—from production to consumption—known as the “farm-to-fork” pathway.

Stage	Example of Contamination	Common Sources
Production	Use of contaminated water for irrigation, animal manure	Bacteria, parasites
Processing	Poor handling, unclean equipment	Cross-contamination
Storage	Improper refrigeration	Bacterial growth (Salmonella, Listeria)
Preparation	Unhygienic cooking areas, infected handlers	Staphylococcus aureus, Hepatitis A
Serving	Use of contaminated utensils, flies	E. coli, Shigella

4. Types of Foodborne Diseases

There are two major types:

1. *Foodborne Infections:*

Caused by consuming food containing *live pathogens* that multiply inside the body.
Example: Salmonellosis, Typhoid, E. coli infection.

2. *Foodborne Intoxications:*

Caused by toxins produced by microorganisms in food before consumption.
Example: Botulism (Clostridium botulinum toxin), Staphylococcal food poisoning.

5. Common Foodborne Diseases

Disease	Causative Agent	Food Source	Key Symptoms
Typhoid Fever	<i>Salmonella Typhi</i>	Contaminated water/food	Prolonged fever, abdominal pain
Salmonellosis	<i>Salmonella spp.</i>	Poultry, eggs, meat	Diarrhea, cramps, fever
Cholera	<i>Vibrio cholerae</i>	Raw vegetables, seafood	Profuse watery diarrhea
E. coli Infection	<i>E. coli</i> O157:H7	Undercooked beef, raw milk	Bloody diarrhea, kidney failure (HUS)
Hepatitis A/E	<i>HAV/HEV</i>	Food handled by infected persons	Jaundice, fever
Botulism	<i>Clostridium botulinum</i>	Improperly canned food	Paralysis, respiratory failure
Staphylococcal Food Poisoning	<i>Staphylococcus aureus</i> toxin	Cream-filled foods, salads	Nausea, vomiting, cramps

6. Factors Contributing to Foodborne Disease Outbreaks

Foodborne outbreaks are usually linked to multiple risk factors acting together:

- Poor personal hygiene among food handlers
- Cross-contamination between raw and cooked food
- Unsafe water used for cleaning or cooking
- Improper food storage, especially lack of refrigeration
- Presence of vectors (flies, rodents) in food preparation areas
- Unregulated street food practices

7. Chain of Transmission (The Fecal-Oral Route)

1. Pathogen Source: Infected humans or animals excrete pathogens in feces.
2. Environmental Contamination: Feces contaminate soil, water, or food.
3. Exposure: Pathogens are ingested through contaminated food.
4. Infection: Pathogens multiply in the host's gastrointestinal tract.
5. Excretion: The cycle continues through improper sanitation or hygiene.

This cycle emphasizes the need for breakpoints—safe sanitation, handwashing and hygienic food handling—to stop transmission.

8. Clinical Features

Foodborne diseases usually present as acute gastrointestinal illness, with symptoms appearing within hours to days after eating contaminated food:

- Nausea and vomiting & Abdominal cramps
- Diarrhea (sometimes bloody)
- Fever
- Dehydration
- In severe cases: shock, paralysis, or liver failure (e.g., botulism, hepatitis)

9. Diagnosis and Management at PHC Level

- **Diagnosis:** Usually clinical; laboratory confirmation through stool culture or serology when available.
- **Management:**
 - Oral rehydration (ORS) for mild/moderate dehydration.
 - Intravenous fluids for severe dehydration.
 - Antibiotics only when indicated (e.g., typhoid, shigellosis).
 - Nutritional support and hygiene counseling.
- **Referral:** Complicated cases (e.g., persistent vomiting, bloody stools, high fever, jaundice).

10. Outbreak Investigation Example

Scenario:

A cluster of diarrhea cases reported from a school in Swat District. All affected students ate biryani from the same vendor during a school event.

Investigation Findings:

- Food samples contained *Salmonella* spp.
- Cooked rice stored for >6 hours without refrigeration.
- Food handlers lacked health certification.

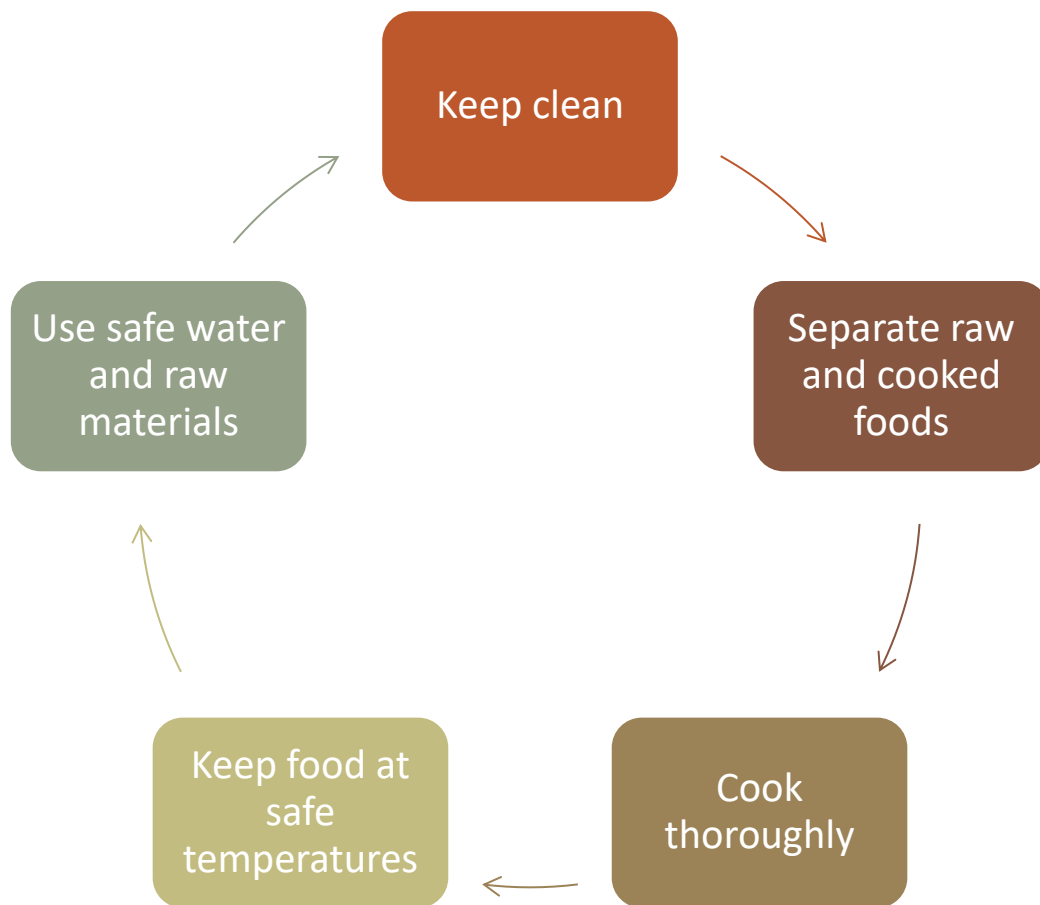
Control Measures:

- Temporary closure of vendor stall
- Health education on safe food storage and handling
- Inspection of food outlets by health department

11. Prevention and Control

Level	Key Actions
Personal	Handwashing before food prep and eating; avoiding street food; washing fruits and vegetables
Household	Safe storage and refrigeration; separating raw and cooked foods; using clean utensils
Community	Regular inspection of eateries; enforcing food safety laws; safe waste disposal
Health System	Surveillance and outbreak reporting; laboratory testing; community awareness campaigns

Five Keys to Safer Food (WHO):



12. Role of Primary Healthcare Workers

PHC workers play a vital role in reducing foodborne diseases through:

- Early identification and reporting of cases
- Educating families and communities on safe food practices
- Monitoring hygiene conditions in local food vendors
- Supporting outbreak investigation teams
- Promoting vaccination (e.g., Typhoid, Hepatitis A)

SESSION 2.2: INDIRECT TRANSMISSION

SUB SESSION 2.2.3: VECTOR-BORNE TRANSMISSION

Learning Objectives

By the end of this session, participants will be able to:

1. Define vector-borne transmission and distinguish between biological and mechanical modes.
2. Identify the major vectors and the diseases they transmit in Pakistan (and especially KP).
3. Describe the ecology and risk factors for vector-borne diseases (VBDs), including environmental, behavioural and structural contributors.
4. Recognize recent local data/trends of vector-borne diseases in KP and Pakistan.
5. Outline prevention and control strategies (including integrated vector management) relevant for primary health care settings.

1. Introduction

Vector-borne diseases are those in which an infectious agent is transmitted from one host to another by a living organism (a vector), most commonly arthropods such as mosquitoes, ticks, fleas or flies. In many low- and middle-income countries and in regions such as KP, vector-borne diseases contribute significantly to the burden of illness and strain health-care systems.

In Pakistan, for example, outbreaks of Dengue continue to surge after monsoon seasons and high vector-larval indices have been reported in districts of KP. Because vectors depend on the environment, human behavior and structural conditions (housing, water storage, sanitation, waste disposal), primary health-care workers play a critical role in prevention, early detection and community education.

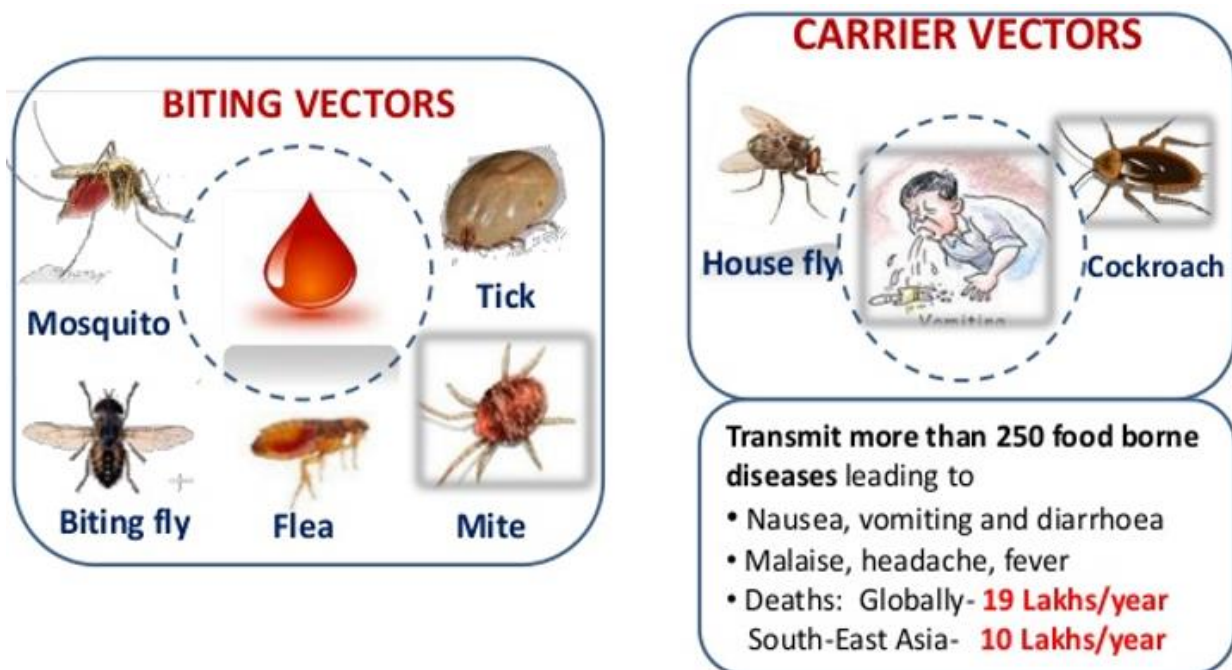
2. Definition and Modes of Vector-Borne Transmission

Vector-borne transmission is the spread of infectious diseases through living vectors (such as mosquitoes, ticks, fleas, flies) that carry pathogens from one host to another.

Modes of transmission:

- **Biological transmission** – The pathogen undergoes part of its life-cycle inside the vector (e.g., malaria via *Anopheles* mosquito).
- **Mechanical transmission** – The vector carries the pathogen on its body or legs without biological changes (e.g., house flies carrying typhoid bacteria).

This distinction is useful when planning control measures: biological transmission often requires vector population control and interrupting lifecycle; mechanical transmission emphasizes hygiene and vector-barrier measures.



3. Vectors and Diseases Common in Pakistan (and KP)

Here is a table summarizing major vectors, diseases and pathogens:

Vector	Disease(s)	Pathogen type
Mosquitoes	Dengue, Malaria, Zika, Chikungunya, JE	Parasites, Viruses
Ticks	Lyme disease, Tick-borne encephalitis	Bacteria, Viruses
Fleas	Plague, Murine typhus	Bacteria
Sandflies	Leishmaniasis	Parasite
Blackflies	Onchocerciasis (river blindness)	Parasite
Tsetse flies	African trypanosomiasis	Parasite
Houseflies	Typhoid, cholera (mechanical transmission)	Bacteria, Viruses

This table underscores that while mosquitoes are the most familiar carriers, other vectors (ticks, flies, sandflies) also play roles, especially in varied ecological settings.

4. Vector Ecology and Risk Factors

Vector-borne disease transmission depends heavily on the vector's ecology and human/environmental interactions.

Key ecological/behavioural risk factors include:

- Stagnant water bodies, unused containers, tyres, open water storage (mosquito breeding ground)
- Poor sanitation and waste-disposal which creates favorable conditions for vectors
- Housing without screens, overcrowded settlements, peri-urban expansion.
- Human behavior: uncovered water containers, lack of vector-control measures, unprotected outdoor sleeping.
- Urbanization, deforestation, climate change: These alter vector habitats and expand range of diseases.

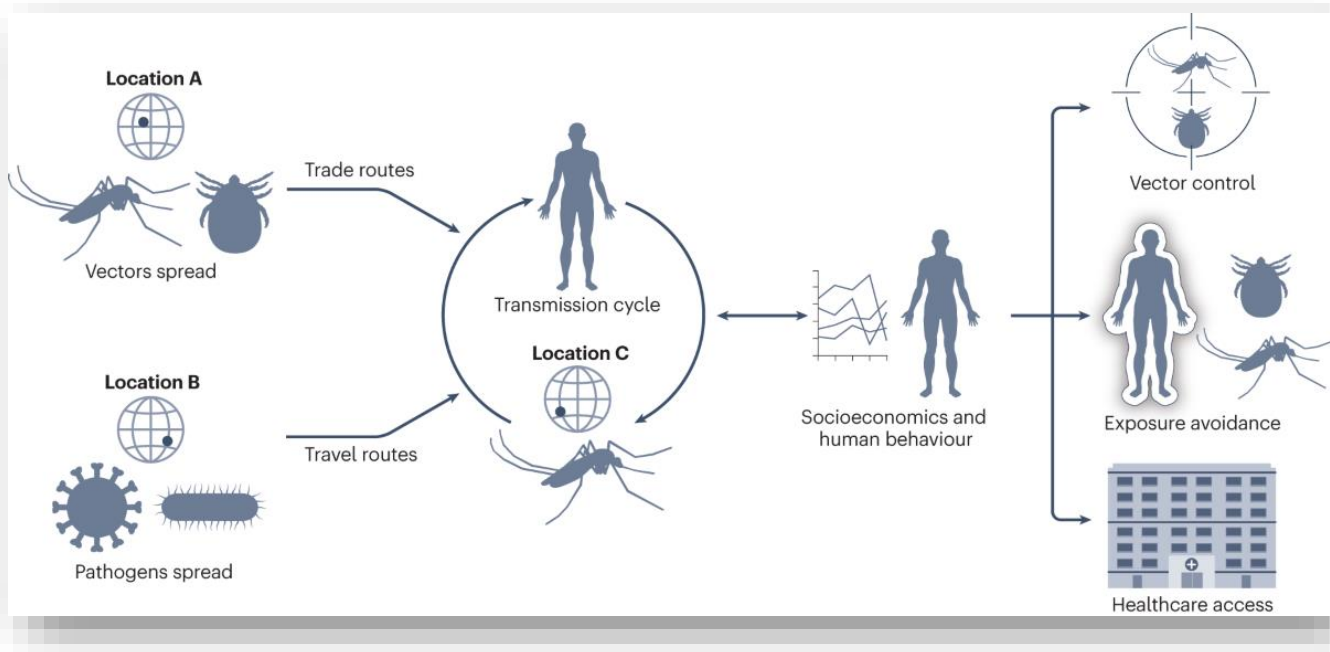
- Seasonal and rainfall patterns: Post-monsoon months often see increased caseloads (especially dengue) in KP.

5. Public Health Importance

Vector-borne diseases (VBDs) carry significant morbidity and mortality.

- Globally, more than 17 % of all infectious diseases are vector-borne, causing over 700,000 deaths annually.
- In Pakistan, dengue and malaria remain major health threats, especially in urban and peri-urban areas; outbreaks often follow flooding and rainfall.
- In KP and other northern provinces, vector-borne diseases are complicated by mountainous terrain, floods, population displacement and limited access to vector control resources.

Primary health-care settings are often the first point of contact for outbreaks; timely recognition, patient management, vector control liaison and community education are critical.



6. Prevention & Control Strategies

For primary health-care workers, the following strategies are important:

Integrated Vector Management (IVM)

This approach combines multiple methods: source reduction, chemical control (insecticides), biological control (larvivorous fish, etc.), environmental management and community education.

Key Actions for PHC Workers

- Encourage elimination of standing water and proper water-storage practices (e.g., covered containers, removal of old tyres)
- Promote use of mosquito nets, window screens and insect repellent especially during high risk months
- Support community clean-up campaigns targeting vector-breeding sites
- Participate in surveillance activities: report unusual clusters of fever, work with vector surveillance teams
- Health-education: teach families about vector-borne disease symptoms, prevention, when to seek care
- Coordinate with local authorities for larviciding, fogging, waste management

Table: Control Measures

Intervention	Main Action	Expected Outcome
Individual / Household	Use mosquito net, eliminate water containers, wear long sleeves	Reduced exposure to vectors
Community	Clean-up campaigns, waste removal, public awareness	Reduced vector breeding sites
Health System / Facility	Early case detection, vector surveillance, community liaison	Timely outbreak response, reduced transmission
Environmental / Government	Drainage of stagnant water, improved sanitation, urban planning	Long-term vector risk reduction

7. Summary & Key Messages

- Vector-borne transmission involves living vectors carrying pathogens—understanding both biology and ecology is essential.
- Pakistan (and KP) face a significant burden of vector-borne diseases (especially dengue) which surge after monsoon season.
- Primary health-care workers in KP are vital in prevention: recognizing risk, educating communities, liaising for vector control and supporting surveillance.
- Key prevention strategies include source reduction (standing water), protective measures (nets, screens), behavior change (water-storage practices) and coordination with vector-control programs.
- Community engagement and sustained action are essential – vector-borne disease control cannot rely solely on reactive measures.

SESSION 2.3: ZOO NOTIC DISEASES

Session Objectives

By the end of this session, participants will be able to:

1. Define zoonotic and nosocomial infections.
2. Explain the modes of transmission for zoonotic infections.
3. Identify common examples of zoonotic diseases and their prevention measures.
4. Describe the major types, causes and prevention strategies of nosocomial infections.
5. Recognize the importance of infection prevention and control (IPC) in healthcare and community settings.

Introduction:

Zoonotic infections are diseases transmitted from animals to humans, either directly (through bites, contact, or secretions) or indirectly (through vectors, contaminated food, or the environment). These infections are caused by bacteria, viruses, parasites, or fungi and represent a significant public health challenge globally.



Modes of Transmission

Zoonotic pathogens can be transmitted through several routes. The table below summarizes the major modes and examples.

Mode of Transmission	Example Diseases	Typical Source
Direct Contact	Rabies, Ringworm	Bite, scratch, or contact with animal secretions
Indirect (via Vector)	Plague, Lyme disease	Fleas, ticks
Foodborne	Brucellosis, E. coli infection	Unpasteurized dairy, contaminated meat
Airborne	Q fever	Inhalation of contaminated dust
Occupational Exposure	Leptospirosis	Contact with animal urine, sewage, or water

Public Health Importance

- **Global Impact:** Over **60%** of all infectious diseases in humans and about **75%** of emerging infections** (like Ebola, SARS and COVID-19)** are zoonotic in origin.
- **Economic Burden:** Zoonoses cause major economic losses through livestock deaths, trade restrictions and healthcare costs.
- **One Health Approach:** Controlling zoonoses requires coordinated efforts between human, animal and environmental health sectors.

Common Zoonotic Diseases

1. Rabies

- *Causative Agent:* Rabies virus
- *Transmission:* Bite/scratch from infected animal (dog, bat)
- *Symptoms:* Fever, confusion, hydrophobia, paralysis
- *Prevention:* Dog vaccination, post-exposure prophylaxis (PEP), awareness campaigns

2. *Brucellosis*

- *Causative Agent:* *Brucella* spp.
- *Transmission:* Unpasteurized milk, animal contact
- *Symptoms:* Undulating fever, fatigue, joint pain
- *Prevention:* Pasteurization of milk, animal vaccination, protective equipment

3. *Leptospirosis*

- *Causative Agent:* *Leptospira interrogans*
- *Transmission:* Contact with water/soil contaminated by rodent urine
- *Symptoms:* Fever, jaundice, renal failure
- *Prevention:* Rodent control, protective clothing, avoid floodwater

4. *Anthrax*

- *Causative Agent:* *Bacillus anthracis*
- *Transmission:* Contact with infected carcasses, inhalation, or ingestion
- *Symptoms:* Black eschar (skin), pneumonia, gastrointestinal distress
- *Prevention:* Livestock vaccination, PPE use, avoid handling dead animals

5. *Crimean-Congo Hemorrhagic Fever (CCHF)*

- *Causative Agent:* CCHF virus (*Nairovirus*)
- *Transmission:* Tick bites or exposure to animal blood
- *Symptoms:* High fever, bleeding, organ failure
- *Prevention:* Tick control, protective gear, patient isolation

6. *Avian Influenza (Bird Flu)*

- *Causative Agent:* Influenza A virus (H5N1, H7N9)
- *Transmission:* Contact with infected poultry
- *Symptoms:* Fever, cough, pneumonia, multi-organ failure
- *Prevention:* Poultry surveillance, biosecurity measures, PPE for workers

Key Facts

- Pakistan reports hundreds of CCHF cases annually, mostly from Baluchistan and Khyber Pakhtunkhwa, due to high livestock interaction and poor tick control.
- Rabies remains endemic, with approximately 2,000–5,000 human deaths per year, mainly from dog bites.
- Brucellosis is common among livestock handlers, veterinarians and abattoir workers in KP and Punjab.

Prevention and Control Strategies

- Strengthen animal vaccination and surveillance.
- Promote hygiene and safe handling of animals and animal products.
- Enforce food safety measures (pasteurization, proper cooking).
- Increase awareness through community education.
- Implement the One Health approach to bridge human, animal and environmental health.

MODULE THREE

INFECTION PREVENTION AND CONTROL (IPC)



SESSION 3.1

INTRODUCTION TO INFECTION PREVENTION & CONTROL

Session Objectives

By the end of this module, participants will be able to:

1. Define Infection Prevention and Control (IPC).
2. Define the commonly used terminologies in Infection Prevention and Control.
3. Explain why IPC is needed in healthcare settings.
4. Outline the critical components of good Infection Prevention and Control practices.
5. Discuss the main benefits of implementing good IPC practices.

Introduction

Infection Prevention and Control (IPC) is a set of measures aimed at preventing health care–associated infections (HAIs) and ensuring safe medical procedures and interventions. According to the International Federation of Infection Control (2007), IPC is a quality standard essential for the safety of patients, healthcare workers and visitors. It represents an integral part of the infrastructure of healthcare delivery systems, addressing factors related to the spread of infections within healthcare settings.

In simple terms, IPC refers to evidence-based practices and procedures that, when applied consistently, prevent the transmission of infectious agents in healthcare environments. It ensures that healthcare is delivered in a way that minimizes risks to patients, healthcare workers and the surrounding community.

In the context of Primary Health Care (PHC), IPC is particularly important because health workers frequently operate in resource-constrained environments where overcrowding, inadequate hygiene and limited access to water and sanitation increase the risk of infection transmission. Effective IPC measures not only protect health workers and patients but also enhance community confidence in healthcare services and improve overall health outcomes.

Common Terminologies in Infection Prevention and Control:

Before applying IPC measures, it is important for healthcare workers to understand some of the commonly used terminologies. These terms help ensure clarity and uniformity in communication among health teams.

- ***Infection Prevention and Control (IPC)***: The combination of policies, procedures and practices that aim to prevent and control the spread of infections within healthcare settings.
- ***Healthcare-Associated Infections (HAIs)***: Infections that patients acquire while receiving treatment in a healthcare facility and which were not present or incubating at the time of admission.
- ***Standard Precautions***: The basic infection prevention practices that apply to all patients, regardless of their infection status.
- ***Transmission-Based Precautions***: Additional practices used for patients known or suspected to be infected with pathogens that require extra measures beyond standard precautions.
- ***Personal Protective Equipment (PPE)***: Specialized clothing or equipment, such as gloves, masks, gowns and eye protection, used by healthcare workers to reduce exposure to infectious agents.
- ***Asepsis***: The absence of disease-causing microorganisms and the maintenance of sterile conditions during procedures.

Standard Precautions

Standard precautions are the foundation of IPC and should be applied to all patients at all times, regardless of their diagnosis. These practices reduce the risk of transmission of pathogens from both recognized and unrecognized sources of infection. Standard precautions include:

- Hand hygiene before and after patient contact.
- Use of personal protective equipment (PPE)
- Safe injection practices and use of sterile equipment.
- Proper waste disposal and management of sharps.
- Respiratory hygiene and cough etiquette.

Transmission-Based Precautions

Sometimes, standard precautions alone are insufficient to prevent infection. In such cases, Transmission-Based Precautions are applied depending on how the disease spreads.

1. *Contact Precautions:*

These prevent infections transmitted through direct or indirect contact with an infected patient or contaminated surfaces (e.g., drainage from wounds, fecal incontinence, or multidrug-resistant organisms).

- Use of gloves and gowns.
- Isolation of patients with the same infection.
- Proper cleaning and disinfection of the patient's environment.

2. *Droplet Precautions:*

These prevent infections spread by large droplets ($>5\mu\text{m}$) produced during coughing, sneezing, or talking. Examples include influenza and meningitis.

- Use of surgical masks by staff and visitors within one meter of the patient.
- Patient placement in single rooms when possible.
- Ensuring patients wear masks when being transported.

3. *Airborne Precautions:*

These prevent infections transmitted by fine particles that remain suspended in the air for long periods, such as tuberculosis, measles and chickenpox.

- Place patients in well-ventilated isolation rooms.
- Use N95 or equivalent respirators for healthcare workers.
- Encourage patients to wear surgical masks when outside isolation areas.

Understanding these terminologies helps healthcare workers apply appropriate precautions and avoid the spread of infections within healthcare facilities.

Why Infection Prevention and Control is Needed

Infection Prevention and Control is needed to safeguard the health of patients, healthcare workers and the general community. Every healthcare facility—whether a large hospital or a small health center (Civil Dispensary, BHU etc.) faces the risk of healthcare-associated infections. IPC ensures that safe and effective healthcare is provided and that infections do not spread within the facility.

Importance of IPC

- ***Protects Patients:*** Prevents infections acquired during healthcare delivery and promotes faster recovery.
- ***Protects Health Workers:*** Reduces occupational exposure to bloodborne pathogens such as HIV, hepatitis B and hepatitis C.
- ***Reduces Healthcare Costs:*** Prevents prolonged hospital stays and reduces the need for additional treatment.
- ***Prevents Outbreaks:*** Effective IPC prevents cross-infection between patients and between facilities.
- ***Improves Quality of Care:*** Demonstrates professionalism, discipline and commitment to safe patient management.

Poor infection control practices lead to healthcare-associated infections, which are costly to individuals, health facilities and the health system as a whole. These infections may result in extended hospital stays, long-term disability, resistance to antibiotics and even death. They also erode public confidence in healthcare services.

Globally, HAIs affect millions of patients every year, making them among the most common adverse events in healthcare delivery. In low- and middle-income countries, up to 20% of hospitalized patients may acquire infections due to inadequate IPC measures. This burden is preventable with consistent implementation of good practices such as hand hygiene, use of PPE, safe waste management and sterilization of instruments.

In primary healthcare settings, IPC is critical because healthcare workers interact closely with patients, families and the community. Infections prevented at this level reduce the overall burden on hospitals and prevent community outbreaks.

Critical Components of Good Infection Prevention and Control Practices

For Infection Prevention and Control programs to be effective, certain components must be present in every healthcare facility. These components ensure that IPC is not an isolated activity but an ongoing and integrated part of healthcare delivery.

Key Components:

1. Training of Health Workers:

Regular and continuous training ensures that all healthcare staff understand IPC principles and practices. Training should cover hand hygiene, safe injection practices, cleaning, disinfection, sterilization and waste management.

2. Identification of IPC Gaps:

Each health facility should periodically assess its IPC practices to identify weaknesses such as lack of supplies, poor compliance, or inadequate infrastructure.

3. Developing Action Plans:

Once gaps are identified, facilities should develop practical action plans with clear responsibilities, timeframes and monitoring mechanisms.

4. Developing and Implementing Standards (SOPs):

Standard Operating Procedures should outline how routine tasks are performed safely and uniformly. These SOPs serve as day-to-day guides for staff.

5. *Ensuring Availability of Resources:*

IPC requires adequate supplies—soap, water, disinfectants, PPE, waste bins, sharps containers and clean linen. Lack of these materials compromises’ implementation.

6. *Monitoring IPC Practices:*

Supervisors should routinely observe and evaluate compliance with IPC standards, providing feedback and support to improve practices.

7. *Surveillance of Healthcare-Associated Infections:*

Systematic recording and analysis of HAIs help track trends, detect outbreaks and guide preventive actions.

8. *Isolation of Infectious Patients:*

Where feasible, patients with highly contagious infections should be isolated to reduce the risk of cross-infection.

Together, these components build a strong, sustainable IPC system that safeguards both healthcare providers and the communities they serve.

Benefits of Good Infection Prevention and Control Practices

Good IPC practices produce wide-ranging benefits at individual, facility and national levels.

- ***For Patients:*** Reduced risk of infection, faster recovery and improved satisfaction with care.
- ***For Healthcare Workers:*** Protection from occupational exposure and reduced absenteeism due to illness.
- ***For Health Facilities:*** Lower treatment costs, improved efficiency, better reputation and compliance with national standards.
- ***For Communities:*** Reduced transmission of infectious diseases, improved trust in health systems and stronger public health outcomes.

Infection Prevention and Control is an indispensable element of quality healthcare. It protects patients, healthcare workers and communities from preventable infections and reduces the burden of disease within the healthcare system. Primary healthcare workers play a central role in implementing IPC measures at the community level, where prevention begins. By understanding and applying standard and transmission-based precautions, maintaining cleanliness, using PPE correctly and promoting hygiene practices, they contribute to safe and effective healthcare delivery.

SESSION 3.2

HEALTHCARE ASSOCIATED INFECTIONS (HAIS)

Session Objectives

By the end of this session, participants will be able to:

1. Define what Healthcare Associated Infections (HAIs) are.
2. Describe the burden and importance of HAIs in healthcare settings.
3. Identify the most common types of HAIs and their main causative organisms.
4. Explain how infections spread through the disease transmission cycle.
5. Discuss the factors that make patients more vulnerable to infections.
6. Understand the impact of HAIs on patients, health workers and the community.

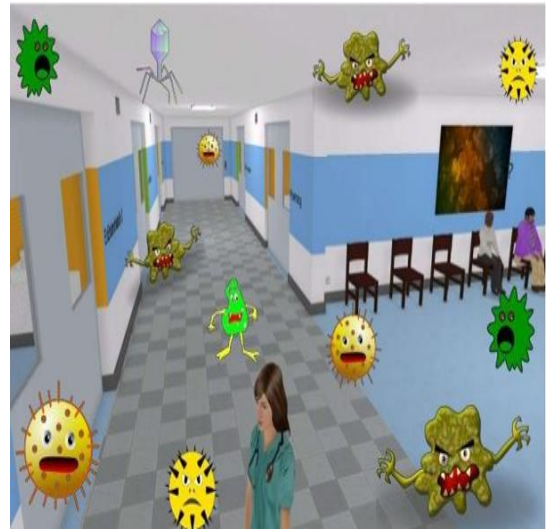
Introduction

Healthcare Associated Infections (HAIs) are infections that patients acquire while receiving treatment or care in a healthcare facility such as a hospital, clinic, or health center. These infections can also affect healthcare workers and even visitors if infection control practices are not properly followed.

HAIs may occur during treatment, soon after, or sometimes even weeks after a medical or surgical procedure. Common examples include wound infections after surgery, urinary tract infections after catheter use, or respiratory infections after being on a ventilator.

The sources of these infections can be:

- Patients themselves (who carry germs on their body),
- Healthcare workers, or
- The healthcare environment (equipment, surfaces, air, or water).



Healthcare Associated Infections are a serious public health issue because they lead to longer hospital stays, higher costs and increased illness and death among patients.

Definition of Healthcare Associated Infections

Healthcare Associated Infections (HAIs) — also known as Hospital Acquired Infections or Nosocomial Infections — are infections that develop as a result of receiving healthcare services.

They may result from:

- Direct patient care,
- Use of contaminated equipment, or
- Contact with an infected environment or person in the health facility.

Key Point:

The term “Healthcare Associated Infection” is now preferred because it covers all types of care settings — hospitals, clinics and even home-based care.

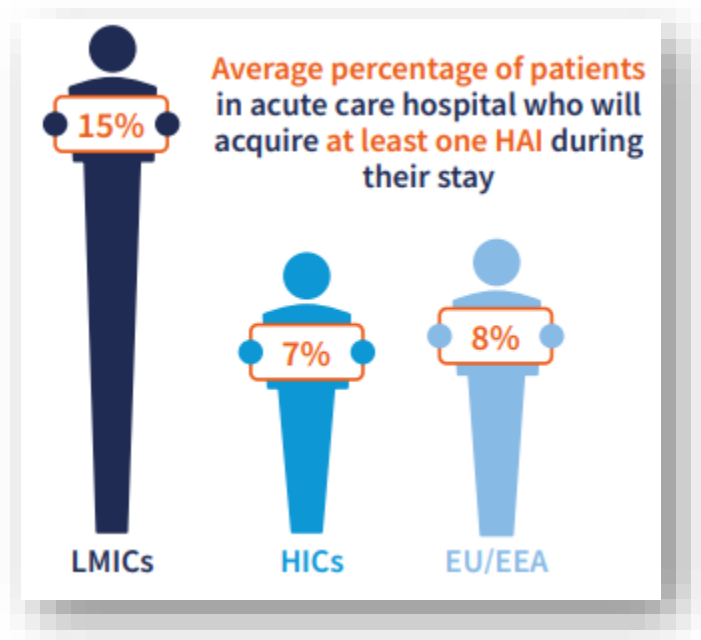
Burden and Magnitude of HAIs

HAIs are one of the biggest challenges in health care systems worldwide.

- According to the World Health Organization (WHO, 2024), 3–10% of patients in developed countries acquire a HAI during their hospital stay.
- The rate is even higher in developing countries, where between 2.5% and 14.8% of hospitalized patients are affected.
- In some intensive care units (ICUs), the infection rate can reach up to 50%.
- A study in a tertiary hospital in Tanzania found a 14.8% prevalence, while a study in Uganda found 34% of patients had HAIs.

These infections are worsened by antimicrobial resistance, which makes treatment more difficult and costlier.

Figure: Average global percentage of patients with at least one HAI in acute care hospitals, 2022–2023.



Abbreviations: HAI, health care-associated infection; LMICs, low- and middle-income countries; HICs, high-income countries; EU/EEA, European Union/European Economic Area

In simple terms:

Every year, millions of people around the world get infections while in hospitals — infections that could have been prevented through good hygiene and infection prevention practices.

Common Healthcare Associated Infections and Their Causative Organisms

Different types of HAIs occur in healthcare settings. Each type is caused by specific germs — bacteria, viruses, or fungi.

Key Messages:

- All health workers, including cleaners, attendants and technicians, are at risk of HAIs.
- Most HAIs can be prevented through good infection prevention and control (IPC) practices.
- Proper hand hygiene, disinfection and waste management save lives.

The table below lists the most common HAIs and their usual causative organisms:

Table 1: Common Healthcare Associated Infections and Causative Organisms

Type of Infection	Common Causative Organisms
Wound Infections	Staphylococcus aureus, Pseudomonas aeruginosa, Proteus spp., Klebsiella spp.
Urinary Tract Infections (UTIs)	Escherichia coli, Klebsiella pneumoniae
Respiratory Tract Infections (RTIs)	Klebsiella pneumoniae, Streptococcus pneumoniae, Mycobacterium tuberculosis, Respiratory syncytial virus
Bloodstream Infections	Staphylococcus spp., E. coli, Klebsiella pneumoniae
Gastrointestinal Infections	Salmonella spp., Shigella spp., Clostridium difficile

The Disease Transmission Cycle

To understand how HAIs spread, it is important to learn about the chain of infection. For an infection to occur, three key factors must exist:

Table 2: The Chain of Infection

Component	Description	Examples
Infectious Agent	Germs that cause disease	Bacteria, viruses, fungi, parasites
Reservoir	Where germs live and grow	Humans, animals, water, instruments
Portal of Exit	How germs leave the source	Blood, urine, feces, droplets
Mode of Transmission	How germs spread	Contact, droplets, air, contaminated items
Portal of Entry	How germs enter the next host	Cuts, mouth, nose, eyes, urinary tract
Susceptible Host	Person at risk of infection	Sick patients, newborns, elderly, health workers

Routes of Transmission

Germs spread through several routes in healthcare settings:

- **Direct contact:** From person to person (e.g. touching an infected wound).
- **Indirect contact:** Through contaminated surfaces, linen, or medical equipment.
- **Airborne:** When germs travel in tiny particles in the air (e.g. tuberculosis).
- **Droplet:** Through large droplets from coughing or sneezing (e.g. influenza).
- **Common vehicle transmission:** Through contaminated food, water, or medications.
- **Vector-borne:** Through insects such as mosquitoes.

Remember:

- Hands are the most common route of infection transmission.
- Contact transmission is the most frequent way HAIs spread in hospitals.

Factors Increasing Susceptibility to Infections

Certain patients and conditions increase the risk of HAIs:

- Poor immunity due to disease or medication.
- Prolonged hospital stay.
- Use of invasive devices like catheters or IV lines.
- Overcrowded wards or poor sanitation.
- Poor hand hygiene by health workers.

Impact of HAIs

HAIs have wide-ranging effects:

- ***For patients:*** Longer hospital stays, more suffering, higher risk of complications.
- ***For health workers:*** Increased risk of occupational exposure.
- ***For hospitals:*** Increased costs for treatment and supplies.
- ***For communities:*** Spread of resistant infections and reduced trust in healthcare facilities.

SESSION 3.3

HYGIENE IN INFECTION PREVENTION AND CONTROL (IPC)

Introduction

Hygiene is the single most important strategy in the prevention of healthcare-associated infections (HAIs). When performed properly, good hygiene practices can reduce the level of contamination by up to 70% (WHO, 2022). Within the context of Infection Prevention and Control (IPC), hygiene refers to maintaining a high standard of cleanliness to reduce the presence and spread of microorganisms in healthcare settings.

Cleanliness is achieved by physically removing organic matter, dust and microorganisms from surfaces, equipment and the human body. In healthcare environments, maintaining proper hygiene is crucial for ensuring safe service delivery, protecting healthcare workers and patients and reducing the burden of HAIs.

Hygiene in IPC encompasses three major areas:

- *Personal Hygiene*
- *Environmental (Facility) Hygiene*
- *Hygiene of Equipment*

Together, these form the foundation of all IPC practices in healthcare settings.

Session Objectives

By the end of this session, participants will be able to:

1. Define hygiene and explain its role in Infection Prevention and Control.
2. Describe the main components of hygiene — personal, facility and equipment hygiene.
3. Demonstrate correct hand hygiene techniques as part of good IPC practices.

1.0 Understanding Hygiene in Infection Prevention and Control

Hygiene in healthcare means maintaining conditions that prevent the growth and transmission of pathogens. It ensures that all healthcare procedures are performed in a clean and safe environment, minimizing the risk of infection to both patients and staff.

In primary healthcare settings, hygiene is particularly important because facilities often operate with limited space, water supply and resources. Despite these constraints, maintaining proper hygiene is both achievable and critical for effective patient care.

2.0 Components of Hygiene

2.1 Personal Hygiene

Personal hygiene refers to maintaining cleanliness of one's body, clothing and overall appearance to prevent contamination and infection. For healthcare workers, this goes beyond personal comfort — it is a professional responsibility that directly affects patient safety.

Personal hygiene practices include:

- Bathing daily and wearing clean uniforms.
- Keeping hair neat and tied back or covered with a cap when necessary.
- Maintaining short, clean nails (no nail polish or artificial nails).
- Ensuring good oral hygiene and overall body cleanliness.
- Avoiding the use of strong perfumes or scented lotions in clinical areas.
- Using Personal Protective Equipment (PPE) appropriately when handling patients or potentially infectious materials.

Hand Hygiene

Among all personal hygiene measures, hand hygiene is the most critical and effective in preventing the spread of infection. The unwashed or poorly washed hands of healthcare workers are the primary route of transmission for many pathogens, including multi-drug resistant organisms.

Effective hand hygiene physically removes or kills transient and resident microorganisms. It protects both the patient and the healthcare worker.

Key Points about Hand Hygiene

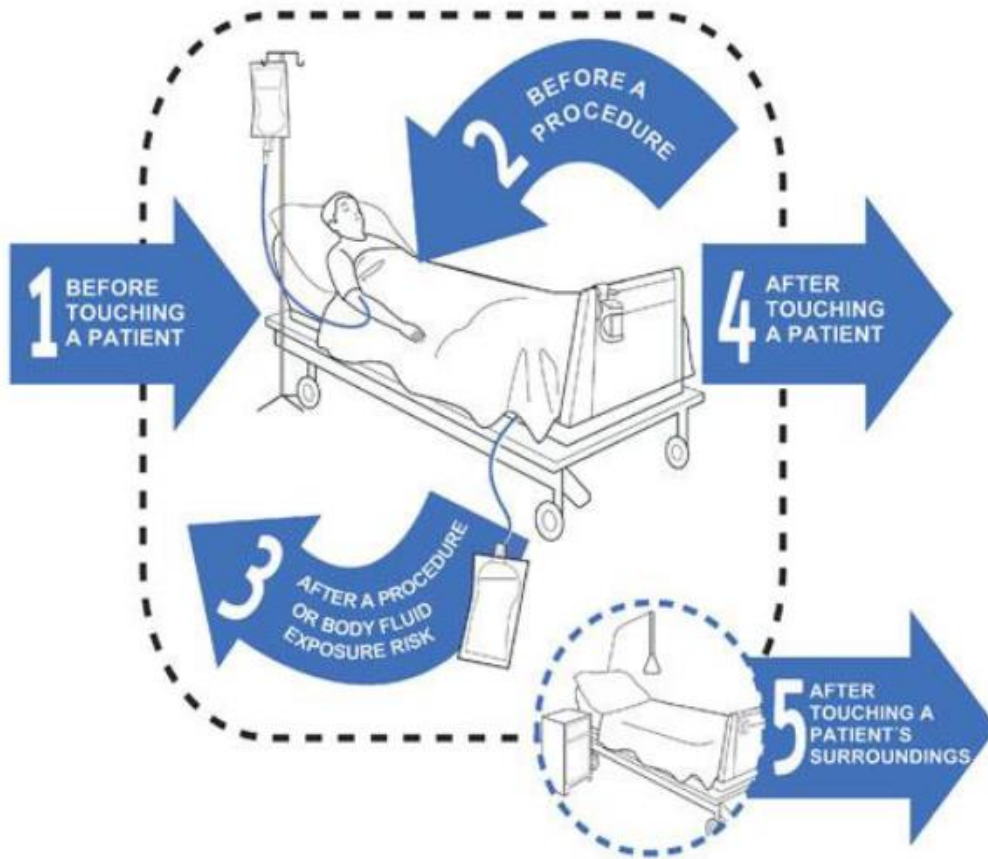
- Hand washing with soap and clean running water is the most effective method.
- Friction during washing helps remove microorganisms.
- When hands are not visibly dirty, alcohol-based hand rub may be used.
- Clear guidelines and reminders (e.g., posters) should be displayed near handwashing stations.
- All healthcare workers, patients and attendants should be encouraged and trained in proper hand hygiene.

2.2 The Five (5) Moments of Hand Hygiene

According to the World Health Organization (WHO), hand hygiene must be performed at the following key moments:

1. Before touching a patient
2. Before clean or aseptic procedures
3. After exposure to body fluids or risk thereof
4. After touching a patient
5. After touching the patient's surroundings

5 Moments of Hand Hygiene



These five moments are critical in breaking the chain of infection within healthcare facilities.

2.3 Types of Hand Hygiene

There are four major types of hand hygiene used in healthcare settings:

1. Social or Routine Hand Washing:

Used for general cleanliness, such as before and after patient contact, before eating, or after using the toilet.

2. Aseptic or Hygienic Hand Washing:

Performed before clean or aseptic procedures (e.g., wound dressing, inserting catheters).

3. *Surgical Hand Scrub:*

A thorough scrub before surgical or invasive procedures to eliminate microorganisms.

4. *Antiseptic Hand Rubbing:*

Application of alcohol-based hand rubs when hands are not visibly soiled.

2.4 Materials Used for Hand Hygiene

To ensure proper hand hygiene, healthcare facilities should provide:

- Clean running water
- Soap, preferably mounted liquid soap dispensers
- Towels for drying, preferably disposable paper towels or single-use cotton towels
- Alcohol-based hand rubs

2.5 Selection of Hand Hygiene Products

The choice of hand hygiene products depends on the following factors:

- Antimicrobial effectiveness
- User acceptance (e.g., skin tolerance, smell and ease of use)
- Cost and availability

Facilities should ensure that selected products meet national IPC standards and are regularly supplied.

3.0 Environmental (Facility) Hygiene

Environmental hygiene refers to maintaining a clean and safe healthcare environment to prevent the growth and transmission of microorganisms. Proper cleaning reduces the presence of dirt, organic matter and pathogens that may cause infections.

Purpose of Environmental Hygiene

- To remove visible dirt and reduce the number of microorganisms.
- To prevent the spread of pathogens through contaminated surfaces or air.
- To provide a safe and pleasant environment for patients, visitors and staff.

Principles of Environmental Hygiene

1. Clean from clean to dirty areas to avoid cross-contamination.
2. Avoid dry dusting and sweeping, as these spread infectious dust and microorganisms.
3. Special areas such as operating theatres, isolation units and neonatal wards require enhanced cleaning protocols.
4. Use appropriate disinfectants and cleaning materials in line with IPC guidelines.
5. Color-code cleaning equipment (e.g., mops, cloths) for different areas such as wards, toilets and kitchens to prevent cross-use.
6. Frequently clean and disinfect high-touch surfaces such as door handles, bed rails and switches.

4.0 Hygiene of Equipment

All medical and patient care equipment must be properly cleaned and disinfected before reuse to prevent infection transmission between patients.

Key Processes in Equipment Hygiene:

1. Decontamination:

This process makes contaminated equipment safe for handling by inactivating pathogens such as HBV, HCV and HIV.

2. Cleaning:

Physical removal of dirt, blood, body fluids and microorganisms using detergent and water.

3. Disinfection or Sterilization:

Depending on the intended use of the equipment, apply appropriate chemical or heat-based sterilization methods.

Healthcare workers should always wear gloves and other PPE when cleaning or decontaminating equipment.


5.0 Practical Demonstration: Hand Hygiene

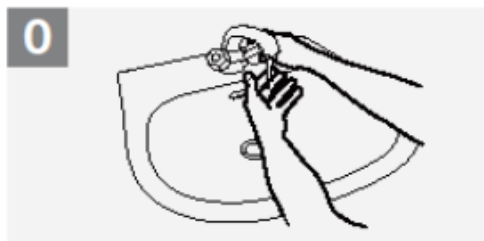
Participants should practice hand hygiene techniques following standard WHO steps.

Materials Needed:

- Sink with running water
- Plain or antiseptic soap
- Alcohol-based hand rub
- Hand hygiene charts (for washing and rubbing techniques)
- Paper or single-use cotton towels

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

 **Duration of the entire procedure: 40-60 seconds**



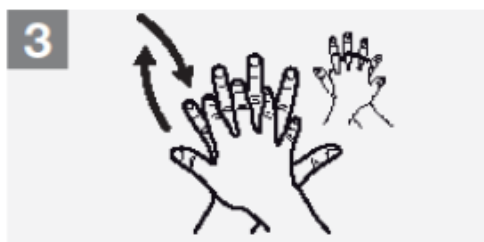
Wet hands with water;



Apply enough soap to cover all hand surfaces;



Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;



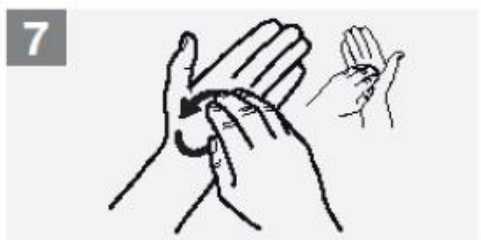
Palm to palm with fingers interlaced;



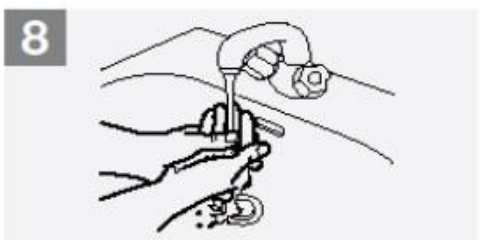
Backs of fingers to opposing palms with fingers interlocked;



Rotational rubbing of left thumb clasped in right palm and vice versa;



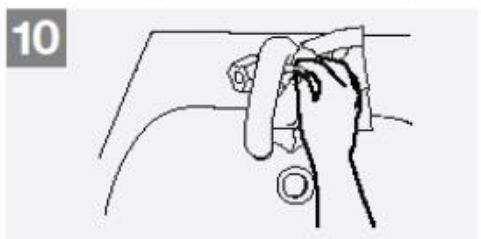
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



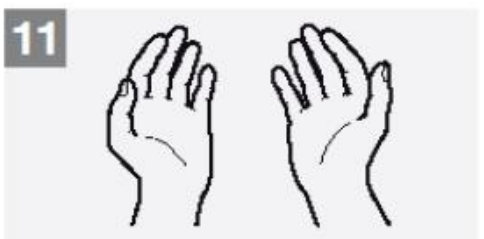
Rinse hands with water;



Dry hands thoroughly with a single use towel;



Use towel to turn off faucet;



Your hands are now safe.

Demonstration Steps:

1. Trainer demonstrates the correct handwashing technique using a step-by-step approach.
2. Participants practice the procedure individually under supervision.
3. Trainer observes and corrects each participant's technique until done correctly.

6.0 Key Messages

- ✓ Hands are the most common means of infection transmission.
- ✓ Hand hygiene is the most effective and affordable method of preventing healthcare-associated infections.
- ✓ Keep hands clean and dry, avoid jewelry and long nails and ensure sleeves are rolled up.
- ✓ Drying hands properly is part of the hand hygiene process.
- ✓ Alcohol-based hand rubs can be used when hands are not visibly dirty but should not replace washing when visibly soiled.
- ✓ Good hygiene practices — personal, environmental and equipment — are central to effective IPC and quality healthcare delivery.

SESSION 3.4

HEALTH CARE WASTE MANAGEMENT (HCWM)

Introduction

Health care waste refers to the total waste stream generated from health care or health research facilities (WHO, 1998). Health care delivery areas produce a variety of wastes, broadly categorized as hazardous (10–25%) and non-hazardous. Among hazardous waste, approximately 1% constitutes sharps waste.

Proper management of health care waste is essential to protect healthcare personnel, patients, communities and the environment. According to the Uganda National Infection Prevention and Control Guidelines (2013), health facilities must manage their waste in line with national IPC standards to prevent infection transmission and ensure environmental safety.

Session Objectives

By the end of this session, participants will be able to:

1. Define Health Care Waste.
2. Discuss the importance of managing health care waste appropriately.
3. Outline the main types of Health Care Wastes.
4. Describe the key steps in Health Care Waste Management (HCWM).

1.0 Importance of Managing Health Care Waste Appropriately

Proper management of health care waste is a vital component of infection prevention and environmental protection. Wastes generated in health facilities can pose significant risks if not handled correctly — they may serve as sources of infection, cause injuries and pollute the environment.

Importance of Health Care Waste Management:

- ***Prevents infection transmission:*** Health care waste can harbor infectious agents that spread diseases to healthcare workers, patients and the community.
- ***Reduces injuries:*** Prevents needle-stick injuries and other accidents that may lead to the transmission of bloodborne infections such as Hepatitis B, Hepatitis C and HIV.
- ***Minimizes environmental pollution:*** Proper disposal reduces contamination of soil, water and air.
- ***Discourages vermin and rodents:*** Proper waste handling prevents infestation by flies, rats and other pests that can spread diseases.

Effective HCWM enhances safety in healthcare facilities and strengthens public trust in health services.

2.0 Types of Health Care Waste

Health care waste is divided into hazardous and non-hazardous categories. Understanding these types helps healthcare workers properly segregate and dispose of waste to minimize risk.

2.1 Hazardous Waste

This type of waste poses risks due to its infectious, toxic, or radioactive nature.

a) Infectious Waste

- Blood and other body fluids (e.g., sputum, vomitus)
- Anatomical wastes such as amputated limbs and placentae
- Pathological wastes including biopsy specimens and diseased organs
- Sharps waste such as used needles, scalpels, broken ampoules and infusion sets

b) Other Types of Hazardous Waste

- ***Chemical Waste:*** Includes reactive chemicals, solvents and disinfectants.
- ***Pharmaceutical Waste:*** Expired, unused, or contaminated medicines.
- ***Radioactive Waste:*** Materials contaminated with radioactive isotopes.
- ***Genotoxic Waste:*** Cytotoxic drugs and related materials.
- ***Pressurized Containers:*** Gas cylinders and aerosol cans.
- ***Heavy Metals:*** Waste containing mercury, lead, or cadmium (e.g., broken thermometers, batteries).

2.2 Non-Hazardous Waste

This includes general or domestic waste that poses no biological, chemical, or radiological hazard.

- Office and administrative waste (e.g., paper, packaging)
- Food waste and plastic bottles

Proper segregation ensures that non-hazardous waste is not contaminated with hazardous material, simplifying disposal and reducing costs.

3.0 Key Steps in Health Care Waste Management

Effective HCWM follows a systematic process from waste generation to final disposal. Each step plays a crucial role in minimizing health and environmental risks.

Key Steps:

1. Waste Minimization
2. Segregation of Waste
3. Handling and Storage
4. Transportation
5. Treatment and Destruction
6. Final Disposal

3.1 Waste Minimization

Waste minimization begins with careful planning and procurement. Facilities should:

- Purchase supplies in appropriate quantities to avoid wastage.
- Choose products that generate less waste or can be reused safely.
- Encourage rational use of consumables and medicines.

3.2 Segregation of Waste

Segregation must be done at the point of waste generation using color-coded containers. This step prevents contamination of non-hazardous waste and reduces the volume of hazardous material requiring special handling.

Color Coding System for Waste Segregation:

Category of Waste	Examples	Color of Bin Liner
Non-Infectious Waste	Paper, food, packaging materials	Black
Infectious Waste	Anatomical and pathological waste, blood and body fluids	Red
Sharps	Needles, scalpels, broken ampoules, infusion sets	Sharps container
Chemical Waste	Formaldehyde, solvents, laboratory reagents	Brown
Pharmaceutical Waste	Expired or leftover medicines	Grey
Radioactive Waste	Materials contaminated with radioactive isotopes	Special labeled container

Note: Mixed waste should never be sorted after generation. Proper segregation at source prevents cross-contamination and injuries.

3.3 Handling of Health Care Waste

All waste handlers must use Personal Protective Equipment (PPE) including:

- Aprons
- Heavy-duty gloves
- Masks or goggles & Protective footwear

Waste should be collected in rigid, covered containers to avoid spillage. Waste handlers must wash hands after each collection and avoid taking protective clothing home.

3.4 Transportation of Waste

- Transport waste using designated covered carts or trolleys.
- Maintain segregation throughout transportation and storage.
- Decontaminate and clean transport containers daily or as needed.
- Always wash hands after handling waste.

3.5 Treatment and Destruction

Treatment aims to eliminate or reduce the hazards associated with waste before final disposal.

Type of Waste	Treatment	Procedure
Microbiological waste (cultures, vaccines)	Autoclaving	121°C for 30 minutes (check efficiency regularly)
Pathological waste (organs, tissues, blood)	Liming and burial	Layer waste and lime alternately in a deep pit
Highly infectious bodies	Burial in lime pit	For diseases such as Ebola
Infectious fluids	Chemical disinfection	Add 1% chlorine solution for 10 minutes

3.6 Disposal of Health Care Waste

Type of Waste	Disposal Method
Non-Infectious Waste	Dump at community skip or through waste-handling company
Infectious Waste	Incineration
Anatomical/Pathological Waste	Burial in a designated pit
Chemical Waste	Flush small quantities (<50ml) with water; store larger volumes for neutralization
Cytotoxic Waste	Incinerate in designated incinerator (clearly labeled “Cytotoxic”)
Radioactive Waste	Store securely in labeled container for collection by the IAEA

Proper disposal ensures that waste does not pose ongoing risks to human health or the environment.

5.0 Summary

Health care waste management is an essential component of Infection Prevention and Control. Proper segregation, handling, transportation and disposal prevent infections, injuries and environmental contamination. At the end of the session, facilitators should evaluate participants’ understanding by asking short questions and clarifying any misconceptions.

Key Takeaways:

- Health care waste poses real risks to health workers and communities.
- Waste minimization and segregation at source are critical steps.
- Color-coded systems simplify waste handling and improve safety.
- Every staff member is responsible for maintaining good waste management practices.

SESSION 3.5

DISINFECTION, STERILIZATION AND ASEPTIC TECHNIQUE

Introduction

Disinfection and sterilization are essential components of the decontamination process, which ensures that patient care equipment and devices are safe for re-use. These procedures are critical to infection prevention in healthcare settings, particularly where medical instruments are reused between patients.

Semi-critical patient care devices, which come into contact with mucous membranes or non-intact skin, must be disinfected, while critical devices—those that enter sterile tissues or the vascular system—must be sterilized before reuse.

Aseptic technique is applied throughout these processes to maintain the sterility of equipment and sterile medicines, ensuring they are not contaminated during storage or use. Together, these practices safeguard patients and healthcare workers by reducing the risk of infection transmission.

Session Objectives

By the end of this session, participants will be able to:

1. Define the terms Disinfection, Sterilization and Aseptic Technique.
2. Discuss the indications for Disinfection and Sterilization.
3. Describe the methods through which Disinfection and Sterilization are achieved.
4. Outline the types of chemical disinfectants used in healthcare settings.

1.0 Key Definitions

Understanding key terminology is essential before applying disinfection and sterilization procedures.

- ***Disinfection:***

The process of destroying microorganisms on inanimate objects but not necessarily all microbial spores. It significantly reduces the microbial load to a level that is not harmful to health. Disinfection can be achieved through heat or chemical agents.

- ***Sterilization:***

The complete destruction of all forms of microbial life, including spores. It ensures that equipment is entirely free from any viable microorganisms. Sterilization is mandatory for instruments that enter sterile areas of the body or the bloodstream.

- ***Aseptic Technique:***

A set of practices used to prevent contamination of sterile equipment, medicines and environments during medical or surgical procedures. It includes the use of sterile gloves, instruments and maintaining a clean field during handling and procedures.



2.0 Indications for Disinfection and Sterilization

Each process is applied according to the level of risk associated with the medical device or procedure.

Disinfection

- Used for semi-critical items that contact mucous membranes or non-intact skin (e.g., endoscopes, vaginal specula, thermometers).
- Appropriate for heat-resistant instruments through high-level heat disinfection or for heat-sensitive instruments using approved chemical disinfectants.
- Achieved using boiling, steaming, or chemical disinfectants.
- Must always follow cleaning, as organic matter can reduce the effectiveness of disinfectants.

Sterilization

- Required for critical items that penetrate sterile body tissues, the bloodstream, or normally sterile areas (e.g., surgical instruments, needles, catheters).
- Ensures complete elimination of all microorganisms, including spores.
- Sterilized instruments must be stored in clean, closed cabinets to prevent contamination and handled using aseptic techniques.

Aseptic Technique

Aseptic technique is crucial for maintaining sterility and preventing infection during medical and surgical procedures. It involves:

- Washing hands before handling sterile equipment or medications.
- Preparing all necessary materials in advance to avoid unnecessary movement.
- Laying sterile instruments on sterile towels or trays.
- Using non-touch technique—avoiding direct contact with sterile parts of instruments, supplies, or invasive sites.

3.0 Processes and Methods of Disinfection and Sterilization

Both disinfection and sterilization require systematic processes that include cleaning, processing and quality control. Proper cleaning is the foundation for both methods.

3.1 Cleaning

- All items must first be thoroughly cleaned with detergent and water to remove visible dirt, blood and organic material.
- Cleaning improves the effectiveness of both disinfection and sterilization processes.

3.2 Disinfection Methods

1. Thermal (Heat) Disinfection:

- The most effective and preferred method for heat-resistant instruments.
- Achieved through boiling or steaming for a specified duration (usually 20 minutes or as per guidelines).
- Referred to as High-Level Disinfection (HLD) when it destroys all microorganisms except spores.

2. Chemical Disinfection:

Used when items are heat-sensitive and cannot tolerate high temperatures. Commonly used disinfectants include:

- ***Chlorine-based compounds*** (e.g., sodium hypochlorite) – effective for general surface disinfection and infectious materials.
- ***Alcohols (70% ethanol or isopropyl alcohol)*** – for small equipment such as thermometers and stethoscope diaphragms.
- ***Glutaraldehyde (2%)*** – for high-level disinfection of heat-sensitive instruments like endoscopes.
- ***Hydrogen peroxide and peracetic acid*** – effective for semi-critical devices.

Always follow the manufacturer's instructions for concentration, contact time and rinsing requirements.

3.3 Sterilization Methods

1. Steam Sterilization (Autoclaving):

- The most reliable and widely used method.
- Uses saturated steam under pressure at temperatures of 121°C–134°C for specific time intervals.
- Suitable for metal instruments, surgical drapes and most reusable equipment.

2. Dry Heat Sterilization:

- Used for materials that cannot withstand moisture, such as powders, glassware and oils.
- Achieved by maintaining 160°C for at least 2 hours.

3. Chemical Sterilization (Cold Sterilization):

- Used for heat-sensitive instruments (e.g., plastic items, optical instruments).
- Involves immersing instruments in chemical agents such as glutaraldehyde or hydrogen peroxide plasma systems.

4. Gas Sterilization (Ethylene Oxide):

- Used for delicate, heat-sensitive equipment and packaged materials.
- Requires specialized equipment and proper aeration after sterilization due to toxic residues.

3.4 Storage and Handling of Sterile Equipment

- Store sterile items in closed, dust-free cabinets or sterile packs.
- Always handle using aseptic technique.
- Inspect packages for integrity before use; torn or wet packs should be reprocessed.
- Label and date sterile packs for rotation (“first in, first out” principle).

4.0 Summary

Disinfection and sterilization are vital to ensure that reusable medical devices and instruments are safe for patient care. Both processes depend on proper cleaning, method selection and adherence to protocols. Aseptic technique complements these processes by preventing contamination during and after sterilization.

Key Points to Remember:

- Always clean equipment before disinfection or sterilization.
- Choose the method based on whether the item is critical, semi-critical, or non-critical.
- Follow correct procedures, contact times and concentrations for chemical agents.
- Maintain proper aseptic technique to preserve sterility until the point of use.
- Store sterile items appropriately and monitor expiry or reprocessing dates.

SESSION 3.6

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Introduction

Personal Protective Equipment (PPE) forms a critical component of infection prevention and control (IPC) practices in healthcare settings. PPE includes a range of specialized clothing and equipment designed to protect healthcare workers from exposure to infectious agents, blood, and body fluids during patient care.

The correct use of PPE serves as a physical barrier, reducing the risk of transmission of communicable diseases between patients and health workers. It complements other infection prevention measures such as hand hygiene, safe waste disposal, and environmental cleaning.

Proper selection, donning (putting on), use, and doffing (removing) of PPE are essential to ensure its effectiveness. Incorrect handling can lead to contamination and increase the risk of infection rather than prevent it.

This session provides an overview of commonly used PPE, indications for use, and guidance on appropriate donning and doffing procedures to maintain a safe healthcare environment.

Session Objectives

By the end of this session, participants will be able to:

1. Define Personal Protective Equipment (PPE) and its importance in infection prevention.
2. Identify commonly used types of PPE in healthcare settings.
3. Discuss the indications and appropriate use of various PPE items.
4. Demonstrate correct donning and doffing of PPE to avoid self-contamination.

1.0 Key Definitions

Before discussing the application of PPE, it is essential to understand key terms used in this session.

- ***Personal Protective Equipment (PPE):***

Specialized clothing or equipment worn by healthcare workers to protect against infectious materials, chemicals, or other hazards during clinical and support activities.

- ***Donning:***

The process of putting on PPE in the correct order to ensure protection.

- ***Doffing:***

The process of removing PPE safely to prevent contamination of skin or clothing.

- ***Self-contamination:***

Unintentional exposure to infectious material during the removal or improper handling of PPE.

2.0 Types and Components of PPE

PPE is selected based on the type of task, level of exposure, and the nature of potential hazards. The main components include:

Type of PPE	Examples	Purpose/Protection Provided
Hand Protection	Gloves (sterile and non-sterile)	Prevent contact with blood, body fluids, and contaminated surfaces.
Body Protection	Gowns, aprons, scrubs, coats	Protect clothing and skin from contamination.
Respiratory Protection	Surgical masks, N95 respirators	Protect from airborne particles and droplets.
Eye and Face Protection	Goggles, face shields	Prevent splashes of fluids or chemicals reaching eyes or face.
Head Protection	Caps, head covers	Prevent contamination of hair and scalp.
Foot Protection	Shoe covers, gum boots	Protect feet from contamination in high-risk areas.

3.0 Indications for PPE Use

The selection and use of PPE depend on the anticipated exposure risk during different healthcare procedures.

Gloves

- For contact with blood, body fluids, mucous membranes, or non-intact skin.
- During handling of contaminated equipment or waste.
- Must be removed immediately after each procedure.

Gowns and Aprons

- Worn during procedures with risk of splashing or soiling (e.g., wound dressing, deliveries).
- Provide barrier protection to clothing and skin.

Masks and Respirators

- Used when dealing with patients with respiratory infections (e.g., tuberculosis, influenza).
- **N95 respirators** required for airborne diseases.

Goggles and Face Shields

- Protect eyes and face from splashes of blood or body fluids during suctioning or surgical procedures.

Caps and Footwear

- Used in operating rooms and high-contamination areas.
- Prevent transfer of contaminants from head or shoes.

4.0 Principles for Appropriate Use of PPE

For PPE to be effective, healthcare workers must follow specific principles during use:

1. Always select PPE appropriate to the risk of exposure.
2. Perform hand hygiene before and after using PPE.
3. Ensure PPE fits properly and is intact (no tears or damage).
4. Avoid touching the face or adjusting PPE during patient care.
5. Remove PPE carefully to avoid self-contamination.
6. Dispose of single-use PPE immediately after use.
7. Decontaminate reusable PPE (e.g., aprons, goggles, boots) according to facility protocols.

5.0 Procedures for Donning and Doffing PPE

5.1 Donning (Putting On) PPE

The sequence of donning PPE ensures maximum protection:

1. Perform hand hygiene.
2. Put on gown or apron.
3. Place mask or respirator securely over nose and mouth.
4. Wear goggles or face shield.
5. Finally, put on gloves, ensuring they cover the cuffs of the gown.

5.2 Doffing (Removing) PPE

Follow this sequence to minimize contamination:

1. Remove gloves first.
2. Remove goggles or face shield.
3. Remove gown or apron carefully, turning it inside out.
4. Remove mask or respirator (outside the isolation area if applicable).
5. Perform hand hygiene immediately.

Table: Donning and Doffing Sequence

Step	Donning (Before Procedure)	Doffing (After Procedure)
1	Hand hygiene	Gloves
2	Gown or apron	Goggles/Face shield
3	Mask or respirator	Gown or apron
4	Goggles/Face shield	Mask or respirator
5	Gloves	Hand hygiene

6.0 Storage, Reuse, and Disposal of PPE

- Single-use PPE (e.g., gloves, surgical masks) must be discarded after each use.
- Reusable PPE (e.g., aprons, goggles, boots) should be cleaned and disinfected after each procedure.
- Store PPE in a clean, dry, and accessible area.
- Always check PPE for damage before use.
- Dispose of used PPE in designated infectious waste bins.

7.0 Common Errors in PPE Use

- Touching contaminated PPE during removal.
- Wearing inappropriate PPE for the task.
- Reusing disposable items.
- Failing to perform hand hygiene before or after PPE use.
- Not replacing damaged or soiled PPE promptly.

Avoiding these errors ensures that PPE remains a reliable barrier against infection.

8.0 Summary

Personal Protective Equipment (PPE) is an essential safeguard for healthcare workers and patients. Proper use, timely removal, and correct disposal are key to preventing infection transmission. PPE should always be used alongside other standard precautions, such as hand hygiene and environmental cleaning, for comprehensive infection control.

Key Points to Remember

- Always wear PPE appropriate to the level of exposure risk.
- Don and doff PPE in the correct order to prevent contamination.
- Perform hand hygiene before and after PPE use.
- Dispose of PPE properly and disinfect reusable items.
- Consistent use of PPE builds a culture of safety in healthcare facilities.

SESSION 3.7

INJECTION SAFETY (DO NO HARM)

Introduction

Injections are among the most commonly performed invasive procedures in healthcare facilities, especially in primary health care settings across Pakistan. While injections are a vital route for administering medications, unsafe practices can lead to serious health risks, including transmission of infections such as Hepatitis B, Hepatitis C and HIV.

Injection Safety refers to the practice of administering injections in a way that does not harm the recipient, does not expose the provider to any avoidable risk and does not generate hazardous waste for the community. A safe injection is therefore one that protects the patient, the healthcare worker and the environment.

Ensuring injection safety is a key element of infection prevention and control (IPC) and supports the “Do No Harm” principle, which is central to healthcare ethics and patient safety.

Session Objectives

By the end of this session, participants will be able to:

1. Define the terms *Injection Safety* and *Safe Injection*
2. Outline the WHO three-part strategy for Injection Safety
3. Explain the “Ten Right Ways” of giving a safe injection
4. Identify common unsafe injection practices in healthcare settings
5. Describe practical ways of ensuring injection safety
6. Demonstrate safe injection administration techniques

Defining Injection Safety and Safe Injection

Injection Safety is the practice of giving injections in a manner that ensures the safety of both the patient and the health worker, while also preventing environmental contamination.

A Safe Injection is one that:

- Does not harm the recipient
- Does not expose the healthcare provider to avoidable risks
- Does not result in waste that is dangerous to the community

In primary healthcare facilities, this means using new, sterile, single-use injection equipment for every patient, performing proper hand hygiene, following aseptic technique and ensuring proper disposal of sharps and medical waste.

WHO Three-Part Strategy for Injection Safety

The World Health Organization (WHO) recommends a three-part strategy for ensuring injection safety globally. These elements are equally applicable to Pakistan's healthcare system:

1. Behavioral Change:

- Promoting safe practices among healthcare workers, patients and the community.
- Encouraging rational use of injections—only when medically indicated.
- Discouraging the demand for unnecessary injections.

2. Ensuring Equipment and Supplies:

- Availability of sterile, single-use syringes and needles.
- Functional safety boxes and appropriate disposal containers.
- Consistent supply of alcohol swabs, cotton and antiseptics.

3. Waste Management:

- Safe segregation, handling and disposal of sharps and infectious waste.
- Using puncture-proof safety boxes and timely destruction or incineration.
- Avoiding reuse of syringes and proper management of healthcare waste to protect the environment.

The Ten Right Ways of Giving a Safe Injection

Following the “Ten Rights” of injection practice ensures safety and quality in every injection procedure.

The Ten Right Ways include:

1. Right Patient – Confirm the correct patient identity before injection.
2. Right Medicine – Verify the prescribed medicine carefully.
3. Right Formulation – Use the correct drug form (e.g., suspension, solution).
4. Right Dosage – Measure and administer the exact dose prescribed.
5. Right Equipment – Always use sterile, single-use syringes and needles.
6. Right Time – Give the injection at the correct time as prescribed.
7. Right Route – Administer via the proper route (e.g., IM, IV, SC).
8. Right Site – Select the appropriate anatomical site for the injection.
9. Right Storage – Ensure medicines and equipment are stored properly.
10. Right Waste Disposal – Dispose of used equipment safely and immediately in a safety box.

These ten principles help prevent cross-infection, medication errors and needle-stick injuries.

Common Unsafe Injection Practices

Unsafe injection practices remain a major public health challenge, particularly in resource-limited and high-volume primary healthcare facilities. Recognizing and addressing these practices is essential for maintaining safety.

Common unsafe practices include:

- ***Provider-related issues:***
 - Over-prescription of injections when oral alternatives exist.
 - Recapping or reusing needles, which increases the risk of needle-stick injuries.
 - Carrying or passing used needles from one area to another.
 - Lack of patient counseling leading to sudden movements during injection.

- *Supplies and system issues:*
 - Shortages of sterile injection equipment or safety boxes.
 - Improper storage of vaccines or injectables.
 - Use of multi-dose vials without proper aseptic technique.

Such unsafe practices contribute to the spread of blood-borne pathogens and undermine patient trust in the health system.

Ensuring Injection Safety

To achieve injection safety in primary healthcare settings, several preventive and procedural measures must be consistently implemented:

- Avoid unnecessary injections — prescribe oral medications whenever appropriate.
- Educate patients not to demand injections unless medically necessary.
- Ensure that only trained healthcare workers administer injections.
- Maintain strict hand hygiene before and after each procedure.
- Clean the injection site with 70% ethyl or isopropyl alcohol and allow it to dry.
- Follow aseptic technique to prevent contamination of sterile supplies.
- Use a new sterile syringe and needle for every patient and every injection.
- Immediately dispose of used syringes and needles in puncture-proof safety boxes.
- Never reuse a syringe or needle for reconstitution, withdrawal, or administration.
- Discard medicines if sterility is compromised or expiration is uncertain.
- Never mix leftover medicines in one vial for future use.
- Follow the “one needle—one syringe—one patient” principle strictly.

By implementing these practices, health facilities can minimize the risk of infections and injuries related to unsafe injections.

Administering a Safe Injection: Practical Demonstration

Participants should observe and practice safe injection procedures under supervision. The demonstration includes:

- Proper hand hygiene before preparation.
- Checking the medicine label, expiry date and dosage.
- Using sterile equipment and maintaining aseptic technique.
- Correct administration route and site selection.
- Safe disposal of sharps immediately after use.
- Performing hand hygiene after the procedure.

During practice sessions, participants should identify safe and unsafe behaviors and discuss ways to correct them.

Key Messages

- A safe injection protects the patient, provider and community.
- Always follow the “Ten Right Ways” of giving injections.
- Never reuse injection equipment; always use sterile, single-use syringes and needles.
- Practice hand hygiene and aseptic technique consistently.
- Proper waste segregation and disposal are essential to prevent injuries and infections.
- Injection safety is everyone’s responsibility—health workers, facility managers and patients alike.

SESSION 3.8

POST EXPOSURE PROPHYLAXIS (PEP)

Session Objectives

By the end of this session, participants will be able to:

- Define key terms used in Post Exposure Prophylaxis (PEP)
- Describe the different types and classifications of exposures
- Identify indications for PEP
- Explain management steps following exposure
- Demonstrate how to fill the PEP documentation forms correctly

Introduction

Post Exposure Prophylaxis (PEP) is an emergency medical intervention given to individuals following potential exposure to infectious body fluids. It consists of short-term, disease-specific treatment aimed at preventing infection—commonly HIV, Hepatitis B, or Hepatitis C—after accidental or non-occupational exposure.

Such exposures may occur through needle-stick injuries, contact with mucous membranes or broken skin, or through sexual assault. The most effective strategy to prevent blood-borne infections is to adhere to infection prevention and control (IPC) measures and avoid exposure to body fluids. However, when exposure occurs, prompt initiation of PEP within 72 hours is crucial for effectiveness.

Common Terminologies in PEP

During this session, participants learn and discuss the meaning of key terms used in PEP. Some commonly used terms include:

- *Exposure*: Contact with blood, tissue, or other potentially infectious body fluids.
- *Occupational Exposure*: Exposure that occurs during the performance of work-related duties (e.g., needle-stick injury).
- *Non-Occupational Exposure*: Exposure not related to one's occupation (e.g., sexual assault, community injury).
- *Percutaneous Exposure*: Exposure through piercing of the skin by a sharp object contaminated with infectious material.
- *Mucous Membrane Exposure*: Contact of infectious fluids with the eyes, nose, or mouth.
- *Standard Precautions*: Infection prevention practices applied to all patients, regardless of diagnosis, to minimize exposure risk.

Key Message:

PEP is not limited to HIV prevention—it can also be provided for Hepatitis B, Hepatitis C, or any condition where prophylaxis can prevent infection.

Types of Exposures

Exposures can be categorized as:

- *Occupational Exposures*: Occur among health care workers while performing duties. Examples include needle-stick injuries, splashes of body fluids, or cuts with contaminated instruments.
- *Non-Occupational Exposures*: Occur outside the workplace, such as sexual assault, unprotected sexual contact, or injuries involving contaminated instruments in the community.

Classification of Exposures

Exposures are further classified based on risk level:

- **High-Risk Exposure:** Direct contact with blood or potentially infectious materials through deep puncture, visible blood on device, or contact with mucous membranes/non-intact skin.
- **Low-Risk Exposure:** Superficial contact with small amounts of body fluids on intact skin, or contact with non-infectious secretions.

Indications for PEP

PEP is indicated for individuals who have had high-risk exposure to potentially infectious material, such as:

- Accidental needle-stick injuries or cuts with sharp instruments
- Splashing of blood or other potentially infectious fluids onto mucous membranes
- Sexual assault or rape
- Contact with open wounds or broken skin by infectious materials

Key Message:

Health workers are at risk primarily through needle-stick injuries, while non-occupational exposures commonly occur through sexual contact or assault.

Management of Exposures

When an exposure occurs, it must be treated as a medical emergency. The following steps are followed:

1. Immediate First Aid:

- Wash the affected area thoroughly with soap and water.
- For mucous membrane exposure, rinse with clean water or saline.
- Avoid squeezing or rubbing the site of injury.
-

2. Report the Incident:

- Inform the supervisor or in-charge immediately.
- Record details in the incident register.

3. Assessment:

- Evaluate the type and severity of exposure.
- Determine the HIV and Hepatitis status of both the source and the exposed person.

4. Initiate PEP:

- If indicated, start antiretroviral prophylaxis within 72 hours of exposure.
- Continue treatment for the prescribed duration (usually 28 days).

5. Documentation:

- Complete the PEP documentation form and update the PEP register.
- Record the follow-up schedule for HIV testing.

6. Follow-Up and Support:

- Provide counseling and psychological support.
- Conduct HIV testing at 4 weeks, 3 months and 6 months.

Table : Decision-Making Guide for PEP Initiation

Exposed Individual	Source of Exposure	Action
HIV-Negative	HIV-Positive	Start PEP for the exposed; follow up HIV test at 4 weeks, 3 months and 6 months
HIV-Positive	HIV-Positive	No PEP; counsel both and follow HIV management guidelines
HIV-Positive	HIV-Negative	No PEP; counsel both. If sexual exposure, assess for PEP for source
HIV-Negative	HIV-Negative	No PEP; follow up HIV testing at 4 weeks, 3 months and 6 months
HIV-Negative	HIV Status Unknown	Start PEP; follow up HIV testing as per protocol

Table 2: Recommended Antiretroviral Regimens for HIV PEP

Category	Antiretroviral Prophylaxis
Adults	Tenofovir (TDF 300 mg) + Lamivudine (3TC 150 mg) + Atazanavir/Ritonavir (ATV/r 300/100 mg)
Children	Abacavir (ABC) + Lamivudine (3TC) + Lopinavir/Ritonavir (LPV/r), dosed as per standard pediatric chart

Key Points to Remember

- PEP is time-sensitive — initiate within 72 hours after exposure.
- Exposures must always be reported, assessed and documented.
- Facilities unable to provide full PEP services should initiate treatment and refer to a higher-level center.
- Documentation in the PEP Register and PEP Form is mandatory for every case.
- Psychological support and counseling are critical for exposed individuals.