Reading Material for
Public Health Technician
(Paper-A)

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Unit 1

Communicable Diseases Control

Objectives:

The student shall be able to understand, define and apply the following terms practically:

1. Infection, Infectious Diseases, Dynamics of Disease Transmission
2. Classification of infections
3. Common waterborne diseases
4. Common airborne diseases
5. Measures for controlling infection

1.1 Infections, Infectious Diseases, Dynamics of Disease transmission

1.1.2 Infection:

It is the invasion of tissues by pathogens, their multiplication, and the reac1ion of host tissues to the infectious agent and the toxins they produce.

1.1.2 Infectious disease:

Also known as a transmissible disease or communicable disease, is an illness resulting from an infection

1.1.3 Dynamics of Disease Transmission:

1.1.3.1 Chain of Infection:

- Source and reservoir
- Susceptible host
- Channels or routes of transmission

1.1.3.1.1 Source and Reservoir:

• Source: It is defined as the person, animal, object or substance from which an infectious agent is passed or disseminated to the host.

• Reservoir: It is defined as any person, animal, arthropod, plant, soil or substance (or combination of these) in which an infectious agent lives and multiplies, on which it depends primarily for survival and where it reproduces itself in such a manner that it can be transmitted to susceptible host.

1.1.3.1.2 Host:

A person or other animal including birds and arthropods that affords lodgment to an infectious agent under natural conditions is called host.

1.1.3.1.3 Channels or Routes of transmission:

Infection control and prevention depends on disrupting the transmission of pathogens from their source (the infected animal or human) to new hosts (animal or human) or locations.

Understanding route of disease transmission and how it contributes to the spread of organisms allows for the identification of effective prevention and control measures not only for specific diseases, but also other pathogens transmitted by a similar route, including unanticipated infectious diseases.

The transmission of micro-organisms can be divided into the following five main routes: direct contact, fomites, aerosol (airborne), oral (ingestion), and vector borne. Some microorganisms can be transmitted by more than one route.

Direct Contact Transmission:

Direct contact transmission occurs through direct body contact with the tissues or fluids of an infected individual. Physical transfer and entry of microorganisms occurs through mucous membranes (e.g., eyes, mouth), open wounds, or abraded skin.

Direct inoculation can occur from bites or scratches. Examples include organisms such as Rabies, Microsporum, Leptospira spp., and staphylococci, including multidrug-resistant (MDR) species methicillin-resistant Staphylococcus aureus and Staphylococcus pseudintermedius (MRSP). This is probably the most common and highest-risk route of pathogen transmission to patients and personnel.

Fomite Transmission:

Fomite transmission involves inanimate objects (non- living) contaminated by an infected individual that then come in contact with a susceptible animal or human.

Fomites can include a wide variety of objects such as exam tables, cages, kennels, medical equipment, environmental surfaces, and clothing. Disease examples include canine parvovirus and feline calicivirus infections.

Aerosol (Airborne) Transmission:

Aerosol transmission encompasses the transfer of pathogens via very small particles or droplet nuclei. Aerosol particles may be inhaled by a susceptible host or deposited onto mucous membranes or environmental surfaces.

This can occur from breathing, coughing, sneezing, or vocalization of an infected individual, but also during certain medical procedures (e.g. suctioning, bronchoscopy, dentistry, inhalation anesthesia). Very small particles may remain suspended in the air for extended periods and be disseminated by air currents in a room or through a facility.

However, most pathogens pertinent to companion animal veterinary medicine do not survive in the environment for extended periods or do not travel great distances due to size and as a result require close proximity or contact for disease transmission.

Oral (Ingestion) Transmission:

The ingestion of pathogenic organisms can occur from contaminated food or water as well as by licking or chewing on contaminated objects or surfaces.

Environmental contamination is most commonly due to exudates, feces, urine, or saliva. Infections caused by Campylobacter, Salmonella, Escherichia coli, and Leptospira and diseases acquired via environmental oral transmission include feline panleukopenia

Vector-Borne Transmission:

Vectors are living organisms that can transfer pathogenic microorganisms to other living organisms including humans or locations. They include arthrodopods (e.g.,house fly, mosquitoes, fleas, ticks) and rodents (rats)
Vector-borne transmission can be an important route of transmission in climates where these pests exist year-round and may be brought into the practice by an infested patient. Examples of vector-borne diseases include heartworm disease, Bartonella infection, Lyme disease (borreliosis), and plague.

Zoonotic Transmission:

It is important to remember many animal diseases are zoonotic and therefore pose a risk for the healthcare team as well as clients. The transfer of these agents can occur by the same five routes of transmission described above. Examples of zoonotic pathogens include Microsporum, Leptospira, Campylobacter, and Bartonella.

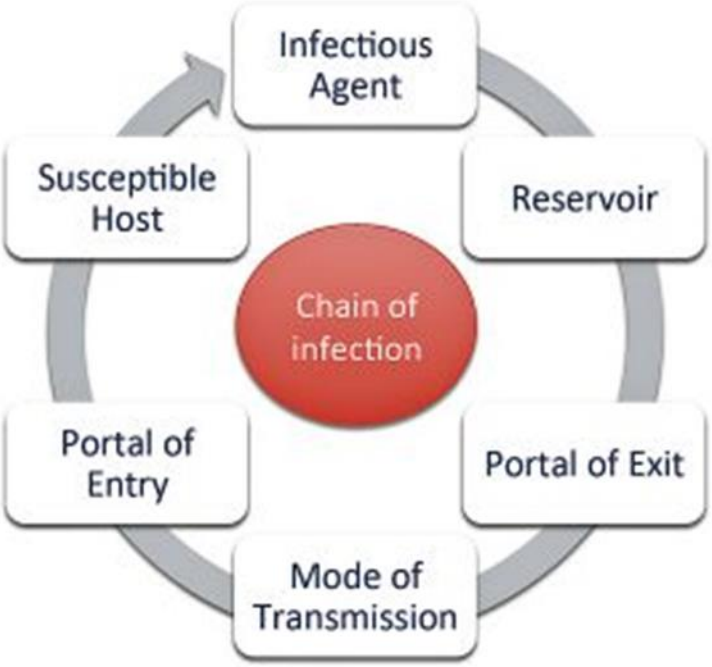


Figure 1.1 showing chain of transmission

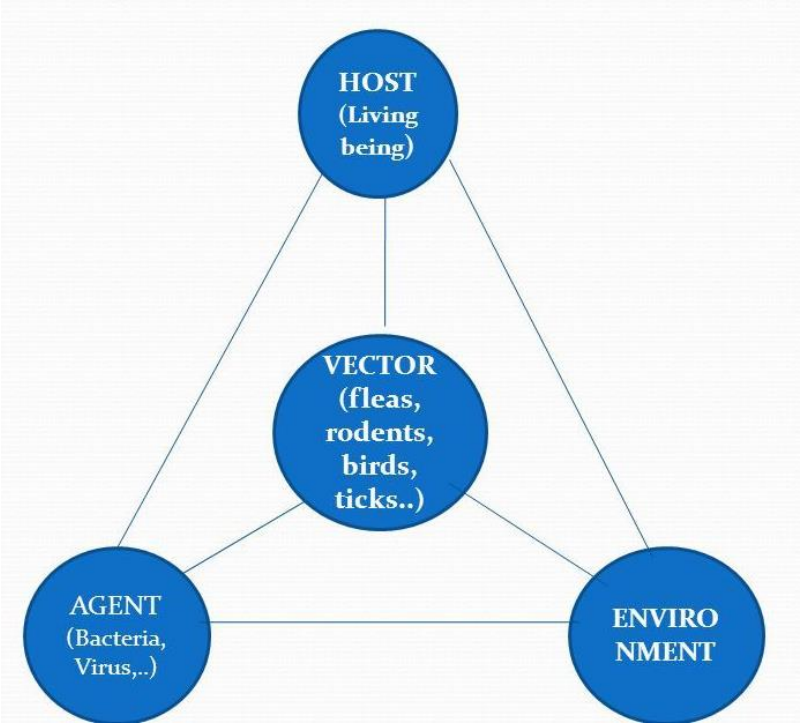


Figure 1.2 showing interaction of agent, host and environment in Epidemiological Triad

1.2. Basis of Classification of Infections:

Infections are classified based on the causative agents and the affected body systems. Broadly, they fall into four categories:

- Bacterial Infections: Caused by bacteria such as Streptococcus or Escherichia coli. Examples include pneumonia and urinary tract infections.

- Viral Infections: Result from viruses like influenza or HIV. Common viral infections include the flu, colds, and COVID-19.

- Fungal Infections: Caused by fungi like Candida or Aspergillus. These infections can affect the skin, nails, or internal organs, and examples include athlete's foot and yeast infections.

- Parasitic Infections: Stem from parasites like Plasmodium or Giardia. Malaria and intestinal parasitic infections are examples.

Within each category, infections can be further classified based on the specific pathogen, the affected organ or system, and the severity of the infection. Proper classification is crucial for accurate diagnosis and effective treatment.

1.3. Common Waterborne diseases:

1.3.1. Cholera:

Causative Agent: Vibrio cholerae (bacteria).

Transmission: Contaminated water or food.

Symptoms: Severe diarrhea, vomiting, dehydration.

Prevention: Safe water and sanitation practices, hand washing and hygiene practices and cholera vaccination.

1.3. 2. Typhoid Fever:

Causative Agent: Salmonella Typhi (bacteria).

Transmission: Contaminated water or food.

Symptoms: High grade fever, abdominal pain, headache.

Prevention: Safe water supply, proper sanitation,hand washing and hygiene practices, and typhoid vaccination.

1.3.3. Dysentery:

Causative Agent: Various bacteria (e.g., Shigella) or parasites (e.g., Entamoeba histolytica).

Transmission: Contaminated water, food, or person-to-person.

Symptoms: Severe diarrhea with blood, abdominal cramps.

Prevention: Hygiene, clean water, proper sewage disposal.

1.3.4.Giardiasis:

Causative Agent: Giardia lamblia (parasite).

Transmission: Contaminated water, often in recreational settings.

Symptoms: Diarrhea, abdominal cramps, weight loss.

Prevention: Filtration of water, proper hygiene.

1.3.5.Hepatitis A:

Causative Agent: Hepatitis A virus.

Transmission: Contaminated water or food.

Symptoms: Jaundice, fatigue, nausea.

Prevention: Hepatitis A vaccination, safe food and water practices.

1.3.6.Cryptosporidiosis:

Causative Agent: Cryptosporidium (parasite).

Transmission: Contaminated water, often in swimming pools.

Symptoms: Watery diarrhea, stomach cramps.

Prevention: Filtration of water, proper hygiene.

1.3.7.Amoebiasis:

Causative Agent: Entamoeba histolytica (parasite).

Transmission: Contaminated water or food.

Symptoms: Diarrhea, abdominal pain, liver abscess in severe cases.

Prevention: Clean water, proper sanitation.

Preventing waterborne diseases involves ensuring a safe water supply, promoting good sanitation practices, and raising awareness about hygiene. Access to clean water and proper sanitation facilities is crucial in reducing the prevalence of these diseases. Public health measures, including vaccinations where available, play a significant role in controlling waterborne infections.

1.4. Common Airborne diseases (through air/ respiration):

1.4.1.Influenza (Flu):

Causative Agent: Influenza viruses (types A, B, C).

Transmission: Airborne respiratory droplets.

Symptoms: Fever, cough, sore throat, body aches.

Prevention: Annual influenza vaccination, respiratory hygiene.

1.4.2.Tuberculosis (TB):

Causative Agent: Mycobacterium tuberculosis bacteria.

Transmission: Airborne respiratory droplets.

Symptoms: Persistent cough, weight loss, fatigue.

Prevention: TB vaccination, proper ventilation, antibiotic treatment.

1.4.3.COVID-19:

Causative Agent: Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

Transmission: Airborne respiratory droplets.

Symptoms: Vary widely, including fever, cough, shortness of breath.

Prevention: Vaccination, wearing masks, social distancing.

1.4.4.Measles:

Causative Agent: Measles virus.

Transmission: Airborne respiratory droplets.

Symptoms: Fever, cough, characteristic rash.

Prevention: Measles, Mumps, Rubella (MMR) vaccination.

1.4.5.Chickenpox (Varicella):

Causative Agent: Varicella-zoster virus.

Transmission: Airborne respiratory droplets or direct contact with lesions.

Symptoms: Itchy skin rash, fever, fatigue.

Prevention: Varicella vaccination.

1.4.6.Common Cold:

Causative Agents: Various viruses, including rhinoviruses.

Transmission: Airborne respiratory droplets.

Symptoms: Runny nose, sneezing, sore throat.

Prevention: Hand hygiene, avoiding close contact with sick individuals.

1.4.7.Pneumonia:

Causative Agents: Bacteria (e.g., Streptococcus pneumoniae), viruses, fungi.

Transmission: Airborne respiratory droplets or aspiration.

Symptoms: Difficulty breathing, chest pain, fever.

Prevention: Pneumococcal vaccination, proper respiratory hygiene.

Preventing airborne diseases involves vaccination where available, practicing good respiratory hygiene, maintaining proper ventilation, and avoiding close contact with infected individuals. Public health measures such as quarantine and isolation play a crucial role in controlling the spread of airborne infections.

1.5. Measures for controlling infection:

- Hand Hygiene:

Proper Handwashing: Encourage regular and thorough handwashing with soap and water for at least 20 seconds.

Hand Sanitizers: Use alcohol-based hand sanitizers when soap and water are not available.

Figure 1.4: Hand washing steps

- Vaccination:

Ensure individuals receive recommended vaccinations to prevent the spread of vaccine-preventable diseases.

Promote vaccination campaigns to achieve herd immunity and protect vulnerable populations.

- Respiratory Hygiene:

Covering Mouth and Nose: Encourage individuals to cover their mouth and nose with a tissue or elbow when coughing or sneezing.

Mask Usage: Promote the use of masks, especially in crowded or healthcare settings.

- Safe Food and Water Practices:

Promote the consumption of clean and properly cooked food.

Ensure access to safe drinking water and proper sanitation facilities to prevent waterborne diseases.

- Vector Control:

Implement measures to control vectors (e.g., mosquitoes, ticks) that transmit infectious diseases.

Management includes anti larval measures (prevention of development and disposal of larva), Anti adult measures.Use insecticides, bed nets, and environmental management to reduce vector populations.

- Isolation and Quarantine:

Isolate individuals with infectious diseases to prevent the spread of pathogens.

Implement quarantine measures for those exposed to infectious agents to prevent further transmission.

- Proper Waste Disposal:

Ensure the proper disposal of medical and household waste to prevent the spread of infections.

Promote recycling and waste reduction practices.

- Good Personal Hygiene:

Encourage regular bathing and grooming.

Promote the use of clean clothing and linens to prevent the spread of infections.

- Health Education:

Provide public education on infection prevention measures.

Dispel myths and misconceptions related to infectious diseases.

- Adequate Ventilation:

Ensure proper ventilation in enclosed spaces to reduce the concentration of airborne pathogens.

Implement ventilation systems that exchange indoor and outdoor air.

- Antibiotic Stewardship:

Promote responsible use of antibiotics to prevent antibiotic resistance.

Educate healthcare professionals and the public about the appropriate use of antibiotics.

- Personal Protective Equipment (PPE):

Ensure the availability and proper use of PPE, such as masks, gloves, and gowns, in healthcare settings and other high-risk environments.

- Surveillance and Monitoring:

Establish robust surveillance systems to monitor the incidence of infectious diseases.

Implement early warning systems to detect and respond to outbreaks promptly.

- Collaboration and Communication:

Foster collaboration between healthcare institutions, public health agencies, and communities. Establish clear communication channels to disseminate information about infectious diseases and preventive measures.
Implementing a combination of these measures, tailored to the specific characteristics of each infectious disease, is essential for effective control and prevention. Public awareness, community engagement, and a coordinated approach among various stakeholders are critical components of successful infection control strategies.

Important Concepts learnt

- Know agent, host, environment and their interactions in spread of infection
- Know mode of transmission and various diseases spreading by these modes
- Know the preventive and control measures and practical implications in the community

Sample Question:

Enlist the diseases spread by water. How will you prevent their outbreak in the community?

Unit 2
Elementary Entomology and Parasitology

Objectives:

The student shall be able to know, enumerate, and understand important diseases spread by parasites and insects and the ways to prevent them. Following is the outline of the chapter

1. **Common protozoa (Plasmodium, E. histolytica)**
2. **Common insects of medical importance**
3. **Broad outline of morphology and life history of important vectors**
4. **Common helminthes (round, hook, thread, tap worms)**
5. **General Prevention and Treatment**

2.1. Common protozoa (Plasmodium, E. histolytica):

2.1.1 Plasmodium:

Overview:

Causative Agent: Plasmodium species (e.g., Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae).

Disease: Malaria.

Life Cycle:
Transmitted through the bite of infected female Anopheles mosquitoes.

The parasites infect liver cells (hepatic stage) and later red blood cells (erythrocytic stage).

Mosquitoes become infected when they bite an infected human, completing the life cycle.

Symptoms:
Fever, chills, sweats, fatigue, anemia, and in severe cases, organ failure.

Geographical Distribution:
Malaria is prevalent in tropical and subtropical regions.

Prevention and Treatment:
Bed nets, insect repellents, antimalarial drugs (e.g., chloroquine, artemisinin-based combination therapies).Drug resistance is a concern, and preventive measures are crucial in endemic areas.

2.1.2 Entamoeba histolytica:

Overview:
Causative Agent: Entamoeba histolytica (amoeba).

Disease: Amebiasis.

Transmission:
Fecal-oral route, often through contaminated food or water.

Life Cycle:
The amoeba exists in two forms: cyst (infectious) and trophozoite (active, feeding stage).

Infection occurs when a person ingests contaminated cysts.

Symptoms:
Diarrhea (which may be bloody), abdominal pain, weight loss, fatigue.
In severe cases, the amoeba can invade the liver, causing liver abscesses.

Geographical Distribution:
Amebiasis is found worldwide but is more prevalent in areas with poor sanitation.

Prevention and Treatment:
Improved sanitation, clean water supply, and proper hygiene.
Antiprotozoal medications (e.g., metronidazole) for treatment.

Understanding the life cycles, transmission routes, and geographical distributions of these protozoa is crucial for effective prevention, diagnosis, and treatment of the associated diseases. Public health measures, including sanitation improvements and targeted interventions, play a significant role in controlling the spread of these protozoan infections.

2.2.1 Common insects of medical importance:

Common insects of medical importance include a variety of species that can directly or indirectly impact human health. These insects are often associated with the transmission of diseases, allergic reactions, or direct damage to human tissues. Understanding these insects is crucial for public health efforts, as it allows for the development of effective control measures and preventive strategies. Here are some common insects of medical importance:

2.2.1.1.Mosquitoes:

Disease Transmission: Mosquitoes are notorious for transmitting diseases such as malaria, dengue fever, Zika virus, and West Nile virus. They are vectors for these

diseases, meaning they can carry and transmit pathogens from one person to another through their bites.

Geographical Distribution: Mosquitoes are found worldwide, with different species prevalent in different regions. They thrive in areas with stagnant water, making proper sanitation and mosquito control essential.

3.2.3 Ticks:

Disease Transmission: Ticks are known vectors for diseases like Lyme disease, Rocky Mountain spotted fever, and tick-borne encephalitis. These diseases are caused by bacteria or viruses transmitted through the saliva of the tick during feeding.

Habitats: Ticks are commonly found in wooded areas, tall grasses, and bushes. They attach themselves to hosts (humans or animals) to feed on blood.

3.2.4 Fleas:

Disease Transmission: Fleas can transmit diseases such as bubonic plague, caused by the bacterium Yersinia pestis. Though rare, cases of plague can still occur in some parts of the world.

Hosts: Fleas often infest pets like dogs and cats, and they can bite humans as well. Proper pet care and hygiene are crucial for preventing flea infestations.

3.2.5 Flies:

Disease Transmission: Houseflies are known to carry and spread various pathogens, including bacteria and viruses, contributing to the spread of diseases like gastroenteritis and food poisoning.They are potential vector of many diseases: typhoid and paratyphoid fever, diarrhoeas and dystentry,cholera and gastroenteritis, amoebiasis, helminthic, infestations, p poliomyelitis, conjunctivitis, trachoma, anthrax,and yaws are some.

Sanitation: Controlling fly populations involves maintaining proper sanitation, especially in areas where food is prepared and stored.

3.2.6 Bedbugs:

Bite Reactions: While bedbugs are not known to transmit diseases directly, their bites can cause allergic reactions and secondary infections. The psychological impact of infestations can also lead to stress and anxiety.
Hiding Places: Bedbugs hide in cracks and crevices in and around beds, making detection and control challenging. Professional pest control may be necessary in severe infestations.

3.2.7 Lice:

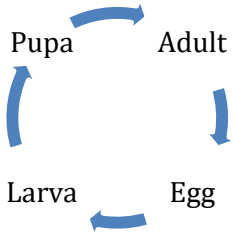
Types: Human lice include head lice, body lice, and pubic lice. While they do not transmit diseases directly, their presence can lead to itching, discomfort, and secondary infections.
Transmission: Lice are usually spread through direct contact with infested individuals or their belongings. Personal hygiene and regular washing of clothes and bedding are essential for prevention.

3.2.8 Sandflies:

Disease Transmission: Sandflies are vectors for diseases such as leishmaniasis, a parasitic infection affecting the skin and internal organs. They are prevalent in tropical and subtropical regions.
Preventive Measures: Using insect repellents and wearing protective clothing can help prevent sandfly bites in endemic areas.

Understanding the biology, behavior, and habitats of these medically important insects is crucial for developing effective control strategies. Public health efforts often focus on integrated pest management, which includes a combination of chemical, biological, and physical control methods, as well as public education to reduce human-vector contact and prevent the spread of diseases.

2.3 Broad outline of morphology and life history of important vectors:



Life Cycle of arthropods

Important vectors, specifically focusing on mosquitoes, ticks, and fleas:

2.3.1. Mosquitoes:

a. Morphology:

- Adult Mosquitoes:

Size and Appearance: Varying sizes, typically small with long, slender legs and wings.
Mouthparts: Females have piercing-sucking mouthparts for blood-feeding; males feed on nectar.
Antennae: Long, segmented antennae.
Wings: Scaled wings with characteristic wing venation patterns.

- Mosquito Larvae:

Aquatic Habit: Larvae develop in water bodies such as ponds, stagnant water, or artificial containers.
Body Structure: Worm-like, with a distinct head and abdomen; breathe through a specialized structure called a siphon.
Feeding: Filter-feeders, primarily consuming organic debris and microorganisms in water.

b. Life History:

- Egg Stage:

Oviposition: Females lay eggs on the surface of water or in areas prone to flooding.
Egg Types: Raft-like clusters or individual eggs depending on species.

- Larval Stage:

Development: Larvae go through multiple instars, molting between each stage.
Feeding: Filter-feeding on organic matter in water.

- Pupal Stage:

Transformation: Larvae transform into pupae, non-feeding and encased in a pupal case.
Metamorphosis: Mosquitoes undergo metamorphosis within the pupal case.

- Adult Stage:

Emergence: Adults emerge from the pupal case onto the water surface.
Blood-Feeding: Females require a blood meal for egg development.
Life Span: Adult lifespan varies, typically a few weeks to several months.

2.3.2. Ticks:

a. Morphology:

- Adult Ticks:

Size and Appearance: Varied sizes, dorsoventrally flattened bodies.
Mouthparts: Chelicerae with a hypostome for blood-feeding.
Legs: Eight legs in the adult stage.
Hard vs. Soft Ticks: Distinguished by the presence or absence of hard, protective shield (scutum).
Feeding: All life stages require blood meals for development.

b. Life History:

- Egg Stage:

Oviposition: Females lay eggs in the environment.

- Larval Stage:

Host Attachment: Larvae attach to a host, feed, and molt to the nymphal stage.

- Nymphal Stage:

Host Attachment: Nymphs attach to a host, feed, and molt to the adult stage.

a. Adult Stage:

Feeding: Adults feed on hosts, mate, and females lay eggs to complete the life cycle.

b. Host Specificity: Different tick species have specific host preferences.

2.3.3. Fleas:

a. Morphology:

c. Adult Fleas:

Size and Appearance: Small, laterally compressed bodies, well-adapted for moving through fur.
Legs: Powerful hind legs for jumping.
Mouthparts: Piercing-sucking mouthparts for blood-feeding.

d. Flea Larvae:

Worm-like: Legless and have bristles for movement.
Feeding: Feed on organic debris in the environment.
b. Life History:

e. Egg Stage:

Oviposition: Females lay eggs on hosts or in their nesting areas.

f. Larval Stage:

Feeding: Larvae feed on organic debris in the environment.
Pupation: Larvae spin a cocoon for pupation.

g. Pupal Stage:

Metamorphosis: Fleas undergo metamorphosis within the cocoon.
Emergence: Adults emerge from the cocoon.

h. Adult Stage:

Feeding: Adults feed on the blood of their host.
Reproduction: Fleas reproduce and continue the life cycle.
Understanding the morphology and life history of these important vectors is crucial for developing targeted control strategies and preventive measures to mitigate the risk of diseases transmitted by these insects.

2.4. Common helminths (round, hook, thread, tapeworms)

Helminths are parasitic worms that can infect humans and animals. There are several types of helminths, and they are broadly categorized into two main groups: flatworms (Platyhelminthes) and roundworms (Nematoda). Within these groups, there are various species of medical importance.

3.1.1 Ascaris lumbricoides (Roundworm):

a. Morphology:

Adult worms are large, cylindrical, and can reach lengths of up to 35 cm.
Males are smaller than females.

b. Transmission:

Ingestion of contaminated food or water containing Ascaris eggs.
Infection:
Larvae hatch in the small intestine, migrate through the bloodstream, and mature in the lungs before returning to the intestine.

c. Diseases:

Ascariasis, causing abdominal discomfort, malnutrition, and in severe cases, bowel obstruction.

3.1.2 Ancylostoma duodenale and Necator americanus (Hookworms):

a. Morphology:

Small, thread-like worms, 1 cm in length.
Have cutting plates or teeth for attaching to the intestinal wall.

b. Transmission:

Penetration of the skin by larvae in contaminated soil.

c. Infection:

Larvae migrate to the lungs and then to the intestine, where they mature.

d. Diseases:

Hookworm disease, causing anemia, weakness, and protein deficiency.

3.1.3 Strongyloides stercoralis (Threadworm):

a.Morphology:

Small, thread-like worms, a few millimeters in length.
Unique life cycle involving free-living and parasitic stages.

b. Transmission:

Penetration of the skin by infective larvae in contaminated soil.

c. Infection:

Larvae can cause an autoinfection cycle, persisting for years in the human host.

d. Diseases:Strongyloidiasis, causing gastrointestinal and respiratory symptoms.

3.1.4 Taenia saginata and Taenia solium (Tapeworms):

a.Morphology:
Long, flat worms with a head (scolex) and multiple segments (proglottids).
b. Transmission:
Ingestion of undercooked or raw contaminated meat containing cysticerci.
c. Infection:
Adult worms attach to the small intestine; segments containing eggs are shed in feces.
d.Diseases:
Taeniasis (intestinal infection) and cysticercosis (tissue infection) caused by T. solium.

2.4.5. General Prevention and Treatment:

- Proper handwashing to prevent fecal-oral transmission.
- Avoiding consumption of undercooked or raw meat.
- Ensuring proper sanitation and waste disposal.

Helminthic infections are a significant public health concern, particularly in regions with poor sanitation and limited access to healthcare. Prevention, education, and appropriate medical interventions are crucial for controlling and treating helminthiasis. Public health campaigns often focus on improving sanitation, promoting hygiene, and implementing deworming programs in endemic areas to reduce the burden of these parasitic infections.

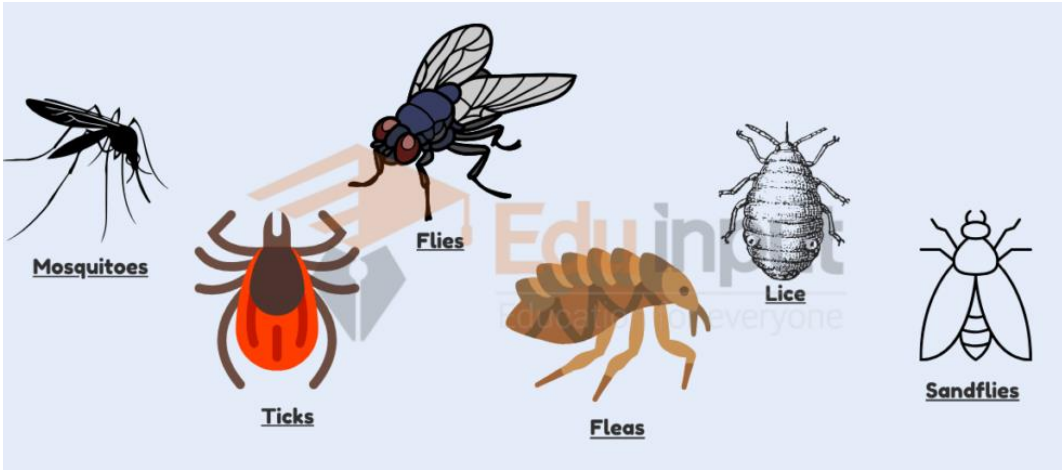


Figure 2.1 Some vectors of Public Health Importance
Source: https://eduinput.com/examples-of-vectors-in-biology/

Important concepts learnt:

- Know entomology, parasitology and its implication on man and health
- Know life cycles of important organisms such as plasmodium, insects, mosquito and housefly.
- Know various diseases spread by protozoa, arthropods and parasites and their prevention and control

Sample Questions:

Enlist diseases spread by mosquito. How will you prevent and control them.

Unit 3
Immunity and Vaccination

Objectives:

The student shall be able to comprehend and understand important concepts of mechanisms of defense against diseases by immunity and vaccination.

Following contents are covered in this chapter:

1. Antigens, antibodies and immunity
2. Vaccination against communicable diseases
3. Types of vaccines, their protection and side effects
4. Safe injection practices and disposal of injection wastes
5. Preparation and administration of vaccines
6. Cold chain system
7. Supplementary vaccination activities

3.1 Antigens, antibodies and immunity:

3.1.1 Antigens:

a. Definition:

Antigens are molecules or molecular structures that the immune system recognizes as foreign and capable of triggering an immune response. They can be present on the surface of pathogens, such as bacteria and viruses, or on the surface of cells, including tumor cells.

b. Characteristics:

- Foreign Nature: Antigens are typically foreign to the body, but the immune system can also recognize self-antigens under certain conditions.
- Specificity: Each antigen is recognized by specific immune cells or antibodies. Diversity: Antigens can be proteins, lipids, carbohydrates, or nucleic acids. The diversity of antigens allows the immune system to respond to a wide range of pathogens.

3.1.2. Antibodies (Immunoglobulins):

a. Definition:
Antibodies, or immunoglobulins (Ig), are proteins produced by the immune system in response to the presence of antigens. They play a crucial role in immune responses by recognizing and binding to specific antigens, marking them for destruction or neutralization.

b.Characteristics:

Structure: Antibodies have a Y-shaped structure with variable regions that bind to antigens and constant regions that determine the antibody's function.
Classes: There are several classes of antibodies (IgG, IgM, IgA, IgD, IgE), each with distinct functions in the immune response.
Production: Antibodies are produced by B lymphocytes (B cells) in response to the recognition of antigens.

3.1.3 Immunity:
a.Definition:

Immunity refers to the ability of an organism to resist and defend against harmful pathogens or their toxins. The immune system employs various mechanisms to provide protection against infections and diseases.

b. Types of Immunity:

- Innate Immunity:

Natural Barriers: Skin, mucous membranes, and other physical barriers.
Cellular Components: Phagocytes (e.g., macrophages), natural killer cells.
Inflammatory Responses: Rapid, non-specific responses to infection or injury.

- Adaptive (Acquired) Immunity:

Humoral Immunity: Involves the production of antibodies by B cells, providing protection against extracellular pathogens.
Cellular Immunity: Involves the activation of T cells, which directly attack infected or abnormal cells.

c.Process of Immune Response:

- Recognition: Immune cells recognize antigens as foreign.
- Activation: Immune cells, especially T and B cells, become activated and undergo clonal expansion.
- Effector Phase: Activated cells carry out effector functions, such as antibody production, phagocytosis, and cell-mediated responses.
- Memory: Some activated cells become memory cells, providing immunological memory for faster and stronger responses upon re-exposure to the same antigen.

3.2 Vaccination against common communicable diseases:

3.2.1. Vaccination:

Vaccination is a strategy to induce immunity by exposing the immune system to harmless forms of pathogens or their antigens. This stimulates the production of memory cells, providing protection against future infections.

Vaccination is a crucial and highly effective public health measure aimed at preventing the spread of communicable diseases, also known as infectious or contagious diseases. The primary goal of vaccination is to stimulate the immune system to recognize and mount a defense against specific pathogens, such as bacteria or viruses, thus preventing the development of diseases or reducing their severity. Here is an overview of vaccination against communicable diseases:

3.2.2 Principles of Vaccination:

- Immunization Concept:

Vaccines contain weakened or inactivated forms of pathogens or pieces of them (antigens) that cannot cause the disease but are sufficient to stimulate an immune response.

- Herd Immunity:

When a significant portion of the population is vaccinated, it provides indirect protection to those who are not vaccinated or cannot be vaccinated due to medical reasons. This concept is known as herd immunity.

3.3 Common Vaccines and the Diseases Their Prevention:

- **Polio Vaccine:**

Disease: Poliomyelitis (polio).
Vaccine Types: Oral Polio Vaccine (OPV) and Inactivated Polio Vaccine (IPV).

- **Measles, Mumps, and Rubella (MMR) Vaccine:**

Diseases: Measles, mumps, and rubella.
Vaccine: Combined vaccine for all three diseases.

- **Diphtheria, Tetanus, and Pertussis (DTP) Vaccine:**

Diseases: Diphtheria, tetanus, and whooping cough (pertussis).
Vaccine: Combined vaccine containing antigens for all three diseases.

- **Hepatitis B Vaccine:**

Disease: Hepatitis B.
Vaccine: Protects against the hepatitis B virus.

- **Haemophilus influenzae type b (Hib) Vaccine**:

Disease: Invasive Hib disease (meningitis, pneumonia).
Vaccine: Prevents infections caused by Haemophilus influenzae type b.

- **Human Papillomavirus (HPV) Vaccine:**

Disease: HPV infection, which can lead to cervical cancer and other cancers.
Vaccine: Protects against certain strains of HPV.

- **Influenza (Flu) Vaccine:**

Disease: Influenza (seasonal flu).
Vaccine: Seasonal vaccines to protect against prevalent influenza strains.

- **Pneumococcal Conjugate Vaccine (PCV):**

Disease: Pneumococcal infections, including pneumonia and meningitis.

Vaccine: Protects against Streptococcus pneumoniae.

- **Varicella (Chickenpox) Vaccine:**

Disease: Chickenpox.
Vaccine: Prevents varicella infection.

- **Meningococcal Conjugate Vaccine**:

Disease: Meningococcal meningitis.
Vaccine: Protects against Neisseria meningitidis.

3.3.1 Importance and Benefits:

- Disease Prevention:

Vaccination prevents the onset of diseases and reduces the severity of symptoms if infection occurs.

- Public Health Impact:

Mass vaccination contributes to the control and eradication of certain diseases, reducing their prevalence in communities.

- Global Health Security:

Vaccination efforts contribute to global health security by preventing the spread of infectious diseases across borders.

- Economic Benefits:

Vaccination reduces healthcare costs associated with treating preventable diseases and minimizes the economic impact of illness on individuals and societies.

3.3.2Challenges and Considerations:

- Vaccine Hesitancy:

Some individuals or communities may be hesitant to accept vaccines due to concerns about safety, misinformation, or cultural factors.

- Access to Vaccines:

Ensuring equitable access to vaccines globally remains a challenge, with issues such as cost, distribution, and infrastructure.

- Emerging Diseases:

Ongoing research is necessary to develop vaccines for emerging infectious diseases and adapt existing vaccines to new strains.

In summary, vaccination is a cornerstone of preventive medicine, contributing significantly to the reduction of morbidity, mortality, and the overall burden of communicable diseases. Public health campaigns, education, and vaccination programs play crucial roles in achieving high vaccine coverage and maintaining herd immunity to protect populations from infectious threats.

3.3.4. Expanded Programme on Immunization:

Pakistan's Immunization program is in place since 1978. During this time, it has gone through a lot of improvement in vaccine management, vaccine delivery, introducing new vaccines in the program and vaccine coverage.

EPI in Pakistan is coordinated at National level via Federal Directorate of Immunization, Ministry of National Health Services, Regulation and Coordination (NHSR&C). The EPI primarily covers the mothers, infants and children for immunization. The immunization schedule is periodically updated as and when required depending upon the local disease burden and requirements.
Following is the EPI schedule for children birth till 16 months of age:

Figure 3.1: EPI schedule

It covers against 12 diseases through vaccines. The list is as follows:

Sr. No	Disease Name	Vaccine Name
1.	Childhood Tuberculosis	BCG
2.	Poliomyelitis	Oral Polio Vaccine (OPV) and Inactived Poliovirus Vaccine (IPV)
3.	Hepatitis B	Hepatitis B virus Vaccine, Pentavalent Vaccine
1. 4.	Diphtheria	Penta valent Vaccine
2. 5.	Pertussis	Penta Valent Vaccine
3. 6.	Tetanus	Penta Valent Vaccine
7.	Meningitis	Pentavalent Vaccine
8.	Pneumonia	PCV-10
9.	Diarrhea	Rotavirus vaccine
10.	Typhoid	TCV
11.	Measles	MR
4. 12.	Rubella	MR

Further, vaccination against tetanus through Tetanus Toxoid (TT) injection to pregnant mothers is also covered in this schedule. This tetanus injection helps the mother make antibodies first, avoiding infection and disease during labor. It also prevents neonatal tetanus due to unsanitary conditions in labour in the new born.

3.3.5 Types of Vaccines, Their Protection, and Side Effects:

Vaccines are critical tools in preventing the spread of infectious diseases by training the immune system to recognize and defend against specific pathogens. There are several types of vaccines, each designed to elicit an immune response that provides protection against particular diseases. Along with their benefits, vaccines may also have side effects. Here's a detailed exploration:

3.3.5.1. Live Attenuated Vaccines:

- Protection:

These vaccines contain weakened, live forms of the virus or bacteria.
The immune response closely mimics a natural infection, providing robust and long-lasting immunity.

- **Examples:**

i. BCG
ii. Measles, Mumps, Rubella (MMR)
iii. Oral Polio Vaccine (OPV)
iv. Yellow Fever

- **Side Effects:**

Mild symptoms similar to the natural infection may occur.Not recommended for immunocompromised individuals.

3.3.5.2. Inactivated (Killed) Vaccines:

- **Protection:**

These vaccines contain inactivated or killed forms of the virus or bacteria.
They stimulate an immune response without causing the disease.

- **Examples:**

i. Hepatitis A
ii. Polio (Inactivated Polio Vaccine - IPV)
iii. Influenza (injectable form)

- **Side Effects:**

Generally, mild reactions like soreness at the injection site.Booster shots may be required for some vaccines.

3.3.5.3. Subunit, Recombinant, or Conjugate Vaccines:

- Protection:

These vaccines use specific pieces of the virus or bacteria (subunits, recombinant proteins, or polysaccharides) to stimulate an immune response.
May include protein subunits or fragments of the pathogen.

- **Examples:**

i. Human Papillomavirus (HPV)
ii. Haemophilus influenzae type b (Hib)
iii. Hepatitis B

- **Side Effects:**

Generally well-tolerated with mild local reactions. Usually, no risk of causing the disease.

3.3.5.4 Viral Vector Vaccines:

- **Protection:**

These vaccines use a harmless virus (vector) to deliver genetic material from the target virus, instructing cells to produce viral antigens.
Elicits a strong immune response.

- **Examples:**

i. Oxford-AstraZeneca COVID-19 vaccine
ii. Johnson & Johnson's COVID-19 vaccine

- **Side Effects:**

Similar to other vaccines, with possible temporary side effects like soreness, fever, or fatigue.

3.3.5.5. mRNA Vaccines:

- **Protection:**

These vaccines use messenger RNA (mRNA) to instruct cells to produce viral proteins, triggering an immune response.

Rapid development and adaptability.

- **Examples:**

i. Pfizer-BioNTech COVID-19 vaccine
ii. Moderna COVID-19 vaccine

- **Side Effects:**

Local reactions at the injection site and temporary flu-like symptoms.

3.3.5.6. Toxoid Vaccines:

- **Protection:**

These vaccines use inactivated toxins produced by bacteria rather than the live bacteria themselves.Induces immunity against the toxins produced by the pathogen.

- **Examples:**

i. Diphtheria
ii. Tetanus

- **Side Effects:**

Typically mild and localized, such as redness or swelling at the injection site.

3.3.5.7.Adverse Effects of Vaccines (Side Effects of Vaccination):

- Local Reactions:

Pain, redness, or swelling at the injection site are common and usually temporary.

- Systemic Reactions:

Fever, fatigue, headache, and muscle pain may occur temporarily after vaccination.

- Allergic Reactions:

Serious allergic reactions are rare but can occur. Anaphylaxis is an extremely rare severe allergic reaction.

- Syncope (Fainting):

Fainting can occur after vaccination, particularly in adolescents.

It's important to note that the benefits of vaccination in preventing serious illness and deaths far outweigh the risks of potential side effects. Vaccination programs are continually monitored for safety, and rigorous testing is conducted before vaccines are approved for use. Individuals with concerns about vaccines should consult healthcare professionals for personalized information and guidance. Vaccination remains a cornerstone of public health efforts to control and eradicate infectious diseases.

3.4.Safe injection practices and disposal of injection wastes:

Safe injection practices and proper disposal of injection wastes are critical components of healthcare practices aimed at preventing the transmission of infections and ensuring the safety of both healthcare workers and patients. Adhering to strict guidelines in the administration of injections and the disposal of associated materials is essential to minimize the risk of needle stick injuries, contamination, and the spread of infectious diseases. Here is a detailed note on safe injection practices and the disposal of injection wastes:

3.4.1.Safe Injection Practices:

- **Use of Sterile Equipment**:

Only use sterile, single-use needles and syringes for each injection to prevent the introduction of pathogens into the bloodstream.

- **Aseptic Technique:**

Adhere to aseptic techniques when preparing and administering injections to minimize the risk of contamination.

- **Hand Hygiene:**

Healthcare providers should practice proper hand hygiene, including handwashing or using alcohol-based hand sanitizers, before and after administering injections.

- **Proper Skin Preparation:**

Cleanse the injection site with an appropriate antiseptic solution before administering injections to reduce the risk of infection.

- **Needle Safety:**

Avoid recapping needles after use and use safety-engineered devices to prevent needlestick injuries.

- **Avoid Multi-Dose Vials for Multiple Patients:**

Whenever possible, use single-dose vials and ampoules to prevent contamination between patients.

- **Proper Disposal of Sharps:**

Dispose of needles, syringes, and other sharps in puncture-resistant containers immediately after use to prevent accidental needlestick injuries.

- **Education and Training:**

Provide healthcare workers with proper education and training on safe injection practices to ensure adherence to guidelines.

- **Monitoring and Surveillance:**

Establish monitoring and surveillance systems to assess and ensure compliance with safe injection practices.

3.4.2.Disposal of Injection Wastes:

- **Sharps Containers:**

Use puncture-resistant containers specifically designed for the disposal of sharps, such as needles and syringes. Containers should be labeled, tightly sealed, and easily accessible.

- **Single-Use Containers:**

Do not reuse containers meant for the disposal of sharps. Once filled, they should be closed, sealed, and replaced with a new container.

- **Proper Sealing:**

Ensure that sharps containers are tightly sealed to prevent accidental needle-stick injuries or spillage during transport.

- **Avoid Overfilling:**

Do not overfill sharps containers. Follow the manufacturer's guidelines on filling levels to maintain safety during disposal.

- **Segregation of Wastes:**

Segregate hazardous waste, such as sharps, from regular medical waste. Properly label and handle each type of waste as per regulatory guidelines.

- **Transportation and Disposal Regulations:**

Adhere to local, national, and international regulations regarding the transportation and disposal of medical waste. Follow guidelines on packaging, labeling, and documentation.

- **Disposal Facilities:**

Utilize approved and licensed medical waste disposal facilities for the final disposal of medical waste, ensuring compliance with environmental regulations.

- **Training and Awareness:**

Provide ongoing training and awareness programs for healthcare staff regarding proper waste disposal procedures and regulatory requirements.

- **Regular Audits:**

Conduct regular audits and assessments of waste disposal practices to identify and address any deviations from guidelines.

Conclusion:
Safe injection practices and proper disposal of injection wastes are integral aspects of healthcare infection control. Strict adherence to guidelines, proper training of healthcare workers, and the implementation of robust waste disposal systems contribute to the overall safety and well-being of both healthcare providers and patients. By maintaining high standards in these practices, healthcare facilities can effectively prevent the transmission of infections and promote a safe healthcare environment.

3.5. Preparation and administration of vaccines:

The preparation and administration of vaccines are crucial steps in public health initiatives aimed at preventing the spread of infectious diseases. Proper procedures ensure the

efficacy of vaccines, minimize the risk of contamination, and contribute to the overall success of vaccination programs.

3.5.1. Vaccine Storage and Handling:

- Refrigeration: Most vaccines must be stored in refrigerators at recommended temperatures to maintain their potency.
- Temperature Monitoring: Regularly monitor and record storage temperatures to ensure vaccines remain effective.
- Cold Chain Management: Follow a strict cold chain process from manufacturing to administration to prevent temperature deviations.

3.5.2. Vaccine Preparation:

- **Reconstitution (if necessary):**

Some vaccines come in a powdered or lyophilized form and require reconstitution with a diluent before administration.
Follow manufacturer instructions for reconstitution, using only the recommended diluent.

- **Single-Dose Vials:**

Use single-dose vials whenever possible to minimize the risk of contamination.
Follow aseptic techniques when drawing the vaccine into a syringe.

- **Multi-Dose Vials:**

Multi-dose vials may be used when a single-dose presentation is not feasible.
Follow guidelines for the proper handling of multi-dose vials to avoid contamination between patients.

- **Checking Expiry Dates**:

Always check the expiration date of the vaccine before administration. Do not use expired vaccines.

- **Mixing Vaccines:**

If multiple vaccines are administered simultaneously, ensure compatibility, and follow recommended guidelines for administration.

3.5.3. Preparation of the Recipient:

- **Screening and Consent:**

Screen recipients for contraindications and precautions. Obtain informed consent before administering vaccines.

- **Patient Education:**

Provide information about the vaccine, potential side effects, and the importance of completing the vaccination schedule.

- **Reviewing Medical History**:

Assess the recipient's medical history, including allergies and previous adverse reactions to vaccines.

- **Preparing the Injection Site:**

Cleanse the injection site with an appropriate antiseptic to minimize the risk of infection.

3.5.4. Administration Techniques:

- **Intramuscular (IM) Injections:**

Administer most vaccines intramuscularly, typically in the deltoid muscle for adults and the anterolateral thigh for infants.
Use the appropriate needle length and gauge based on age and muscle mass.

- **Subcutaneous (SC) Injections**:

Some vaccines, like certain influenza vaccines, can be administered subcutaneously.
Use proper technique and needle size.

- **Intradermal (ID) Injections:**

Rarely used for vaccines but may be employed for specific tests like the tuberculin skin test.

- **Correct Needle Insertion Angle:**

Ensure the correct angle for needle insertion to optimize vaccine absorption.

3.5.5. Post-Vaccination Care:

- **Observation Period:**

Observe recipients for a short period after vaccination to monitor for immediate adverse reactions.

- **Documentation:**

Document vaccine administration details, including the date, type of vaccine, lot number, and site of injection.

- **Providing Vaccine Information Sheets:**

Provide recipients with vaccine information sheets (VIS) that detail the vaccine, its benefits, and potential side effects.

- **Reporting Adverse Events:**

Healthcare providers should report any significant adverse events to the appropriate health authorities.

3.5.6. Emergency Preparedness:

- **Anaphylaxis Kit:**

Have an anaphylaxis kit ready for immediate treatment in case of severe allergic reactions.

- **Training:**

Healthcare providers should be trained in recognizing and managing vaccine-related emergencies.

Conclusion:
The preparation and administration of vaccines require meticulous attention to detail, adherence to guidelines, and ongoing education for healthcare providers. Proper vaccine management and administration practices are essential for the success of immunization programs, ensuring the safety and well-being of individuals and communities. By following established protocols, healthcare professionals contribute to the overall effectiveness of vaccination campaigns in preventing and controlling infectious diseases.

3.6.Cold chain system:

The cold chain system is a temperature-controlled supply chain that is designed to maintain the integrity and efficacy of temperature-sensitive products, such as vaccines, drugs, and certain biologics. This system ensures that these products are stored, transported, and delivered within a specific temperature range, safeguarding their potency and effectiveness. The cold chain is particularly critical in the healthcare sector, where vaccines play a vital role in preventing and controlling infectious diseases.

3.6.1 Key Components of the Cold Chain System:

Storage Facilities:

- Refrigerators and Freezers: These appliances are designed to maintain precise temperature ranges. Refrigerators are typically used for storing vaccines, while freezers are employed for specific vaccines that require ultra-low temperatures.

- Cold Rooms: Larger storage spaces used in central storage facilities, pharmaceutical warehouses, or distribution centers.

Temperature Monitoring Devices:

- Data Loggers: Electronic devices that continuously monitor and record temperature data throughout the cold chain. They provide a historical record of temperature fluctuations.

- Temperature Alarms: Alerts and alarms triggered when the temperature deviates from the recommended range, allowing for immediate corrective action.

Transportation:

- Cold Boxes and Coolers: Insulated containers used for short-term transportation of vaccines and other temperature-sensitive products.

- Refrigerated Trucks and Containers: Vehicles designed to maintain the required temperature during the transportation of larger quantities of vaccines over longer distances.

- Thermal Packaging: Insulated packaging materials used during transport to protect products from temperature fluctuations.

Handling and Packaging:

- Cold Packs and Ice Packs: Used to maintain the desired temperature inside containers during transportation.

- Temperature Labels: Indicators that change color or display a visual signal when exposed to temperatures outside the recommended range.

Training and Quality Assurance:

- Education and Training: Training programs for personnel involved in the cold chain to ensure proper handling, storage, and transportation.

- Quality Control: Regular inspections, audits, and assessments to ensure that the cold chain system is functioning effectively and meeting regulatory standards.

Importance of the Cold Chain System:

- **Preservation of Vaccine Potency:**

Maintaining the recommended temperature range ensures that vaccines retain their potency and efficacy.

- **Prevention of Wastage:**

Proper cold chain management minimizes the risk of vaccine wastage due to exposure to incorrect temperatures.

- **Global Immunization Programs:**

Facilitates large-scale immunization efforts by enabling the safe and effective distribution of vaccines worldwide.

- **Public Health Impact:**

Contributes to the success of vaccination programs, leading to the prevention and control of infectious diseases.

3.6.2Challenges and Considerations:

- **Infrastructure:**

In some regions, limited infrastructure poses challenges for maintaining a robust cold chain system.

- **Power Outages:**

Interruptions in the electricity supply can compromise temperature control in storage facilities.

- **Remote Areas:**

Reaching remote or underserved areas may pose difficulties in maintaining the cold chain.

- **Equipment Maintenance:**

Regular maintenance of refrigeration equipment is essential to prevent malfunctions.

Conclusion:
The cold chain system is a critical infrastructure in healthcare, ensuring that vaccines and other temperature-sensitive products remain effective from manufacturing to administration. Maintaining the cold chain is a collaborative effort involving healthcare professionals, logistics providers, and policymakers. By addressing challenges and embracing technological advancements, the global community can strengthen the cold chain system, contributing to the success of immunization programs and the overall improvement of public health

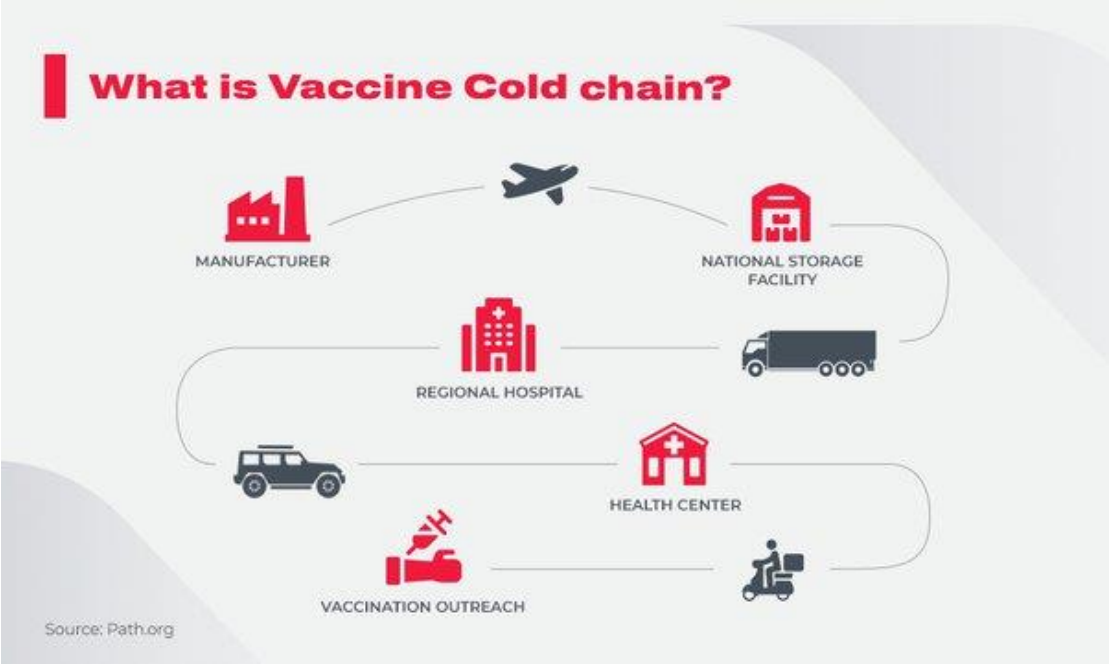


Figure: 3.2: Cold chain Source: https://www.quora.com/What-is-cold-chain-management-system

Figure: 3.2 Cold Chain Equipment (Unit Level)
Source: Internet R60178374_g.jpg (638×479) (open-pr.com)

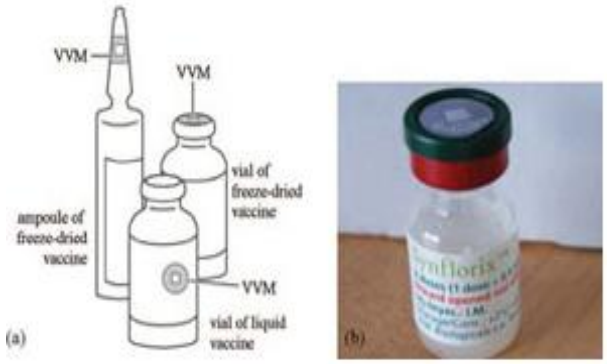


Figure: 3.4(a) Vaccine Vial Monitors (VVMs) on the neck of an ampoule, or on the label or cap of a vaccine vial (Source: WHO, 2004, as in Figure 6.1, p.10). (b) A vial of liquid PCV10 vaccine with the VVM on the cap (Photo: WHO).

3.7. Supplementary vaccination activities:

Also known as Supplemental Immunization Activities (SIAs), refer to targeted vaccination campaigns conducted in addition to routine immunization programs. These campaigns aim to reach specific populations or geographical areas to provide additional protection against vaccine-preventable diseases. Supplementary vaccination activities play a crucial role in achieving and sustaining high vaccination coverage, especially in situations where routine

immunization may not be sufficient to control outbreaks or reach certain vulnerable populations.

3.7.1 Objectives of Supplementary Vaccination Activities:

- **Targeted Coverage Improvement:**

Reach populations or areas with lower routine immunization coverage to increase vaccine uptake.

- **Outbreak Response:**

Control and prevent outbreaks of vaccine-preventable diseases, especially in areas with an increased incidence of cases.

- **Reaching High-Risk Groups:**

Focus on specific groups, such as mobile populations, refugees, or internally displaced persons, who may have limited access to routine healthcare services.

- **Introducing New Vaccines:**

Introduce newly developed vaccines or incorporate additional antigens into the existing vaccination schedule.

- **Closing Immunization Gaps**:

Address gaps in immunity by providing booster doses or catch-up vaccinations for those who may have missed routine immunizations.

3.7.3 Components of Supplementary Vaccination Activities:

- **Microplanning:**

Detailed planning at the local level to identify target populations, assess logistics, and ensure adequate resources.

- **Social Mobilization**:

Community engagement and awareness campaigns to inform and educate the population about the upcoming vaccination activities.

- **Training and Capacity Building:**

Training of healthcare workers and volunteers to ensure they are equipped to administer vaccines, manage logistics, and address potential challenges.

- **Cold Chain Management:**

Ensure the maintenance of a robust cold chain system to preserve vaccine potency during storage and transportation.

- **Data Management:**

Accurate recording and reporting of vaccination data to monitor coverage and assess the success of the supplementary activities.

- **Monitoring and Supervision:**

Regular supervision and monitoring of vaccination sites to ensure compliance with protocols, assess performance, and address issues promptly.

3.7.3 Types of Supplementary Vaccination Activities:

- **Mass Vaccination Campaigns:**

Large-scale campaigns targeting entire populations in a specific geographic area.

- **Follow-Up Campaigns:**

Additional rounds of vaccination conducted to ensure that all eligible individuals receive the required doses.

- **Outreach Sessions**:

Bringing vaccination services to communities that may face barriers accessing healthcare facilities.

- **School-Based Campaigns**:

Targeting school-age children to ensure high coverage and protect against diseases prevalent in this age group.

- **Targeted Populations:**

Focusing on specific populations, such as high-risk groups or those with limited access to routine immunization services.

3.7.4.Challenges and Considerations:

- **Logistical Challenges:**

Ensuring the timely delivery of vaccines, maintaining the cold chain, and managing supplies.

- **Community Acceptance:**

Addressing concerns and misconceptions within communities to enhance acceptance of supplementary vaccination activities.

- **Coverage Equity:**

Reaching vulnerable and marginalized populations to ensure equitable vaccine coverage.

- **Coordination and Collaboration**:

Coordinating efforts among various stakeholders, including government agencies, NGOs, and international partners.

Success Stories:

- **Polio Eradication Efforts:**

SIAs have played a crucial role in the global effort to eradicate polio by targeting high-risk areas and ensuring widespread vaccine coverage.

- **Measles and Rubella Elimination:**

Campaigns targeting school-age children and high-risk areas have been instrumental in efforts to eliminate measles and rubella in various regions.

Conclusion:
Supplementary vaccination activities are integral to achieving and maintaining high vaccination coverage, preventing outbreaks, and reaching populations that may be underserved by routine immunization programs. The success of these campaigns relies on meticulous planning, effective implementation, and community engagement. As global

efforts continue to expand vaccination coverage, supplementary activities remain a vital strategy in the ongoing battle against vaccine-preventable diseases.

Important Concepts

- Know Immunity and its types
- Know Vaccines, types and its adverse effect
- Know EPI Schedule for children and pregnant mothers
- Know Cold Chain and VVM
- Know Supplementary Immunization activities
- Know status of polio eradication in Pakistan and its reasons
- Know safe injection practices and proper disposal of vaccines

Sample Question:

What is EPI? Enlist the vaccines and schedule of vaccination for children under two years and pregnant females.

Unit 4
Vector Borne Diseases

Objectives:

The student shall be able to know, enumerate, and understand important diseases spread by vectors and ways to prevent them. Following is the outline of the chapter:

1. **Detection of cases of malaria and dengue**
2. **Instruments and techniques for insecticidal and larvicidal activities**
3. **Precautions and personal protection during spraying operations**

4.1. Detection of cases of malaria and dengue

Malaria and dengue fever are mosquito-borne infectious diseases caused by parasites (malaria) and viruses (dengue) transmitted by the bites of infected mosquitoes. Early detection of cases is crucial for prompt and effective management, as both diseases can lead to severe complications if left untreated.

4.2.1 Detection of Malaria Cases:

4.1.1.1 Clinical Presentation:

Malaria often presents with symptoms such as fever, chills, sweats, headache, nausea, and muscle aches. However, the clinical presentation can vary depending on the species of the malaria parasite.

4.1.1.2. Diagnostic Tests:

- Microscopic Examination of Blood Smears:

Microscopic examination of blood smears remains the gold standard for malaria diagnosis. Giemsa-stained blood smears are examined for the presence of malaria parasites within red blood cells.

- Rapid Diagnostic Tests (RDTs):

RDTs detect specific malaria antigens in the blood. They provide a quick and reliable diagnosis, especially in resource-limited settings where microscopic examination may not be readily available.

- Polymerase Chain Reaction (PCR):

Molecular techniques like PCR can identify and differentiate malaria species accurately. PCR is particularly useful for confirming cases and in research settings.

4.1.1.3. Laboratory Investigations:

- Complete blood count (CBC) can reveal characteristics associated with malaria infection, such as thrombocytopenia (low platelet count) and anemia.

4.1.1.4. Clinical History and Epidemiological Factors:

Obtaining a detailed travel history, including recent visits to malaria-endemic regions, helps in early suspicion and diagnosis.

4.1.1.5. Serological Tests:

Serological tests may be used to detect antibodies against malaria parasites. However, these are generally not as reliable for acute diagnosis and are often used for epidemiological studies.

4.1.2. Detection of Dengue Cases:

4.1.2.1. Clinical Presentation:

Dengue fever typically presents with sudden-onset high fever, severe headaches, pain behind the eyes, joint and muscle pain, rash, and mild bleeding tendencies. Severe forms of dengue (dengue hemorrhagic fever or dengue shock syndrome) may involve more severe symptoms and complications.

4.1.2.2. Diagnostic Tests:

- Molecular Tests:

Reverse transcription-polymerase chain reaction (RT-PCR) can detect the viral RNA in blood, providing a specific diagnosis. This method is most effective in the early stages of infection.

- NS1 Antigen Test:

Rapid tests detecting the non-structural protein 1 (NS1) antigen are commonly used for early diagnosis. They are particularly useful in the first few days of illness.

- IgM and IgG Antibody Tests:

Serological tests detecting dengue-specific antibodies (IgM and IgG) can confirm past or recent infections. IgM antibodies are typically detectable during the acute phase.

4.1.2.3. Complete Blood Count (CBC):

CBC may reveal a rapid decrease in platelet count, a characteristic feature of dengue infection.

4.1.2.4. Tourniquet Test:

The tourniquet test involves inflating a blood pressure cuff on the arm to check for petechiae (small red or purple spots) on the skin, which may indicate dengue infection.

4.1.2.5. Clinical History and Epidemiological Factors:

Similar to malaria, obtaining a detailed travel history and information about recent exposure to areas with dengue transmission is crucial for diagnosis.

4.1.3 Common Considerations for Both Diseases:

- **Vector Surveillance:**

Monitoring mosquito populations, especially Aedes mosquitoes for dengue and Anopheles mosquitoes for malaria, helps in assessing the risk of transmission in a given area.

- **Travel History:**

Given that both diseases are prevalent in specific geographic regions, a thorough travel history is essential for accurate diagnosis.

- **Timely Reporting:**

Rapid reporting of suspected cases to public health authorities is critical for the implementation of control measures and prevention of outbreaks.

- **Public Awareness:**

Educating communities about the signs and symptoms of malaria and dengue encourages early reporting and seeking medical attention.

- **Integrated Surveillance:**

Integrated surveillance systems that encompass clinical, laboratory, and epidemiological data contribute to a comprehensive understanding of the prevalence and distribution of both diseases.

Conclusion:

Early detection of cases of malaria and dengue is pivotal for effective patient management, outbreak control, and prevention of severe complications. A combination of clinical assessment, diagnostic tests, and epidemiological information enhances the accuracy of diagnosis and allows for timely intervention. Public health efforts should focus on strengthening diagnostic capacities, promoting awareness, and implementing robust surveillance systems to mitigate the impact of these mosquito-borne diseases.

4.2. Instruments and techniques for insecticidal and larvicidal activities

Insecticidal and larvicidal activities involve the use of various instruments and techniques to control and eliminate insect pests and their larvae. These activities can be are crucial components of vector control programs aimed at preventing the spread of vector-borne diseases. Since no single method is likely to provide a solution in all situations, the present trend is to adopt an ‘integrated approach’ for vector control.
Broadly these activities are discussed under following headings:

a. Anti-larval measures: include environmental control, chemical control and biological control
b. Anti-adult measures: include residual sprays, space sprays and genetic control.
c. Protection against bites and physical contact with the vector.

Here is a detailed note on the instruments and techniques used for insecticidal and larvicidal activities:

4.2.1 **Instruments for Insecticidal and Larvicidal Activities:**

a.Sprayers:

- Knapsack Sprayers: Portable sprayers worn on the back, suitable for small-scale applications in agriculture and vector control.
- Handheld Sprayers: Compact and easy-to-use sprayers for targeted application in homes, offices, and public spaces.
- Power Sprayers: Motorized sprayers for large-scale applications in agricultural fields and outdoor spaces.

b. Fogging Machines:

- Thermal Foggers: Produce a fine mist of insecticide particles through the combustion of a fogging solution. Effective for outdoor and large-scale applications.
- Cold Foggers (ULV Foggers): Use high-pressure air to create ultra-low volume (ULV) droplets, suitable for indoor and outdoor spaces.

c.Dusters:

- Hand Dusters: Manual devices for applying insecticidal dust or powder in targeted areas.
- Motorized Dusters: Powered devices for large-scale dusting in agricultural settings.

d. Larvicidal Applicators:

- Granular Spreaders: Equipment for broadcasting larvicidal granules over water bodies to target mosquito larvae.
- Aerial Application Systems: Used for the aerial dispersal of larvicides over large water bodies.

e. Bait Stations:

Containers or devices designed to attract and kill insects using bait or insecticidal substances. Used for targeted pest control in specific areas.

f. Insecticide-Treated Nets (ITNs):

Nets treated with insecticides, primarily used to protect against mosquitoes. Widely employed in malaria control programs.

g. Screening:

Screening of buildings with thick mesh of copper or bronze gauze.

h. Repellents:

Diethyltolumaide (deet) (e.g. mospel etc) has been found to be an outstanding repellant against mosquito bites in particular.

Techniques for Insecticidal and Larvicidal Activities:

i. Indoor Residual Spraying (IRS):

Application of insecticides to the interior surfaces of dwellings, targeting resting mosquitoes. Commonly used for malaria vector control.

j. Space Spraying:

Spraying insecticides in the air to create a fine mist or fog, targeting flying adult mosquitoes. Effective in outdoor and indoor spaces.

k. Larviciding:

- Source Reduction: Removing or treating breeding sites to eliminate mosquito larvae. This includes proper waste management, clearing stagnant water, and using larvicidal agents.

- Biological Larvicides: Introducing natural predators, such as mosquito larvae-eating fish or bacteria, to control larvae in aquatic habitats.

- Chemical Larvicides: Application of chemicals, such as temephos or methoprene, to water bodies to kill mosquito larvae.

- Residual Spraying in Agriculture:Application of insecticides on crops and plants to control agricultural pests, reducing the risk of vector-borne diseases.

l. Space Treatment for Indoor Pests:

Applying insecticides indoors to control pests like cockroaches and ants. Can involve the use of sprays, aerosols, or bait stations.

- Rotational Insecticide Use:

Alternating the use of different insecticides to prevent the development of resistance in insect populations.

- Community Participation:

Engaging communities in vector control activities, including proper waste disposal, maintaining clean surroundings, and reporting potential breeding sites.

- Personal Protective Measures:

Providing individuals with personal protective measures, such as insecticide-treated bed nets and repellents, to reduce contact with disease vectors.

4.3. Precautions and personal protection during spraying operations:

Spraying operations involving insecticides or other chemical agents require strict adherence to precautions and personal protection measures to ensure the safety of those involved in the application and to minimize the risk of adverse health effects. Whether for vector control, agricultural pest management, or indoor pest control, following proper precautions is crucial.

4.3.1. Precautions:

- Risk Assessment:

Conduct a thorough risk assessment before spraying to identify potential hazards, including toxicity of the chemical, environmental impact, and exposure risks.

- Appropriate Formulation:

Choose the appropriate formulation of the insecticide, considering factors such as concentration, persistence, and mode of action.

- Weather Conditions:

Avoid spraying during windy conditions to prevent drift and ensure the effective deposition of the insecticide at the target site.

- Protective Buffer Zones:

Establish protective buffer zones around sensitive areas, such as water bodies, schools, and residential areas, to minimize unintended exposure.

- Warning Signs and Notifications:

Clearly mark sprayed areas with warning signs and inform the public about the spraying schedule to reduce the risk of accidental exposure.

- Restricted Entry Intervals (REIs):

Enforce REIs to limit access to treated areas for a specified period, ensuring that individuals do not enter before it is safe.

- Proper Equipment Calibration:

Calibrate spraying equipment regularly to ensure accurate and controlled application of the insecticide, avoiding overuse or underuse.

- Avoidance of Contamination:

Prevent contamination of water sources, food, and personal items by properly handling and storing insecticides.

- Emergency Preparedness:

Have emergency response plans in place, including protocols for accidental spills, exposure incidents, and first aid measures.

4.3.2 Personal Protection:

- Protective Clothing:

Wear appropriate protective clothing, including long-sleeved shirts, long pants, chemical-resistant gloves, and boots, to minimize skin contact.

- Respiratory Protection:

Use respiratory protection, such as masks or respirators, to prevent inhalation of airborne insecticide particles. The type of respiratory protection depends on the toxicity of the chemical being used.

- Eye Protection:

Wear protective goggles or a face shield to prevent eye exposure. Chemical-resistant goggles should be used, especially in situations where there is a risk of splashing.

- Head Protection:

Use a hat or a hood to protect the head from direct exposure to insecticides.

- Chemical-Resistant Apron:

When handling concentrated insecticides, use a chemical-resistant apron to protect the torso.

- Properly Fitted Clothing:

Ensure that all protective clothing fits properly and covers exposed skin to minimize the risk of contact with the insecticide.

- Decontamination Supplies:

Keep decontamination supplies, such as water, soap, and towels, readily available for immediate use in case of accidental exposure.

- Training and Education:

Provide thorough training to individuals involved in spraying operations on the proper use of personal protective equipment (PPE) and safety protocols.

- Medical Surveillance:

Establish a system for medical surveillance to monitor the health of individuals regularly exposed to insecticides.

- Hygiene Practices:

Encourage good hygiene practices, including regular handwashing, after handling insecticides and before eating, drinking, or smoking.

Conclusion:
The precautions and personal protection measures during spraying operations are essential to safeguard the health and well-being of those involved in the application process and to prevent unintended exposure to the general population. Adhering to safety protocols, using appropriate protective equipment, and implementing strict control measures contribute to the effective and responsible use of insecticides in various applications. Ongoing training, monitoring, and evaluation are crucial elements in maintaining a safe working environment during spraying operations.

Important Concepts

- Know basic terminologies regarding vectors
- Know the life cycle of arthropods esp. Mosquito
- Know diseases spread by different vectors
- Know Integrated Vector Management measures for all stages of vectors development

Sample Question:

Enlist the diseases spread by mosquito. What anti-larval and anti-adult measure will you adopt to prevent mosquito bites amongst the community where you are working as a public health technician?

Most common mosquito-borne diseases

Mosquito	Type of Mosquito	Disease caused
	Aedes	Chikungunya Dengue Lymphatic filariasis Rift Valley fever Yellow Fever Zika
	Anopheles	Lymphatic filariasis Malaria
	Culex	Japanese encephalitis Lymphatic filariasis West Nile fever

Table: 4.1 showing different types of mosquito and diseases spread by it
Source: K.Park 24th edition, Environment and Health pg.809

Unit 5: Public Health Administration

Objectives:

The student shall be able to understand and apply the following terms practically:

1. **Definition of public health and preventive medicine**
2. **Epidemiological basis for public health**
3. **Concepts of health and disease**
4. **Non-communicable diseases**
5. **Levels of prevention**

5.1 Definition of public health and preventive medicine

5.1.1. Public Health (Winslow Definition):

Public health is “the science and art of preventing disease, prolonging life, and promoting health through the organized efforts and informed choices of society, organizations, public and private communities, and individuals.” — CEA Winslow Key Terms in Public Health:

- Clinical Care and Management: prevention, treatment, and management of illness and preservation of mental and physical well-being through services offered by medical and allied health professions; also known as health care. Determinant: factor that contributes to the generation of a trait.
- Epidemic: occurrence in a community or region of cases of an illness, specific health-related behavior, or other health-related event clearly in excess of normal

expectancy. Both terms are used interchangeably; however, epidemic usually refers to a larger geographic distribution of illness or health-related events.

- Pandemic: denoting a disease affecting or attacking the population of an extensive region, country, or continent Health outcome: result of a medical condition that directly affects the length or quality of a person's life.
- Intervention: action or ministration that produces an effect or is intended to alter the course of a pathologic process.
- Population health: approach to health that aims to improve the health of an entire population.
- Prevention: action so as to avoid, forestall, or circumvent a happening, conclusion, or phenomenon (e.g., disease) (Source: Key Public health Terms, Centres for Disease Control and Prevention)

Organizing the medical, nursing and allied services for health promotion and prevention of diseases, its early diagnosis, prompt treatment and disability limitation requires development of the social machinery that will ensure to every individual in the community a standard of living adequate for maintenance of health.

5.1.2. Preventive Medicine:

The science and art of preventing disease, prolonging life and promoting physical, mental health and efficiency.

5.2. Epidemiological basis for Public Health

5.2.1.Epidemiology:

The "study of distribution and determinants of health-related states or events in specific populations and the application of that study to the control of health problems."

Epidemiology is a crucial field within public health that serves as the foundation for understanding and addressing health issues at the population level. It involves the study of the distribution and determinants of health-related states or events in specified populations, as well as the application of this knowledge to control health problems. The epidemiological basis for public health is multifaceted and plays a vital role in shaping health policies, interventions, and preventive strategies.

One fundamental aspect of the epidemiological basis for public health is the investigation of disease patterns and their distribution within populations. Epidemiologists analyze the occurrence of diseases, injuries, and other health-related events to identify trends, hotspots, and vulnerable populations. This information is essential for public health practitioners to allocate resources effectively, target interventions where they are most needed, and develop strategies for disease prevention and control.

Furthermore, epidemiology explores the determinants of health outcomes, seeking to understand the factors that contribute to the occurrence of diseases or the maintenance of health. These determinants can include biological, environmental, behavioral, and social factors. By identifying the root causes of health issues, public health professionals can design interventions that address these factors, leading to more effective and targeted health promotion and disease prevention efforts.

Epidemiology also provides a scientific basis for the assessment of risk factors associated with various health conditions. Through cohort and case-control studies, epidemiologists can establish associations between exposures and outcomes, helping to identify factors that increase or decrease the risk of disease. This information is vital for developing evidence-based recommendations and interventions to reduce the burden of diseases and improve overall population health.

In addition to understanding disease distribution and determinants, epidemiology contributes to the evaluation of public health interventions. By assessing the impact of preventive measures, treatment strategies, and health policies, epidemiologists can determine the effectiveness of interventions in real-world settings. This evidence-based approach ensures that public health programs are not only well-intentioned but also proven to produce positive health outcomes.

Overall, the epidemiological basis for public health is essential for guiding public health practice and policy. It provides the tools and methods necessary for the surveillance of health events, the identification of risk and protective factors, and the evaluation of interventions. Through the insights gained from epidemiological research, public health professionals can make informed decisions, allocate resources wisely, and work towards improving the health and well-being of populations on a global scale.

5.3. Concepts of health and disease

5.3.1. Health: is a state of complete physical, mental and social well-being not merely an absence of disease or infirmity. (World Health Organization, 1948)

5.3.2.Disease: any harmful deviation from the normal structural or functional state of an organism, generally associated with certain signs and symptoms and differing in nature from physical injury.

The concepts of health and disease are fundamental to understanding the overall well-being of individuals and populations. Health is a multidimensional state that goes beyond the mere absence of disease. It encompasses physical, mental, and social well-being, reflecting a dynamic equilibrium between an individual and their environment. Spiritual, emotional, vocational, cultural etc. are few other dimensions. This holistic perspective is

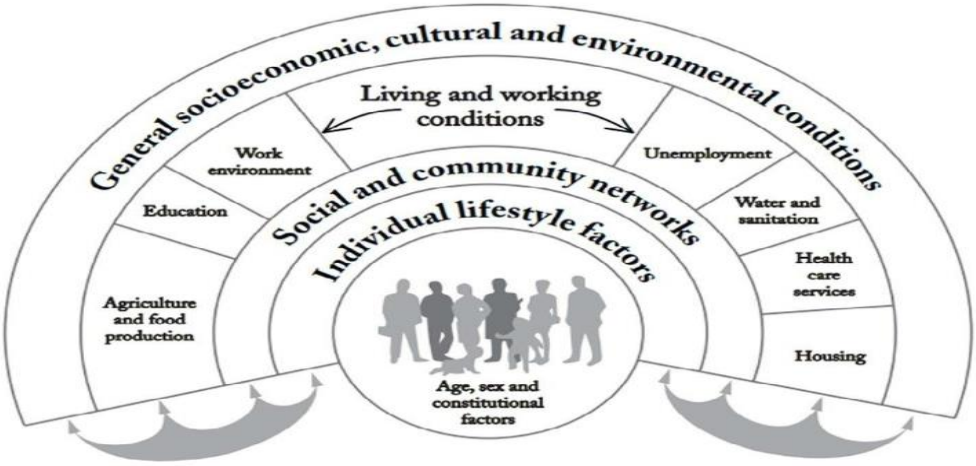
encapsulated in the World Health Organization's definition of health as **"a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."**

Disease, on the other hand, is often characterized by a disruption of this equilibrium, manifesting as deviations from normal biological, psychological, or social functioning. Diseases can be acute or chronic, infectious or non-communicable, and they can affect individuals differently based on factors such as genetics, lifestyle, and environmental exposures. Understanding the etiology, pathophysiology, and impact of diseases is crucial for diagnosis, treatment, and prevention.

The biomedical model traditionally conceptualizes health and disease through a purely biological lens, focusing on the physiological processes and anatomical structures associated with illness. However, contemporary perspectives recognize the importance of broader determinants, including social, economic, and environmental factors. The social model of health emphasizes the role of social structures, cultural norms, and economic inequalities in shaping health outcomes, highlighting the need for addressing social determinants to promote health equity.

Furthermore, the biopsychosocial model integrates biological, psychological, and social factors to comprehensively understand health and disease. It recognizes the interconnectedness of physical health, mental well-being, and social context in shaping an individual's overall health status. This model underscores the importance of considering not only the biological aspects of disease but also psychological and social factors that influence health outcomes and recovery.

Preventive measures and health promotion strategies aim to maintain or improve health and prevent the onset of diseases. These efforts often involve lifestyle modifications, vaccination programs, and public health campaigns. Health education plays a crucial role in empowering individuals to make informed decisions about their well-being, promoting a proactive approach to health maintenance.



Source: Dahlgren and Whitehead

Figure 5.1 showing Determinants of health

Conclusion:
The concepts of health and disease are multi-sided and evolving. A comprehensive understanding requires consideration of biological, psychological, and social dimensions, acknowledging the dynamic interplay between individuals and their environments. Embracing a holistic approach to health not only informs clinical practice and public health interventions but also contributes to the broader goal of enhancing the overall quality of life for individuals and communities.

5.4. Non-communicable diseases (NCDs):

Definition: It refers to diseases, which cannot transfer from one person to another person, but may transfer genetically from one generation to the next generation.

Non-communicable diseases are often chronic in nature, characterized by long durations and slow progression. NCDs encompass a range of health conditions, including cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases, among others. These diseases pose a significant global health challenge, contributing to a substantial portion of morbidity and mortality worldwide.

- Cardiovascular diseases, such as heart disease and stroke, are leading causes of NCD-related deaths. Risk factors for these conditions include unhealthy diets, physical inactivity, tobacco use, and excessive alcohol consumption.
- Similarly, cancer, characterized by uncontrolled cell growth, has multiple risk factors, including genetic predisposition, exposure to carcinogens, and lifestyle choices.

- Diabetes mellitus, both type 1 and type 2, is another prevalent non-communicable disease. Type 2 diabetes, in particular, is strongly associated with factors like obesity, sedentary lifestyles, and poor dietary habits.

- Chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD) and asthma, can result from long-term exposure to environmental pollutants, tobacco smoke, or occupational hazards.

The rise of non-communicable diseases is closely linked to modernization, urbanization, and lifestyle changes. Sedentary behaviors, unhealthy diets high in processed foods, and tobacco and alcohol use contribute significantly to the increasing prevalence of NCDs. Moreover, aging populations and advancements in medical care contribute to longer life expectancies, amplifying the impact of chronic diseases on global health systems.

Preventing and controlling non-communicable diseases require a comprehensive, multi-faceted approach. Public health initiatives often focus on addressing modifiable risk factors, promoting healthy behaviors, and implementing policies that create supportive environments. For instance, campaigns to reduce tobacco use, increase physical activity, and encourage healthier dietary choices are essential components of NCD prevention.

Early detection and management are critical aspects of dealing with non-communicable diseases. Regular screenings, health check-ups, and monitoring of risk factors can aid in identifying conditions at an early stage when interventions are most effective. Additionally, the integration of technology, such as electronic health records and telemedicine, can enhance the management and surveillance of NCDs.

International collaboration is crucial in addressing the global burden of non-communicable diseases. Governments, non-governmental organizations, and the private sector must work together to implement policies that promote health and prevent NCDs. This includes initiatives to reduce harmful alcohol use, improve access to healthy foods, create smoke-free environments, and enhance healthcare infrastructure for NCD management.

Chronic Diseases:

It is defined as an impairment of bodily structure and/or function that necessitates a modification of the patient's normal life, and has persisted over an extended period of time.

Examples:

i. Blindness

ii. Cancers

iii. Cardiovascular System related diseases

iv. Diabetes Mellitus

v. Mental disorders

vi. Musculoskeletal disorders such as arthritis

vii. Obesity

5.4.1.Blindness

Definition: According to the World Health Organization (WHO) Visual acuity of less than 3/60 or its equivalent or inability to count fingers in daylight at a distance of 3 meters is defined as blindness

Problem Statement:

More than180 million people worldwide are visually disabled.

Causes:

A. Developing Countries

- Cataract
- Trachoma
- Malnutrition (Vitamin A deficiency)
- Corneal opacity
- Refractive errors
- Glaucoma
- Congenital disorders
- Diabetes mellitus (DM)
- Hypertension (HTN)
- Accidents

B. Developed Countries

- Accidents
- Glaucoma
- Diabetes
- Hypertension
- Cataract
- Congenital disorders

Prevention

The concept of avoidable blindness is gaining popularity.

a. Primary Eye Care

- Provision of adequate nutrition
- Periodic eye examination
- Train lady health worker to promote personal hygiene, sanitation, good dietary habits and safety
- Provision of topical Tetracycline, Vitamin A capsule, eye bandages and shields

b. Secondary Eye Care

- Definitive management at BHU, RHC, THQ.
- Mobile eye camps

c. Tertiary Eye Care

• At teaching hospitals where surgical intervention is done

d. Specific Programmes

• Trachoma control

• School eye health services

• Vitamin A prophylaxis (with polio vaccine)

• Occupational eye health services

5.4.2. Cancers

Cancer may be regarded as a group of diseases characterized by:

• Abnormal growth of cells

• Ability to invade adjacent tissues and distant organs

Problem Statement

• Causes 12% of all deaths throughout the world

• 2nd leading cause of death in developed countries next to CVS diseases

• In the developing world, cancer ranks 3rd leading cause of death

• Incidence of cancer in Pakistan: 100/100,000 population.

Ranking order by site of Cancer		
	MALE	**FEMALE**
1.	Lung	Breast
2.	Stomach	Cervix
3.	Colon/rectum	Colon/rectum
4.	Prostate	Stomach

Table 5.1 showing common cancers according to gender worldwide.

Causes of Cancer:

1. Environmental Factors

• Tobacco

• Alcohol

• Dietary factors

• Occupational exposures to benzene, arsenic, asbestos, etc

• Viruses e.g. HBV, HIV, CMV, EBV

• Parasites: schistosomiasis may produce bladder cancer

• Pesticides

• Radiation, sunlight, pollution.

Personal habits such as Betel chewing may produce oral cancer.

2. Genetic Factors

- Retinoblastoma occurs in children of the same parent.

Cancer Control

Prevention:

A. Primary Prevention

- Control of tobacco and alcohol consumption
- Personal Hygiene: Improvement in personal hygiene may decline cancer of cervix
- Reduced exposure to radiation
- Occupational exposures: Measures to protect workers from industrial carcinogens
- Immunization against HBV and HPV
- Foods, drugs and cosmetics must be tested for carcinogens
- Control of air pollution
- Treatment of precancerous lesions such as cervical tears, intestinal polyposis, warts etc
- Legislation to control known environmental carcinogens
- Cancer education: The aim of cancer education is to motivate people to seek early diagnosis and treatment

B. Secondary Prevention

1. Cancer registration

• Hospital based registries

• Population based registries

2. Early case detection

• By screening for pre-malignant conditions in high risk groups

3. Treatment:

• Surgical removal

• Radiotherapy

• Chemotherapy

5.4.3. Coronary Heart Disease (CHD)

Definition: It is defined as an impairment of heart function due to inadequate blood flow to the heart compared to its needs, caused by obstructive changes in the coronary circulation to the heart. It presents as:

- Angina pectoris
- Myocardial infarction
- Irregularities of the heart
- Cardiac failure
- Sudden death

Problem Statement: Incidence in Pakistan 18/1000 population. Measuring the Burden of Disease WHO has called CHD as our modern epidemic. In Pakistan, circulatory diseases cause over 100,000 deaths per year

Risk Factors:

Non- Modifiable Risk Factors

- Age
- Sex
- Family history
- Genetic factors
- Personality

Modifiable Risk Factors

- Smoking
- Obesity
- Sedentary lifestyle
- Diabetes
- Serum cholesterol
- Stress

Other (Minor) Factors:

- Hormones(hyperestrogenemia)
- Alcohol
- Oral contraceptives
- Less use of Dietary fiber
- Sucrose
- Soft drinks
- Cigarette

Prevention of CHD:

Small changes in risk factors in the total population can result in the biggest reduction in mortality.

A. Primordial Prevention: It involves preventing the emergence and spread of CHD risk factors

B. Prevention in Whole Populations: It includes:

1. Dietary Changes

- Decrease fat intake to 20-30% of total energy intake
- Consumption of saturated fats less than 10% of total energy intake
- High Density Lipoproteins (HDL) levels more than 30 mg/dl in blood.
- A reduction of dietary cholesterol to below 100mg/1000Kcal/day
- An increased complex carbohydrate use
- Avoidance of alcohol
- Decrease salt intake to 5g daily or less

2. Smoking

- The goal is to achieve a smoke free society

3. Blood Pressure: The goal is to reduce mean population blood pressure levels by healthy lifestyle.

4. Physical Activity: Regular physical activity should be a part of normal daily life.

C. High Risk Strategy: For those at the risk of developing CHD are identified, are brought under preventive care and motivated to take positive actions against risk factors.

D. Secondary Prevention:
Continuation of Primary Prevention and generally meant to early diagnosis and prompt treatment with efforts to minimize the impact of disease on the patients, community, health system and country.

5.4.4 Diabetes Mellitus

It is a syndrome characterized by disordered metabolism and chronic hyperglycemia due to either an absolute deficiency of insulin secretion or reduction in its bio-effectiveness or both.

Epidemiological Factors:
1. Agent Factors
- Pancreatic disorders
- Defects in the formation of insulin
- Destruction of B-cells by viral infections and chemicals
- Decreased insulin sensitivity
- Genetic defects
- Auto-immunity

2. Host Factors

- Age: Increased incidence with age
- Sex: Affects both sexes almost equally
- Genetic is about 90% in identical twins.

3. Social and Environmental Factors

- Sedentary lifestyle
- Diet: There is no evidence that DM is associated with any particular nutrient in diet
- Malnutrition in early infancy and childhood may result in failure of beta cell function
- Viral infection e.g. rubella, mumps
- Chemical agents e.g. rodenticide VALCOR.
- Alcohol: Produce DM by damaging the pancreas and liver
- Stress: Surgery, trauma and stress of situations may bring out the disease

Prevention

A. Screening for Diabetes

1. Urine test for glucose (sensitivity is just 10- 50%)

2. Blood sugar testing:

- Fasting
- Random
- 2-hours after 75 g oral glucose

B. Primary Prevention (Has no role in Type 1 DM as it is immune mediated in 89% of the cases))

- Emphasis must be given on primordial prevention
- Maintenance of normal body weight
- Elimination of risk factors

C. Secondary Prevention

- HbA1c 6 monthly testing

- Taking care of Self-care by adhering to diet and drug regimens
- Home blood glucose monitoring
- Routine checkup of blood pressure, visual acuity and weight

D. Tertiary Prevention

- Establishment of diabetic clinics
- Epidemiological research
- Establish national registries for diabetics

Complications

- Blindness
- Kidney failure
- Coronary thrombosis
- Gangrene of lower extremities
- Mortality

5.4.5 Hypertension (Htn):

Normal blood pressure of an adult is 120/80 mmHg. Sustained high blood pressure is known as hypertension. Blood pressure of 140/90 mmHg taken on at least two separate occasions is considered hypertension. This value may be changed with age and disease conditions.

Incidence in Pakistan: 100-150/1000 population

Causes:

1. Primary (Essential) Hypertension

In essential hypertension, no cause can be identified and it accounts for 90% of the cases of HTN.

2. Secondary Hypertension

When HTN is caused by some other disease or abnormality, it is called secondary hypertension and it accounts for 10% of the cases of HTN. It usually occurs in young patients due to renal failure, renal artery stenosis, coarctation of aorta, Cushing syndrome, hyperthyroidism, pregnancy, etc.

Risk Factors for HTN:

1. Non-modifiable Risk Factors

- Age: Blood pressure rises with age
- Genetic Factors: Children of hypertensive patients are more prone to develop hypertension.

2. Modifiable Risk Factors

- Obesity: The greater the weight gain, the greater the risk of high blood pressure
- Lack of exercise: Physical activity by reducing body weight may have an indirect effect on blood pressure
- Heavy alcohol intake: It is associated with increased risk of HTN
- Cigarette smoking
- Heavy salt intake: High salt intake increases the blood pressure
- Saturated fat: They increase blood pressure

Prevention and Control

A. Primary Prevention:

1. Population Strategy:

The goal of population strategy is to shift the community distribution of blood pressure towards lower level or ‘biological normality’. This involves multifactorial approach based on non-pharmacological intervention:

- Nutrition
- Weight Reduction
- Exercise Promotion

- Behavioral Changes
- Health Education
- Self- Care

2. High Risk Strategy:
Strategies targeted towards high risk fragments of the population. e.g. those having family history of HTN.

B. Secondary Prevention:

- Early case detection
- Treatment
- Patient Compliance

5.4.6. Obesity

An abnormal growth of the adipose tissue due to enlargement of fat cell size (hypertrophic obesity); or an increase in fat cell number (hyperplastic obesity) or both. A body mass Index (BM1) of 30 or more in males and 28.6 or more in females indicates obesity.

Causes (Aetiological Factors)

- Age: any age
- Gender: more in men
- Genetic factors
- Physical inactivity
- Overeating
- Psycho-social factors
- Familial tendency
- Endocrine factors e.g. Cushing syndrome
- Drugs e.g. steroids, insulin, contraceptives
- High socioeconomic status

Hazards of Obesity

• Increased mortality

• Increased morbidity due to: HTN, DM, CHD, gallbladder diseases, renal diseases and decreased fertility

Prevention and Control

A. Primary Prevention: It should begin in early childhood.

a. Dietary Changes

- Avoid overeating
- Avoid simple CHO and fats
- Avoid refined foods and sweets
- Increased use of dietary fibers

b. Increased Physical Activity
c. Monitoring of childhood obesity

B. Secondary Prevention: Use of weight reduction methods for weight control among obese through high risk strategy, community programs and individual interventions and or use of surgical methods such as bariatric surgeries for very obese people.

5.4.7. Rheumatic Heart Disease / Rheumatic Fever

Rheumatic fever (RF) is a febrile disease affecting connective tissues particularly in the heart and joints initiated by infection of the throat by group A beta-hemolytic streptococci bacteria. Rheumatic fever often leads to rheumatic heart disease (RHD).

Incidence and Problem Statement:

• The prevalence rate in school-age children in various parts of the world ranges from very low to as high as 33 cases per 10,000.

• It has been estimated that RF is the most common cause of heart disease in the 5-30 year age group throughout the world

Epidemiological Factors

1. Agent Factors

- The onset of RF is usually preceded by a streptococcal sore throat.

2. Host Factors

- Age: Peak incidence in 5-15 years age group
- Sex: Affects both sexes
- Socioeconomic status: RF is linked to poverty, overcrowding, poor housing conditions and inadequate health services

Prevention of RHD

A. Primary Prevention

• Aim is to prevent the first attack of Rheumatic fever

• Diagnose streptococcal throat infection by throat swab culture
B. Secondary Prevention
• Proper diagnosis
• Treatment: Aim is to prevent recurrence of RF through chemoprophylaxis with intramuscular injection of benzyl penicillin every 3 weeks for at least 5 years or till the child grows up to 18 years of age (whatever is later).

C. Non-Medical Measures

• Improving living conditions, breaking the poverty-disease-poverty cycle, Improving socio-economic status

D. Monitoring and Surveillance through periodic surveys of school children.

5.4.8. Stroke

Stroke (also known as a cerebrovascular accident or brain attack) is a medical condition in which poor blood flow to the brain causes cell death. There are two main types of stroke: ischemic, due to lack of blood flow, and hemorrhagic, due to bleeding. Both cause parts of the brain to stop functioning properly

Risk Factors

- Age: Incidence rates rises steeply with age.
- Sex: The incidence rates are higher in males than females.
- Hypertension
- Cardiac abnormalities (e.g. left ventricular hypertrophy, cardiac dilatation)
- Diabetes
- Smoking
- Elevated blood lipid levels
- High viscosity of blood.
- Oral contraceptives

Prevention and Control:

A. Primary Prevention:

- Eliminate risk factors

B. Secondary Prevention:

- Early diagnosis of cases by proper examination and CT scan and MRI where possible
- Proper treatment of cases
- It will also require identifying risk factors and their control to prevent future attacks
- Health education is essential for good compliance of patients as the drugs may be required for lifelong

C. Tertiary Prevention:

- Rehabilitation of cases

Conclusion:

In conclusion, non-communicable diseases represent a significant public health challenge with far-reaching social, economic, and health consequences. With rising burden of NCDs, countries like Pakistan are facing now ‘double burden of disease’ where communicable diseases are already at high and steady steep in NCDs is seen. The prevention and control of NCDs require a holistic approach that addresses lifestyle factors, promotes early detection, and fosters global collaboration. By prioritizing public health measures and implementing evidence-based interventions, there is the potential to reduce the burden of non-communicable diseases and improve the overall well-being of populations worldwide.

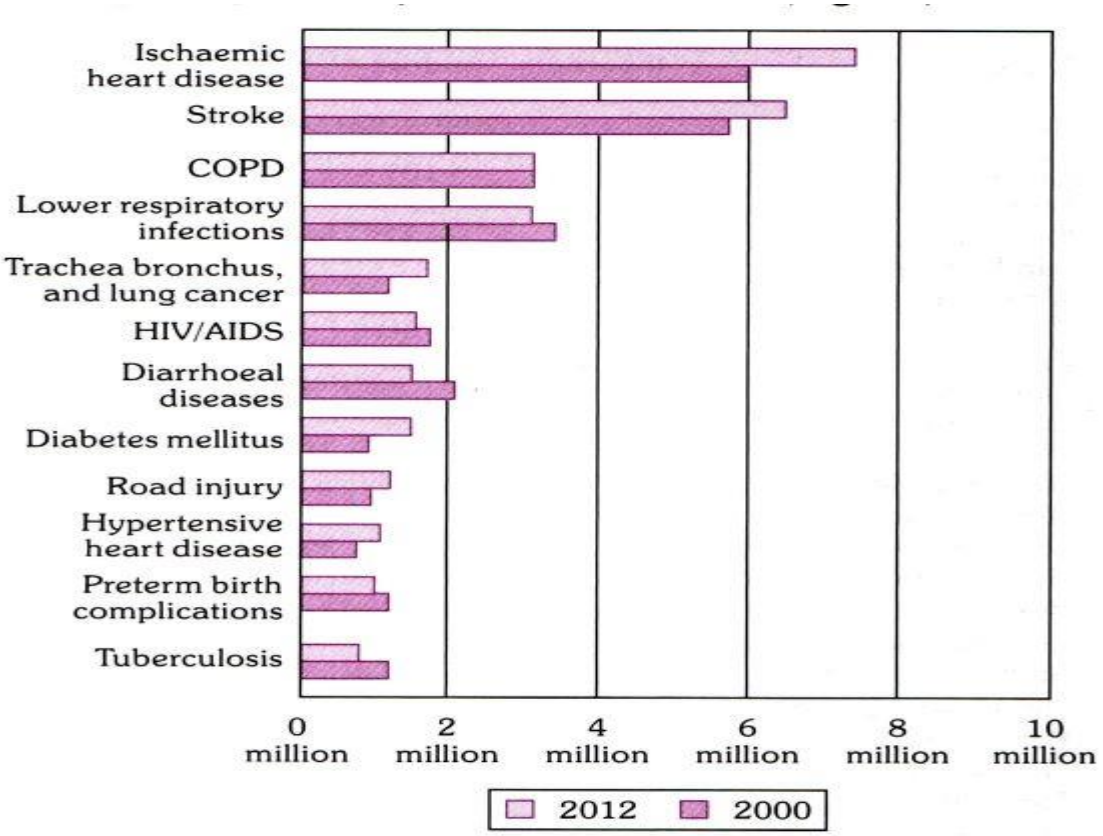


Figure 4.2 showing Comparison of the leading causes of death worldwide over a decade 2000, 2012. (Source K Park 24th edition page:49)

5.5. Levels of prevention

5.5.1. Primordial Prevention: Primordial prevention is actually prevention in chronic diseases e.g., cancer, coronary heart disease, Diabetes mellitus. In primordial prevention,

efforts are directed towards discouraging children from adopting harmful lifestyles, preventing risk factors of diseases.

Primordial prevention is done through individual and mass education e.g. smoking leads to coronary heart disease and it should be discouraged.

Levels of prevention	Modes of intervention
Primary	health promotion and specific protection
Secondary	early diagnosis and treatment
tertiary	disability limitation and rehabilitation

Table 5.2 showing various levels of prevention and modes of interventions

5.5.2. Primary Prevention: It can be defined as actions taken prior to the onset of disease, which remove possibility of disease occurrence. It is applied in the pre-pathogenesis phase. It includes the concept of *Positive Health.* This concept encourages achievement and maintenance of an acceptable level of health that will enable every individual to lead a socially and economically productive life. This is done through Health Promotion and Specific Protection by two different approaches:

• Population (mass) strategy
• High-risk strategy

5.5.3. Secondary Prevention: It is applied in the pathogenesis phase. It is defined as action which halts the progress of a disease at its early stage and
prevents complications. This is done by early diagnosis and prompt treatment. Secondary prevention is an imperfect tool in the control of transmission of disease. It is often more expensive and less effective than primary prevention.

5.5.4. Tertiary Prevention: When the disease process has advanced beyond its early stages, prevention is done by tertiary prevention. It is done in late
pathogenesis phase. It is defined as all measures available to reduce or limit impairments and disabilities, minimize suffering caused by existing departure from good health and to promote the patient's adjustment to irremediable (irreversible) conditions. It is achieved through disability limitation
and rehabilitation.

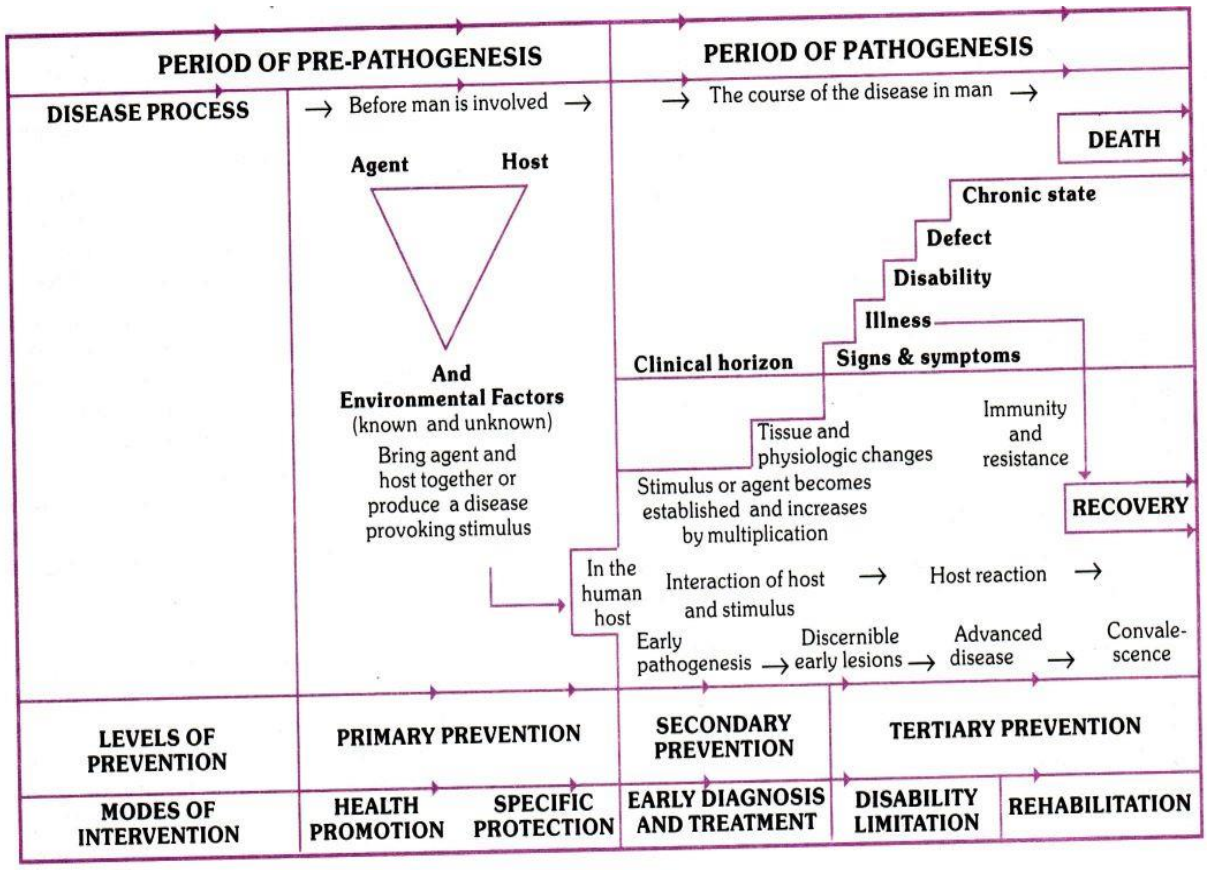


Figure 5.2 showing Natural history of disease (Source: K Park 24th edition page no. 40)

**** Investigation of Epidemic or Outbreak (Additional Read)**

1.Confirmation of the outbreak: Answer following questions

- Is there an increase in the number of cases expected in the population/time/place?
- Confirm numbers; interview cases, review laboratory findings
- Is further investigation needed? The extent and urgency of the investigation should be considered.

2. Verify Diagnosis by
   - Obtaining medical records and laboratory reports
   - Repeating tests if necessary
   - Further clinical testing if needed
3. Case Definition in terms of person, place, time and lab investigations
4. Case Finding
5. Description of data collected
6. Formulation of Hypothesis
7. Hypothesis testing and Analysis of the Data and its interpretation
8. Further collection of data and literature search
9. Implementation of control and preventive measures
10. Report generation and Communication to the higher authorities.

Important Concepts

- Know Health, its determinants and dimensions
- Understand disease and role of various factors in disease development especially for Non Communicable diseases
- Understand Epidemiology and its importance
- Know how to investigate an epidemic and role PHT in its investigation
- Understand levels of prevention and modes of intervention
- Know various non communicable diseases and how levels of prevention can be applied in disease prevention and control

Sample Questions:

1. How will prevent obesity in the community?
2. How will you investigate epidemic of cholera in the community as a public health technician in your place of posting?

Unit 6
Vital Statistics

Objectives:

The student shall be able to comprehend and understand important concepts and registration mechanisms of vital events.

Following contents are covered in this chapter:

1. System of registration for vital events in Pakistan (urban and rural)
2. Basic measurements; different types of rates (growth, death, fertility, mortality, morbidity)
3. Elementary statistical methods (means, average etc.)
4. Role of Public Health Technicians in data collection

6. 1. System of registration for vital events in Pakistan (urban and rural)

According to the UN Principles and Recommendations for a Vital Statistics System, the vital events that are recommended for inclusion in a civil registration system are the following: live births, deaths, foetal deaths, marriages, divorces, annulments, separation (judicial), adoption, legitimation, recognition.

The system of registration for vital events in Pakistan involves a combination of efforts from the National Database and Registration Authority (NADRA) and local administrative bodies, particularly Union Councils, hospitals records, doctors, grass root workers such as lady health workers and public health personals etc. Further nationwide surveys such as Pakistan Demographic and Health Surveys and Pakistan Demographic Survey conducted at different times, provide important information on population distribution, fertility and fertility patterns, family planning, maternal health , child health and mortality rates. Pakistan Bureau of Statistics, Ministry of Planning and Development and Special Initiatives, NADRA, various local and international organizations play a very important part in the completion, compilation and dissemination of this information. However, it should be kept in mind that administrative systems for civil registration and vital events is still evolving and it's advisable to verify information with the latest sources.

6.1.1Overview:

1. **National Database and Registration Authority (NADRA):**

Role: NADRA is a crucial organization responsible for maintaining and managing vital records, including births, deaths, marriages, and divorces.

Urban Areas: In urban areas, individuals typically register births and deaths at NADRA Registration Centers, which are spread across cities and towns.

Documentation: NADRA issues official documents such as birth certificates and death certificates, which are essential for various purposes, including obtaining national identity cards and passports.

2. **Union Councils (Local Level):**

Role: Union Councils play a significant role, especially in rural areas, in the registration of vital events.
Rural Areas: In rural areas, Union Council offices are often responsible for maintaining registers for births, deaths, marriages, and divorces.
Collaboration with NADRA: Union Councils work in collaboration with NADRA to ensure a comprehensive and coordinated approach to vital event registration.

3. **Registration Process:**

Timely Registration: Individuals are generally required to register vital events, such as births and deaths, within a specified period after they occur.
Forms and Documentation: The registration process involves filling out specific forms and submitting supporting documents, which may include hospital records, affidavits, or other relevant proofs.

4**. Documentation and Certificates:**

Issuance: Upon successful registration, NADRA or Union Councils issue official documents such as birth certificates, death certificates, marriage certificates, and divorce certificates.
Legal Importance: These certificates carry legal significance and are crucial for various official and legal proceedings, including inheritance, property transactions, and family-related matters.

5. **Challenges and Initiatives:**
Awareness and Accessibility: Challenges may exist, especially in rural areas, regarding awareness about the importance of registration and accessibility to registration centers.
Government Initiatives: The government and relevant authorities make efforts to address these challenges through awareness campaigns, mobile registration units, and other initiatives to ensure a more inclusive and efficient system.

6. **Continuous Improvement through:**
Technological Integration: NADRA continually works towards improving the registration system by integrating technology for efficient data management and retrieval.
Capacity Building: Training programs and capacity-building initiatives are implemented to enhance the skills of personnel involved in the registration process.

Conclusion:
The system of registration for vital events in Pakistan involves a collaborative effort between NADRA and local administrative bodies. While NADRA primarily handles urban areas, Union Councils play a crucial role in rural regions. The issuance of official

documents is essential for legal and official purposes, and ongoing initiatives aim to address challenges and improve the overall efficiency and inclusivity of the registration system. To obtain the most accurate and up-to-date information, individuals are encouraged to consult official sources or relevant government authorities.

6.2. Basic measurements; different types of rates (growth, death, fertility, mortality, morbidity):

Basic Measurements in Demography:

1. Population Size:
Refers to the total number of individuals in a given population at a specific point in time.

2. Population Density:
The number of individuals per unit of area, usually per square kilometer or square mile.

3. Population Distribution:
Describes how individuals are spread across a geographic area, including patterns of concentration or dispersion.

4. Birth Rate (Crude Birth Rate):
The number of live births per 1,000 people in a population within a given time period.

5. Death Rate (Crude Death Rate):
The number of deaths per 1,000 people in a population within a given time period.

6. Natural Increase Rate:
Calculated by subtracting the death rate from the birth rate, representing the overall growth rate of a population without considering migration.

7. Total Fertility Rate (TFR):
The average number of children a woman is expected to have in her lifetime under current fertility rates.

8. Replacement Level Fertility:
The fertility rate at which each generation can exactly replace itself without increasing or decreasing population size.

9. Infant Mortality Rate:
The number of deaths of infants under one year of age per 1,000 live births in a given time period.

10. Life Expectancy:
The average number of years a person can expect to live, usually at birth, based on current mortality rates.

Different Types of Rates:

1. Growth Rate:
Represents the percentage change in the population size over a specific period, considering births, deaths, and migration.

2. Death Rate (Mortality Rate):

While the crude death rate gives a general overview, mortality rates can be specific to age groups or causes of death.

3. Birth Rate (Fertility Rate):

Fertility rates can be specific to age groups, reflecting the number of births among women of childbearing age.

4. Morbidity Rate:

Measures the prevalence of a specific disease or illness in a population at a given time.

5. Crude Rate:

A rate that has not been adjusted or standardized to account for any population characteristics, providing a general overview.

6. Specific Rate:

Rates that are calculated for specific subgroups or categories within the population, such as age-specific mortality rates or fertility rates.

7. Age-specific Rate:

A rate that is calculated for a specific age group, often used in demographic analysis to understand variations within populations.

8. Sex-specific Rate:

Rates calculated separately for males and females, providing insights into gender-specific patterns.

9. Gross Reproduction Rate (GRR):

An extension of the total fertility rate, representing the number of daughters a woman would have if she experienced the age-specific fertility rates observed in a given year.

10. Net Migration Rate:

The difference between the number of immigrants and emigrants per 1,000 people in a population within a given time period.

Understanding these measurements and rates is crucial for demographers, policymakers, and researchers to assess population dynamics, health trends, and overall societal well-being. It allows for informed decision-making in areas such as public health, social policy, and urban planning

Total Fertility Rate (TFR)	3.7
General Fertility Rate (GFR)	124
Crude Birth Rate (CBR)	27
Crude Death Rate (CDR)	6.7
Rate of Natural Increase	2.0
Infant Mortality Rate (IMR)	56
Life Expectancy at Birth (Years)	65.0
Life Expectancy at Birth Male (Years)	64.5
Life Expectancy at Birth Female (Years)	65.5
Sex Ratio	103

Table 6.1 showing different rates in Pakistan, 2020 (Source: Pakistan Demographic Survey, 2020)

6. 3.Elementary statistical methods

Elementary statistical methods involve the use of basic concepts and techniques to analyze and summarize data. These methods provide a foundation for more advanced statistical analyses. Here, we will focus on key elementary statistical methods, including means, averages, and other measures of central tendency.

6.3.1. Mean (Arithmetic Mean or Average):

The mean is calculated by summing up all the values in a dataset and then dividing the sum by the total number of observations.

6.3.2. Median:

The median is the middle value of a dataset when it is ordered from least to greatest. If there is an even number of observations, the median is the average of the two middle values. The median is less sensitive to extreme values compared to the mean and is a robust measure of central tendency.

6.3.3. Mode:

The mode is the value that appears most frequently in a dataset.

A dataset may have no mode, one mode (unimodal), or multiple modes (multimodal).

4. Range:

The range is the difference between the maximum and minimum values in a dataset. It provides a measure of how spread out the values are but can be influenced by extreme values.

5. Variance:
Variance measures the average squared difference of each value from the mean.

6. Standard Deviation:
The standard deviation is the square root of the variance.
Standard deviation provides a more interpretable measure of dispersion than variance.

7. Coefficient of Variation (CV):
The coefficient of variation is the ratio of the standard deviation to the mean, expressed as a percentage.It is useful for comparing the relative variability of datasets with different units of measurement.

8. Percentiles:
Percentiles are values that divide a dataset into 100 equal parts.
The median is the 50th percentile, and quartiles (Q1 and Q3) divide the data into four parts. Percentiles are helpful for understanding the distribution of values in a dataset.

9. Skewness:
Skewness measures the asymmetry of a distribution. A positive skewness indicates a longer tail on the right, while negative skewness indicates a longer tail on the left.

10. Kurtosis:
Kurtosis measures the shape of the distribution's tails. Positive kurtosis indicates heavier tails than a normal distribution, while negative kurtosis indicates lighter tails.

Elementary statistical methods are fundamental tools for summarizing and understanding quantitative data. They provide insights into the central tendency, dispersion, and shape of distributions, facilitating effective data interpretation and decision-making. Advanced statistical techniques often build upon these elementary methods to conduct more sophisticated analyses.

6.4. Role of Public Health Technicians in data collection:

Public health technicians play a vital role in the field of public health, particularly in data collection and surveillance. Their responsibilities encompass various aspects of data collection, analysis, and reporting, contributing to the development and implementation of

effective public health interventions. Here is a detailed note on the role of public health technicians in data collection:

1. Surveillance and Monitoring:

Disease Surveillance: Public health technicians are involved in monitoring the incidence and prevalence of diseases. They collect data on reported cases, analyze trends, and identify potential outbreaks.

Behavioral Surveillance: Technicians collect and analyze data related to health behaviors, such as smoking, physical activity, and nutrition, to understand and address public health issues.

2. Data Collection and Entry:

Field Data Collection: Technicians often work in the field to collect data directly from communities, healthcare facilities, or other sources. This may involve conducting surveys, interviews, or inspections.

Database Management: They enter collected data into databases, ensuring accuracy and completeness. This process facilitates efficient data analysis and reporting.

3. Health Assessments:

Public health technicians contribute to health assessments by collecting data on various health indicators. This may include demographics, disease prevalence, and environmental factors affecting community health.

4. Outbreak Investigation:

During disease outbreaks, technicians play a crucial role in collecting and analyzing data to identify the source, transmission patterns, and affected populations. This information is essential for effective outbreak response.

5. Quality Assurance:

Technicians ensure the quality of collected data by following standardized protocols and procedures. They may conduct regular checks to identify and rectify errors, ensuring the reliability of the data.

6. Community Engagement:

Public health technicians often interact with communities to gather information, explain the purpose of data collection, and address concerns. Building trust within communities enhances the accuracy and completeness of collected data.

7. Data Analysis:

While more complex analyses may be conducted by epidemiologists or data scientists, public health technicians often perform basic data analyses. They generate descriptive statistics and contribute to interpreting findings.

8. Reporting and Communication:

Technicians contribute to the preparation of reports and presentations summarizing key findings. Effective communication of data is crucial for informing policymakers, healthcare professionals, and the public.

9. Public Health Programs and Interventions:

Data collected by technicians informs the development, implementation, and evaluation of public health programs. It guides decisions on resource allocation and the targeting of interventions to address specific health issues.

10. Training and Capacity Building:
Public health technicians may be involved in training programs to enhance the capacity of healthcare professionals, community workers, or other stakeholders in data collection methods and practices.

11. Ethical Considerations:
Public health technicians adhere to ethical standards in data collection, ensuring participant confidentiality, informed consent, and respectful engagement with communities.

In summary, public health technicians play a multifaceted role in data collection, acting as a crucial link between communities and public health agencies. Their work forms the foundation for evidence-based decision-making, policy development, and the improvement of overall population health. Effective data collection by public health technicians is essential for responding to emerging health threats, implementing preventive measures, and promoting community well-being.

Important Concepts

- Understand the definition and components of vital statistics
- Importance of vital statistics, method of data collection and role of PHT in it
- Elementary Methods of data compilation and expression

Sample Questions:

1. What is meant by Vital statistics? How it is collected in the country?
2. What is the role of public health technician in the collection of data for vital statistics?
3. Define Census. What is the role of public health technician in collection of data.