MEDICAL EDUCATION RESOURCE

# Zoonotic Diseases : General

# Zoonotic Diseases ?

## Definition ?

- **Zoonosis** ? Diseases and infections **naturally transmitted between vertebrate animals and humans ?**
- **WHO definition ?**:
    - Diseases transmitted between animals and humans under natural conditions
- **CDC definition ?**:
    - Diseases caused by germs that spread between animals and people

## Meaning of Zoonosis ?

- **Animal–human interface disease**
- Involves:
    - **Reservoir in animals**
    - **Transmission to humans**
- Can involve:
    - Domestic animals
    - Wild animals
    - Birds
    - Rodents

## Animal–Human Interface ?

- Critical zone where **pathogen transfer occurs**
- Influenced by:
    - Close human–animal contact
    - Environmental contamination
    - Urbanization & deforestation

- Example:
    - Wet markets, livestock farms, pet handling

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## Role of Animals in Zoonoses ?

### Domestic Animals

- Dogs ? Rabies
- Cattle ? Brucellosis, TB

### Livestock

- Sheep/goat ? Anthrax, brucellosis
- Pigs ? Japanese encephalitis (amplifier host)

### Rodents ?

- Plague
- Leptospirosis

### Dogs & Cats

- Rabies
- Toxoplasmosis (cats)

### Wild Animals

- Reservoir for emerging infections

### Birds

- Avian influenza

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## Public Health Importance ?

- **High global burden**
- **Frequent outbreaks & epidemics**
- **Emerging & re-emerging diseases ?**
- **Food safety relevance**
- **Environmental linkage**
- **Occupational hazard**

## Why Important in PSM ?

- Major part of **communicable disease control**
- Involves:
    - **Epidemiology**
    - **Surveillance**
    - **Prevention strategies**
- Requires:
    - **Intersectoral coordination ?**
- Important for:
    - **National health programs**
    - **Outbreak investigation**

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## Importance in Tropical Countries ?

- High burden due to:
    - Warm climate (vector survival)
    - Poor sanitation
    - Close human–animal contact
- Examples:
    - Rabies
    - Leptospirosis
    - JE
    - Plague

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## Emerging & Re-emerging Zoonoses ?

### Emerging

- Newly identified or increasing:
    - COVID-19 (zoonotic origin)
    - Nipah virus

### Re-emerging

- Previously controlled but resurging:
    - Plague

- Leptospirosis

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## Occupational Risk Groups ?

- Veterinarians
- Farmers
- Slaughterhouse workers
- Dairy workers
- Laboratory personnel
- Forest workers

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## One Health Concept ? (VERY IMPORTANT)

- **Human health + Animal health + Environment = Interconnected ?**

### Core Principles

- Human health linked with:
  - Animal health
  - Environmental health

### Need for Collaboration ?

- Health sector
- Veterinary sector
- Animal husbandry
- Municipal authorities
- Forest & wildlife departments
- Water & sanitation sector

? **Exam One-Liner ?**
**“One Health approach integrates human, animal, and environmental health for zoonotic disease control.”**

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## Classification of Zoonoses ?

### Based on Transmission

- **Direct zoonoses**

- **Cyclozoonoses**
- **Metazoonoses**
- **Saprozoonoses**

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## Modes of Transmission ?

### 1. Direct Contact ?

- Animal bite, scratch
- Example ? Rabies

### 2. Food-borne Zoonoses ?

- Contaminated animal products
- Example ? Brucellosis, salmonellosis

### 3. Water-borne Zoonoses ?

- Contaminated water
- Example ? Leptospirosis

### 4. Vector-borne Zoonoses ?

- Arthropod transmission
- Example ? Plague, leishmaniasis

### 5. Airborne Transmission

- Inhalation of infected particles
- Example ? Q fever

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## Common Zoonotic Diseases of Public Health Importance (India) ?

- Rabies ?
- Leptospirosis ?
- Brucellosis
- Plague
- Leishmaniasis (Kala-azar)
- Toxoplasmosis
- Anthrax

- Japanese encephalitis

? **As per NCDC manual ?**:

- Rabies, leptospirosis, brucellosis, plague, leishmaniasis, toxoplasmosis = major concerns

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## Types of Zoonoses (Functional Classification) ?

### Food-borne Zoonoses

- Salmonella
- Brucella

### Water-borne Zoonoses

- Leptospira

### Vector-borne Zoonoses

- Plague (flea)
- Kala-azar (sandfly)

### Direct Contact Zoonoses

- Rabies
- Anthrax

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## General Principles of Prevention & Control ?

### 1. Control of Reservoir ?

- Vaccination of animals
- Culling (if required)
- Animal health surveillance

### 2. Interrupt Transmission ?

- Safe food handling
- Water sanitation
- Vector control
- Personal hygiene

### 3. Protection of Human Host ?

- Vaccination (e.g., rabies)
- PPE for high-risk workers
- Health education

### 4. Environmental Control ?

- Waste management
- Sanitation
- Control of stray animals

### 5. Surveillance & Early Diagnosis ?

- Reporting systems
- Outbreak detection
- Laboratory confirmation

### 6. One Health Approach ?

- Intersectoral coordination
- Integrated disease control

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## ? Ultra High-Yield Points (Exam Gold) ?

- Zoonosis = **animal ? human disease transmission**
- **Rabies = most important zoonosis in India ?**
- **Rodents ? key reservoir in many zoonoses ?**
- **One Health = integrated approach ?**
- **Food + water + vector + contact ? main transmission modes**
- **Occupational risk = veterinarians, farmers ?**

## Classification of Zoonoses ? (VERY IMPORTANT)

Zoonoses are classified based on the **life cycle of the pathogen and number of hosts involved ?**

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### 1. Direct Zoonoses (Orthozoonoses) ?

- **Definition ?**
  - Diseases transmitted from **vertebrate animal ? human directly**
  - **No intermediate host required**
- **Key Feature ?**
  - Transmission occurs through:
    - Direct contact
    - Bite / scratch
    - Contaminated animal products
- **Mode of Transmission**
  - Skin contact
  - Animal bite
  - Aerosols
  - Contaminated soil
- **Examples ?**
  - Rabies ?
  - Anthrax
  - Brucellosis
  - Leptospirosis
- **Exam One-Liner ?**
  ? *Single vertebrate host ? direct transmission to human*

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### 2. Cyclozoonoses ?

- **Definition ?**
  - Zoonotic diseases that require **more than one vertebrate host**
  - **No invertebrate host involved ?**
- **Key Feature ?**
  - Life cycle is completed between **two or more vertebrate species**
  - Humans are usually **accidental hosts**
- **Examples ?**
  - Taeniasis (Taenia solium, Taenia saginata)
  - Echinococcosis (Hydatid disease)
- **Mechanism ?**
  - Animal ? animal ? human transmission cycle

- **Exam One-Liner ?**
  ? *Multiple vertebrate hosts, no vector involved*

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## 3. Metazoonoses ?

- **Definition ?**
  - Zoonotic diseases transmitted by **invertebrate vectors ?**
  - Require **both vertebrate host + invertebrate host**
- **Key Feature ?**
  - Part of life cycle occurs in:
    - Vertebrate host (animal/human)
    - Invertebrate host (vector)
- **Vector involvement ?**
  - Mosquitoes
  - Ticks
  - Fleas
  - Sandflies
- **Examples ?**
  - Plague (flea) ?
  - Leishmaniasis (sandfly) ?
  - Japanese encephalitis (mosquito) ?
  - Kyasanur Forest Disease (tick)
- **Exam One-Liner ?**
  ? *Vector essential for transmission*

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## 4. Saprozoonoses ?

- **Definition ?**
  - Zoonotic diseases requiring **both vertebrate host + non-living environment ?**
- **Key Feature ?**
  - Infective stage develops in:
    - Soil
    - Water
    - Organic matter
- **Transmission**
  - Contact with contaminated environment
- **Examples ?**
  - Leptospirosis ? (water/soil contamination)
  - Toxocariasis
- **Exam One-Liner ?**
  ? *Environment plays essential role in life cycle*

## Table: Definition and Key Features of Zoonotic Diseases ?

| COMPONENT | DETAILS |
|---|---|
| **Definition** | Diseases transmitted between **vertebrate animals and humans** |
| **Reservoir** | Animal reservoir present ? |
| **Transmission** | Animal ? human (direct / indirect) |
| **Agents** | Bacteria, viruses, parasites, fungi |
| **Involvement** | May involve vector or environment |
| **Epidemiology** | Can be endemic or epidemic |
| **Trend** | Includes emerging & re-emerging diseases ? |

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## Table: Public Health Importance of Zoonoses ?

| ASPECT | DETAILS |
|---|---|
| **Burden** | High global prevalence, significant morbidity & mortality |
| **Outbreak Potential** | Epidemic and pandemic risk ? |
| **Occupational Risk** | Farmers, veterinarians, slaughterhouse workers |
| **Food Safety** | Contamination of meat, milk, eggs |
| **Environmental Link** | Role of soil, water, climate |
| **Economic Impact** | Loss in livestock productivity |

| ASPECT | DETAILS |
|---|---|
| **Intersectoral Need** | Requires coordination between multiple sectors ? |

## Table: One Health Approach in Zoonotic Disease Control ?

| SECTOR | ROLE |
|---|---|
| **Human Health Sector** | Diagnosis, treatment, surveillance |
| **Veterinary Sector** | Animal vaccination, disease control in animals |
| **Animal Husbandry** | Livestock management, safe farming practices |
| **Municipal Authorities** | Waste management, stray animal control |
| **Forest & Wildlife Department** | Monitoring zoonoses in wildlife |
| **Water & Sanitation Sector ?** | Safe water supply, sewage disposal |

## Table: Occupations at Risk for Zoonotic Diseases ?

| OCCUPATION | RISK EXPOSURE |
|---|---|
| **Veterinarians** | Animal handling, infected animals |
| **Farmers** | Livestock contact |
| **Slaughterhouse Workers** | Exposure to infected tissues |
| **Dairy Workers** | Milk-borne infections |
| **Laboratory Personnel** | Handling infectious samples |

| OCCUPATION | RISK EXPOSURE |
| --- | --- |
| **Forest Workers** | Wildlife |

## Flowchart: Animal Reservoir ? Transmission ? Human Infection ?

Animal reservoir
(dog / cattle / rodent / bird)
?
Shedding of pathogen
?
Contamination of environment
(food / water / soil / vector)
?
Modes of transmission

- Direct contact
- Bite / scratch
- Food-borne
- Water-borne
- Vector-borne
  ?
  Human exposure
  ?
  Entry into human body
  ?
  Infection in human host ?

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## Figure: One Health Triangle ? (Human–Animal–Environment)


? **Key Concept ?**

- Human health, animal health, and environment are **interconnected**
- Integrated approach required for control of zoonotic diseases

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## Flowchart: Why Zoonotic Diseases are Important in PSM ?

Presence of animal reservoir
?
Close human–animal interaction
?
Multiple transmission routes
(food / water / vector / contact)
?
High disease burden
?
Frequent outbreaks / epidemics ?
?
Occupational exposure risk
?
Environmental involvement
?
Public health impact
?
Need for surveillance + prevention
?
Requires One Health approach ?

## Table: Determinants of Zoonotic Diseases ?

| DETERMINANT | DETAILS |
|---|---|
| **Agent Factors** | Type of organism (bacteria, virus, parasite), infectivity, virulence |
| **Host Factors** | Age, immunity, occupation, behavior |
| **Environmental Factors** | Climate, sanitation, water supply, presence of vectors |
| **Animal Factors** | Type of reservoir, density of animals, infection in animals |
| **Socioeconomic Factors** | Poverty, overcrowding, poor hygiene |
| **Behavioral Factors** | Food habits, animal handling practices |
| **Ecological Changes** | Deforestation, urbanization, climate change ? |

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## Table: Host Factors and Examples ?

| HOST FACTOR | EXPLANATION | EXAMPLE |
|---|---|---|
| **Age** | Children more susceptible | Rabies in children |
| **Immunity** | Immunocompromised at higher risk | Toxoplasmosis in HIV |
| **Occupation** | Increased exposure to animals | Brucellosis in farmers |
| **Sex** | Males more exposed (occupational) | Leptospirosis in male workers |
| **Behavior** | Risky habits (uncooked food, animal contact) | Taeniasis from undercooked meat |
| **Nutrition** | Malnutrition increases susceptibility | Severe infections in malnourished |

## Table: Animal Reservoirs and Diseases ?

| ANIMAL RESERVOIR | DISEASE |
|---|---|
| **Dog** | Rabies ? |
| **Cattle** | Brucellosis, Tuberculosis |
| **Rodents** | Plague, Leptospirosis ? |
| **Pig** | Japanese encephalitis |
| **Sheep/Goat** | Anthrax, Brucellosis |
| **Cat** | Toxoplasmosis |
| **Birds** | Avian influenza |
| **Wild Animals** | Various emerging zoonoses |

## Table: Occupation-wise Important Zoonoses ?

| OCCUPATION | COMMON ZOONOSES |
|---|---|
| **Veterinarians** | Rabies, Brucellosis |
| **Farmers** | Leptospirosis, Brucellosis |
| **Slaughterhouse Workers** | Anthrax, Brucellosis |
| **Dairy Workers** | Brucellosis, Tuberculosis |
| **Laboratory Personnel** | Brucellosis, Q fever |

| OCCUPATION | COMMON ZOONOSES |
| --- | --- |
| **Forest Workers** | Kyasanur Forest Disease, Plague |

# GENERAL PRINCIPLES OF PREVENTION OF ZOONOTIC DISEASES ?

## Household-Level Prevention ?

- **Safe handling of animals ?**
  - Avoid contact with sick animals
- **Hand hygiene ?**
  - After handling animals / animal products
- **Safe milk and meat ?**
  - Boil milk
  - Avoid raw products
- **Proper cooking of meat ?**
- **Safe disposal of animal waste ?**
- **Avoid contact with stray animals ?**

## Food Safety Measures ?

- **Pasteurization of milk ?**
- **Proper cooking of meat ?**
- Avoid:
  - Undercooked meat
  - Raw dairy products
- **Food hygiene ?**
  - Clean utensils

- Safe storage

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## Occupational Prevention ?

- **PPE for high-risk occupations ?**
  - Gloves
  - Masks
  - Boots
- High-risk groups:
  - Farmers
  - Veterinarians
  - Slaughterhouse workers
- **Safe handling of animal products ?**
- **Vaccination (where applicable) ?**

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## Community-Level Prevention ?

- **Control of stray animals ?**
- **Rodent control ?**
- **Vector control ?**
- **Environmental sanitation ?**
  - Waste management
  - Drainage
- **Health education ?**

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## Programme / One Health Level Prevention ?

- **Surveillance systems ?**
  - Early detection of outbreaks
- **Intersectoral coordination ?**
  - Health
  - Veterinary
  - Animal husbandry
  - Municipal authorities
  - Water & sanitation
- **Vaccination of animals ?**

- **One Health approach ?**
    - Integrated human–animal–environment strategy

# ? Important Exam One-Liners ?

- **Zoonosis prevention = reservoir control + transmission break + host protection?**
- **Pasteurization = key for milk-borne zoonoses ?**
- **Rodent control = important for leptospirosis ?**
- **Dog vaccination = key for rabies ?**
- **One Health = integrated approach ?**
- **PPE = essential in occupational exposure ?**

# FINAL TABLES ?

## Table: Household Prevention Measures ?

| MEASURE | DETAILS |
|---|---|
| **Animal Handling ?** | Avoid contact with sick animals |
| **Hand Hygiene ?** | Wash hands after animal contact |
| **Food Safety ?** | Proper cooking of meat, boil milk |
| **Waste Disposal ?** | Safe disposal of animal waste |
| **Avoid Stray Animals ?** | Prevent bites and infections |

## Table: Occupational Protection Measures ?

| MEASURE | DETAILS |
|---|---|

| | |
|---|---|
| **PPE ?** | Gloves, masks, boots |
| **Safe Handling ?** | Careful handling of animals/products |
| **Vaccination ?** | For high-risk workers (where applicable) |
| **Training ?** | Awareness about zoonoses |
| **Hygiene ?** | Hand washing after exposure |

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## Table: Food-borne Zoonoses Prevention ?

| MEASURE | DETAILS |
|---|---|
| **Pasteurization ?** | Safe milk consumption |
| **Proper Cooking ?** | Kill pathogens in meat |
| **Food Hygiene ?** | Clean storage and preparation |
| **Avoid Raw Products ?** | Prevent infection |
| **Inspection ?** | Meat inspection before consumption |

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## Table: Reservoir Control Measures ?

| RESERVOIR | CONTROL STRATEGY |
|---|---|
| **Dogs ?** | Vaccination, stray control |
| **Rodents ?** | Rodent control measures |
| **Livestock ?** | Vaccination, surveillance |

| RESERVOIR | CONTROL STRATEGY |
|---|---|
| **Wild Animals** | Monitoring and control |
| **Vectors ?** | Vector control measures |

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## Table: Disease-wise Key Prevention Strategy ?

| DISEASE | KEY PREVENTION |
|---|---|
| **Rabies ?** | Dog vaccination, PEP |
| **Leptospirosis ?** | Rodent control, avoid contaminated water |
| **Brucellosis ?** | Pasteurization, occupational protection |
| **Anthrax ?** | Safe carcass disposal, animal vaccination |
| **Toxoplasmosis ?** | Avoid raw meat, cat hygiene |
| **Taeniasis ?** | Proper cooking of meat |
| **Hydatid Disease ?** | Dog deworming, avoid raw offal |

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## ? Final High-Yield Summary ?

- **3 pillars = Reservoir control + Transmission control + Host protection ?**
- **Food safety + sanitation = most important measures ?**
- **Occupational exposure = major risk factor ?**
- **One Health approach = modern strategy ?**