

# GENERAL EPIDEMIOLOGY OF COMMUNICABLE DISEASES

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## Definition of Communicable Disease ?

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### Core Definition

- Disease caused by **specific infectious agents**
- Capable of **transmission from one host to another**

### Key Concepts

- **Transmission pathways**
  - Person ? Person
  - Animal ? Human (**Zoonosis**)
  - Reservoir ? Host
- **Important exam point**
  - Not all infectious diseases are communicable
  - Example ? **Tetanus (non-communicable infectious disease)**

## Components of Infectious Disease Cycle ?

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### Epidemiological Triad (VERY IMPORTANT)

- Basic model explaining **disease causation**

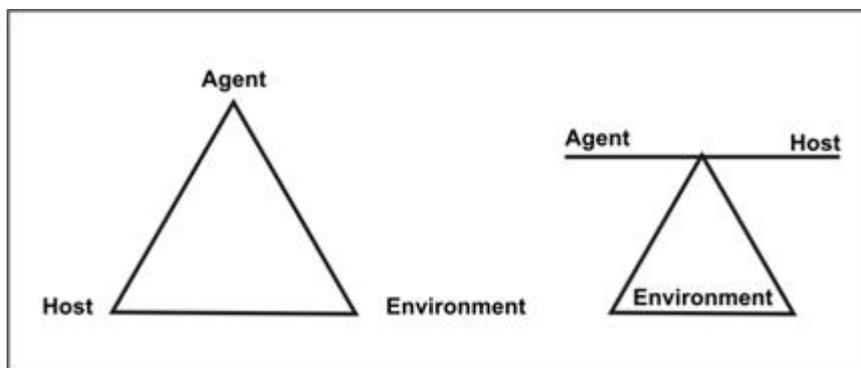
### Components

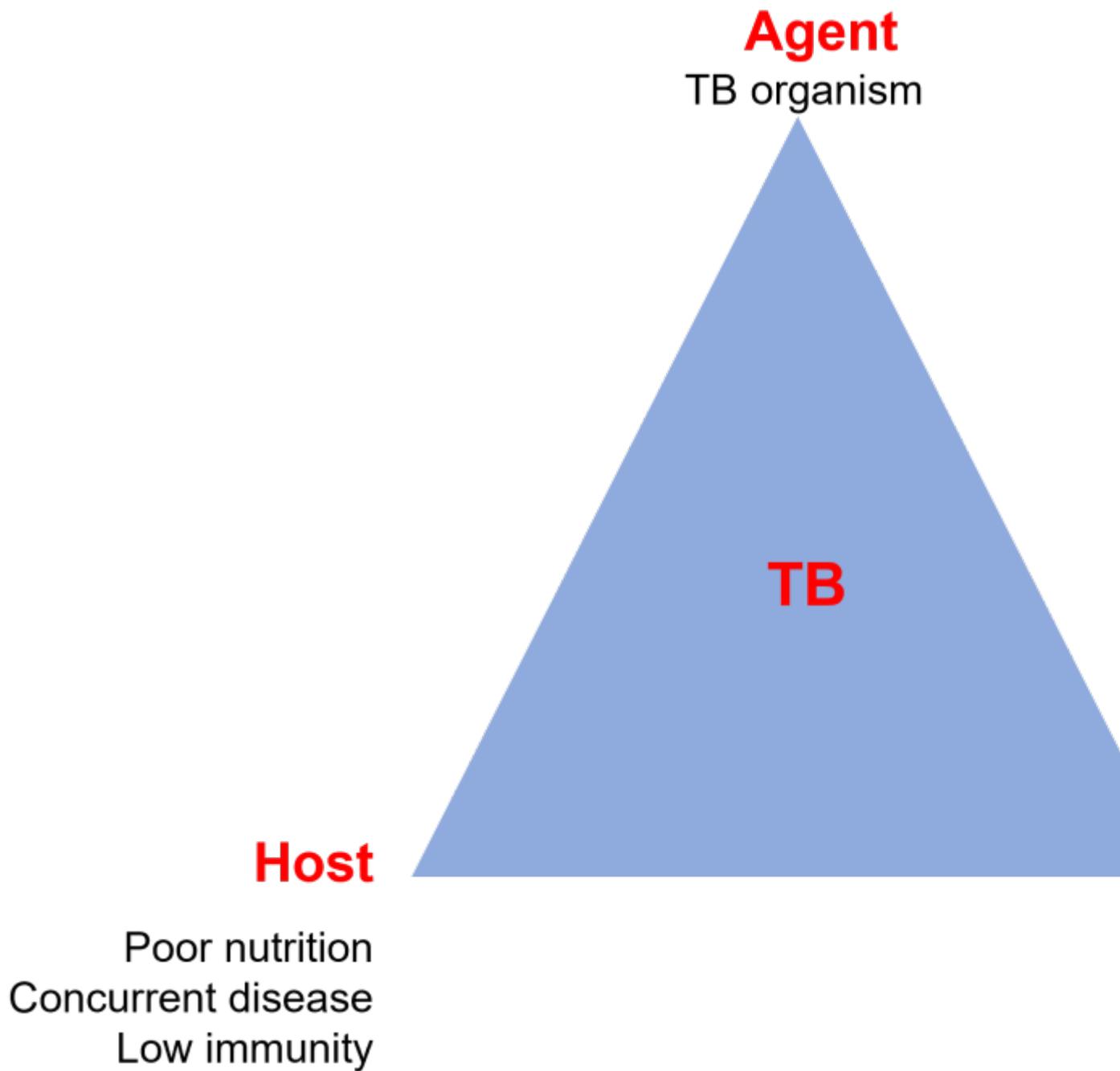
- **Agent**
  - Microorganism causing disease
  - Bacteria, viruses, parasites, fungi

- **Host**
    - Susceptible individual
    - Influenced by immunity, age, genetics
  - **Environment**
    - External factors affecting transmission
    - Climate, sanitation, vectors, crowding
- 

## Epidemiological Triad Diagram ?

<https://www.researchgate.net/publication/285232549/figure/fig2/AS%3A301552041512962%401448907017549/The-Epidemiological-Triad>





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### Interaction Concept ?

- Disease occurs when:
  - **Agent + susceptible host + favorable environment interact**
- **Equilibrium**

- Balanced interaction ? No disease
- **Imbalance**
  - Leads to disease occurrence

#### ? Exam Insight

- Control strategies target:
  - **Agent** ? drugs, vaccines
  - **Host** ? immunity, nutrition
  - **Environment** ? sanitation, vector control

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## Clinical Application ?

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- **COVID-19**
  - Agent ? SARS-CoV-2
  - Host ? Humans
  - Environment ? Crowding, travel
- **Malaria**
  - Agent ? Plasmodium
  - Host ? Human
  - Environment ? Mosquito breeding

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## AGENT FACTORS ? VERY IMPORTANT

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### Definition

- **Characteristics of the causative organism** that determine disease occurrence and severity
- 

### Properties of Agent

- **Infectivity**
  - Ability of organism to **enter, survive, and multiply in host**
  - Example ? Measles (high infectivity)
- **Pathogenicity**
  - Ability to **produce clinical disease**
  - Example ? Poliovirus (many infections, few clinical cases ? low pathogenicity)

- **Virulence**
    - Degree of **severity of disease**
    - Example ? Rabies (high virulence)
  - **Toxigenicity**
    - Ability to **produce toxins**
    - Example ? *Corynebacterium diphtheriae*
  - **Antigenicity**
    - Ability to **induce immune response**
    - Basis of **vaccine development**
- 

## Comparison (VERY IMPORTANT MCQ) ?

### Infectivity vs Pathogenicity vs Virulence

- **Infectivity**
  - Entry & multiplication in host
  - Deals with **spread of infection**
- **Pathogenicity**
  - Ability to cause disease
  - Deals with **clinical illness occurrence**
- **Virulence**
  - Severity of disease
  - Deals with **fatality/complications**

### ? Quick Exam Trick

- Infectivity ? Entry
  - Pathogenicity ? Disease
  - Virulence ? Severity
- 

## HOST FACTORS

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### Definition

- **Factors related to susceptibility of host** to infection
-

## Components

- **Age**
    - Extremes of age (infants, elderly) ? ? susceptibility
  - **Sex**
    - Some diseases show **sex predilection**
    - Example ? Autoimmune diseases more in females
  - **Immunity**
    - Most important factor
    - Includes:
      - Innate immunity
      - Acquired immunity
  - **Nutrition**
    - Malnutrition ? ? immunity ? ? infections
  - **Behavior (Lifestyle & Habits)**
    - Personal hygiene
    - Sexual behavior
    - Smoking, alcohol
    - Occupational exposure
- 

## Clinical Insight ?

- TB more common in:
  - Malnourished + immunocompromised ? **Host factor dominance**
- COVID severity:
  - Elderly + comorbid ? **Host + agent interaction**

# ENVIRONMENTAL FACTORS

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## Definition

- **External factors that influence occurrence and transmission of disease**
-

## Types

### Physical Environment

- Climate ? temperature, humidity affect disease spread
  - Water ? contamination leads to water-borne diseases
  - Air ? airborne infections (TB, measles)
- 

### Biological Environment

- Presence of **vectors** ? mosquitoes, flies
  - Other microorganisms interacting with host
- 

### Social Environment

- **Crowding** ? facilitates transmission (TB, COVID)
  - **Sanitation** ? poor hygiene ? diarrheal diseases
  - **Socioeconomic status**
    - Poverty ? malnutrition, poor access to healthcare
- 

## Clinical Insight ?

- Malaria ? strongly influenced by **biological environment (vector)**
  - Cholera ? linked to **water contamination (physical environment)**
  - TB ? associated with **crowding (social environment)**
- 

# RESERVOIR OF INFECTION ?

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### Definition

- Natural habitat where the infectious agent lives, grows, and multiplies
- 

## Types

### Human Reservoir

- **Case**
    - Person with **clinical disease**
  - **Carrier**
    - Person harboring organism **without symptoms**
- 

### **Animal Reservoir**

- Source of **zoonotic diseases**
  - Examples:
    - Rabies ? dog
    - Plague ? rodents
- 

### **Environmental Reservoir**

- Organisms survive in **non-living environment**
  - Examples:
    - Soil ? tetanus
    - Water ? cholera
- 

## **Types of Reservoir (VERY IMPORTANT) ?**

- **Human Reservoir**
  - Case ? Symptomatic individual
  - Carrier ? Asymptomatic but infectious
- **Animal Reservoir**
  - Zoonotic transmission
  - Examples ? Rabies, plague
- **Environmental Reservoir**
  - Non-living sources
  - Examples ? Soil (tetanus), water (cholera)

### **? Exam Trick**

- Reservoir = “**Where organism normally lives**”
  - Source = “**From where infection spreads**”
-

# CARRIER ?

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## Definition

- **Person harboring the infectious agent without showing symptoms**
  - Acts as a **hidden source of infection**
- 

## Types of Carrier

- **Healthy Carrier**
    - Never develops disease
    - Example ? Typhoid carrier
  - **Incubatory Carrier**
    - Transmits infection **during incubation period**
    - Example ? Measles
  - **Convalescent Carrier**
    - Continues to transmit **after recovery**
    - Example ? Cholera
- 

## Types of Carrier (VERY IMPORTANT) ?

- **Healthy Carrier**
  - No symptoms at any stage
  - Important in **disease persistence**
- **Incubatory Carrier**
  - Infectious **before symptoms appear**
  - Important in **early spread**
- **Convalescent Carrier**
  - Infectious **after clinical recovery**
  - Important in **late spread**

## ? Exam Trick

- Incubatory ? Before
  - Convalescent ? After
  - Healthy ? Always asymptomatic
-

# SOURCE OF INFECTION

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## Definition

- Person, animal, or object from which infection is actually transmitted to host
- 

## Key Concept

- Source may or may not be the same as reservoir
- 

## Reservoir vs Source of Infection ?

- **Reservoir**
    - Natural habitat of organism
    - Where organism **lives and multiplies**
  - **Source of Infection**
    - Immediate origin from which infection spreads
    - Where host **actually acquires infection**
- 

## Important Differences (VERY IMPORTANT) ?

- **Reservoir**
  - Long-term habitat
  - Example ? Human in typhoid
- **Source**
  - Immediate transmission point
  - Example ? Contaminated food/water

## ? Exam Trick

- Reservoir ? **“Lives there”**
  - Source ? **“Comes from there”**
-

## Clinical Insight ?

- Typhoid:
  - Reservoir ? Human
  - Source ? Contaminated water/food
- Tetanus:
  - Reservoir ? Soil
  - Source ? Wound contamination

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# MODES OF TRANSMISSION ? VERY HIGH-YIELD

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## Definition

- Mechanism by which **infectious agent spreads from source to host**

## A. Direct Transmission

### Types

- **Direct Contact**
  - Physical contact between infected and susceptible person
  - Example ? STDs, skin infections
- **Droplet Infection**
  - Large respiratory droplets (>5  $\mu\text{m}$ )
  - Spread within **1 meter**
  - Example ? Influenza, COVID-19
- **Vertical Transmission**
  - Mother ? child
  - During pregnancy, delivery, or breastfeeding
  - Example ? HIV, Hepatitis B

## B. Indirect Transmission

### Types

- **Airborne Transmission**
    - Droplet nuclei (<5 μm), remain suspended
    - Travel long distances
    - Example ? TB, measles
  - **Vehicle-borne Transmission**
    - Through contaminated **food, water, blood**
    - Example ? Cholera, Hepatitis A
  - **Vector-borne Transmission**
    - Through insects
    - Example ? Malaria (mosquito), plague (flea)
  - **Fomite Transmission**
    - Through inanimate objects
    - Example ? Towels, utensils
- 

## Flowchart: Modes of Transmission ?

- **Transmission**
    - Direct
      - Direct contact
      - Droplet
      - Vertical
    - Indirect
      - Airborne
      - Vehicle-borne
      - Vector-borne
      - Fomite
- 

## Direct vs Indirect Transmission (VERY IMPORTANT) ?

- **Direct Transmission**
  - No intermediate object
  - Immediate transfer
  - Examples ? Contact, droplet, vertical
- **Indirect Transmission**
  - Requires intermediate medium
  - Delayed spread possible
  - Examples ? Airborne, vector, vehicle

? Exam Trick

- Direct = **No mediator**
  - Indirect = **Mediator present**
- 

## Clinical Insight ?

- COVID-19 ? Droplet + airborne
  - Malaria ? Vector-borne
  - Cholera ? Water-borne
- 

# CHAIN OF INFECTION ?

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## Definition

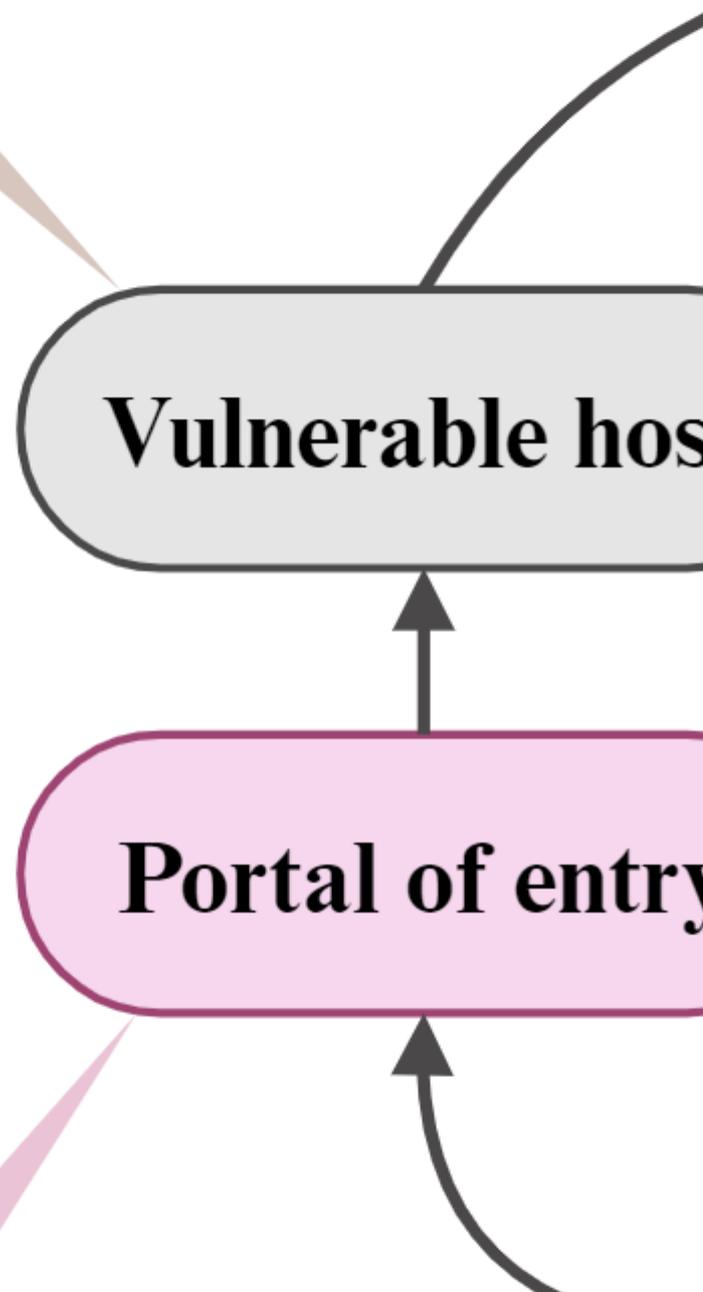
- Sequence of events required for **disease transmission**
- 

## Components

- **Agent**
  - **Reservoir**
  - **Portal of Exit**
    - Route by which organism leaves host
    - Example ? Respiratory secretions
  - **Mode of Transmission**
  - **Portal of Entry**
    - Route by which organism enters new host
    - Example ? Respiratory tract
  - **Susceptible Host**
- 

## Chain of Infection Diagram ?

Person most at risk of  
infection due to  
lacking the ability to  
fight infection









# Susceptible

This is the person who is most likely to get an infection because they do not have the ability to fight the infection. This includes residents, staff or visitors.

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## Key Concept ?

- Infection occurs only when **all links are intact**

### ? Prevention Principle

- Breaking **any one link** ? Stops transmission
- 

## Clinical Insight ?

- Hand hygiene ? breaks **mode of transmission**
  - Vaccination ? reduces **susceptible host**
  - Isolation ? controls **reservoir/source**
- 

### ? Ultra High-Yield Summary

- Direct vs indirect transmission
- Droplet vs airborne difference
- Chain of infection components
- Breaking chain = disease control

# INCUBATION PERIOD ?

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## Definition

- **Time interval between exposure to infectious agent and appearance of first symptoms**
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## Key Features

- **Silent phase**
  - No clinical symptoms present

- **Organism multiplies in host**
    - Reaches threshold to produce disease
- 

## Importance ?

- **Diagnosis**
    - Helps in identifying **probable exposure time**
  - **Quarantine**
    - Duration based on **maximum incubation period**
- 

## Examples (High-yield)

- Measles ? 10–14 days
  - COVID-19 ? 2–14 days
  - Cholera ? Few hours to 5 days
- 

## Exam Insight ?

- **Short incubation period**
    - Rapid onset
    - Example ? Food poisoning
  - **Long incubation period**
    - Delayed onset
    - Example ? Rabies
- 

# PERIOD OF COMMUNICABILITY ?

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## Definition

- **Time during which an infected individual can transmit disease to others**
-

## Key Features

- May occur:
    - **Before symptoms** (incubatory phase)
    - **During illness**
    - **After recovery** (carrier state)
- 

## Importance ?

- **Isolation planning**
    - Determines duration of **isolation precautions**
  - **Control of outbreaks**
    - Identifies period of **maximum infectivity**
- 

## Examples (High-yield)

- Measles ? Infectious **before rash appears**
  - COVID-19 ? Infectious **even before symptoms**
  - Typhoid ? Carrier state prolongs communicability
- 

## Key Difference (VERY IMPORTANT) ?

- **Incubation Period**
  - Exposure ? Symptoms
- **Period of Communicability**
  - Infectious phase ? Spread of disease

### ? Exam Trick

- Incubation = “**No symptoms yet**”
  - Communicability = “**Can spread disease**”
-

## Clinical Insight ?

- Quarantine ? Based on **incubation period**
- Isolation ? Based on **period of communicability**

# SECONDARY ATTACK RATE (SAR) ?

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## Definition

- Measure of spread of infection among close contacts of a primary case
- 

## Key Concept

- Indicates **transmissibility within a defined group** (family, school, hostel)
  - Excludes **primary case**
- 

## Formula ?

$$\text{SAR} = \left( \frac{\text{New cases among contacts}}{\text{Total susceptible contacts}} \right) \times 100$$
$$\text{SAR} = \left( \frac{\text{New cases among contacts}}{\text{Total susceptible contacts}} \right) \times 100$$

---

## Interpretation ?

- **High SAR**
    - Highly infectious disease
    - Example ? Measles
  - **Low SAR**
    - Less transmissible
-

## Exam Insight ?

- Used mainly in:
  - **Outbreak investigations**
  - **Household transmission studies**

### ? Exam Trick

- SAR = “Spread among contacts”

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# HERD IMMUNITY ? VERY IMPORTANT

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## Definition

- Resistance of a group to spread of infection due to immunity of a large proportion of individuals
- 

## Key Concept

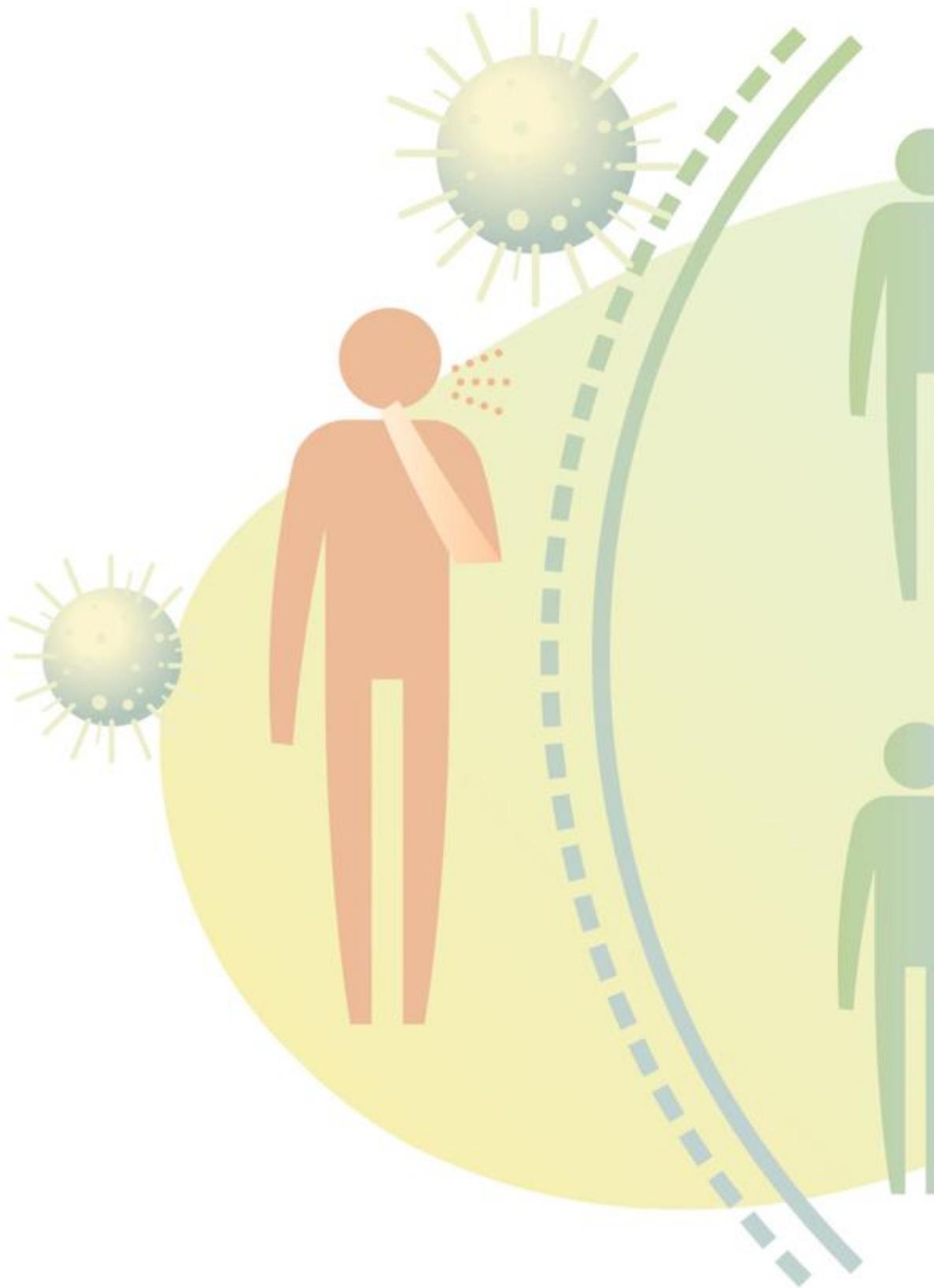
- Protects:
    - **Non-immune individuals indirectly**
  - Transmission chain gets **interrupted**
- 

## Herd Immunity Diagram ?



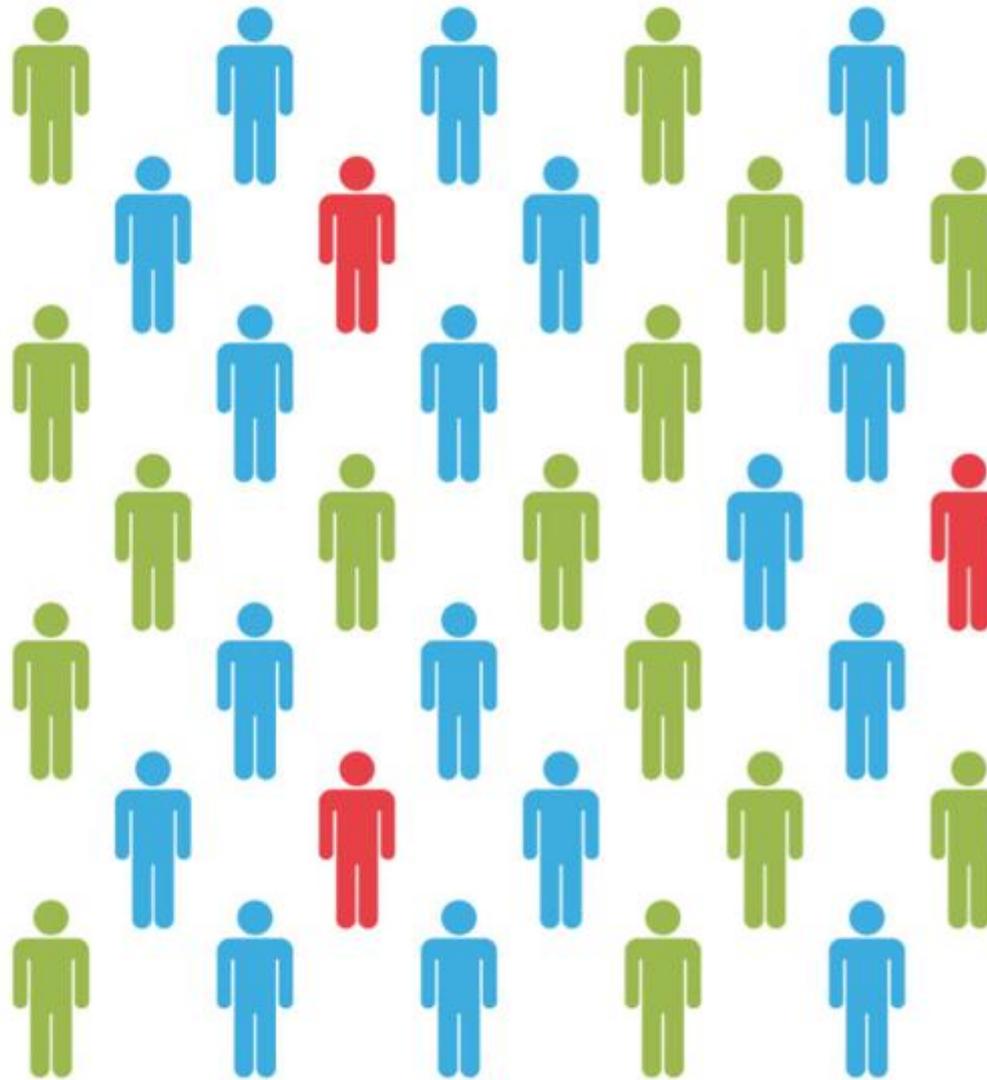
# HERD IMMUNITY







# HERD IMMUNITY



 Not immunize  
sick and conta

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## Factors Affecting Herd Immunity ?

- **Immunization Coverage**
    - Higher coverage ? better protection
  - **Infectivity of Agent**
    - Highly infectious diseases need **higher coverage**
- 

## Clinical Insight ?

- Measles requires **~95% vaccination coverage**
  - COVID-19 control depended on **mass vaccination + prior exposure**
- 

## Exam Insight ?

- Herd immunity important in:
  - **Vaccine-preventable diseases**
  - **Epidemic control strategies**

### ? Exam Trick

- Herd immunity = “**Community protection**”

# LEVELS OF PREVENTION IN COMMUNICABLE DISEASES ?

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## Definition

- Strategies applied at different stages to **prevent occurrence, progression, and complications of disease**
-

## Types

### Primary Prevention

- Prevents **occurrence of disease**
  - **Methods**
    - Immunization
    - Health education
    - Environmental sanitation
- 

### Secondary Prevention

- Detects disease at **early stage**
  - **Methods**
    - Early diagnosis
    - Screening
    - Prompt treatment
- 

### Tertiary Prevention

- Reduces **complications and disability**
  - **Methods**
    - Disability limitation
    - Rehabilitation
- 

## Levels of Prevention (VERY IMPORTANT) ?

- **Primary Prevention**
  - Before disease onset
  - Example ? Vaccination (Measles)
- **Secondary Prevention**
  - Early disease stage
  - Example ? Screening for TB
- **Tertiary Prevention**
  - After disease established
  - Example ? Rehabilitation in polio

### ? Exam Trick

- Primary ? Prevent

- Secondary ? Detect early
- Tertiary ? Limit damage

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# CONTROL OF COMMUNICABLE DISEASES ?

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## Definition

- Measures aimed at **reducing transmission and burden of disease**
- 

## A. Control of Source

- **Isolation**
    - Separating infected individuals
  - **Treatment**
    - Eliminates infectious agent
- 

## B. Break Transmission

- **Sanitation**
    - Safe water, waste disposal
  - **Vector Control**
    - Mosquito control, insecticides
- 

## C. Protect Host

- **Immunization**
    - Active protection
  - **Chemoprophylaxis**
    - Preventive drugs
    - Example ? Malaria prophylaxis
-

## Flowchart: Control Measures ?

- **Control of Communicable Disease**
  - Source control
    - Isolation
    - Treatment
  - Break transmission
    - Sanitation
    - Vector control
  - Protect host
    - Immunization
    - Chemoprophylaxis

## Clinical Insight ?

- COVID-19:
  - Isolation ? Source control
  - Masking ? Break transmission
  - Vaccination ? Protect host
- Malaria:
  - Mosquito control ? Break transmission
  - Chemoprophylaxis ? Protect host

## Ultra High-Yield Summary ?

- Levels of prevention = **3 stages**
- Control measures = **3 pillars**
- Always link with **epidemiological triad**

**ISOLATION & QUARANTINE ? VERY IMPORTANT**

## Isolation

### Definition

- Separation of **infected (sick) individuals** from healthy population

### Key Points

- Applied to **confirmed cases**
  - Prevents **direct transmission**
  - Duration depends on **period of communicability**
- 

## Quarantine

### Definition

- **Restriction of movement of exposed but healthy individuals**

### Key Points

- Applied to **contacts/exposed persons**
  - Duration based on **incubation period**
  - Prevents **potential spread before symptoms**
- 

## Isolation vs Quarantine (VERY IMPORTANT MCQ) ?

- **Isolation**
  - Applied to ? Sick individuals
  - Stage ? After disease onset
  - Basis ? Period of communicability
  - Purpose ? Prevent spread from cases
- **Quarantine**
  - Applied to ? Healthy but exposed individuals
  - Stage ? Before symptoms
  - Basis ? Incubation period
  - Purpose ? Prevent possible spread

? Exam Trick

- Isolation ? “**Ill person**”
  - Quarantine ? “**Questionable exposure**”
- 

# DISINFECTION

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## Definition

- **Destruction of pathogenic microorganisms on inanimate objects**
- 

## Types

### Concurrent Disinfection

- Done **during the course of illness**
  - Prevents ongoing transmission
  - Examples:
    - Disinfection of patient’s excreta
    - Cleaning contaminated articles
- 

### Terminal Disinfection

- Done **after patient is removed or recovers/dies**
  - Eliminates residual infection
  - Examples:
    - Room disinfection
    - Linen, bedding sanitation
- 

## Clinical Insight ?

- COVID-19:
    - Isolation ? Positive patient
    - Quarantine ? Close contacts
    - Concurrent disinfection ? Daily surface cleaning
-

## Ultra High-Yield Points ?

- Isolation ? Based on **communicability**
- Quarantine ? Based on **incubation period**
- Disinfection ? **Inanimate objects only**

## IMMUNITY ?

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### Definition

- Ability of the body to resist and fight infection
- 

## Types of Immunity

### Innate Immunity

- **Natural, non-specific**
  - Present from birth
  - Examples:
    - Skin barrier
    - Phagocytes
- 

### Acquired Immunity

- **Develops after exposure**
  - Specific to antigen
- 

## Types of Acquired Immunity

### Active Immunity

- **Natural Active**
  - Infection ? body produces antibodies
  - Example ? Measles infection
- **Artificial Active**

- Vaccination
  - Example ? COVID vaccine
- 

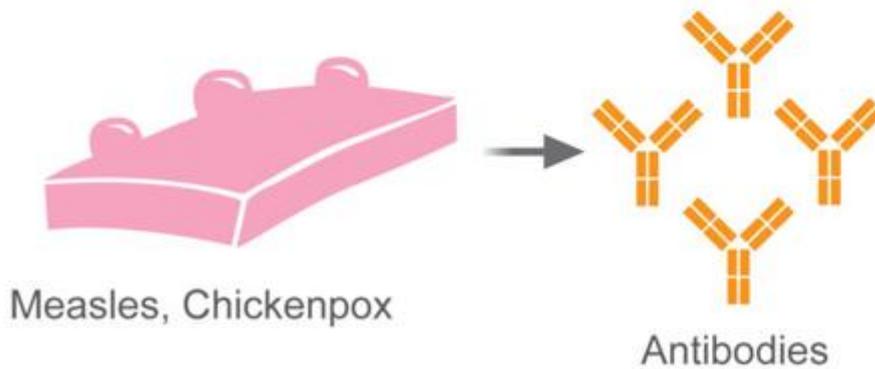
## Passive Immunity

- **Natural Passive**
    - Transfer of antibodies from mother
    - Example ? IgG via placenta
  - **Artificial Passive**
    - Administration of antibodies
    - Example ? Rabies immunoglobulin
- 

## Flowchart: Types of Immunity ?

# Types of Imm

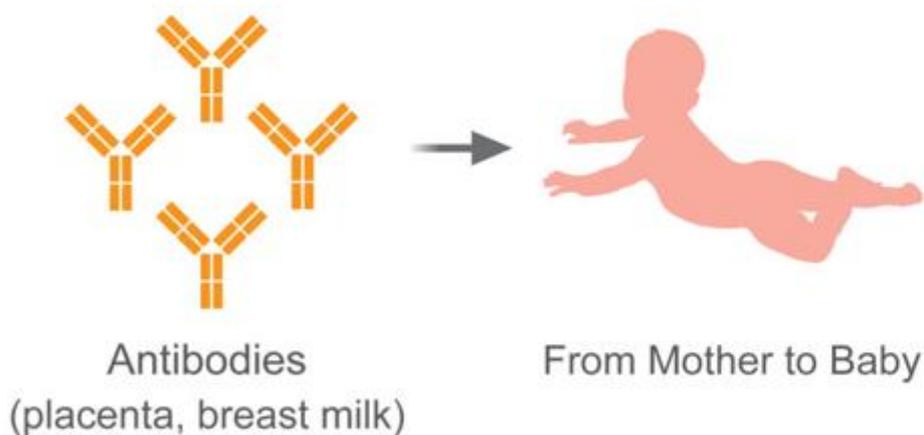
## A Active naturally acquired immunity



## B

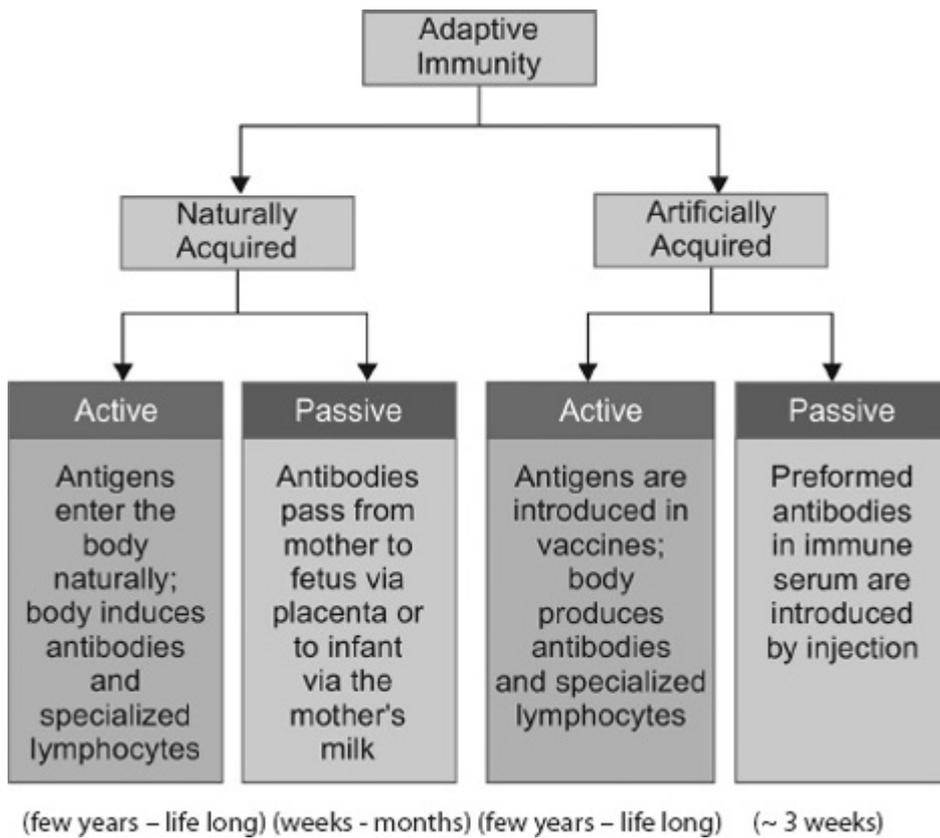


## C Passive naturally acquired immunity



## D





[https://www.monash.edu/\\_\\_data/assets/image/0012/3877995/1-Overview-of-the-primary-and-secondary-immune-responses.jpg](https://www.monash.edu/__data/assets/image/0012/3877995/1-Overview-of-the-primary-and-secondary-immune-responses.jpg)

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## Exam Insight ?

- **Active immunity**
  - Slow onset
  - Long-lasting
- **Passive immunity**
  - Immediate protection
  - Short duration

### ? Exam Trick

- Active ? **Body produces antibodies**
- Passive ? **Antibodies given directly**

# EPIDEMIC, ENDEMIC, PANDEMIC ?

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## Definitions

- **Endemic**
    - Constant presence of disease in a particular area
    - Example ? Malaria in some regions
  - **Epidemic**
    - Sudden increase in number of cases above expected level
    - Example ? Dengue outbreak
  - **Pandemic**
    - Worldwide spread of disease
    - Example ? COVID-19
- 

## Endemic vs Epidemic vs Pandemic (VERY IMPORTANT) ?

- **Endemic**
    - Constant occurrence
    - Limited geographic area
    - Predictable pattern
  - **Epidemic**
    - Sudden rise in cases
    - Localized region
    - Unexpected increase
  - **Pandemic**
    - Global spread
    - Multiple countries/continents
    - Large-scale impact
- 

## Clinical Insight ?

- Malaria ? Endemic
- Dengue outbreak ? Epidemic
- COVID-19 ? Pandemic

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## Ultra High-Yield Points ?

- Endemic = **Constant presence**
- Epidemic = **Sudden rise**
- Pandemic = **Global spread**

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## MCQs SECTION ?

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### Concept-Based MCQs

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1. Infectivity refers to:

- A. Severity of disease
- B. Ability to cause death
- C. Ability to enter and multiply in host ?
- D. Ability to produce toxins

2. Pathogenicity is:

- A. Spread of disease
- B. Ability to cause clinical disease ?
- C. Severity of infection
- D. Immune response

3. Virulence indicates:

- A. Infectivity
- B. Pathogenicity
- C. Severity of disease ?
- D. Antigenicity

4. Which is NOT a component of epidemiological triad?

- A. Agent
- B. Host
- C. Environment
- D. Treatment ?

---

5. Carrier is defined as:

- A. Symptomatic patient
  - B. Person harboring infection without symptoms ?
  - C. Immune individual
  - D. Vaccinated person
- 

6. Quarantine is applied to:

- A. Sick individuals
  - B. Healthy individuals
  - C. Exposed but healthy individuals ?
  - D. Recovered patients
- 

7. Isolation is based on:

- A. Incubation period
  - B. Period of communicability ?
  - C. Herd immunity
  - D. Virulence
- 

8. Herd immunity protects:

- A. Only vaccinated individuals
  - B. Only infected individuals
  - C. Non-immune individuals indirectly ?
  - D. Only children
- 

9. Secondary attack rate measures:

- A. Primary infection
  - B. Community prevalence
  - C. Spread among contacts ?
  - D. Mortality rate
- 

10. Endemic disease means:

- A. Sudden increase
  - B. Constant presence in area ?
  - C. Worldwide spread
  - D. Sporadic cases
-

# Clinical Scenario MCQs ?

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11. A family of 5 develops measles after one child gets infected. This is best measured by:

- A. Incidence rate
  - B. Secondary attack rate ?
  - C. Prevalence rate
  - D. Case fatality rate
- 

12. A patient with COVID-19 is kept in a separate ward to prevent spread. This is:

- A. Quarantine
  - B. Isolation ?
  - C. Disinfection
  - D. Surveillance
- 

13. A traveler exposed to Ebola is kept under observation for 21 days without symptoms. This is:

- A. Isolation
  - B. Screening
  - C. Quarantine ?
  - D. Immunization
- 

14. A disease spreads rapidly through airborne particles and affects multiple countries. This is:

- A. Endemic
  - B. Epidemic
  - C. Pandemic ?
  - D. Sporadic
- 

15. A child receives antibodies through breast milk. This is:

- A. Active immunity
  - B. Artificial immunity
  - C. Natural passive immunity ?
  - D. Artificial active immunity
- 

16. A patient develops disease after a latent period following exposure. This period is:

- A. Incubation period ?
  - B. Communicable period
  - C. Latent period
-

- D. Infectious period
- 

17. Use of mosquito nets in malaria prevention acts by:

- A. Killing agent
  - B. Protecting host
  - C. Breaking transmission ?
  - D. Isolation
- 

18. A person spreads disease before symptoms appear. This is:

- A. Healthy carrier
  - B. Incubatory carrier ?
  - C. Convalescent carrier
  - D. Passive carrier
- 

19. Cholera spreading through contaminated water is:

- A. Direct transmission
  - B. Airborne
  - C. Vehicle-borne transmission ?
  - D. Vector-borne
- 

20. Vaccination of majority of population prevents disease spread. This is:

- A. Isolation
  - B. Herd immunity ?
  - C. Disinfection
  - D. Quarantine
- 

## Ultra High-Yield Focus ?

- Infectivity vs Pathogenicity vs Virulence
- Isolation vs Quarantine
- Direct vs Indirect transmission
- Herd immunity
- SAR