

Dynamics of Disease Transmission

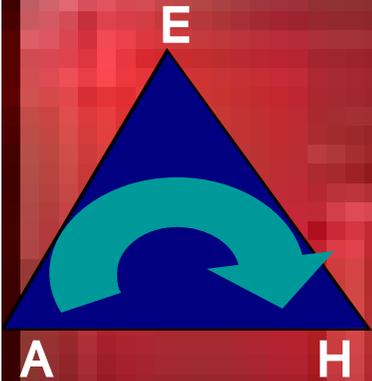
Dr. Akhilesh Bhargava

MD, DHA, PGDHRM

Prof. Community Medicine

&

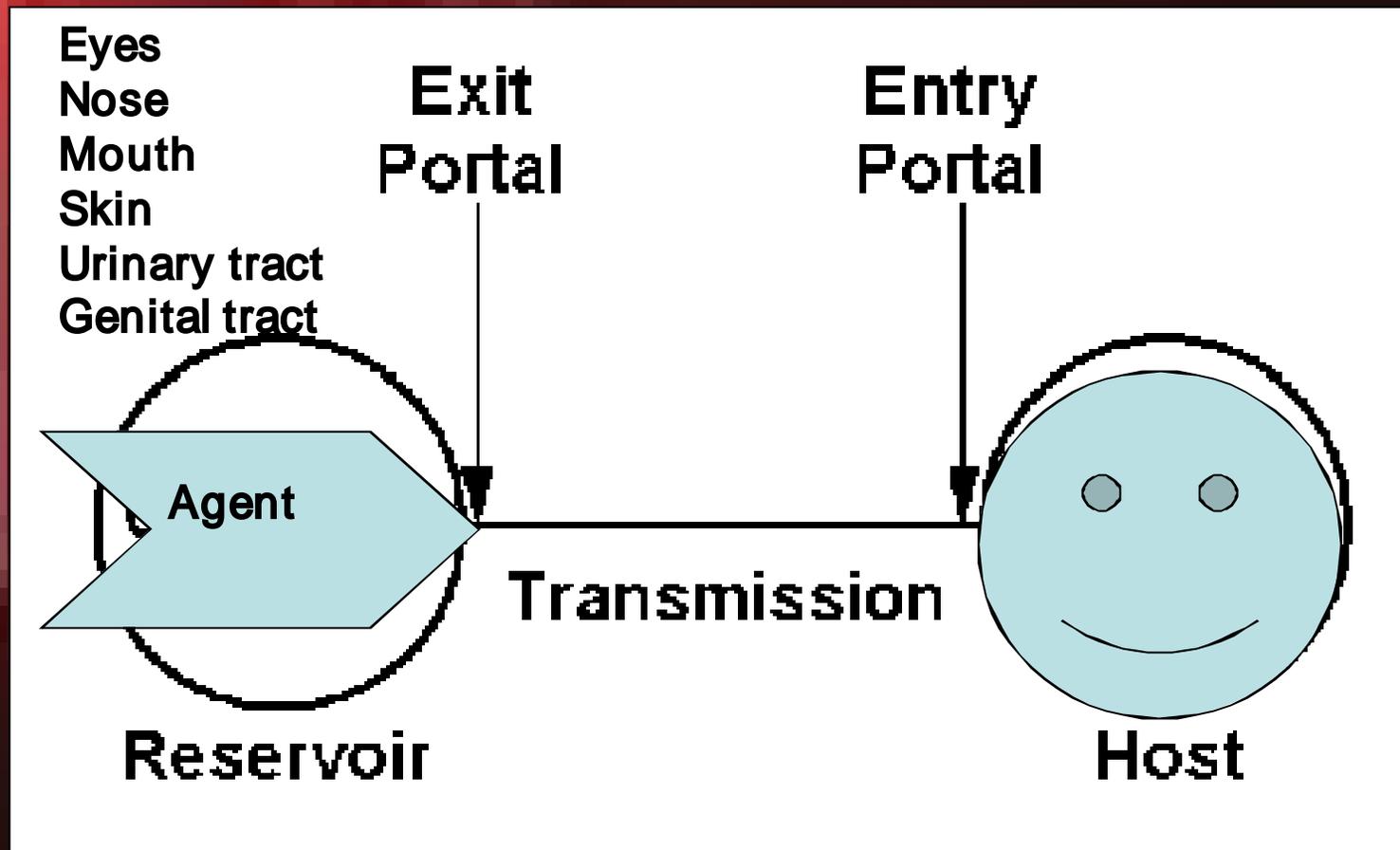
Director-SIHFV, Jaipur



Transmission-prerequisites

- Agent
- Source for agent
- Portal of exit from host
- Suitable mode of transmission
- Portal of entry suitable to agent
- Susceptible host

Chain of Transmission Mode



Modes of Spread

- ❖ **Direct**
- ✓ **Contact**
 - ✓ Ensures certainty
 - ✓ Larger dose,
 - ✓ Less chances of organism dying outside human host
- ✓ **Airborne**
 - ✓ Droplet (3-5 microns), Distance 1-2 feet
 - ✓ Droplet Nuclei (< 3 microns) Distance 3-5 feet
 - ✓ Infected dust
- ✓ **Transplacental**

❖ Indirect

❖ vehicles

- ✓ Water
- ✓ Food
- ✓ Milk
- ✓ Blood and plasma
- ✓ Organs
- ✓ Number of case dependent on dose of infection in vehicle
- ✓ Cases confined to exposed population
- ✓ Large Geographic spread
- ✓ Cases start disappearing with vehicle control
- ✓ Common source is traceable

✓ Vectors

✓ Mechanical

✓ Biological

✓ **Cyclo- propogative** (change in form & number)

e.g. Plague bacilli in Rats

✓ **Cyclo- developmental** (Change in form)

e.g. Malarial parasite in mosquito

✓ **Propogative** (Change in number)

e.g. Microfilaria in mosquito

Herd Immunity

- Resistance of a group to an attack by a disease to which a large proportion of the members of the group are immune
- If a large % of population is immune \Rightarrow entire population is protected, not just those who are immune

Herd Immunity

- Why?
 - If a large % of population is immune then likelihood is small that an infected person will encounter a susceptible person and transmit the infection
 - More of the encounters will be with other immune people
- Important for immunization programs
 - Do not need 100% coverage immunization rates

Herd Immunity

Necessary conditions:

- Disease agent must be restricted to a single host species within which transmission occurs
- Transmission must be relatively direct from one member of the host species to another
- Infections must induce solid immunity

Herd Immunity

- Works when:
 - Probability of an infected person encountering every *other individual* in the population (random mixing) is the same
- Does NOT work when:
 - An infected person interacts **only** with people who are susceptible (no random mixing); likely to transmit the disease to those people

How to Prevent & Control Diseases ?

- Individual patient level
 - **Counseling**
 - **Screening**
 - **Treatment**
- Community level
 - **Surveillance**
 - **Targeted measures**
 - **Agent**
 - **Environment**
 - **Host**
 - **Route of transmission**

Basic Control Strategies

- Substitution
- Treatment
- Isolation
- Shielding

- **Substitution**

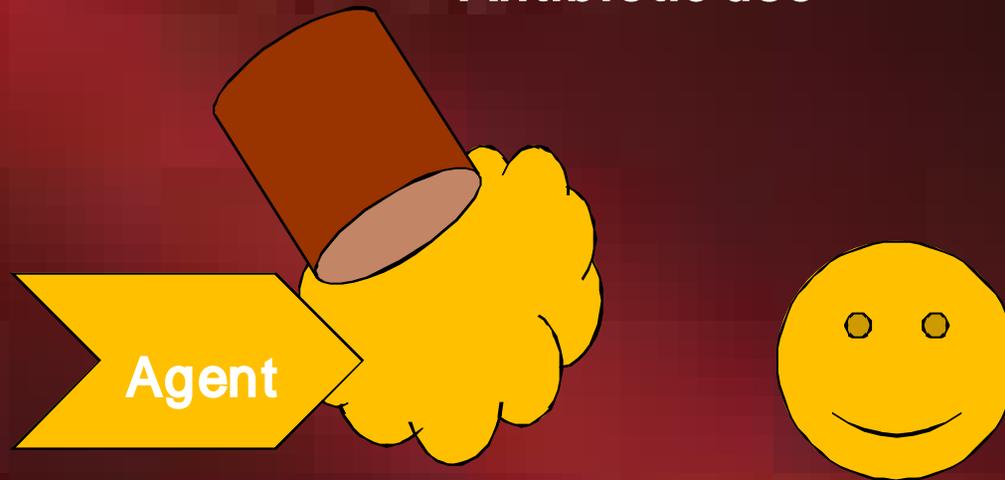


Usually applicable where
Physical / Chemical / Nutritional
agents are involved

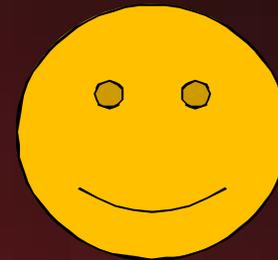
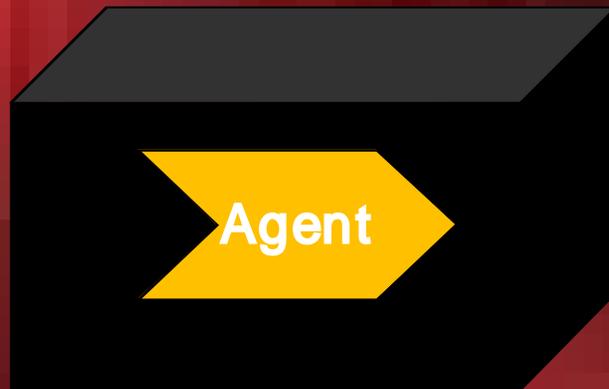
- **Treatment**

**Treatment with
chemicals / Sterilization**

Antibiotic use



- **Isolation**



Disinfection/ Sterilization

Universal Precautions

Vector control

- **Shielding**



Boosting immune system-Vaccination

Repellents

Housing

Behavioral modifications

Chemoprophylaxis

Prevention & control... Blocking Transmission

- **Food Hygiene**
- **Water Treatment**
- **Vector Control**
- **Personal Hygiene**
- **Sterilization & Disinfection**
- **Environmental Engineering**

Prevention & Control: Targeted Strategies

Targeted at Reservoir (Human Host)

- Early Diagnosis
- Notification
- Isolation
- Surveillance
- Quarantine
- Disinfection

Targeted at Route of transmission

– Direct spread

- Contact tracing (TB, HIV)
- Air quality monitoring
- Reducing air microbial density
- Avoid overcrowding, improving ventilation
- Personal behavior-safe sex, lifestyle advice)
- Isolation/quarantine

– Indirect spread

- Environmental control (proper food handling; water processing)
- Safeguarding blood supply
- Vector control (pest control)

Direct spread through Air borne transmission (Droplet) is difficult to control in general population

Targeted at Susceptible Host

- Immunization
- Chemo- prophylaxis
- Physical barriers-
 - » Mosquito nets
 - » Clothing
 - » Housing
- Improving Quality of life
 - Behavioral
 - Diet/exercise
 - Smoking/ Alcohol
 - Hygiene practices

Targeted at Agent

In the environment

Radiation

Sterilization

Antiseptics

Incineration

In Human beings

Prompt Diagnosis and Treatment of patients with drugs e.g. Antibiotics

Targeted at Environment

- Early Diagnosis
 - Lifestyle & behavior (e.g. breastfeeding)
- Health services
 - Policy (notification, contact tracing)
 - Adequate provision for prompt Diagnosis & Treatment

– Legislation

- Food hygiene (PFA Act)
- Air-
 - The Air (Prevention & Control of Pollution) Act, 1981
- Water supply
 - The Water (Prevention & Control of Pollution) Act, 1974
- Sanitation
 - The Environment protection Act, 1986
 - The National Environmental Tribunal Act, 1995
 - The Bio-medical waste (Management & Handling Rules), Act, 1998