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# **Communicable Diseases**

## **Infectious Cycle**



# Infection

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- Infection is the invasion, development & multiplication of microorganisms in the body of man or animals
- Infection may or may not lead to clinical disease
- Infection may be inapparent, subclinical, latent, manifest or clinical infection, which depends on
  - Agent factors
  - Host factors
  - Environmental factors



# Infection

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- Inapparent (subclinical) infection is an infection with no clinical symptoms, usually diagnosed by laboratory (serology or culture)
- Occurrence of CD in the community is a dynamic process which may follow a different forms
- Epidemic sudden abnormal increases in number of cases in a community or a region
- Outbreak it is an epidemic on a small scale, among confined groups, school or hospital
- Sporadic cases scattered infrequent cases. They maintain the disease in the endemic areas & may start an outbreak or even epidemic
- Pandemic an epidemic involving more than one country in the world



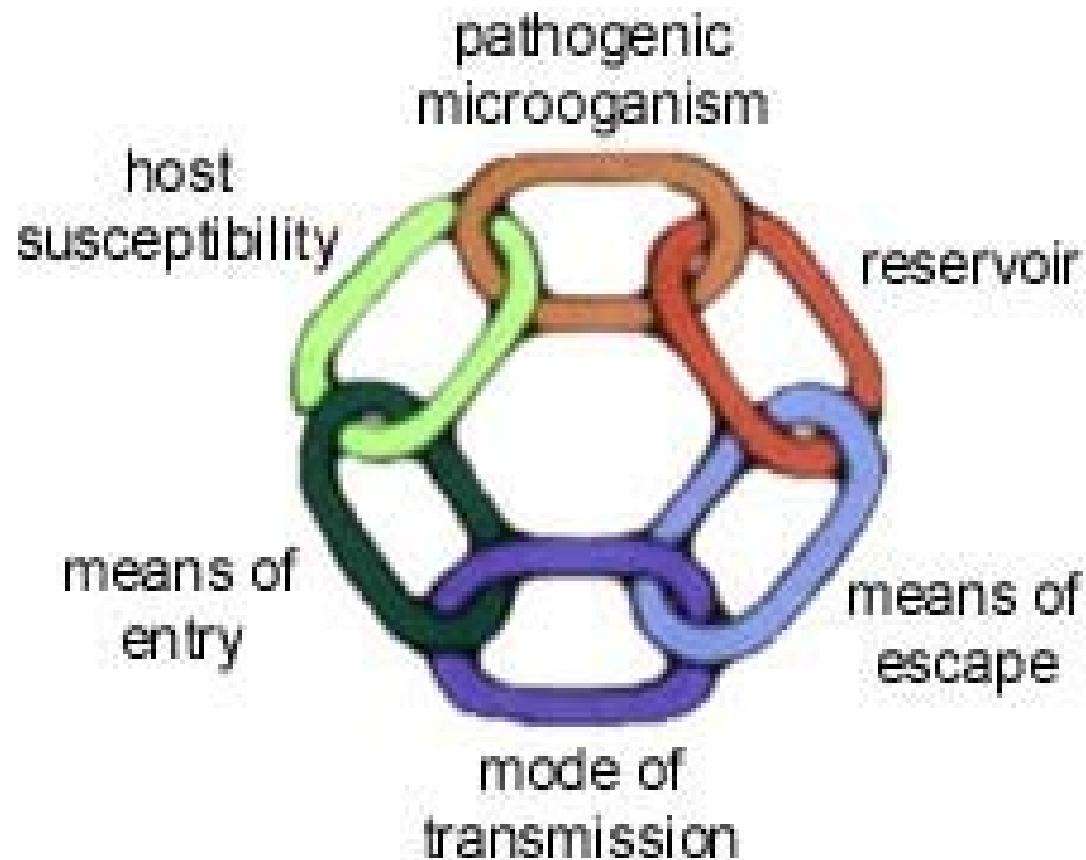
# Epidemiological Components of CD & Infectious Cycle

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- Identification & occurrence of disease
- Causative agents
- Reservoir or source of infection
- Portal of exit
- Period of communicability
- Mode of transmission
- Incubation period
- Susceptibility & resistance
- Clinical features, complication & diagnosis



## Infectious Cycle



## Causative Agents

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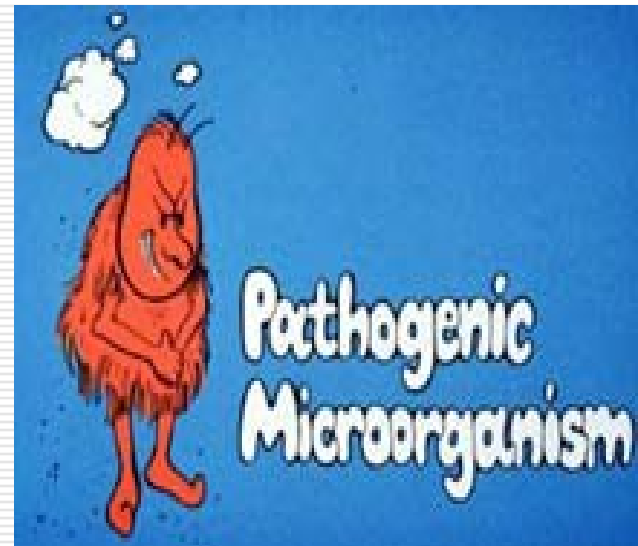
- Bacteria
- Viruses
- Rickettsiae
- Fungi
- Parasites



# Characteristics of Causative Agents

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- Antigenicity & serotypes
- Resistance
- Pathogenicity
- Mutation
- Toxin production



# Reservoir or Source of Infection

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- A reservoir defined as any person, animal, arthropods, plant, soil, or substances in which the infectious agents lives & multiply
- Human reservoir
- Animal reservoir
- Non-living reservoir



# Human Reservoir

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- When man exposed to infection by particular biologic agent he can disseminate the pathogenic agents to others either in the form of
- Cases
- Carriers



# Human Reservoir

## Cases

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- **Clinical cases (manifested)**
  - Typical
  - Atypical
- **Subclinical cases (not manifested)**
  - Inapparent
  - Missed
  - Abortive



# Human Reservoir

## Carriers

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- They are infected persons
- Apparently healthy
- No symptoms
- Having the organism in their bodies
- Excreted organism with their discharges
- Disseminate infections to others



# Human Reservoir

## Carriers

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- **Importance of carriers**
- They are clinically healthy persons moving freely without limitation, living a normal life, infection spread easily to others
- Large number of carriers exceed very much number of cases
- Not diagnosed & not known by others with more probability of spread of infection
- In some diseases, they are dangerous because of nature of their work (food handlers)
- Carriers of some diseases may remain infective for long period or for life



# Human Reservoir

## Carriers

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- **Classification of carriers**
- **According to relation to the case**
- **Incubatory carrier**
  - **Become infective before onset of disease during I.P**
  - **In the last few days as cholera & typhoid**
  - **In the last few weeks as viral hepatitis A**
- **Convalescent carriers**
  - **In some infectious diseases the recovered cases continue to excrete the infective agents**
  - **Clinical recovery doesn't coincides with bacteriological recovery**



# Human Reservoir

## Carriers

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- **Contact carriers**
  - In some infectious diseases contacts of cases having moderate immunity may be infected & get rid of infection within maximally 2 weeks e.g. typhoid
- **Healthy carriers**
  - Those infected persons from polluted environment such as contaminated food & water
  - This occurs in endemic infectious diseases



# Human Reservoir

## Carriers

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- According to period of carrier state
- Transient carrier
  - They are infective only for few days e.g. last few days of I.P (cholera)
- Temporary carrier
  - They are infective for few weeks to few months e.g. viral hepatitis A last week of I.P & viral hepatitis B, 3 w to 3 mo
- Chronic carrier
  - Who are still infective for years e.g. chronic convalescent carriers in hepatitis B & typhoid



# Human Reservoir

## Carriers

- According to foci of infection: habitat of organism
- Respiratory system
  - Throat: Diphtheria, staph. aureus, strept. hemolyticus
  - Nose: Diphtheria, staph.
  - Nasopharynx: Meningococci, pneumococci
- GIT
  - Gall bladder: Salmonella typhi & paratyphi
  - Small intestine: Salmonella typhi & paratyphi
  - Large intestine: Amebiasis
- UT
  - Salmonella typhi & paratyphi
- Skin lesion
  - Staph. aureus



# Human Reservoir

## Carriers

- According to discharge that carry the organism outside the body
- Respiratory discharges
  - From nose & throat through coughing, sneezing, spitting e.g. staph., strep., influenza & meningitis
- Fecal carriers
  - Typhoid, paratyphoid, amebiasis
- Urinary carriers
  - Typhoid, paratyphoid
- Skin carriers
  - Skin lesions
- Blood
  - Hepatitis B, C & HIV



## Animal Reservoir

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- **Animal could be a source of infection in some diseases transmitted naturally between animals may accidentally on exposure infect man (zoonosis)**
- **Organisms come out with different discharges of infected animal**
- **Man get infected by inhalation, ingestion, contact**
- **Animals act as reservoir in plague, yellow fever, & brucellosis**



## Animal Reservoir

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- Example of zoonosis
- **Cattle:** bovine TB, brucellosis, salmonellosis, tinea saginata food poisoning, Q fever, campylobacter, anthrax
- **Horses:** tetanus, glanders, dermatophytosis
- **Dogs:** rabies, hydatid disease
- **Cats:** rabies toxoplasmosis, dermatophytosis
- **Poultry:** salmonella food poisoning, avian TB, avian flu, histoplasmosis
- **Pigeon:** psittacosis
- **Fish:** heterophyes heterophyes, diphylobothrium latum
- **Pigs:** tinea solium, swine flu



## Non-living Reservoir

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- Soil & inanimate things
- Soil: transmission of tetanus & anthrax
- Water: legionnaire disease



## Portal of Exit

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- The organism leaves the body of reservoir through
  - Respiratory orifices
  - GIT
  - Genitourinary tract
  - Discharge of skin & mucous membrane
  - In utero transmission
  - Blood
  - Via milk as HIV, CMV
  - With tears as HIV



## Period of Communicability (Infectious Period)

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- Infectivity is either terminated by clinical cure as small pox, chicken pox, measles
- Infectivity may start the last few days or weeks of IP & extend during convalescent period



## Period of Infectivity in Childhood Infectious Diseases

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| Disease        | Infectious period                                                                            |
|----------------|----------------------------------------------------------------------------------------------|
| Chicken pox    | 5 days before rash to 6 days after last crop                                                 |
| Diphtheria     | 2-3 weeks (shorter with antibiotic therapy)                                                  |
| Measles        | From onset of prodromal symptoms to 4 days after onset of rash                               |
| Mumps          | 3 days before salivary swelling to 7 days after                                              |
| Rubella        | 7 days before onset of rash to 4 days after                                                  |
| Scarlet fever  | 10-21 days after onset of rash (shortened to 1 day by penicillin)                            |
| Whooping cough | 7 days after exposure to 3 weeks after onset of symptoms (shortened to 7 days by antibiotic) |



# Mode of Transmission

1- Air Born

2- Water Born



3- Food Born

4- Vector Born

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## Mode of Transmission

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- **Direct transmission**
  - Direct contact, skin to skin  
kissing, sexual relation, AIDS, gonorrhea,  
leprosy, eye infections
  - Droplet
  - Contact with soil
  - Tetanus, ankylostoma
  - Transplacental (vertical)
- **Indirect droplet infection**
  - Air born infections
  - Droplet nuclei
  - Dust



## Mode of Transmission

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- **Droplet infection (respiratory infection)**

Droplet means minute residue of water vapor coming out from nose & mouth during coughing, sneezing, spitting, singing, laughing or even talking loudly.

- **Direct droplet**

Where there is a direct project of droplet from the source to the susceptible either,

- Direct contact as in kissing
- Inhalation of droplets where the host is within the range of sprayed droplets (60 cm) helped by overcrowding & illventilation (influenza, meningitis, measles)





**A sneeze occurs at about 100 miles an hour .**



- **True**
- **False**

# True

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- Humans sneeze at a speed of up to 100 miles per hour and
- Cough at up to 60 miles per hour.



## Mode of Transmission

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- Indirect droplet

This occur by using the recently contaminated articles, towels, fomites, & thermometers from discharge of reservoir

- Air born infections

Air may act as a vehicle in transmission of droplet infection i.e. carry the infective agents. Occur either

- Droplet nuclei

They are tiny particles of organisms after evaporation of the fluid material, they can be carried by air as influenza



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Fomite born: as towels, clothes, cups, spoons that transfer agents to host

## Mode of Transmission

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- **Dust**

Some of the large droplets, which are expelled during coughing or spitting settle down on the floor, carpet, furniture, clothes & other objects & become part of dust. During sweeping & dusting or bed making, the dust is released into air carrying organisms as TB, staph, pneumo



## Mode of Transmission

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- **Contact infection**
- **Contact infection invading the skin and mucous membrane, as in bilharziasis, ancylostomiasis, leptospirosis, syphilis**
- **Contact infection invading injured skin or mucous membrane, as in tetanus, rabies, gas gangrene, sepsis**



## Diseases Transmitted by Droplet Infection

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- **Bacterial**
  - TB, meningitis, streptococcal pharyngitis, diphtheria, whooping cough, & pneumonia
- **Viral**
  - Measles, rubella, mumps, chickenpox & smallpox, influenza, common cold



## Mode of Transmission

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- Food born infection

The infectious agents enter the body with food or drink through:

- Direct faecoral transmission (hand to mouth)
- Vehicle transmission:
  - Transmission of infection through ingestion of contaminated water, raw vegetables, fruits, milk, meat, eggs & fish
- Vector born houseflies & cockroaches (mechanically transmission)
- Human fertilization of edible crops lead to contamination of food
- Dust if the food is exposed to contaminated dust
- Autoinfection: entrobilus, T. solium, intestinal TB



## Diseases Transmitted by Food & Drink

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- **Bacterial**
  - Typhoid, paratyphoid, cholera, shigellosis, gastroenteritis, diarrheal diseases, food poisoning, brucellosis
- **Viral**
  - Viral hepatitis, poliomyelitis, rota virus
- **Parasitic diseases**
  - Ascariasis, amebiasis, taeniasis, entrobiasis, hydatid disease



## Mode of Transmission

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- Blood-borne infection
- Injury: (injection infection) needle
- Sex
- Arthropode
- In utero



## Mode of Transmission

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- Arthropod-borne infection
- Mechanical transmission
  - Insect has no role in multiplication of the organism
- Biological transmission
  - The insect plays an important role in the multiplication of the organism



## Mode of Transmission

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- Arthropode born infection
- Mosquitoes
  - Anopheles: transmit malaria
  - Culex piping: transmit rift valley fever, encephalitis
  - Aedes Aegypti:
    - Transmit yellow fever, dengue fever
- Tsetse flies:
  - Transmit African trypanosomiasis
- Lice: transmit infection either
  - After scratching of the skin the organism present with feces of insect can enter the skin (posterior station) as in typhus
  - Through body fluids, the insect should be crushed in order the organism enter the skin (relapsing fever)



## Mode of Transmission

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- **Flea**
    - Transmit plague, murine typhus, *hymenoleps diminuta*
  - **Ticks**
    - Hard ticks transmit spotted fever, Q fever, tularamia
    - Soft ticks transmit tick born relapsing fever
  - **Mites** transmit scabies, scrub typhus
  - **Sand flies** transmit leishmania
  - **House flies**
    - Transmit food born, eye infection, accidental myasis
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## Means of Entry

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## **Incubation Period (IP)**

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- **IP is the period between invasion of the body by the pathogenic organisms & the appearance of symptoms of disease**
  - **IP is characteristic of each disease which may be**
    - **Very short (few hours) as in staphylococcus food poisoning**
    - **2-6 mo in HBV**
    - **Years in HIV**
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# Incubation Period (IP)

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- **Epidemiological importance of IP**
  - **Preventive measures**
    - Short IP: passive immunization or chemoprophylaxis
    - Long IP: active immunization
  - **Supervision & observation of**
    - Contacts for early diagnosis & treatment
  - **In quarantinable diseases:**
    - Isolation of exposed travelers for the maximum IP except if they have valid immunization certificate
  - **Tracing the source of infection in**
    - Short IP disease as food poisoning
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# Incubation Period (IP) of Important Infections

## Short IP < 7 days

| Infection           | IP             |              |
|---------------------|----------------|--------------|
|                     | Maximum range  | Normal range |
| Anthrax             | 2-5            |              |
| Bacillary dysentery | 1-7            |              |
| Cholera             | Hours – 5 days | 2-3 hours    |
| Diphtheria          | 2-5            |              |
| Gonorrhea           | 2-5            |              |
| Meningococcemia     | 2-10           | 3-4 days     |
| Scarlet fever       | 1-3            |              |
|                     |                |              |

# Incubation Period (IP) of Important Infections

## Intermediate IP 7-21 days

| Infection      | IP               |              |
|----------------|------------------|--------------|
|                | Maximum range    | Normal range |
| Amoebiasis     | 14 days – months | 21           |
| Chicken pox    | 14-21            |              |
| Lassa fever    | 7-14             |              |
| Malaria        | 8 days – months  |              |
| Measles        | 7-14 days        | 10           |
| Mumps          | 12-21            | 18           |
| Poliomyelitis  | 3-21             | 7-10         |
| Psittacosis    | 4-14             | 10           |
| Rubella        | 14-21            | 18           |
| Typhoid        | 7-21             |              |
| Typhus         | 7-14             | 12           |
| Whooping cough | 7-1-             | 7            |

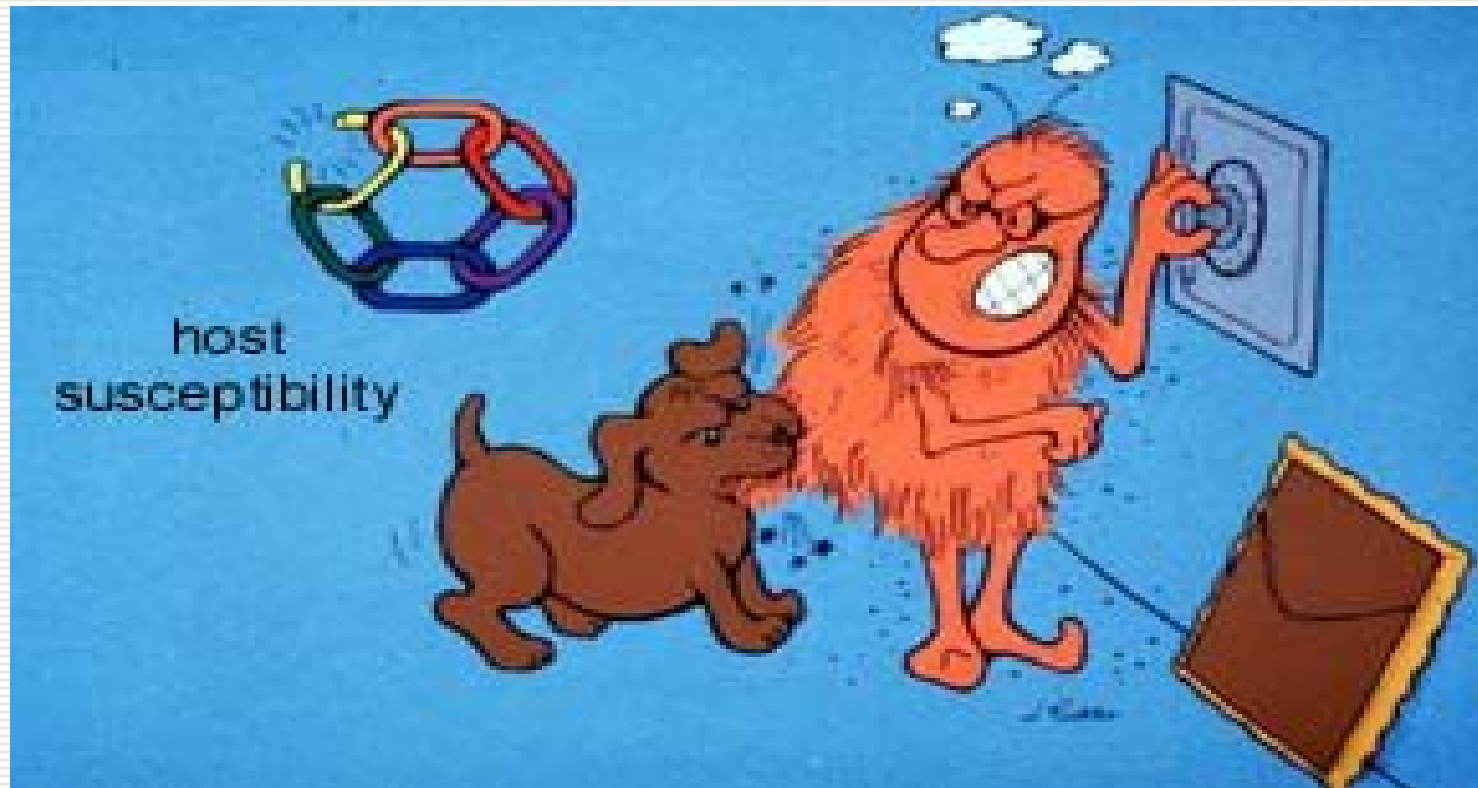
# Incubation Period (IP) of Important Infections

Long IP > 21 days

| Infection             | IP                 |              |
|-----------------------|--------------------|--------------|
|                       | Maximum range      | Normal range |
| Brucellosis           | Days – months      |              |
| Filariasis            | 3 months- years    |              |
| Hepatitis A           | 2-6 weeks          | 4 weeks      |
| Hepatitis B           | 6 weeks- 6 months  | 12 weeks     |
| Hepatitis C           | 2 weeks – 2 months |              |
| Leishmania cutaneous  | 1 week- months     |              |
| Leishmania visceral   | 2 weeks – 2 years  | 2-4 months   |
| Rabies                | Variable           | 2-8 weeks    |
| Schistosomiasis       | Weeks – years      |              |
| Trypanosoma gambiense | Weeks – years      |              |
| TB                    | Months – years     |              |
| Leprosy               | Years              | 2-5 years    |

## Susceptibility & Resistance

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## Susceptibility & Resistance

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- Epidemiological variables affect susceptibility & resistance are
  - Host (person)
  - Place
  - Time
  - Environment
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## Susceptibility & Resistance

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- **Host (person) factors which determine level of personal immunity**
  - Genetic factors
  - Age
  - Sex
  - Nutrition
  - Occupation
  - Chronic disease
  - Socioeconomic & cultural level of individual
  - Lifestyle
  - Immunity
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## Susceptibility & Resistance

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- **Place**
  - There are disease which are prevalent in rural areas as parasitic infestation
  - In urban areas, food poisoning, typhoid are more prevalent
  - There are some infectious diseases are more common in certain foci in world, cholera in south east Asia
  - There are some diseases in certain places as nosocomial infections
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## Susceptibility & Resistance

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- Time refers to date
  - The occurrence of disease can be observed over a long period of time
  - Secular trends
    - Reflects periodicity & natural history of disease over many years e.g. meningococcal meningitis having an epidemic every 10 years
  - Season
    - In summer, higher incidence of disease as gastroenteritis, legionnaire disease
    - In winter, droplet infection more common
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## Susceptibility & Resistance

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- **Environment**
  - **Physical environment**
    - Temperature, humidity, sanitation, pollution
  - **Biological environment**
    - Presence of animals, insects
  - **Social environment**
    - Sanitary living condition, nutrition, lifestyle
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## Indications for Prophylactic Immunoglobulin

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- **Human normal Ig (pooled Ig)**
    - Virus A hepatitis (travelers & debilitated children)
    - Measles (child with heart or lung disease)
  
  - **Human specific Ig**
    - Virus B hepatitis (needlestick injuries, sexual partner)
    - Tetanus (susceptible injured patients)
    - Rabies (post-exposure protection)
    - Chickenpox (immunosuppressed children)
    - Respiratory syncytial virus infection (high risk infants)
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## Indications for Chemoprophylaxis

| Infection to be prevented | Indication for chemoprophylaxis | Antimicrobial agent indicated                  | Adult dose                                |
|---------------------------|---------------------------------|------------------------------------------------|-------------------------------------------|
| Diphtheria                | Susceptible contacts            | Erythromycin                                   | 500 mg 6 hourly                           |
| Meningococcal             | Susceptible contacts            | Rifampicin<br>Ciprofloxacin                    | 600mg/12 hr /2 days<br>500 mg single dose |
| Whooping cough            | Susceptible contacts            | Erythromycin                                   | 500 mg 6 hr/7 days                        |
| TB                        | Susceptible contacts            | Isoniazid                                      | 300 mg daily/6 m                          |
| Rheumatic fever           | Following rheumatic             | Penicillin                                     | 250 mg 12 hourly                          |
| Endocarditis              | Heart valve lesion              |                                                |                                           |
| Tetanus                   | Wound or injury                 | Erythromycin                                   | 500 mg 6 hr/7 days                        |
| Gas gangrene              | Wound or injury                 | Penicillin or<br>Metronidazole                 | 600 mg 6 hr/5 days<br>500 mg 8 hr/5 days  |
| Abd/pelvis sepsis         | Colonic or gynecolog surgery    | Gentamycin,<br>cephalosporin,<br>metronidazole |                                           |
| Malaria                   | Travel to malarious area        |                                                |                                           |

## Infection & Chronic Disease

| Infection                                                                                                                                    | Chronic disease                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Viral infection</b><br><b>Group A, beta hemolytic streptococci</b><br><b>Treponema pallidum</b>                                           | <b>CHD</b><br><b>Rheumatic heart</b><br><b>Syphilitic aortitis</b>                                                                       |
| <b>Group A, beta hemolytic streptococci</b><br><b>E. coli, proteus, klebsella</b><br><b>Bilharzias</b><br><b>E. coli, proteus, klebsella</b> | <b>Glomerulonephritis</b><br><b>Chronic pyelonephritis</b><br><b>Chronic cystitis &amp; cancer bladder</b><br><b>Chronic prostatitis</b> |
| <b>Coxsackie virus, mumps virus</b>                                                                                                          | <b>DM</b>                                                                                                                                |
| <b>Streptococcus pneumoniae</b>                                                                                                              | <b>Chronic tonsillitis</b><br><b>Chronic bronchitis</b><br><b>COPD</b>                                                                   |
| <b>Campylobacter pylori</b>                                                                                                                  | <b>Chronic gastritis</b><br><b>Peptic ulcer</b><br><b>Cancer stomach</b>                                                                 |
| <b>HBV &amp; or HCV</b>                                                                                                                      | <b>Chronic persistent hepatitis</b><br><b>Chronic active hepatitis</b><br><b>Liver cirrhosis</b><br><b>Liver cancer</b>                  |

## Infection & Chronic Disease

| Infection            | Chronic disease |
|----------------------|-----------------|
| Shigella, klebsiella | Reiter disease  |