

Microbe-Human Interactions: Infection and Disease Part (2)

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Salmonella sp.



Signs and Symptoms of Inflammation

- Earliest symptoms of disease as a result of the activation of the body defenses
 - Fever, pain, soreness, swelling
- Signs of inflammation:
 - **Edema** – accumulation of fluid
 - **Granulomas** and **abscesses** – walled-off collections of inflammatory cells and microbes
 - **Lymphadenitis** – swollen lymph nodes

Signs of Infection in the Blood

- Changes in the number of circulating white blood cells
 - **Leukocytosis** – increase in white blood cells
 - **Leukopenia** – decrease in white blood cells
 - **Septicemia** – microorganisms are multiplying in the blood and present in large numbers
 - **Bacteremia** – small numbers of bacteria present in blood not necessarily multiplying
 - **Viremia** – small number of viruses present not necessarily multiplying

Infections That Go Unnoticed

- **Asymptomatic** (subclinical) infections – although infected, the host doesn't show any signs of disease
- Inapparent infection, so person doesn't seek medical attention

Portals of Exit

- Pathogens depart by a specific avenue; greatly influences the dissemination of infection
 - **Respiratory** – mucus, sputum, nasal drainage, saliva
 - **Skin scales**
 - **Fecal exit**
 - **Urogenital tract**
 - **Removal of blood**

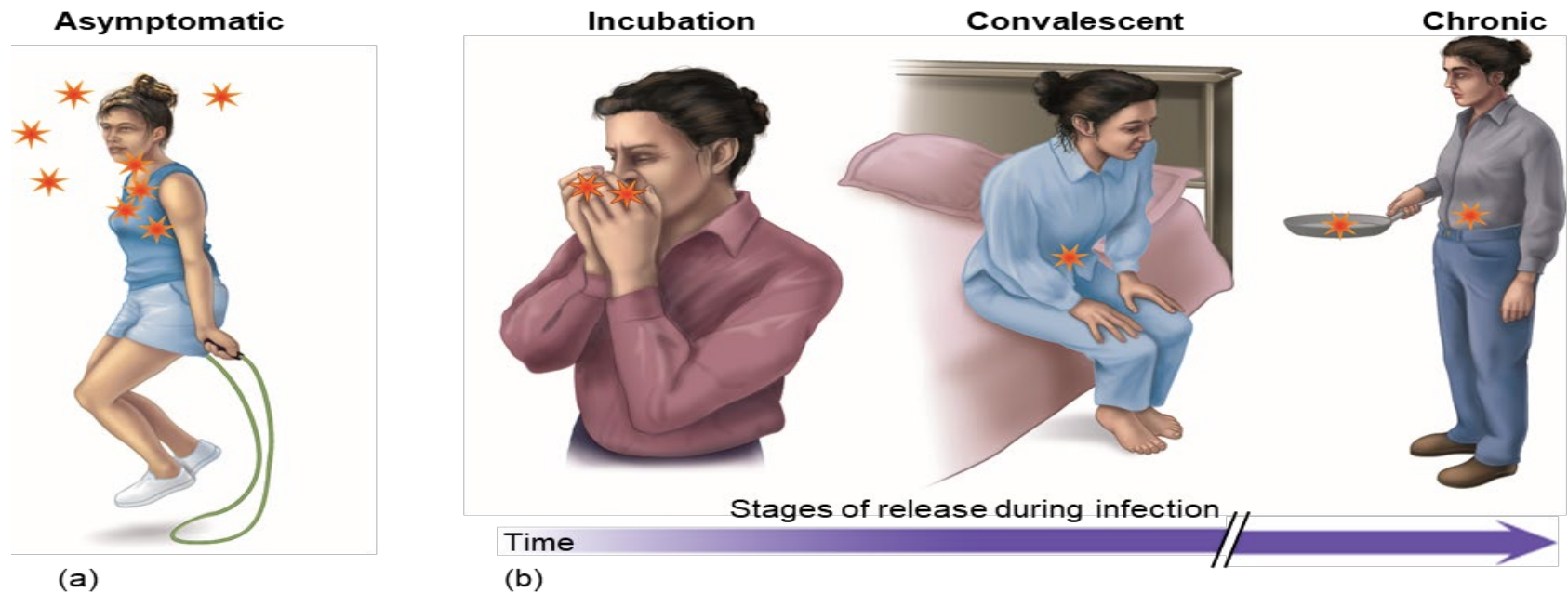
Sources and Transmission of Microbes

- **Reservoir** – primary habitat of pathogen in the natural world
 - Human or animal carrier, soil, water, plants
- **Source** – individual or object from which an infection is actually acquired

Living Reservoirs

- **Carrier** – an individual who inconspicuously shelters a pathogen and spreads it to others; may or may not have experienced disease due to the microbe
- **Asymptomatic carrier** – shows no symptoms
- **Passive carrier** – contaminated healthcare provider picks up pathogens and transfers them to other patients

- **Asymptomatic carrier** – shows no symptoms
 - **Incubation carriers** – spread the infectious agent during the incubation period
 - **Convalescent carriers** – recuperating without symptoms
 - **Chronic carrier** – individual who shelters the infectious agent for a long period



Animals as Reservoirs and Sources

- A live animal (other than human) that transmits an infectious agent from one host to another is called a **vector**
- Majority of vectors are arthropods, fleas, mosquitoes, flies and ticks
- Some larger animals can also spread infection mammals, birds, lower vertebrates

- **Biological vectors** – actively participate in a pathogen's life cycle
- **Mechanical vector** – not necessary to the life cycle of an infectious agent and merely transports it without being infected

- An infection indigenous to animals but naturally transmissible to humans is a **zoonosis**
- Humans don't transmit the disease to others
- At least 150 zoonoses exist worldwide; make up 70% of all new emerging diseases worldwide
- Impossible to eradicate the disease without eradicating the animal reservoir

Acquisition and Transmission of Infectious Agents

- **Communicable disease** – when an infected host can transmit the infectious agent to another host and establish infection in that host
- Highly communicable disease is **contagious**
- **Non-communicable** infectious disease does not arise through transmission from host to host
 - Occurs primarily when a compromised person is invaded by his or her own normal microflora
 - Contact with organism in natural, non-living reservoir

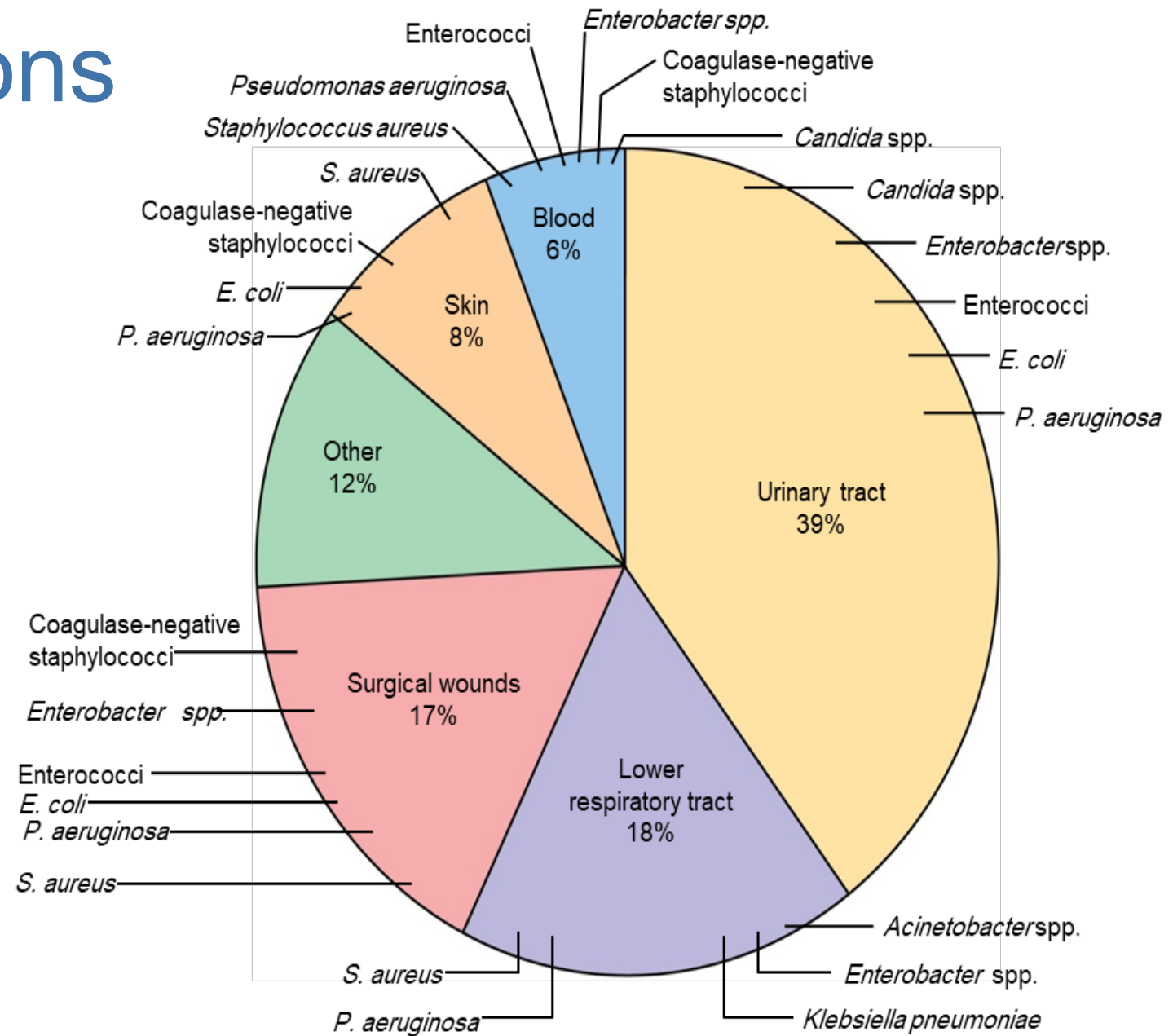
Patterns of Transmission

- **Direct contact** – physical contact or fine aerosol droplets
- **Indirect contact** – passes from infected host to intermediate conveyor and then to another host
 - **Vehicle** – inanimate material, food, water, biological products, fomites
 - Airborne – droplet nuclei, aerosols



Nosocomial Infections

- Diseases that are acquired or developed during a hospital stay
- From surgical procedures, equipment, personnel, and exposure to drug-resistant microorganisms
- 2 to 4 million cases/year in U.S. with approximately 90,000 deaths



Universal Blood and Body Fluid Precautions

- Stringent measures to prevent the spread of nosocomial infections from patient to patient, from patient to worker, and from worker to patient – **universal precautions**
- Based on the assumption that all patient specimens could harbor infectious agents, so must be treated with the same degree of care

Epidemiology

- The study of the frequency and distribution of disease and health-related factors in human populations
- Surveillance – collecting, analyzing, and reporting data on rates of occurrence, mortality, morbidity and transmission of infections
- Reportable, notifiable diseases must be reported to authorities
- Centers for Disease Control and Prevention (CDC) in Atlanta, GA – principal government agency responsible for keeping track of infectious diseases nationwide

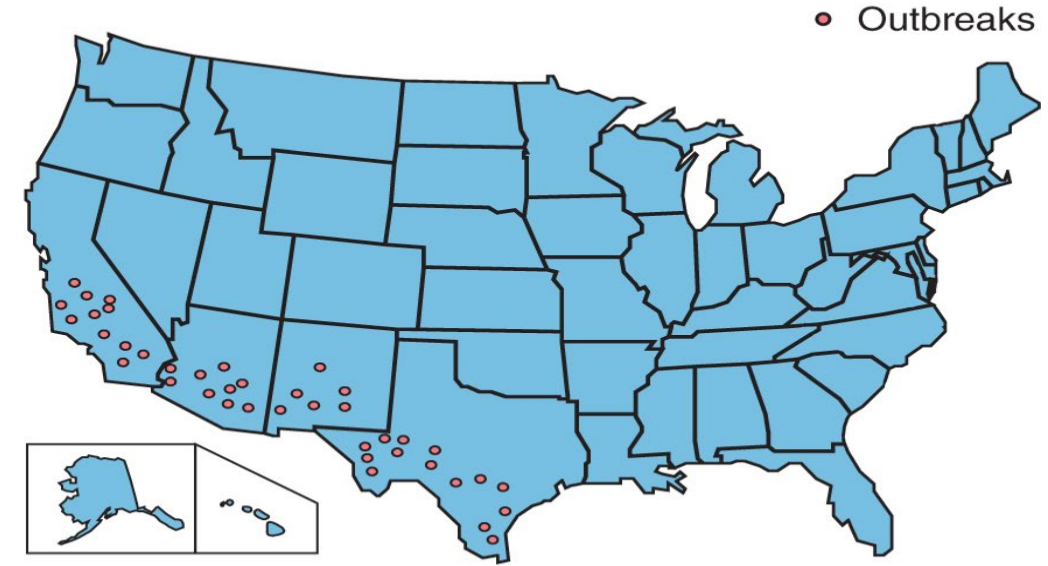
Frequency of Cases

- **Prevalence** – total number of existing cases with respect to the entire population usually represented by a percentage of the population
- **Incidence** – measures the number of new cases over a certain time period, as compared with the general healthy population
- **Mortality rate** – the total number of deaths in a population due to a certain disease
- **Morbidity rate** – number of people afflicted with a certain disease

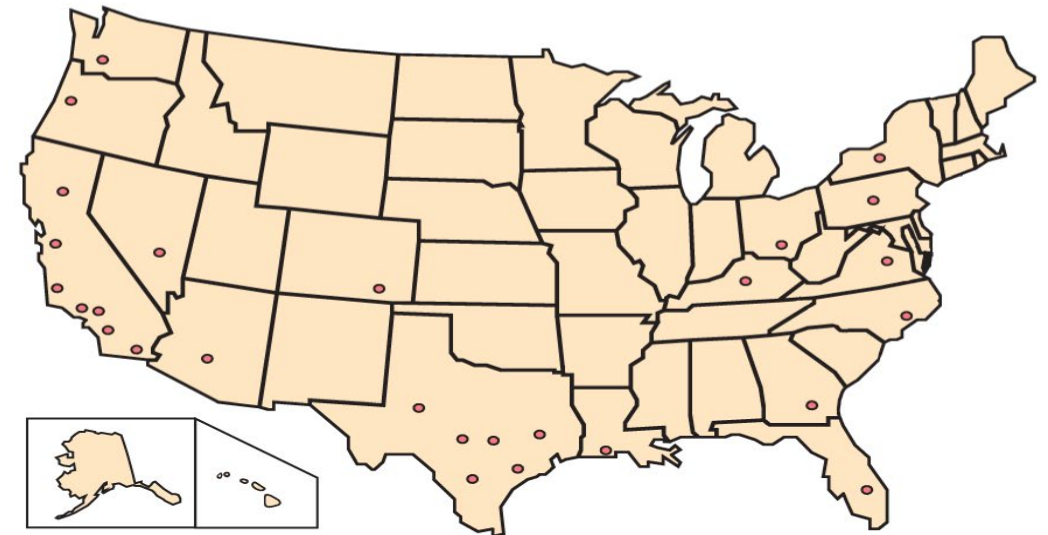
Patterns of Infectious Disease Occurrence

- **Endemic** disease that exhibits a relatively steady frequency over a long period of time in a particular geographic locale
- **Sporadic** when occasional cases are reported at irregular intervals

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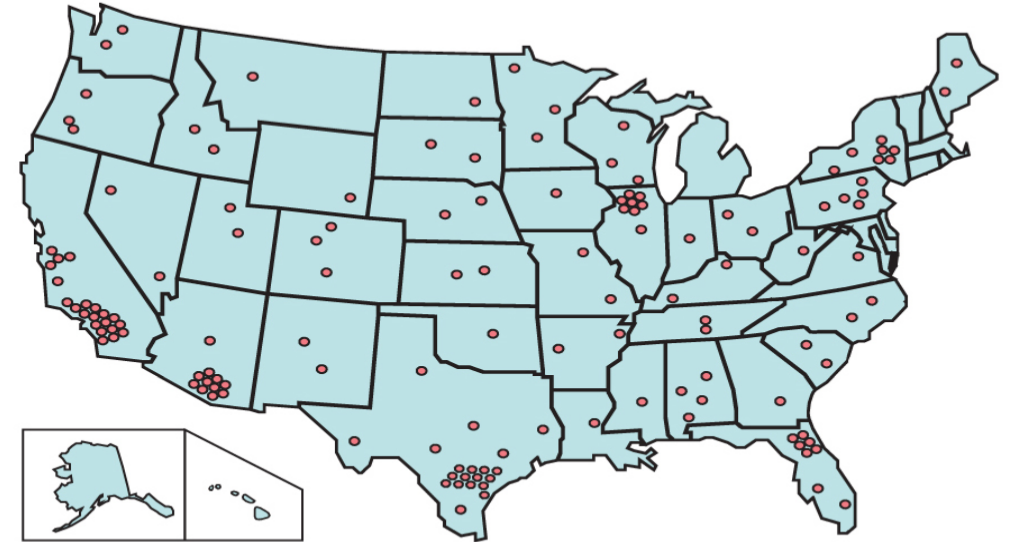


(a) Endemic Occurrence (Valley fever)



(b) Sporadic Occurrence (Typhoid fever)

- **Epidemic**
when prevalence of a disease is increasing beyond what is expected



(c) Epidemic Occurrence (Influenza)

- **Pandemic**
epidemic across continents



(d) Pandemic Occurrence (AIDS)

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