Pathogenic Microbiology

Principles of Disease and Epidemiology

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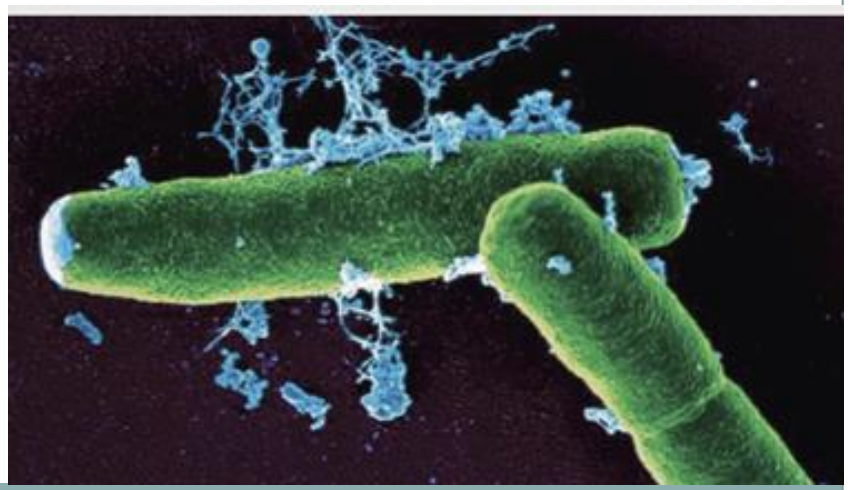


Frequency of Disease

- Sporadic disease – a disease that occurs occasionally in a population.
  - Typhoid fever
- Endemic disease – a disease is constantly present in a population.
  - Common cold
  - Rabies in skunk, bats
- Epidemic disease – a disease that acquired by many in a population over a short period of time.
  - Influenza
- Pandemic disease – an epidemic disease that occurs worldwide
  - SARS

Duration of Disease

- Acute disease – a disease that develops rapidly but last only a short time.
  - Influenza
- Chronic disease – a disease that develops more slowly.
  - Body reactions tend to be less severe
  - Disease tends to be more continual or recurrent for long periods
    - Mononucleosis
    - Tuberculosis
    - Hepatitis B

Duration of disease

- Subacute disease – intermediate disease between acute and chronic
  - Subacute sclerosing panencephalitis
    - Caused by measles virus (rubeola)
- Latent disease – causative agent of disease remains inactive for a time, then becomes active to produce symptoms
  - Chickenpox (Varicella– Zoster)
  - Shingles is the latent disease

Extent of Infection

- Local infection
  - Infection of a microorganism that is confined to a small region of the body
- Systemic or generalized infection
  - Microorganisms are spread through out the body via blood or lymph
- Focal infection
  - After an microorganism spreads they become confined to specific areas of the body
    - Teeth, tonsils, sinuses

Extent of Infection

- Bacteremia
  - Presence of bacteria in the blood
    - Anthrax (remember Koch)
- Sepsis
  - Replication of bacteria in the blood
- Toxemia
  - Presence of toxins in blood
    - Tetanus
- Viremia
  - Presence of viral particles in blood
    - HIV

Types of Infection

- Primary infection
  - An acute infection that causes initial illness
- Secondary infection
  - An infection caused by an opportunistic after a primary infection has weakened defenses
    - Can be more dangerous than primary infections
      - *Pneumocystis* in AIDS patients
      - Streptococcal bronchopneumonia following influenza
- Inapparent (subclinical) infection
  - Infection that does not cause noticeable disease
    - Polio, hepatitis A

Development of Disease

- Progression of disease
  - Incubation period
    - Time between introduction of microorganism into host and first appearance of signs
    - Varies between organism
    - Depends of number of microorganism and host defenses
    - Can pass disease
- Period of illness
  - Disease is most acute
  - Exhibits signs of disease
    - Fever, chills
    - Muscle pain (myalgia)
    - Photophobia
    - Sore throat (tonsillitis)
    - Swollen lymph nodes (lymphadenopathy)
  - Outcomes
    - Disease overcome
    - Patient dies
  - Reservoirs of infections

Spread of infection

- Reservoirs of infection
  - Supplies continual source of microorganism
    - Adequate environment for microorganism to survive
  - May be human, animal or non living

Human reservoirs

- Human reservoirs
  - Carriers – those who harbor pathogens, but do not become ill or show signs of illness
    - May have inapparent illness
    - Symptom free stage
    - AIDS, diphtheria, typhoid fever, hepatitis, gonorrhea, amoebic dysentery, and streptococcal infections

Animal Reservoirs

- Animal reservoirs
  - Domestic and wild
  - Zoonoses
    - Diseases in animals that can be transmitted to humans
      - Rabies, brucellosis, ringworm, Lyme disease, plague

Non living Reservoirs

- Non living reservoirs
  - Soil
    - *Clostridium tetani*
    - *Clostridium botulinum*
  - Water
    - Contaminated by feces
      - *Vibrio cholerae*
      - *Salmonella typhi*
  - Food
    - Improperly stored
    - Trichinosis, salmonellosis

Transmission of Disease

- Three routes of transmission
  - Contact transmission
  - Vehicle transmission
  - Vector transmission

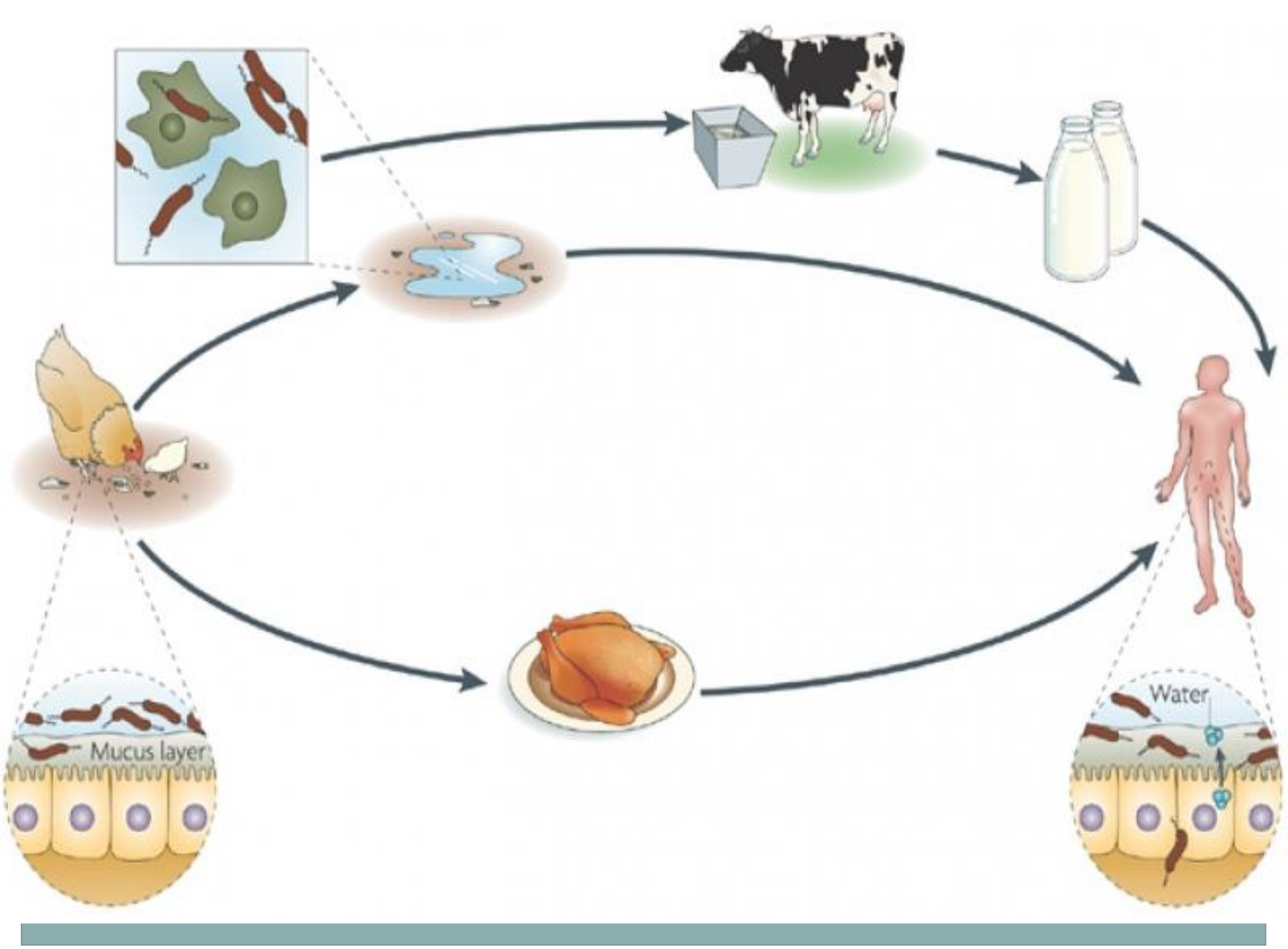
Contact Transmission

- Contact transmission
  - 1- direct contact (person to person)
    - Physical contact between source of infection and susceptible host
    - Touching, kissing, sexual intercourse
    - Common cold, staphylococcal infections, hepatitis A, STIs (STDs), measles, AIDS
    - Gloves and universal precautions prevent spread
  - 2- indirect transmission
    - Infectious agent transmitted from reservoir to a non-living object (fomite)
      - Towels, bedding, eating utensils, money, toys, contaminated needles
    - AIDS, hepatitis B

- Contact transmission
  - 3- droplet transmission
    - Microbes discharged in mucus droplets
      - Coughing, sneezing, laughing, talking
    - Influenza, pneumonia, pertussis

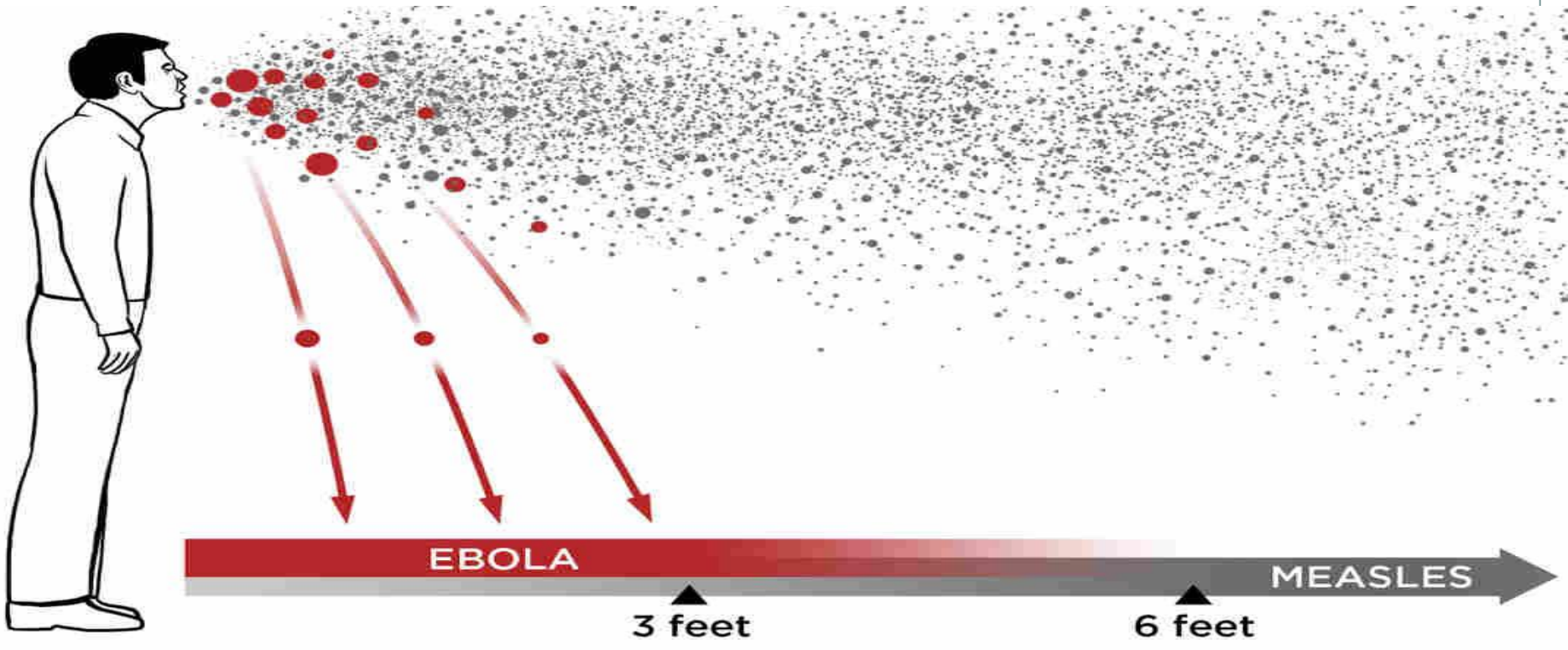
Vehicle Transmission

- Vehicle transmission
  - 1- waterborne transmission
    - Microorganisms spread through poorly or untreated sewage
      - Cholera, leptospirosis, shigellosis
  - 2- food borne transmission
    - Poorly or undercooked foods
    - Poorly stored foods
      - Food poisoning
      - Tapeworms


Mucus layer
Water

Vehicle Transmission

- Vehicle transmission
  - 3- airborne transmission
    - Can travel mucus droplet or duct > 1 meter
    - Tuberculosis, histoplasmosis, measles



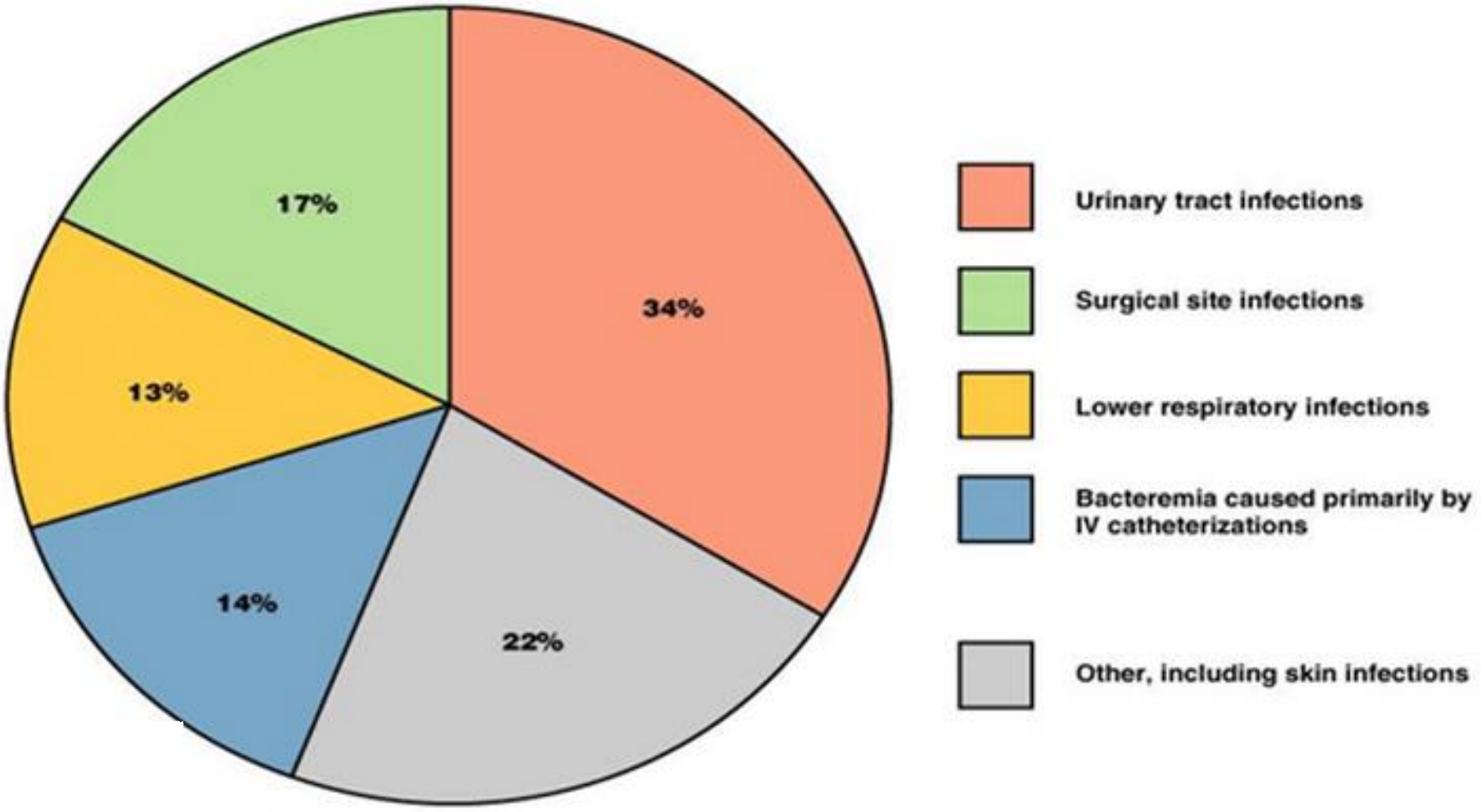
Vector Transmission

- Vector transmission
  - A vector is an animal that carries infection from one organism to another
    - Most arthropods
  - 1- mechanical transmission
    - Passive transport (i.e. feet of vector)
    - Common house fly
  - 2- biological transmission
    - Active process
    - Vector bites or sucks blood of infected host and ingests pathogen
    - Acts as multiplier for pathogen
    - Pathogen can be passed in vector stool, salivary gland
    - Often involved in protozoa or helminth life cycles

Nosocomial infections

- Microorganisms in hospital environment
  - Disinfection, sterilization constant in hospital
  - Most are opportunistic organisms
    - *Staphylococcus*
    - *E. coli*
    - *Pseudomonas*
    - *Enterococcus*

Frequency of nosocomial infections



Control of Nosocomial infections

- Reduce number of pathogens patient is exposed to
  - Aseptic technique
  - Careful handling of contaminated materials
  - Frequent hand washing
    - 31%
  - Disinfect tubs, respirators
  - Single use intubation tubes, bandages, instruments
  - Avoiding invasive procedures
  - Minimize immunosuppressive drugs
  - Avoid overuse of antibiotics

Epidemiology

- Epidemiology
  - the science that studies when and where disease occur and its transmission
  - Famous epidemiologists
    - John Snow – cholera
    - Ignaz Semmelweis – puerperal sepsis
    - Florence Nightingale - typhus

Types of Epidemiology Investigations

- 1- Descriptive Epidemiology
  - Collecting data
  - Information about affected individuals
  - Place and period of infection
  - Often uses a retrospective study (look back)
  - Snow ‘s study of cholera

Types of Epidemiology Investigations

- 2- Analytical epidemiology
  - Analyzes a particular disease and its probable cause
  - Case control method
    - Factors that precede disease
  - Cohort method
    - Compare group with disease with those without
      - Blood transfusions and hepatitis B
  - Florence Nightingale
- 3- experimental epidemiology
  - Hypothesis of disease
  - Experiment
    - Control and experimental groups