Epidemiology of Infectious Disease

B.M.C. Durfee High School
Objectives

• Describe the three main contributors to disease
• Identify the characteristics of infectious disease agents
Introduction

• There have been many advances in the treatment of infectious disease

• They are still significant causes of morbidity and mortality in developed & developing countries
  
  o HIV and pneumonia influenza were 8th and 6th leading US causes of death in 1992

  o Institutional outbreaks of disease
Epidemiological Triangle

- Three main contributors to disease occurrence
  - Agent
  - Host
  - Environment

- Use this model to explain the etiology of infectious disease (may not be that simple)
Key Topics in Infectious Disease

Epidemiology

- Methods for transmission of disease agents
- Methods for investigation and control of epidemics also include examination of agent, host and environment
- The epidemiologic triangle recognizes three major factors in the pathogenesis of disease and is one of the fundamental public health conceptions of disease causality
Epidemiologically Significant Infectious Diseases

• Water and Foodborne
  - Amebuasus
  - Cholera
  - Giardiasis
  - Legionellosis

• Vaccine Preventable
  - Chickenpox
  - Diptheria
  - Measels
  - Mumps
  - Polio
  - Tetanus
More Infectious Diseases...

- Sexually Transmitted
  - AIDS
  - Gonorrhea
  - Syphilis
  - Chlamydia

- Person to person
  - Herpes simplex
  - Streptococcal
  - Tuberculosis
  - Leprosy

- Arthropod borne
  - Encephalitis
  - Lyme disease
  - Malaria
  - Plague
More Infectious Diseases...

• Zoonotic
  o Psittacosis
  o Q Fever
  o Rabies

• Fungal
  o Coccidiomycosis
  o Candidiasis
Microbial Agents

• Bacteria
  o Leading killers in 19th century
  o Improvements with antibiotics
  o Still leading cause of illness
  o TB, salmonella, strep
  o Antibiotic resistance

• Viruses in Rickettsial
  o Viral hepatitis A, herpes simplex, influenza, viral meningitis
  o Q fever, Rocky mountain spotted fever

• Protozoa
  o Malaria
  o Amebiasis
  o Giardiasis
Microbial Agents...

- **Mycoses (Fungus)**
  - Blastomycosis
  - Ringworm
  - Athletes Foot

- **Arthropods (Insects, Spiders)**
  - Mosquitoes, ticks, flies, mites
  - Malaria, encephalitis

- **Helminths (Parasitic worms)**
  - Moist tropical areas
  - Intestinal parasites:
    - Roundworms
    - Tapeworms
Characteristics of Infectious Disease Agents

• These characteristics will determine:
  o When an infectious disease agent will be transmitted to a host
  o Whether it will produce a disease
  o The severity of disease
  o The outcome of infection
Characteristics of Infectious Disease Agents...

• Infectivity:
  - Capacity of agent to enter and multiply in host and produce infection or disease
  - Polio and measles have high infectivity

• Pathogenicity:
  - Capacity of disease to cause disease in infected host
  - Measles is high; polio is low
  - Measured by proportion of infected individuals with disease
Characteristics of Infectious Disease Agents...

- **Virulence**
  - Severity of disease
  - Rabies is always fatal is extremely virulent
  - Proportion of cases that are severe
  - Case fatality rate (CFR)

- **Toxigenicity**
  - Capacity of agent to produce toxin or poison
  - Botulism and shellfish poisoning

- **Resistance**
  - Ability of agent to survive adverse environmental conditions
  - Hepatitis is very resistant; influenza is fragile
Characteristics of Infectious Disease Agents...

• Antigenicity
  o Ability of agent to induce antibody production in the host
  o Immunogenicity: infection’s ability to produce specific immunity
  o May or may not induce long term immunity
Host

- Agent needs to be capable of infecting a host; not just present
- Host after exposure may progress from subclinical infection to active case of disease
- End result varies:
  - Complete recovery
  - Disability
  - Death
Host...

• Ability to cause infection depends on many factors
  o Agent properties
  o Host properties
  o Important determinant: host’s ability to fight infectious agent
    ▪ Nonspecific defense mechanisms
    ▪ Specific defense mechanisms
Host...

- Nonspecific Defense Mechanisms
  - Skin
  - Mucus
  - Tears
  - Saliva
  - Gastric juice with high pH
  - Phagocytes and macrophages
More on Nonspecific Defense

- As we age our ability of nonspecific defense decreases
- Nutrition of host is critical
- Genetic factors
Disease Specific Defense Mechanisms

• Immunity against a particular agent
• Immunity is resistance of host to disease agent
  o Active or passive
  o Natural or artificial
Environment

• Domain that is external to the host where the disease may survive, exist or originate

• Influences that are not part of the host:
  o Physical
  o Climate
  o Biological
  o Social
  o Economic

• Environment may enhance or diminish survival of disease agents
Reservoirs

• Fosters survival of infectious agents
  o Physical environment
  o Vectors: animals or insects
  o Human reservoir hosts
  o Environmental reservoir: contaminated water

• Zoonoses:
  o Infectious diseases that is transmitted between species
  o Examples:
    ▪ Rabies and plague
Review

• Describe the three main contributors to disease:
  • Agent
  • Host
  • Environment

• Identify the characteristics of infectious disease agents:
  • Infectivity
  • Pathogenicity
  • Virulence
  • Toxigenicity
  • Resistance
  • Antigenicity
Learn Long
Live Long