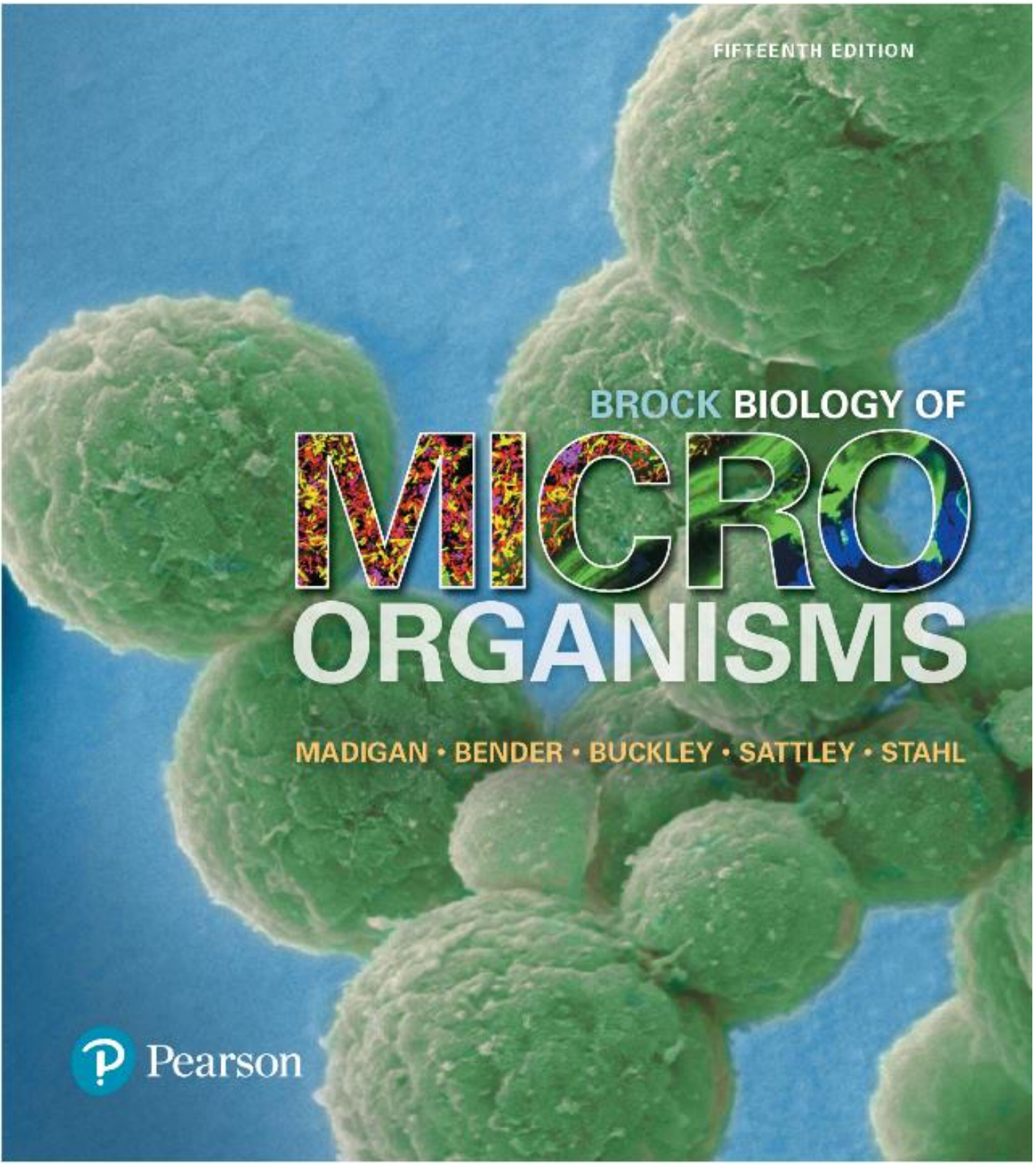


PowerPoint® Lecture Presentations

CHAPTER 29

Epidemiology

The Language of Epidemiology

- Epidemiology
  - Importance
  - Agencies
- Disease incidence and prevalence
  - To describe any given disease in a population, epidemiologists give the *incidence* and *prevalence* of the disease.
    - The incidence of a disease is the *number of new cases* of the disease in a given period of time.
    - The prevalence of a disease is the total number of *new and existing cases* in a population in a given time.

The Language of Epidemiology

- The scope of disease
  - Epidemic
  - Pandemic
  - Endemic
  - Sporadic
  - Outbreak

(a) Endemic disease (b) Epidemic disease (c) Pandemic disease

The Language of Epidemiology

- Stages of disease
  - *Infection*
  - *Incubation period*
  - *Acute period*
  - *Decline period*
  - *Convalescent period*

  - Chronic vs. Acute

The Language of Epidemiology

- Mortality and Morbidity
  - *Mortality* is the incidence of *death* in a population.
  - *Morbidity* of a disease refers to the incidence of disease, including fatal and nonfatal diseases.

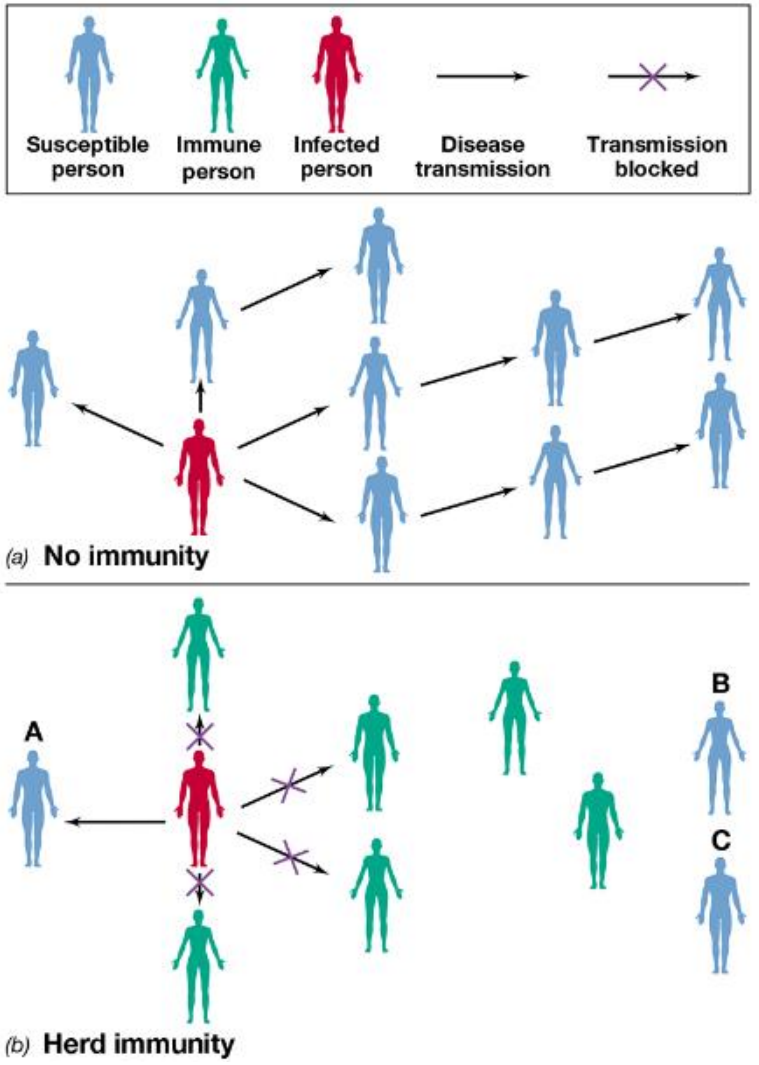
TABLE 29.1 Worldwide deaths due to infectious diseases[a]

Disease	*Deaths (% of deaths from all infectious diseases)*	*Causative agent(s)*
Respiratory infections[b]	31	Bacteria, viruses, fungi
Diarrheal diseases	15	Bacteria, viruses
Acquired immunodeficiency syndrome (AIDS)	13	Virus
Tuberculosis[c]	15	Bacterium
Malaria	6	Protist
Measles[c]	3	Virus
Meningitis, bacterial[c]	2	Bacterium
Pertussis (whooping cough)[c]	2	Bacterium
Tetanus[c]	1	Bacterium
Hepatitis (all types)[d]	1	Viruses
Other communicable diseases	11	Various agents

[a]Data show the ten leading causes of death due to infectious diseases and are representative of recent years. Worldwide in 2012 there were 56 million total deaths and 32% of these were from infectious diseases, nearly all in developing countries. In the United States in 2012, deaths from infectious diseases were about 4% of total deaths (influenza, pneumonia and septicemia were leading causes). Data adapted from data published by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), Atlanta, Georgia (USA).
[b]For some acute respiratory agents such as influenza and *Streptococcus pneumoniae* there are effective vaccines; for others, such as colds, there are no vaccines.
[c]Diseases for which effective vaccines are available.
[d]Vaccines are available for hepatitis A virus and hepatitis B virus. There are no vaccines for other hepatitis agents.

The Host Community

- Herd immunity
  - defined as the resistance of a group to infection due to immunity of a high proportion of the group
    - If a high proportion of individuals are immune to an infection, then the whole population will be protected.
    - Immunized people protect nonimmunized people because the pathogen cannot be passed on, and the cycle of infectivity is broken.



Characteristics of Disease Epidemics

- Basic reproduction number (R_0)
  - The R_0 is the number of expected secondary cases of a given disease from each single case.
    - The mathematical model assumes an entirely susceptible population.

TABLE 29.3 Basic reproduction number (R_0) and herd immunity necessary for community protection from selected infectious diseases

Disease	[a]R_0	*Herd immunity*[a]
Diphtheria	7	85%
Ebola	1.8	—
Influenza[b]	1.6	29%
Measles	18	94%
Mumps	7	86%
Pertussis	17	94%
Polio	7	86%
Rubella	7	85%
SARS-CoV	3.6	—
Smallpox	7	85%

[a]R_0 and herd immunity values are the highest estimates for each disease. Herd immunity values are shown only for those diseases for which vaccines are available.
[b]Values shown are for the pandemic (H1N1) 2009 influenza. Each influenza epidemic has a different R_0 and herd immunity value. Herd immunity values assume a 100% effective vaccine. Vaccine efficacy for influenza is about 60% and observed herd immunity values are 40% or greater depending on the susceptible host populations.

Infectious Disease Transmission and Reservoirs

- Modes of disease transmission
  - Pathogens can be classified by their mechanism of transmission, but all mechanisms have the following stages in common.
    - escape from host
    - travel
    - entry into new host
  - Pathogen transmission can be direct or indirect.

Infectious Disease Transmission and Reservoirs

- Modes of disease transmission
  - Direct host-to-host transmission
    - Droplet, direct contact, vertical to fetus
      - Zoonosis
    - Examples?
  - Indirect host-to-host transmission
    - Living agents are called vectors.
      - Biological, mechanical
    - Nonliving agents are called fomites (vehicles)

Infectious Disease Transmission and Reservoirs

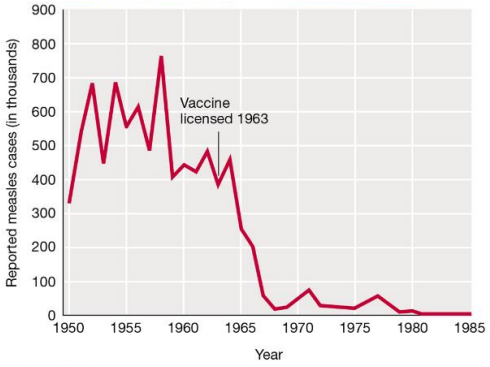
- Reservoirs and Carriers
  - *Reservoirs* are sites in which infectious agents remain viable and from which individuals can become infected.
    - A number of infectious diseases are caused by pathogens that propagate in humans and animals.
    - For other pathogens, nonliving matter serves as reservoirs.

Characteristics of Disease Epidemics

- Carriers
  - pathogen-infected individuals showing no signs of clinical disease
  - potential sources of infections
  - may be individuals in the incubation period of the disease
    - Typhoid Mary

Public Health and Infectious Disease

- Isolation, quarantine, and surveillance
  - controls directed against transmission of the pathogen
  - Immunization
  - Quarantine
  - Surveillance



- Major epidemics are usually classified as *common-source* or *host-to-host* epidemics

TABLE 29.4 Reportable infectious agents and diseases in the United States, 2016

Diseases caused by bacteria

Anthrax
Botulism
Brucellosis
Chancroid
Chlamydia trachomatis infection
Cholera
Diphtheria
Ehrlichiosis/Anaplasmosis
Gonorrhea
Haemophilus influenzae, invasive disease
Hansen's disease (leprosy)
Hemolytic uremic syndrome
Legionellosis
Listeriosis
Lyme disease
Meningococcal disease (*Neisseria meningitidis*)
Pertussis
Plague
Psittacosis
Q fever
Salmonellosis
Shiga toxin–producing *Escherichia coli* (STEC)
Shigellosis
Spotted fever rickettsiosis
Streptococcal toxic shock syndrome
Streptococcus pneumoniae, invasive disease
Syphilis, all stages
Tetanus
Toxic shock syndrome (staphylococcal)
Tuberculosis
Tularemia
Typhoid fever
Vancomycin-intermediate *Staphylococcus aureus* (VISA)
Vancomycin-resistant *Staphylococcus aureus* (VRSA)
Vibriosis (non-cholera *Vibrio* infections)

Diseases caused by viruses

Arboviruses (encephalitis, non-neuroinvasive disease, and Zika)
Dengue
Hantavirus pulmonary syndrome
Hepatitis A, B, C
HIV infection/AIDS
Novel influenza A
Measles
Mumps
Polio
Rabies
Rubella
Severe acute respiratory syndrome (SARS-CoV)
Smallpox
Varicella (chicken pox)
Viral hemorrhagic fevers
West Nile virus
Yellow fever

Diseases caused by protists

Babesiosis
Cryptosporidiosis
Cyclosporiasis
Malaria
Giardiasis

Disease caused by a helminth

Trichinellosis (trichinosis)

Disease caused by a fungus

Coccidioidomycosis/Valley fever

Terms... and more Terms...

- What is the difference between a carrier and a vector?
  - Examples?
- What is a reservoir? Vector?
- What is the major difference between a vector and a vehicle?
  - Examples?