3. **Pathology, Infection, and Disease**
   - 14-1 Define pathology, etiology, infection, and disease.

4. **Pathology, Infection, and Disease**
   - Pathology: the study of disease
   - Etiology: the study of the cause of a disease
   - Pathogenesis: the development of disease
   - Infection: colonization of the body by pathogens
   - Disease: an abnormal state in which the body is not functioning normally

5. What are the objectives of pathology? 14-1

6. **Normal Microbiota**
   - 14-2 Define normal and transient microbiota.
   - 14-3 Compare commensalism, mutualism, and parasitism, and give an example of each.
   - 14-4 Contrast normal microbiota and transient microbiota with opportunistic microorganisms.

7. **Normal Microbiota and the Host**
   - Transient microbiota may be present for days, weeks, or months
   - Normal microbiota permanently colonize the host
   - Symbiosis is the relationship between normal microbiota and the host

8. **Symbiosis**
   - In commensalism, one organism benefits, and the other is unaffected
   - In mutualism, both organisms benefit
   - In parasitism, one organism benefits at the expense of the other
   - Some normal microbiota are opportunistic pathogens
Normal Microbiota and the Host

- Microbial antagonism is a competition between microbes
- Normal microbiota protect the host by
  - Occupying niches that pathogens might occupy
  - Producing acids
  - Producing bacteriocins
- Probiotics: live microbes applied to or ingested into the body, intended to exert a beneficial effect

How do normal microbiota differ from transient microbiota? 14-2
Give several examples of microbial antagonism. 14-3
How can opportunistic pathogens cause infections? 14-4

The Etiology of Infectious Diseases

- List Koch’s postulates.

Koch’s Postulates

- The same pathogen must be present in every case of the disease.
- The pathogen must be isolated from the diseased host and grown in pure culture.
- The pathogen from the pure culture must cause the disease when it is inoculated into a healthy, susceptible laboratory animal.
- The pathogen must be isolated from the inoculated animal and must be shown to be the original organism.

Koch’s Postulates

- Koch’s postulates are used to prove the cause of an infectious disease
  - Some pathogens can cause several disease conditions
  - Some pathogens cause disease only in humans

Explain some exceptions to Koch’s postulates. 14-5
18 ▶️ Classifying Infectious Diseases
- 14-6 Differentiate a communicable from a noncommunicable disease.
- 14-7 Categorize diseases according to frequency of occurrence.
- 14-8 Categorize diseases according to severity.
- 14-9 Define herd immunity.

19 ▶️ Classifying Infectious Diseases
- Symptom: a change in body function that is felt by a patient as a result of disease
- Sign: a change in a body that can be measured or observed as a result of disease
- Syndrome: a specific group of signs and symptoms that accompany a disease

20 ▶️ Classifying Infectious Diseases
- Communicable disease: a disease that is spread from one host to another
- Contagious disease: a disease that is easily spread from one host to another
- Noncommunicable disease: a disease that is not transmitted from one host to another

21 ▶️ Occurrence of a Disease
- Incidence: fraction of a population that contracts a disease during a specific time
- Prevalence: fraction of a population having a specific disease at a given time
- Sporadic disease: disease that occurs occasionally in a population

22 ▶️ Occurrence of a Disease
- Endemic disease: disease constantly present in a population
- Epidemic disease: disease acquired by many hosts in a given area in a short time
- Pandemic disease: worldwide epidemic
- Herd immunity: immunity in most of a population

23 ▶️

24 ▶️ Severity or Duration of a Disease
- Acute disease: symptoms develop rapidly
- Chronic disease: disease develops slowly
Subacute disease: symptoms between acute and chronic
Latent disease: disease with a period of no symptoms when the causative agent is inactive

25 Extent of Host Involvement
- Local infection: pathogens are limited to a small area of the body
- Systemic infection: an infection throughout the body
- Focal infection: systemic infection that began as a local infection

26 Extent of Host Involvement
- Sepsis: toxic inflammatory condition arising from the spread of microbes, especially bacteria or their toxins, from a focus of infection
- Bacteremia: bacteria in the blood
- Septicemia: growth of bacteria in the blood

27 Extent of Host Involvement
- Toxemia: toxins in the blood
- Viremia: viruses in the blood
- Primary infection: acute infection that causes the initial illness
- Secondary infection: opportunistic infection after a primary (predisposing) infection
- Subclinical disease: no noticeable signs or symptoms (inapparent infection)

28 Does Clostridium perfringens cause a communicable disease? 14-6
Distinguish the incidence from the prevalence of a disease. 14-7
List two examples of acute and chronic diseases. 14-8
How does herd immunity develop? 14-9

29 Patterns of Disease
- 14-10 Identify four predisposing factors for disease.
- 14-11 Put the following in proper sequence, according to the pattern of disease: period of decline, period of convalescence, period of illness, prodromal period, incubation period.
30 Predisposing Factors

- Make the body more susceptible to disease
  - Short urethra in females
  - Inherited traits, such as the sickle cell gene
  - Climate and weather
  - Fatigue
  - Age
  - Lifestyle
  - Chemotherapy

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- What is a predisposing factor? 14-10
- The incubation period for a cold is 3 days, and the period of disease is usually 5 days. If the person next to you has a cold, when will you know whether you contracted it? 14-11

33 The Spread of Infection

- 14-12 Define reservoir of infection.
- 14-13 Contrast human, animal, and nonliving reservoirs, and give one example of each.
- 14-14 Explain three methods of disease transmission.

34 Reservoirs of Infection

- Continual sources of infection
  - Human: AIDS, gonorrhea
    - Carriers may have inapparent infections or latent diseases
  - Animal: rabies, Lyme disease
    - Some zoonoses may be transmitted to humans
  - Nonliving: botulism, tetanus
Transmission of Disease

- Contact
  - Direct: requires close association between infected and susceptible host
  - Indirect: spread by fomites
  - Droplet: transmission via airborne droplets

Vehicle Transmission

- Transmission by an inanimate reservoir
  (food, water, air)

Vectors

- Arthropods, especially fleas, ticks, and mosquitoes
- Transmit disease by two general methods:
  - Mechanical transmission: arthropod carries pathogen on feet
  - Biological transmission: pathogen reproduces in vector

Why are carriers important reservoirs of infection? 14-12
How are zoonoses transmitted to humans? 14-13
Give an example of contact transmission, vehicle transmission, mechanical transmission, and biological transmission. 14-14

Nosocomial (Hospital-Acquired) Infections

- Define nosocomial infections, and explain their importance.
- Define compromised host.
- List several methods of disease transmission in hospitals.
• 14-18 Explain how nosocomial infections can be prevented.

**Nosocomial Infections**
- Are acquired as a result of a hospital stay
- Affect 5–15% of all hospital patients

**Common Causes of Nosocomial Infections**

**MRSA**
- USA100: 92% of health care strains
- USA300: 89% of community-acquired strains

**Which Procedure Increases the Likelihood of Infection Most?**

- What interacting factors result in nosocomial infections? 14-15
- What is a compromised host? 14-16
- How are nosocomial infections primarily transmitted, and how can they be prevented? 14-17, 14-18

**Emerging Infectious Diseases**

- 14-19 List several probable reasons for emerging infectious diseases, and name one example for each reason.
- Diseases that are new, increasing in incidence, or showing a potential to increase in the near future
- Contributing factors
• Genetic recombination
  • E. coli O157, avian influenza (H5N1)
• Evolution of new strains
  • V. cholerae O139
• Inappropriate use of antibiotics and pesticides
  • Antibiotic-resistant strains
• Changes in weather patterns
  • Hantavirus

58 **Emerging Infectious Diseases**
• Modern transportation
  • West Nile virus
• Ecological disaster, war, and expanding human settlement
  • Coccidioidomycosis
• Animal control measures
  • Lyme disease
• Public health failure
  • Diphtheria

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• Give several examples of emerging infectious diseases. 14-19

61 **Epidemiology**
• 14-20 Define epidemiology, and describe three types of epidemiologic investigations.
• 14-21 Identify the function of the CDC.
• 14-22 Define the following terms: morbidity, mortality, and notifiable infectious diseases.

62 **Epidemiology**
• The study of where and when diseases occur
• Centers for Disease Control and Prevention (CDC)
• Collects and analyzes epidemiological information in the United States
• Publishes Morbidity and Mortality Weekly Report (MMWR)
• www.cdc.gov

63 Epidemiology

64 Epidemiology
• Descriptive: collection and analysis of data
  • Snow
• Analytical: comparison of a diseased group and a healthy group
  • Nightingale
• Experimental: controlled experiments
  • Semmelweis

65 Epidemiology
• Case reporting: health care workers report specified disease to local, state, and national offices
• Nationally notifiable diseases: physicians are required to report occurrence

66 The CDC
• Morbidity: incidence of a specific notifiable disease
• Mortality: deaths from notifiable diseases
• Morbidity rate: number of people affected in relation to the total population in a given time period
• Mortality rate: number of deaths from a disease in relation to the population in a given time

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• After learning that 40 hospital employees developed nausea and vomiting, the hospital infection control officer determined that 39 ill people ate green beans in the hospital cafeteria, compared to 34 healthy people who ate in the cafeteria the same day but did not eat green beans in the hospital cafeteria. What type of epidemiology is this? 14-20

70
What is the CDC’s function? 14-21
In 2003, the morbidity of hemolytic uremic syndrome was 176, and the mortality was 29. The morbidity of listeriosis was 696; the mortality was 33. Which disease is more likely to be fatal? 14-22