Chapter 12 Outline

- Introduction
- Healthcare-Associated Infections
- Infection Control
- Concluding Remarks

Introduction

- Healthcare epidemiology: the study of the occurrence, determinants, and distribution of health and disease within healthcare settings facilities
- The primary focus of healthcare epidemiology is on infection control and the prevention of healthcare-associated infections
- Includes any activities designed to study and improve patient care outcomes
- [http://www.cdc.gov/oralhealth/infectioncontrol/](http://www.cdc.gov/oralhealth/infectioncontrol/)
Healthcare-Associated Infections

- Two categories:
  1. Those acquired within healthcare facilities (healthcare-associated infections)
  2. Those acquired outside of healthcare facilities (community-acquired infections)
- Frequency of healthcare-associated infections (HAIs): Of approximately 40 million hospitalizations per year in the U.S., an estimated 2 million patients (~5% of the total) acquire HAIs.

Pathogens Most Often Involved in HAIs

- The most common bacterial causes of HAIs in the U.S.:
  - Gram-positive cocci: *Staphylococcus aureus*, coagulase-negative staphylococci, and *Enterococcus* spp.
  - Gram-negative bacilli: *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter* spp., and *Klebsiella* spp.
- The sources of these pathogens are healthcare professionals, other healthcare workers, visitors, and the patients themselves.
- Approximately 70% of HAIs involve drug-resistant bacteria.
Most Common Types of HAIs

- The 4 most common types of HAIs, in descending order of frequency, are:
  1. Urinary tract infections (UTIs)
  2. Surgical site infections (also referred to as postsurgical wound infections)
  3. Lower respiratory infections (primarily pneumonia)
  4. Bloodstream infections (septicemia)
- Other types: gastrointestinal diseases caused by *Clostridium difficile* (referred to as *Clostridium difficile*-associated diseases)

Patients Most Likely to Develop HAIs

- Elderly patients
- Women in labor and delivery
- Premature infants and newborns
- Surgical and burn patients
- Diabetic and cancer patients
- Patients receiving treatment with steroids, anticancer drugs, antilymphocyte serum, and radiation
- Immunocompromised patients
- Patients who are paralyzed or are undergoing renal dialysis or catheterization

http://rationalwiki.org/wiki/Ignaz_Semmelweis
The 3 major factors that combine to cause HAIs are:

- An ever-increasing number of **drug-resistant pathogens**
- The failure of **healthcare personnel** to follow infection control guidelines
- An increased number of **immunocompromised patients**

**Additional Factors Contributing to HAIs**

- Overcrowding of hospitals and shortages of healthcare staff
- The indiscriminate use of antimicrobial agents
- A false sense of security about antimicrobial agents
- Lengthy and more complicated types of surgery
- Increased use of less-highly trained healthcare workers
- Increased use of anti-inflammatory and immunosuppressant agents
- Overuse and improper use of indwelling devices
What Can be Done to Reduce the Number of HAIs?

- **Strict compliance with infection control guidelines**

- **Handwashing is the single most important measure to reduce the risks of transmitting pathogens from one patient to another or from one anatomic site to another on the same patient!**

- ALSO: disinfection and sterilization techniques, air filtration, use of ultraviolet lights, isolation of especially infectious patients, and wearing gloves, masks, and gowns whenever appropriate.

Infection Control

- *Infection control* – the numerous measures taken to prevent infections from occurring in healthcare settings.

- *Asepsis* means "without infection"; there are 2 types:
  - **Medical asepsis**
    - Precautionary measures necessary to prevent direct transfer of pathogens from person to person and indirect transfer of pathogens through the air or on instruments, bedding, equipment, and other inanimate objects (fomites)
  - **Surgical asepsis or sterile technique**
    - Practices used to render and keep objects and areas sterile
Infection Control, cont.

- Surgical aseptic techniques are practiced in operating rooms, labor and delivery areas, and during invasive procedures (e.g., drawing blood, injecting medications, urinary and cardiac catheterization, lumbar punctures)

- Differences between medical and surgical asepsis:
  1. Medical asepsis is a clean technique
  2. Surgical asepsis is a sterile technique

The goal of medical asepsis is to exclude pathogens, whereas the goal of surgical asepsis is to exclude all microorganisms.

Infections Control, cont.

- Standard Precautions – are to be applied to the care of ALL patients in ALL healthcare settings, regardless of the suspected or confirmed presence of an infectious agent
  - They provide infection control guidelines regarding hand hygiene; wearing of gloves, masks, eye protection, and gowns; respiratory hygiene/cough etiquette; safe injection practices; lumbar puncture; cleaning of patient-care equipment; environmental control; handling of soiled linens; resuscitation devices; patient placement; and disposal of used needles and other sharps

  - Standard Precautions
    ▶ Apply to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status
    ▶ Designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infections
Healthcare Professional Donning Personal Protective Equipment (PPE) - sterile gown (A), mask (B), and gloves (C)
Proper Procedure for Glove Removal

Transmission-Based Precautions

- **Transmission-Based Precautions** are used for patients who are known or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens for which additional safety precautions beyond Standard Precautions are required to interrupt transmission within healthcare settings.

- The three types of Transmission-Based Precautions are:
  1. Contact Precautions
  2. Droplet Precautions
  3. Airborne Precautions

Which type of precautions are being addressed?
Contact transmission is divided into 2 subgroups:

1. Direct-contact (i.e., transfer of microorganisms by body surface-to-body surface)

2. Indirect contact (i.e., transfer of microorganisms by a contaminated intermediate object)

Examples of Diseases Requiring Contact Precautions

- Acute viral (hemorrhagic) conjunctivitis
- Acute respiratory infectious diseases or aseptic meningitis in infants and young children
- Chickenpox
- Cutaneous diphtheria
- Disseminated shingles
- Extrapulmonary tuberculosis with draining lesion
- Gastroenteritis in diapered or incontinent persons
- Impetigo
- Infection or colonization with multidrug-resistant organisms
- Major draining abscesses or wound infections
- Monkeypox
- Poliomyelitis
- Severe mucocutaneous herpes simplex infections
- Smallpox
- Staphylococcal scalded skin syndrome
- Major staphylococcal or streptococcal disease of skin, wounds, or burns
- Viral hemorrhagic fevers due to Lassa, Ebola, Marburg, or Crimean-Congo fever viruses
Examples of Diseases Requiring Droplet Precautions

- Adenovirus infection in infants and young children
- Adenovirus pneumonia
- Epiglottitis or meningitis caused by *Haemophilus influenzae* type b; major skin, wound, or burn infections due to group A streptococcus
- Scarlet fever in infants and young children
- Influenza
- Meningitis or pneumonia caused by *Neisseria meningitidis*
- Mumps
- *Mycoplasma* pneumonia;
- parvovirus B19 skin infection
- Whooping cough
- Pharyngeal diphtheria
- Pneumonic plague
- German measles
- Severe acute respiratory syndrome (SARS)
- Strep throat in infants and young children
- Rhinovirus infection
- Viral hemorrhagic fevers due to Lassa, Ebola, Marburg, or Crimean-Congo fever viruses
Examples of Diseases Requiring Airborne Precautions

- Chickenpox
- Confirmed or suspected pulmonary or laryngeal tuberculosis
- Extrapulmonary tuberculosis with draining lesions; disseminated shingles in any patient
- Localized shingles in immunocompromised patients; measles; monkeypox
- Severe acute respiratory syndrome (SARS)
- Smallpox

Note that some of these diseases also require Droplet Precautions and/or Contact Precautions
A type N95 respirator is used when Airborne Precautions are indicated.

**Airborne Infection Isolation Room**

- The preferred placement for patients who are infected with pathogens that are spread via airborne droplet nuclei (5 µm or less in diameter), and therefore require Airborne Precautions, is an airborne infection isolation room (AIIR).
- An AIIR is under negative pressure to prevent room air from entering the corridor.
- The air evacuated from an AIIR passes through a HEPA filter.
Protective Environments

- Patients who are especially vulnerable to infection are placed in a Protective Environment - patients with severe burns or leukemia, transplant or immuno-suppressed patients, patients receiving radiation treatment, leukopenic patients, premature infants

- The room is under positive pressure and air entering the room passes through HEPA filters

Handling Food and Eating Utensils

- Some of the regulations for safe handling of food and eating utensils include:
  - Using high-quality, fresh food
  - Properly refrigerating and storing food
  - Properly washing, preparing, and cooking food
  - Properly disposing of uneaten food
  - Covering hair and wearing clean clothes and aprons
  - Thoroughly washing hands and nails before handling foods
  - Keeping all cutting boards and other surfaces scrupulously clean
  - Washing cooking and eating utensils in a dishwasher with a water temperature > 80°C
Handling Fomites

- Fomites are nonliving, inanimate objects, other than food, that may harbor and transmit microbes. Examples: patients’ gowns, bedding, towels, hospital equipment, telephone, computer keyboard, etc.

- Transmission of pathogens by fomites can be prevented by observing certain rules:
  - Use disposable equipment and supplies whenever possible
  - Disinfect or sterilize equipment soon after use
  - Use individual equipment for each patient
  - Use disposable thermometers or thermometer covers

Medical Waste Disposal

- General Regulations
  - Follow OSHA standards for disposal of medical wastes

- Disposal of Sharps
  - Sharps should be handled and disposed of properly
  - Dispose of sharps in specifically designed puncture-resistant containers ("sharps containers")
Infection Control Committees and Infection Control Professionals

• All healthcare facilities should have some type of formal infection control program in place.

• The Infection Control Committee (ICC) is composed of representatives from most of the hospital’s departments, including medical and surgical services, pathology, nursing, hospital administration, risk management, pharmacy, housekeeping, food services, and central supply.
  – The chairperson is usually an infection control professional such as an epidemiologist or infectious disease specialist, an infection control nurse, or a microbiologist.

Role of the Clinical Microbiology Laboratory (CML) in Hospital Epidemiology and Infection Control

• CML personnel participate in infection control by:
  – Monitoring the types and numbers of pathogens isolated from hospitalized patients
  – Notifying the appropriate infection control person should an unusual pathogen or an unusually high number of isolates of a common pathogen be detected
  – Processing environmental samples, including samples from hospital employees, that have been collected from within the affected ward(s)
Concluding Remarks

- HAIs can add several weeks to a patient’s hospital stay and may lead to serious complications and even death.
- Insurance companies rarely reimburse healthcare facilities for costs associated with HAIs.
- HAIs can be avoided through proper education and disciplined compliance with infection control practices!
- All healthcare workers must fully comprehend the problem of HAIs, must be completely knowledgeable about infection control practices, and must personally do everything in their power to prevent HAIs from occurring!