

Infection Control

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INFECTION

The Infectious Process

- A. For an infection to occur, a process involving six links or steps must be present.
 1. If any links are missing, the infection will not occur.
 2. Infection control measures can interrupt the process by eliminating one or more of the steps.
- ◆ B. Six links form the chain of infection.
 1. Infectious agent (microorganism): bacteria, virus, fungi, etc.
 - a. Capability of producing an infection depends on
 - (1) Virulence and number of organisms present.
 - (2) Susceptibility of host.
 - (3) Existence of portal of entry.
 - (4) Affinity of host to harbor microorganism.
 - b. The circumstances above must be present to produce an infection.
 2. Reservoir: People, equipment, water, etc., provide survival for organism.
 - a. Appropriate environment for growth and multiplication of microorganism must be present.
 - b. Reservoirs' sources include respiratory, gastrointestinal, reproductive, and urinary tracts, and the blood.
 3. Portal of exit from reservoir: Allows the microorganism to move from reservoir to host (includes excretions, secretions, skin, droplets).
 - ◆ 4. Route of transmission of microorganisms: five routes. Three primary routes (contact, droplet and airborne); two lesser routes (vehicle [contaminated items such as food, water, and devices] and vector [e.g., mosquitoes, fleas, rats]).
 - a. **Contact**—most frequent source of healthcare-associated infection.
 - (1) Direct contact—transmission body to body and physical transmission (sexual intercourse, kissing, or touch).
 - (2) Indirect contact—contact with contaminated intermediate object (needle, dressing, dirty hands).
 - b. **Droplet**—transmission of large particle droplets (larger than 5 microns); diphtheria, pertussis, pneumonia, etc.
 - c. **Airborne**—transmission of small particle droplets or residue of 5 microns (measles, varicella, tuberculosis [TB]).
 - d. Two lesser routes.
 - (1) **Common vehicle**: transmission by contaminated items such as food, water, devices.
 - (2) **Vector-borne**: mosquitoes, fleas, rats, etc.
 5. Portal of entry: mucous membrane, gastrointestinal (GI) tract, genitourinary (GU) tract, respiratory tract, and nonintact skin.
 6. Susceptible host: A host who is immunosuppressed, fatigued, malnourished, weakened by other diseases, elderly, stressed, or hospitalized with wounds, IVs, and catheters is at high risk.

Barriers to Infection

- ◆ A. The primary barrier to infection is the individual's general health and immunologic system (defense mechanisms).
- B. Factors that contribute to infection susceptibility.
 1. Disease states.
 2. Altered nutritional status.
 3. Stress and fatigue.
 4. Metabolic function.
 5. Age.
 6. Medications.
- ◆ C. The body's protection against infection.
 1. The immune process.
 - a. Natural immunity is inherited.
 - b. Acquired immunity comes from disease exposure or vaccinations.
 2. Anatomic barriers (skin and mucous membranes).
 - a. Integrity of the skin and mucous membrane—when integrity is broken, bacteria can enter the body.
 - b. How quickly a wound heals depends on the degree of vascularization in the injured area.
 3. The inflammatory process.
 - a. When an area is inflamed, cells activate the plasmin, clotting, and kinin systems to release histamine.
 - b. Histamine creates increased vascular permeability at the injured site.
 - c. Phagocytes are summoned to the site to combat the infection.
- D. Assessing the probability of infection.
 1. Considering the numbers of organisms, virulence, and resistance of the host, the client's risk factors can be evaluated.
 2. Combining these variables with the client's general health and immune status, the probability of healthcare-associated infection can be assessed.

- ◆ E. Conditions predisposing client to infection.
 1. Surgical wounds.
 2. Alterations in the respiratory or genitourinary tracts (most common sites for healthcare-associated infections).
 3. Invasive devices such as central lines or venipuncture sites.
 4. Implanted prosthetic devices—cardiac valves, grafts, shunts, or orthopedic joints or pins.

CENTERS FOR DISEASE CONTROL AND PREVENTION GUIDELINES

Principles of Precautions

- ◆ A. Risk reduction.
 1. Standard precautions—hand hygiene is primary method.
 2. Follow procedures to recognize and reduce risks.
 3. Assign infection control practitioner for every 250 beds.
 4. Have hospital epidemiologist on site.
 5. Program of surveillance for healthcare-associated infections with appropriate interventions.
- B. The Centers for Disease Control and Prevention (CDC) guidelines, revised in 1994, contain two tiers of precautions.
- ◆ C. First-tier *standard precautions* blend the major features of universal precautions (blood and body fluids precautions) and body substance isolation into a single set of precautions.
 1. Used for the care of all clients in hospitals regardless of diagnosis or infection status.
 2. Applies to blood, all body fluids, secretions, and excretions, whether or not they contain visible blood; nonintact skin; and mucous membranes.
 3. Standard precautions are designed to reduce the risk of transmission of both recognized and unrecognized sources of infection in hospitals.
 4. As a result of the new category of standard precautions, clients with diseases or conditions that previously required category-specific or disease-specific precautions are now covered under this category and do not require additional precautions.
- ◆ D. Second-tier *transmission-based precautions* are designed only for the care of specified clients. They reduce the disease-specific precautions into three sets of precautions based on routes of transmission.
 1. Categories designed for clients documented or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens for which additional precautions must be used to interrupt transmission to others in the hospital.
- ◆ 2. Three types of transmission-based precautions include airborne precautions, droplet precautions, and contact precautions.
 - a. *Airborne precautions* reduce the risk of airborne transmission of infectious agents, such as measles, varicella, and tuberculosis.
 - b. *Droplet precautions* are used to prevent the transmission of diseases such as meningitis, pneumonia, scarlet fever, diphtheria, rubella, and pertussis.
 - c. *Contact precautions* are used for clients known or suspected to have serious illnesses easily transmitted by direct contact, such as herpes simplex, staphylococcal infections, hepatitis A, respiratory syncytial virus, and wound or skin infections.
- 3. All three types of precautions may be used at one time when multiple routes of transmission are suspected in a client. These precautions are always used in conjunction with standard precautions. **Table 6-1** outlines recommendations for transmission-based precautions.
- E. Transmission-based precautions are used (in addition to standard precautions) when a client is infected with microorganisms or communicable disease.
 - ◆ 1. Airborne precautions.
 - a. Implemented when infections can spread through the air (TB, chickenpox, rubeola).
 - b. Pathogens can be suspended in air for long periods and are transmitted when a person inhales particles that contain the pathogen.
 - c. Healthcare workers should wear HEPA (high-efficiency particulate air) filter respirators when working with clients who have TB.
 - ◆ 2. Droplet precautions.
 - a. This system is used when caring for clients who have infections that spread by large-particle droplets containing microorganisms (includes rubella, diphtheria, mumps, pertussis, influenza).
 - b. Clients with this type of infection should be in a private room or with another client with same disease.
 - c. Healthcare workers should wear a surgical mask for protection when coming within 3 feet of client.

Table 6-1 HICPAC* RECOMMENDATIONS FOR TRANSMISSION-BASED PRECAUTIONS

	Contact	Droplet	Airborne
Purpose	Prevent transmission of known or suspected infected or colonized microorganisms by direct hand or skin-to-skin contact that occurs when providing direct client care. Conditions in which contact precautions are required: diphtheria, herpes simplex, scabies, <i>Staphylococcus</i> infection, hepatitis A, and respiratory syncytial virus wound or skin infection.	Prevent transmission of large-particle droplets, larger than 5 microns (μm) (e.g., diphtheria, pertussis, streptococcal pharyngitis, pneumonia, scarlet fever, meningitis, rubella).	Prevent transmission of small-particle residue of 5 microns (μm) or smaller droplets (e.g., measles, varicella, tuberculosis).
Client placement	<ul style="list-style-type: none"> • Private room • Can be placed in room of client with same microorganism. 	<ul style="list-style-type: none"> • Private room • Can be placed in room of client with same diagnosis. 	<ul style="list-style-type: none"> • Private room • Can be placed in room of client with same diagnosis. • Monitor negative air pressure. • Keep door closed. • Keep client in room.
Respiratory protection	<ul style="list-style-type: none"> • Mask not necessary. 	<ul style="list-style-type: none"> • Use mask when working within 3 feet of client. 	<ul style="list-style-type: none"> • Respiratory protective equipment • Do not enter room of clients with rubeola or varicella if susceptible to these infections.
Gloves and gown	<ul style="list-style-type: none"> • Wear gloves when entering room. • Change gloves after contact with infective material, such as wound drainage or fecal material. • Wash hands immediately after removing gloves. • Wear gown when working with clients with diarrhea, ostomies, or wound drainage not in dressing. • Wear gown if contact with client or environment will occur. 	<ul style="list-style-type: none"> • Follow standard precautions. 	<ul style="list-style-type: none"> • Follow standard precautions.
Client transport	<ul style="list-style-type: none"> • Transport only if essential. • Ensure precautions are maintained to minimize risk of transmission. 	<ul style="list-style-type: none"> • Transport only if essential. • Place mask on client when outside room. 	<ul style="list-style-type: none"> • Transport only if essential. • Place mask on client when outside room.
Client care items	<ul style="list-style-type: none"> • Client care items and environmental surfaces are cleaned daily. • Dedicate equipment to single client use (e.g., stethoscope, thermometer). 		

*Hospital Infection Control Practices Advisory Committee

Source: Centers for Disease Control and Prevention. (2007). 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Retrieved from http://www.cdc.gov/hicpac/2007IP/2007ip_appendA.html

- ◆ 3. Contact precautions.
 - a. These precautions are used when caring for clients infected or colonized by microorganisms that spread by direct contact (skin to skin) or indirect contact (touch) with a contaminated object.
 - b. Client requires private room or room with another client with same illness.
 - c. Wear gloves and gown when entering room and change gloves as needed during care. Remove gloves and gown and wash hands when leaving client's room.
 - d. Use dedicated equipment when a client has multiple drug resistant microorganisms.
- ◆ F. Transmission guidelines.
 - 1. Infections and conditions fall into two categories because microorganisms are transmitted in more than one way.
 - a. Chickenpox and zoster can spread through both airborne and contact routes.
 - b. Adenovirus infection can spread through droplet and contact.
 - 2. If client's infection spreads through two transmission routes, institute both precautions and hang both signs on client's door.
- ◆ G. Transmission-based precautions and client transfer.
 - 1. When client is transferred to another unit or area for testing, client must wear a mask and impervious dressing.
 - 2. Transporter takes necessary precautions and wears appropriate barriers.
 - 3. Staff in receiving area have been notified and understand precautions.
- ◆ H. Methods of infection prevention.
 - 1. Vaccinations.
 - a. Currently more than 25 vaccines licensed in United States.
 - b. Preventive vaccines: smallpox, measles, mumps, rubella, polio, diphtheria, pertussis, and tetanus.
 - c. Goal of vaccines: to prevent specific infectious diseases in a specific population.
 - 2. Education.

Standard Precautions

- ◆ A. The term *standard precautions* incorporates universal blood and body fluid precautions.
- ◆ B. Apply standard precautions to all clients regardless of diagnosis or infection status.
- ◆ C. The following guidelines are recommended by the CDC for use with all clients (whether identified as infectious or not) to prevent transmission of

infections. Please follow these guidelines when caring for clients.

1. Hand hygiene: Wash hands thoroughly with soap and water or alcohol-based hand rub or gel before and after all client contact. Wash hands and change gloves between contact with clients.
2. Wear gloves if there is a possibility of direct contact with blood or bodily secretions (e.g., pus, sputum, urine, feces, blood, saliva).
 - a. This includes a neonate before first bath.
 - b. Wash as soon as possible if unanticipated contact with these body substances occurs.
3. Gloves should be worn when in contact with items or surfaces soiled with blood or body fluids.
4. The CDC states that healthcare workers in contact with clients must remove all false fingernails.
5. Protect clothing with gowns or plastic aprons if there is a possibility of being splashed or direct contact with contaminated material.
6. Wear masks and/or goggles or face shields to avoid being splashed, especially during suctioning, irrigations, and deliveries.
7. Do not break needles into receptacles; rather, discard them intact and uncapped into containers.

HEALTHCARE-ASSOCIATED INFECTIONS

Risks of Hospitalization

- A. The CDC has replaced the term “nosocomial infections” with healthcare-associated infections (HAIs). The term was revised to reflect changes in healthcare development.
- ◆ B. Major risk—HAI infections; leading cause of death in United States.
 1. More than 75,000 deaths/year as direct or indirect result of infections (CDC, 2014).
 2. These infections begin in hospital or healthcare facility—each year more than 700,000 clients in the United States acquire infections in these settings (CDC, 2014).
 3. Major source of HAIs: Healthcare workers and clients are reservoirs.
 4. One-third of all HAIs could be prevented with effective infection control programs in health-care facilities.
 5. CDC states these figures can be reduced with client education and strict adherence to infection control practices.

- ◆ C. Most common sites for infection.
 1. Urinary tract infections most common (80% related to catheterization).
 2. Pneumonia second most common HAI.
 - a. Affects 40% of all critically ill or immunocompromised clients.
 - b. Causes 15% of all in-hospital deaths.
 3. Surgical wound infections account for 60% of additional hospital days.
- ◆ D. Intravascular devices present increased risk.
 1. Risk of infection related to device itself, site of insertion, and technique of insertion.
 - ◆ 2. *Staphylococcus* is usual cause of infection and bacteremia.

Drug-Resistant Strains of Pathogens

A. Major organisms: *Clostridium difficile*, *Staphylococcus aureus* (MRSA), and vancomycin-resistant enterococcus (VRE).

- ◆ B. Vancomycin-resistant enterococcus (VRE) was a serious development in the 1990s.
 1. *Enterococcus faecium* (called a supergerm) frequently invades surgical wounds, heart valve replacements, and abdominal and urinary tracts.
 2. Enterococcal infections are often impervious to antibiotics—25% of these infections in intensive care clients were untreatable.
 - ◆ 3. The most common is *C. difficile*, an anaerobic, gram-positive, spore-forming bacillus associated with infectious diarrhea.
 - ◆ 4. Methicillin-resistant *Staphylococcus aureus* (MRSA).
 5. Resistant strain of *Mycobacterium tuberculosis*.
- C. A new super antibiotic, called Zyvox, is a new weapon against drug-resistant infections.
 1. The first entirely new type of antibiotic in 35 years.
 2. Drug should be reserved to fight life-threatening infections that are resistant to other antibiotics.
- D. A new multidrug-resistant bacteria (carbapenem-resistant *Klebsiella pneumoniae* or CRKP) is now being found in hospitals.
 1. CRKP is now found in 36 states especially in long-term care facilities.
 2. This gram-negative bacteria lives in our intestines and is resistant to almost all antibiotics.
 3. This organism enters the body through the lungs as ventilator-causing pneumonia, an IV-causing sepsis, or the urinary tract.
 4. It is transmitted by person-to-person contact.

5. The only drug that has been found to work is colistin, a toxic antibiotic that can damage the kidneys.
6. Nursing care involves simple strict hygiene to prevent transmission and strict isolation.

Basic Infection Control Measures

A. Hand hygiene.

- ◆ 1. Many nurses believe wearing gloves eliminates the need to wash hands—not so!
 - a. Donning gloves with unclean hands can transfer microorganisms to outside of glove. (People carry between 10,000 and 10 million bacteria on each hand.)
 - b. It is important to wash hands between client contacts *and* before and after using gloves.
- 2. Proper method of washing hands.
 - a. Wet hands with warm, not hot, running water.
 - b. Apply soap or antimicrobial agent.
 - ◆ c. Rub hands together vigorously for at least 15 seconds—include all surfaces of fingers and hands.
 - d. Rinse hands thoroughly under running water to remove all soap.
 - e. Dry hands with paper towels removed one at a time from dispenser.
 - f. Use paper towel to turn off faucet if there is no foot pedal.
- 3. Washing with waterless agents.
 - a. Use only if hands are free of obvious dirt.
 - b. Apply small amount on palm of hand.
 - c. Rub hands together vigorously, covering all surfaces of hands and fingers.
 - d. Rub until dry.
- ◆ B. Gloving: basic infection control measure.
 1. The Occupational Safety and Health Administration (OSHA) stipulates that gloves in all sizes are to be available for health-care workers.
 2. Gloves are necessary for any task or procedure that may result in blood or body fluid exposure to hands.
 3. Important to change gloves *and* wash hands between clients.
- C. Latex allergy to gloves.
 1. Affects 8% to 12% of healthcare workers.
 2. Assess allergy to avocados, bananas, kiwi fruit, or chestnuts. Client may have cross-sensitivity to latex.
 3. Classified as immediate immunological reaction caused by latex proteins.
 4. Reaction may progress to anaphylaxis.

5. Know symptoms of latex allergy: contact dermatitis, local swelling, itching, hives, redness.
 6. If healthcare worker thinks he or she has latex allergy, he/she should switch to latex-free gloves *immediately*.
- ◆ D. Items needed as protective barriers.
1. Gloves most common barrier protection: Protects health workers from mucous membranes, wounds, or infectious body substances.
 2. Face mask: Prevents airborne infection. Change mask every 30 minutes or sooner if it becomes damp.
 3. Face shield or goggles: Reduces risk of contamination of mucous membranes of eyes. Wear when there is risk of being sprayed or splashed with contaminated body fluids.
 4. Gown: Protects clothing from splashed blood or body fluids.
- ◆ E. Removing protective garb.
1. Untie ties of gown if tied in front (ties are contaminated).
 2. Remove gloves.
 - a. Do not touch outer surface to skin.
 - b. Pull first glove down, turning inside out as you pull it off.
 - c. Insert two fingers of ungloved hand inside glove edge and pull downward.
 - d. Discard gloves in dedicated receptacle.
 3. Remove gown: Unfasten waist ties (if tied in back), then neck ties. Pull gown off shoulders and over arms, turning gown inside out as it is removed, and discard.
 4. Remove face shield or goggles (do not touch face) and discard.
 5. Remove mask: Untie lower string first, then upper strings, and discard.
 6. Complete procedure by washing hands.
- ◆ F. Isolation protocol.
1. Prepare for isolation.
 - a. Check physician's orders.
 - b. Obtain isolation cart.
 - c. Place isolation cart at client's door.
 - d. Place a linen hamper and trash cans conveniently.
 2. Follow dressing procedure when entering or leaving room.
 - a. Gown or wear plastic apron.
 - b. Use a mask (HEPA filter recommended).
 - c. Use an eye shield or goggles if appropriate.
 3. Remove items from isolation room by double-bagging (using red biohazard bags).
- G. Governmental regulatory agencies.
- ◆ 1. CDC goal is disease reduction.
 - ◆ 2. OSHA goal is to reduce risk exposure.

3. OSHA requires that healthcare facilities have educational protocols in place for prevention of bloodborne pathogens and hepatitis B control.

HANDLING BIOHAZARD WASTE

Biohazard waste is any solid or liquid waste that presents a threat of infection

- Separate at point of origin or before it leaves client's room—reduces risk of exposure.
- Use impermeable red plastic bag labeled "biohazard." Close securely and double bag.
- Red bags cannot be placed with other material; they could contaminate all waste.

Storage of biohazard material

- Appropriately sealed. May be stored for 30 days.
- Waste must be restricted, locked up, or stored separately.
- Waste must be labeled correctly so tracking may be done.

Healthcare-Associated Infections (Formerly Called Nosocomial Infections)

Definition: Infections acquired while the client is in the hospital or healthcare facility—infections that were not present or were incubating at the time of admission.

- A. Affect more than 2 million and estimated to cause or contribute to more than 99,000 deaths annually in the United States.
- B. Many of these infections are caused by pathogens transmitted from one client to another by health-care workers.
- C. Usually caused by poor or no hand hygiene technique between clients.

Infectious Diarrhea

- ◆ A. Most common cause is *Clostridium difficile*—associated diarrhea (CDAD) infectious diarrhea.
1. Anaerobic, gram-positive bacillus—20% to 40% of hospitalized clients become colonized within a few days of entering hospital.
 2. Spores and microbes found on hospital toilets, bedpans, floors, and healthcare workers' hands.
- ◆ B. Recognizing signs and symptoms of CDAD.
1. Diarrhea occurring after antibiotics.
 2. Abdominal pain—crampy pain and abdominal tenderness.
 3. Fever—above 102.2°F (39°C).
 4. Leukocytosis—white blood cells (WBCs) can go as high as 50,000/mm³ (average is 4500 to 11,000).
 5. Lab tests will confirm CDAD with a positive stool assay for toxin A or B and autotoxin neutralization test.

◆ C. Preventive methods.

- ◆ 1. Wash hands before and after client contact *and* after removing gloves with antiseptic soap.
Alert: The alcohol-based gels do *not* kill *C. difficile*, so soap and water must be used.
- 2. In addition to standard precautions, institute contact isolation precautions—includes placing client in a private room and always wearing gloves and gown when in direct contact with client.
- 3. After removing gloves and gown, do not touch any potentially contaminated surface.
- 4. Use dedicated equipment such as stethoscope and blood pressure (BP) cuff—never use electronic thermometer because of the potential for spreading bacteria.
- 5. Dispose of all contaminated items (bed linens, towel) in proper receptacles.
- 6. Instruct family and friends to use infection precautions.

D. Treatment.

- 1. Antibiotics for a mild case.
- 2. For more severe cases, the physician may discontinue the antibiotic and start antimicrobial therapy (metronidazole drug of choice).
- 3. CDC has recently advised against using vancomycin to treat CDAD because of vancomycin-resistant enterococcus (VRE).

Pneumonia

◆ A. Second most common infection—affects 40% of all critically ill or immunosuppressed clients.

- 1. Aspiration of gram-negative bacteria are typically acquired in the hospital.
- 2. Gram-positive strain (*Staphylococcus aureus*) is leading cause of condition; develops into methicillin-resistant condition (MRSA).
 - a. Vancomycin, drug of choice to treat MRSA, is rapidly losing its effectiveness.
 - b. MRSA may occur when food, fluid, or gastric contents enter lung via aspiration.
 - c. MRSA may also occur when airborne particles are inhaled through respirations or anesthesia equipment.
- 3. Viral pneumonia (causes 20% of all HAIs). Most common are adenoviruses, influenza, and respiratory syncytial viruses (RSV).
- 4. Fungal pneumonia *Aspergillus* through contact with unfiltered air system, food, or plants.

◆ B. Preventive measures.

- 1. Change ventilator tubing no more frequently than every 48 hours.
- 2. Use closed suction system.
- 3. Remove pooled secretions above cuff when endotracheal (ET) tube is repositioned.

- 4. Provide frequent mouth care.
- 5. Provide 100% relative humidity at body temperature with all ventilation systems (will help client fight off pneumonia infection).
- 6. Recognizing signs and symptoms.
 - a. Onset 72 hours after hospital admission.
 - b. Crackles in lung and dullness on percussion.
 - c. Purulent sputum.
 - d. Positive bacterial or fungal culture.
 - e. In elderly client, may be confusion and fatigue with no fever.

C. Treatment.

- 1. Administer antibiotics as prescribed.
- 2. Observe for dyspnea, respiratory rate, and administer O₂ (as prescribed) to maintain PaO₂ at 80 mm Hg plus.
- 3. Position client at 45-degree angle.
- 4. Encourage fluid intake—good nutrition.
- 5. Encourage incentive spirometry.

◆ **Bloodstream Infections**

A. Types of infection.

- 1. Presence of bacteria in bloodstream.
- 2. Fungemia—infection in bloodstream caused by a fungal organism.

◆ B. Two categories of infection.

- 1. Primary infection means host has no preexisting infection but there is direct introduction of microorganisms into bloodstream and host becomes infected via external (catheter) or internal means (internal tubing during manipulation).
- 2. Secondary infection occurs when host has another site of infection (urinary tract) that enters bloodstream.

◆ C. Preventive measures.

- 1. IV therapy increases risk of invasion by harmful microorganisms (invasive devices and venipuncture sites provide route for infection to occur).
- 2. Use of impeccable standard precaution methods will reduce risk.

Tuberculosis

◆ A. Tuberculosis is an infectious disease caused by the tubercle bacillus *Mycobacterium tuberculosis*.

- 1. Currently 100 million afflicted—30 to 40 million will die and one-third may be resistant.
- 2. Main reservoir for the organism is respiratory tract.
- 3. Transmission occurs between individuals through respiratory contact via droplets transmitted through productive coughing.

- ◆ B. Symptoms.
 1. Occur 4–12 weeks after exposure.
 2. Active disease and symptoms of cough, weight loss, and fever usually occur within first 2 years after infection.
 3. Latent infections (asymptomatic) are not infectious and may last a lifetime.
 4. Without treatment, tuberculosis progresses.
- ◆ C. Multidrug-resistant tuberculosis (MDR-TB).
 1. Disease can progress from diagnosis to death in 4–15 weeks.
 2. Clients develop resistance to standard drug regimen as a result of noncompliance and/or inappropriate drug therapy.
 3. MDR-TB also caused by person-to-person contact through sneezing or coughing, or from a person with primary drug resistance.
 4. According to the CDC, MDR-TB accounts for 1.2% of TB cases.
- ◆ D. Effective tuberculosis control requirements: early identification, isolation, and treatment of persons with active tuberculosis.
 1. Purified protein derivative (PPD) skin test used to quickly identify infection in the absence of clinical symptoms.
 2. Sputum specimens for acid-fast bacilli (AFB), culture, sensitivity, and chest x-rays.
 - a. PPD skin test is read 48–72 hours after the injection.
 - b. Positive skin test is indicated by an induration of 10 mm or more at site of injection.
 - c. HIV or immunosuppressed—5 mm or more is considered positive. If positive, chest x-ray will rule out active TB.
- ◆ 3. CDC recommendation for tuberculosis isolation—directional airflow, negative-pressure ventilation system in room.
 - a. Anyone entering the client's room should wear a mask that forms a tight-fitting seal against particulates 1–5 μ .
 - b. Disposable particulate respirators are suggested by the CDC when adequate ventilation is not available in the room.

Infected Wounds

- ◆ A. The longer a person is hospitalized prior to the surgical procedure, the greater risk of postsurgical infection.
- B. Factors that influence infection rates.
 1. Duration of time in the operating room.
 2. Time surgery is done (between midnight and 8 AM is period of greatest risk).

3. Whether client has postsurgical drains in place.
4. If the surgery enters a colonized or infected part of the body.

EMERGING VIRUSES

Biology of Infectious Disease

- A. Various forms of flora help protect the human from invasion of pathogens, usually microorganisms that can cause disease.
- B. Host defenses determine whether infection will occur.
 1. Natural barriers: skin and mucous membranes.
 2. Nonspecific immune responses: white cells.
 3. Specific immune responses: antibodies.
- C. Pathogenesis of infection.
 1. Toxins: protein molecules that cause development of disease (diphtheria, cholera, tetanus, etc.).
 2. Virulence factors: assist pathogens in invasion and resistance of host defense mechanisms (different forms of *Haemophilus influenzae*).
 3. Microbial adherence: ability to adhere to surfaces to invade tissue (*Escherichia coli* attaching to human cells in GI tract).
 4. Antimicrobial resistance: agents that can exert selective pressures on microbial populations allowing bacteria to develop resistance to an antimicrobial agent (MRSA).

Marburg and Ebola Viruses

Definition: Acute infection (perhaps related to exposure to monkeys in Africa or the Philippines) that produces severe illness.

Characteristics

- A. Vector is unknown, human to human.
- B. Transmission occurs via skin and mucous membrane contact with an infected person.
- C. Incubation period is 5–10 days.
- D. Mortality rate is 25–90%.

Assessment

- A. Fever with myalgia and headache with upper respiratory symptoms.
- B. Hemorrhagic symptoms begin within a few days.

Implementation

- A. Mask-gown-glove precautions.
- B. There is no vaccine or effective antiviral therapy.

Hanta Virus

Definition: Acute infection caused by the hanta virus transmitted to humans from rodents.

Characteristics

- A. Transmission is through inhalation of infectious aerosols from rodent excreta.
- B. Characterized by acute renal failure or acute pulmonary edema.
- C. Incubation period 7–36 days.

Assessment

- A. Sudden onset with high fever, headache, backache, and abdominal pain.
- B. Hemorrhages appear; severe neurological symptoms occur in 1%; severe cases are 10–15%.

Implementation

- A. Treatment is ribavirin IV and supportive care.
- B. Overall mortality rate is 6–15%.

Lassa Fever

Definition: Systemic arena virus infection that involves visceral organs; spares the central nervous system (CNS).

Characteristics

- A. Most human cases result from contamination of food with rodent urine; human-to-human transmission can occur.
- B. Mortality rate 16–45%.
- C. Incubation period 1–24 days.

Assessment

- A. Initial symptoms are sore throat, fever, headache, myalgia, and malaise.
- B. Onset of severe symptoms take several days; severity correlates with amount of virus absorbed and degree of fever.

Implementation

- A. Standard precautions, airborne isolation including high-efficiency mask and negative-pressure room.
- B. Ribavirin used to reduce mortality rate, given within 6 days of onset.
- C. Supportive care including fluid and electrolyte balance critical.

Dengue Fever

Definition: Acute febrile disease caused by flavivirus transmitted by bite of *Aedes* mosquito.

Characteristics

- A. Occurs mostly in children living where dengue is endemic (Southeast Asia, China, and Cuba).
- B. Incubation period is 3–15 days.

Assessment

- A. Abrupt onset with chills, headache, and aching joints, with rapid rise in temperature (104°F, 40°C) followed by afebrile period for 24 hours.
- B. Second rise in temperature follows with rash covering entire body.

Implementation

- A. Dengue prophylaxis requires eradication of mosquito vector.
- B. Treatment is symptomatic—complete bed rest and acetaminophen (avoid aspirin).

Severe Acute Respiratory Syndrome

◆ *Definition:* A respiratory illness of unknown etiology; the first severe and readily transmittable viral disease of the 21st century.

Characteristics

- A. First detected in November 2002 in China; in March 2003, the World Health Organization (WHO) announced a global alert. Severe acute respiratory syndrome (SARS) proceeded to be reported in 30 countries.
- B. SARS is believed to be caused by a new variety of the coronavirus (the common cold).
- ◆ C. Transmission of SARS.
 - 1. Spread by person-to-person contact.
 - 2. Possibly spread by contact with objects that have been contaminated with infectious droplets.
 - 3. Disease may have airborne transmission, but this is still undetermined.
- D. Incubation period is 2–7 days (or possibly as long as 10 days).

Assessment

- ◆ A. SARS begins with elevated temperature (> 100.4°F or > 38°C).
 - 1. Fever may be associated with chills, headache, or malaise.
 - 2. During this prodromal period, client may develop mild respiratory symptoms.
- ◆ B. After 3 to 7 days, lower respiratory symptoms develop.
 - 1. Dry, nonproductive cough and dyspnea.
 - 2. Hypoxemia may develop, as well as respiratory distress syndrome.
- C. The last stage of SARS is classified as atypical pneumonia.
- D. No definitive diagnostic test for SARS; CDC has serum tests to detect antibodies to the virus but specificity is still being evaluated.
- E. Epidemiological criteria: travel (through an airport) within 10 days of onset of symptoms; close contact with a person known or suspected to have SARS.

Implementation

- ◆ A. Implement immediate infection control measures with a suspected case of SARS.
 1. Use standard hand hygiene (soap and water or alcohol-based gel).
 2. Use contact protection (gloves, gown, and eye shield).
 3. Use airborne protection: N95 disposable respirators; place client in a negative-pressure isolation room.
- B. No accepted medical treatment.
 1. A viral drug, ribavirin (a drug used to treat AIDS clients), may be useful for those younger than age 40.
 2. Elderly clients do not react well to this drug.
- C. Give supportive care; in some cases mechanical ventilation is started when normal functioning of the lungs is compromised.
- D. Complementary physicians are recommending the herb Echinacea because it boosts immune responses and aids clients in fighting the virus.
- E. As of 2006, the SARS virus had mutated to a weaker virus that is no longer a threat. It could, however, reverse course in the future.

West Nile Virus

◆ *Definition:* A mosquito-borne viral disease that has been detected in 43 states. It is a single-stranded RNA virus of the family of encephalitis-causing viruses.

Characteristics

- A. First cases were identified in New York City in 1999; introduced by an infected host (bird or human) or vector (mosquito).
- B. Transmission occurs in summer and early fall when mosquitoes are active.

Assessment

- A. Infection occurs 3 to 14 days after infected mosquito bites.
 1. 80% of infections are mild, without symptoms.
 2. 20% develop flu symptoms, lasting less than 1 week.
 3. Less than 1% develop a severe illness—encephalitis or meningitis.
- B. Assess for symptoms of severe neurologic disease.
 1. Fever, headache, stiff neck, and mental confusion.
 2. Tremors, muscle weakness, and convulsions in about 15% (of the 1%).
- C. Symptoms may be confused with (or misdiagnosed) Guillain-Barré syndrome.

- D. The Food and Drug Administration (FDA) has approved a rapid West Nile Virus test, called West Nile IgM STATus test.
 1. This test can confirm the diagnosis in 15 minutes.
 2. Early diagnosis and treatment may prevent serious complications.
- E. MAC-ELISA (membrane attack complex–enzyme-linked immunosorbent assay) is another diagnostic test to detect antibody in serum or cerebrospinal fluid (collected within 8 days of illness onset).

Implementation

- A. No treatment is needed for asymptomatic West Nile virus.
- B. Clients with symptoms of encephalitis or meningitis require hospitalization.
 1. No specific therapy is available; give supportive therapy.
 2. Airway management, respiratory support (mechanical ventilation) may be ordered to control cerebral edema.
 3. Fluid management.
- C. Use standard precautions to protect healthcare workers.
- D. Teach clients preventive methods.
 1. Avoid mosquito bites.
 2. Use the chemical insect repellent DEET, which will offer protection. (Studies show DEET lasts 5 hours after application.)

Avian (Bird) Influenza (H5N1)

Definition: A viral infection caused by the avian influenza virus found in wild birds.

Characteristics

- A. Infected birds carry the virus in their intestines (which does not cause illness). Virus that causes illness is transferred to domesticated birds.
- B. Virus is then transmitted to people who work closely with these birds or eat meat that has been undercooked.
- C. Outbreaks of H5N1 occurred in poultry in eight countries during 2003–2004.
- D. This virus can result in a pandemic threat—there is a 50-50 chance it could mutate and easily spread from one person to another.

Assessment

- A. Symptoms range from fever, cough, and sore throat to eye infections, pneumonia, and severe respiratory distress.

- B. Humans have little or no immune protection because these viruses do not commonly infect humans.

Implementation

- A. The CDC recommends total infection control precautions with airborne precautions to prevent transmission.
- B. Isolation precautions for clients who have traveled within 10 days to a country where avian flu has been detected and who are hospitalized with a severe respiratory illness.
 - 1. Use of a HEPA-filtered negative-pressure isolation room.
 - 2. Healthcare workers should wear a respirator mask (N95 face piece).
- C. The FDA has approved a vaccination against H5N1 avian flu.
 - 1. Vaccine will be stockpiled and sold publicly if the virus acquires the ability to pass from person to person.
 - 2. Vaccine would be used in the early phase for protection until a specific vaccine that is tailored to the actual strain is developed.

IMMUNOSUPPRESSION

The Immunosuppressed Client

◆ *Definition:* An acquired immune deficiency characterized by a defect in natural immunity against disease. With loss of the immune system, the individual is susceptible to a variety of “opportunistic infections.”

Characteristics

- A. The immune system—how it functions.
 - 1. A complex system of organs and cells that work to distinguish foreign invaders from natural components in the body.
 - a. The body’s skin and mucous membranes provide the *first line of defense* against invading organisms.
 - b. When a foreign organism enters the body, it may be destroyed by circulating white blood cells, macrophages, and neutrophils—the *second line of defense*.
- ◆ 2. The immune system is triggered when an antigen has not been stopped or destroyed by the body’s first and second defense system.
 - a. Lymphocytes then mobilize to defend the body against invaders or antigens.
 - b. Lymphocytes fall into two classes.
 - (1) B cells (30% of blood lymphocytes) develop in the bone marrow.

- (2) T cells (70% of blood lymphocytes) originate in the bone marrow but complete development in the thymus gland.

◆ B. Etiology of immunosuppression.

1. Drug treatment protocols.
 - a. Cancer chemotherapeutic agents.
 - b. Antibiotics such as tetracycline, chloramphenicol, streptomycin, and gentamicin inhibit cellular immunity.
 - c. Mafenide and silver sulfadiazine inhibit neutrophil movement to the area of inflammation.
 - d. Steroids cause temporary lymphocytopenia, increase in neutrophils, decrease in monocytes and eosinophils.
 - (1) Chronic use leads to nonresponsive immune system.
 - (2) Anergy may lead to susceptibility to opportunistic infections.
2. Age—the older a client’s chronologic age, the more susceptible to infections.
3. Acute and chronic diseases.
 - a. Acquired immune deficiency syndrome (AIDS).
 - b. Cancer.
 - c. Inflammatory bowel disease.
 - d. Diabetes.
 - e. Chemical sensitivity.
 - f. Chronic fatigue syndrome.
4. Poor nutritional status.
 - a. Protein and calorie depletion lead to lymphocyte suppression.
 - b. Iron deficiency causes atrophy of the liver, spleen and bone marrow, and lymphoid tissue.
 - c. Zinc deficiency affects thymus gland.
5. Surgery and anesthesia.
6. Stress, both specific and generalized.
 - a. Environmental stress such as pollution, high-intensity sound, or noise, may create stress that results in immunosuppression.
 - b. Stressful life events, such as loss of job, marriage, or death, decrease immune function.
7. Psychiatric illness, especially major illness such as schizophrenia, depression, or manic episode.
8. Lesions of the central nervous system, especially the hypothalamus, produce changes in the immune response.

Assessment

- ◆ A. Observe for possible sites of infection.
 1. IV sites and invasive devices (prosthetic devices).
 2. Catheter sites.

3. Surgical wounds.
4. All body crevices.
5. Respiratory tract (lungs) and genitourinary tract.
- ◆ B. Observe for signs of inflammation or systemic infection.
 1. Changes in temperature—fever may be only sign since signs of inflammation may not appear due to diminished neutrophils.
 2. Changes in white blood cell count and differential count.
 3. Signs of inflammation: pain, redness, swelling, and heat.
- C. Assess the lungs for adventitious sounds.
- D. Assess nutritional status.
 1. Calorie and protein intake to build immune system.
 2. Adequate vitamins (including vitamins A and C) and minerals (iron and zinc).

Implementation

- ◆ A. Prevention and early detection of infection.
 - ◆ 1. Hand hygiene and gloving are essential for prevention.
 - a. Wash hands frequently during the care, and wash thoroughly before and after any contact with an immunosuppressed client. Use antiseptic, not bar soap, or waterless antiseptic.
 - b. Wear gloves for any client contact where there is possibility of contact with blood, body secretions, or contaminated surface.
 - ◆ 2. Use of aseptic technique when caring for all possible entrance sites for infection: catheters, central lines, endotracheal tubes, pressure-monitoring lines, and peripheral IV lines.
 - ◆ 3. Be aware of possibility of cross-contamination—deliver care first to the immunosuppressed client.
 - ◆ 4. Assign client to private room, if possible.
 - a. Keep door closed to prevent transmission of airborne organisms.
 - b. Keep room well ventilated.
 5. Use masks for all persons with the slightest evidence of upper respiratory or other type of infection.
 6. Damp dust with a disinfectant solution when cleaning client's room or objects used in care.
 7. Use a humidifier to reduce microorganisms that may thrive in an arid environment.
 8. Do not allow water to collect and stagnate; change every 24 hours to prevent breeding of organisms.
 - ◆ 9. Prevent contamination of suctioning equipment.
 - a. Use two-glove technique to prevent spread of organisms.
 - b. Complete thorough hand hygiene before and after suctioning.
 - c. Clean connecting tubes with germicide solution.
 - d. Change tubes every 8 hours.
 - ◆ 10. Use strict aseptic technique for every dressing change.
- ◆ B. Complete, impeccable skin care for the immunosuppressed client.
 1. Observe all pressure areas for signs of breakdown.
 2. Turn frequently, every hour if client is immobile.
 3. Complete passive or active range-of-motion exercises when indicated.
 4. Change any wet clothing or dressing immediately; wetness will break down skin.
 5. Lubricate and massage skin to prevent cracks and stimulate blood circulation to potential areas of breakdown.
- ◆ C. Perform pulmonary toilet.
 1. Assess pulmonary function frequently for lung sounds, coughing, drainage, and ability to breathe.
 2. Perform toilet every 2–4 hours.
- D. Monitor nutritional status.
 1. Provide high-calorie, high-protein diet; without adequate nutrients, client cannot produce enough lymphocytes to fight infection.
 2. Malnutrition impairs the humoral system of the immune response.
 3. Administer enteral feedings for clients with normal GI functions.
 4. Administer total parenteral nutrition (TPN/TNA) if GI tract is not functioning. This achieves high-density caloric support.
- E. Assist client to handle stressful conditions.
 1. Support accommodation to hospital regimen. Normalize hospital environment as much as possible.
 2. Allow client to be as independent as possible.
 - a. Support concerns about forced dependency.
 - b. Support client taking an active role in care activities.
 3. Provide method of dealing with psychological impact of illness—special consultation, extra time to communicate, etc.
 4. Provide care that will enhance body image.
 - a. Frequent assistance for bathing, hair washing, etc.
 - b. Use touch to communicate; do not act as if client is “untouchable.”

5. Allow client to make choices and discuss options for care.
 6. Allow private time for client and make allowances for family and friends to spend time with client.
- F. Present realistic optimism when caring for client—a no-hope attitude on the part of the nurse will be conveyed.

AIDS

Definition: The most severe form of a continuum of illnesses associated with human immunodeficiency virus (HIV) infection.

Characteristics

- ◆ A. Normal versus AIDS immune response.
 1. In the normal immune system, killer/suppressor and helper/inducer T cells are evenly distributed.
 - ◆ 2. AIDS clients show an acquired defect of immunity.
 - a. Helper T cells are depleted, which causes a reversal of normal ratio of helper/inducer to killer/suppressor T cells.
 - b. Client cannot activate effective immune response either to foreign invaders or to cancer cells.
 - c. This deficiency leads to the majority of signs and symptoms observed in AIDS clients.
- B. HIV is a bloodborne retrovirus and has a different life cycle from a normal virus.
 1. Genetic information is usually sequenced by DNA being transcribed into RNA, which is then translated into proteins necessary for life.
 2. Retroviruses reverse the sequence: RNA code is transcribed backward into DNA and may be integrated into host cell chromosomes.
 3. This retrovirus invades CD4+ T-lymphocyte (immunity) cells, renders them useless, and then duplicates itself (which affects client's immune function so that the disease becomes clinically manifested).
 - ◆ 4. HIV attaches and changes the protein on the surface of the helper T cells.
- ◆ C. Transmission of the HIV virus.
 1. HIV does not appear to be highly contagious.
 - ◆ 2. Transfer of the virus occurs through a transfer of body fluids, either from mother to child during perinatal period or through intimate sexual contact or parenteral exposure. Fluids with HIV transmission potential of the disease are: semen, blood, breast milk, vaginal/cervical secretions.
- 3. Body fluids containing infected lymphocytes must enter the bloodstream or body cavity to spread the virus.
- 4. The virus exists in tears, saliva, urine, feces, spinal fluid, sputum, pus, and bone marrow; epidemiological evidence has not confirmed transmission through these body fluids.
 - ◆ a. High concentrations of HIV found in blood, semen, and cerebrospinal fluid.
 - b. Lower concentrations of HIV found in urine, vaginal secretions, saliva, feces, breast milk.
- D. HIV statistics.
 1. More than 1.1 million Americans are living with HIV—47,500 new infections occur each year.
 2. Two major risk groups continue to be homosexual or bisexual men (accounting for 47.9% of AIDS cases) and IV drug abusers (which make up 85% of all AIDS cases).
- E. Opportunistic conditions: disease processes that occur as a result of suppressed immune system.
 - ◆ 1. *Pneumocystis jiroveci*: a parasitic infection of the lungs. One of the two rare diseases that affect 85% of AIDS clients; similar to other types of pneumonia.
 - ◆ 2. Kaposi sarcoma: a type of cancer usually occurring on the surface of the skin or in the mouth. This disease may also spread to internal organs.
 - 3. Dementia with AIDS virus: a clinical syndrome in which there is acquired persistent intellectual impairment, in this case caused by the HIV virus.

TESTING FOR HIV

- The ELISA (enzyme-linked immunosorbent assay) test was developed to screen national donor blood.
 - a. This test does not test for AIDS, but rather for antibodies to the HIV virus.
 - b. Once exposed to a virus, it takes the body time to produce antibodies. A person may already be infected, and if the body has not yet produced antibodies, the ELISA test will be negative.
 - c. Test is also imperfect in that it may produce a false positive or false negative.
- All positive results must be retested via ELISA.
- If second test is positive, the Western blot test is given for final confirmation.

Assessment

- A. Assess for chronic fatigue, diarrhea, skin breakdown, fever, dehydration, and neurologic symptoms.
- B. Assess physical status for degree of independence.
 - 1. Ability to be mobile without assistance.
 - 2. Amount of medication that interferes with alertness.

Implementation

- A. New therapies have extended the life span of AIDS clients.
 - 1. Trends of both AIDS cases and deaths are declining.
 - 2. Decrease is thought to be related to prevention efforts targeted at high-risk populations and new medications.
- B. More than 20 antiretroviral drugs have been approved by the FDA.
- ◆ C. CDC recommends aggressive antiretroviral therapy (ART)—viral suppression is the goal.
 - 1. HAART (highly active antiretroviral therapy)—one protease inhibitor and two non-nucleoside reverse transcriptase inhibitors are recommended.
 - 2. According to WHO, by the end of 2012, 9.7 million people were on ART.
 - 3. The impact of ART in 2012 was that 4.2 million deaths were averted.
- D. HIV death rate has dropped by 85% since its peak. This is due to ART and decreased HIV incidence after the 1980s.

Hepatitis

See Hepatitis A, B, C, D in Chapter 8.

Healthcare Workers' Exposure to HIV

- A. The Public Health Service updated recommendations for management of healthcare workers' exposure to HIV. The decision to recommend HIV postexposure prophylaxis (PEP) takes into account two factors:
 - 1. The nature of the exposure.
 - 2. The amount of blood or body fluid involved in the exposure.
- ◆ B. Healthcare facilities should have the protocols available and mandate prompt reporting and postexposure care.
 - 1. Healthcare workers must be educated to report occupational exposures immediately after they occur.
 - 2. PEP is most likely to be effective if implemented as soon after the exposure as possible.

- 3. Exposure is defined as a percutaneous injury, contact of mucous membrane or nonintact skin, or contact with intact skin when the duration of contact is prolonged.
- 4. Risk assessment is performed on all healthcare workers who have been exposed to potentially HIV-infected blood or body fluids.
- 5. The FDA has recently approved a point-of-care HIV test that provides results in 5 minutes. If positive, a follow-up confirmation test must be done.
- 6. Goal is to balance risk for infection against potential toxicity of the PEP drugs.
- C. Recommendations for PEP:
 - 1. A basic 4-week regimen of two drugs (zidovudine and lamivudine) is appropriate for most HIV exposures.
 - 2. Expanded regimen that includes the addition of a protease inhibitor (indinavir or nelfinavir) is recommended for increased risk for transmission of HIV exposures.
 - 3. There is now available a boosted protease inhibitor (Kaletra) that helps to reduce the viral load.

HIV-HBV Healthcare Worker Alert

- A. Accidental contact with blood or body fluids.
 - ◆ 1. Any percutaneous or mucocutaneous exposure should receive immediate first aid.
 - a. Percutaneous exposure—a break in the skin caused by contaminated needle or sharp instrument, broken glass container holding blood or body fluids, or human bite.
 - b. Mucocutaneous exposure—body fluid contact to open wounds, nonintact skin (eczema), or body fluid splash to mucous membranes (mouth, eyes).
 - ◆ 2. Apply immediate first aid to site.
 - a. Needlestick or puncture wound: Scrub area vigorously with soap and water for 5 minutes.
 - b. Oral mucous membrane exposure: Rinse area several times with water.
 - c. Ocular exposure: Irrigate immediately with water or normal saline solution.
 - d. Human bite: Cleanse wound with Betadine (povidone-iodine) and sterile water.
- 3. Report unusual occurrence to the charge nurse or supervisor.
- 4. Complete an unusual occurrence form and follow reporting requirements mandated by OSHA.

- B. Health Care Worker Protection Act.
1. The Health Care Worker Protection Act was passed to reduce number of healthcare workers who are accidentally exposed to potentially contaminated, infected blood via a needlestick.
 - a. More than 600,000 needlesticks and injuries are reported yearly.
 - b. Most common cause of exposure to blood-borne pathogens is needlestick injuries with postinjury risk for HIV exposure.
 2. This act makes the use of safe needle devices a requirement if facility receives Medicare funding.
 - ◆ 3. More than 20 pathogens can be transmitted through small amounts of blood.
 - a. Hepatitis B is the most common infectious disease transmitted through work-related exposure to blood and needlesticks.
 - b. In addition to HIV and hepatitis B, syphilis, varicella-zoster, and hepatitis C can be transmitted via this route.

BIBLIOGRAPHY

- Centers for Disease Control and Prevention. (2007). 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Retrieved from http://www.cdc.gov/hicpac/2007IP/2007ip_appendA.html
- Centers for Disease Control and Prevention. (2011). Healthcare-associated infections (HAI): Basic infection control and prevention plan for outpatient oncology settings. Retrieved from: <http://www.cdc.gov/HAI/settings/outpatient/basic-infection-control-prevention-plan-2011/index.html>
- Centers for Disease Control and Prevention. (2013). Infection control in health care facilities. Retrieved from <http://www.cdc.gov/flu/professionals/infectioncontrol/>
- Centers for Disease Control and Prevention. (2013). HIV/AIDS & STDs. Retrieved from <http://www.cdc.gov/std/hiv/default.htm>
- Centers for Disease Control and Prevention. (2014). Healthcare-associated infections (HAI). Retrieved from <http://www.cdc.gov/hai/>
- Centers for Disease Control and Prevention. (2014). Healthcare-associated infections (HAI): Guidelines and recommendations. Retrieved from http://www.cdc.gov/hai/prevent/prevent_pubs.html
- Centers for Disease Control and Prevention. (2014). Healthcare associated infections (HAI). HAI Prevalence Survey (updated 1/15/2015). Retrieved from <http://www.cdc.gov/HAI/surveillance/>
- Centers for Disease Control and Prevention. (2014). HIV/AIDS. Retrieved from <http://www.cdc.gov/hiv/>
- Gardam, M., Reason, P., & Gitterman, L. (2012). Healthcare-associated infections: New initiatives and continuing challenges. *Nursing Leadership*, 25:36–41.
- Global AIDS Overview: The Global HIV/AIDS Crisis Today. Retrieved from <http://www.aids.gov/federal-resources/around-the-world/global-aids-overview/>
- Hinkle, J. L., & Cheever, K. (2014). *Brunner & Suddarth's textbook of medical surgical nursing* (13th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- HIV Treatment: Global Update on HIV Treatment 2013: Results, impact and opportunities, WHO report in partnership with UNICEF and UNAIDS, June 2013. Retrieved from http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2013/20130630_treatment_report_en.pdf
- O'Horo, J. C., Silva, G. L., Munoz-Price, L. S., & Safdar, N. (2012). The efficacy of daily bathing with chlorhexidine for reducing healthcare-associated bloodstream infections: A meta-analysis. *Control & Hospital Epidemiology*, 33(3):257–67.
- Rupp, M. E., Cavalieri, R. J., Lyden, E., Kucera, J., Martin, M., Fitzgerald, T.,... Van Schooneveld, T. C. (2012). Effect of hospital-wide chlorhexidine patient bathing on healthcare-associated infection. *Infection Control & Hospital Epidemiology*, 33(11):1094–100.
- Safdar, N., Anderson, D. J., Braun, B. I., Carling, P., Cohen, S., Donskey C.,... Zerr, D. M. (2014). The evolving landscape of healthcare-associated infections: Recent advances in prevention and a road map for research. *Infection Control & Hospital Epidemiology*, 35(5):480–93.
- Septimus, E., Yokoe, D. S., Weinstein, R. A., Per, T. M., Maragakis, L. L., & Berenholtz, S. M. (2014). Maintaining the momentum of change: The role of the 2014 updates to the compendium in preventing healthcare-associated infections. *Infection Control & Hospital Epidemiology*, 35(5):460–3.
- Yokoe, D. S., Anderson, D. J., Berenholtz, S. M., Calfee, D. P., Dubberke, E. R., Ellingson, K.,... Maragakis, L. L. (2014). Introduction to “A compendium of strategies to prevent healthcare-associated infections in acute care hospitals: 2014 updates.” *Infection Control & Hospital Epidemiology*, 35(5):455–9.

INFECTION CONTROL REVIEW QUESTIONS

1. A nurse is just exiting an isolation room. Considering infection control protocol, which actions, in order, would the nurse take? _____
 1. Bag equipment and double-bag it out at the door.
 2. Remove protective gear.
 3. Dispose of equipment appropriately inside the room.
 4. Wash hands.
2. The nurse is assigned to care for two clients. One client has just returned from surgery for an abdominal resection. The second client is hospitalized with an acute case of tuberculosis. Which special precautions should the nurse take when providing care for these two clients?
 1. Proper hand hygiene between clients and use of specific isolation garb.
 2. Provide care to the client with tuberculosis before the client with abdominal surgery.
 3. Strictly adhere to barrier nursing principles.
 4. Thorough hand hygiene and gloving is sufficient in this situation.
3. CDC guidelines are specific for clients with tuberculosis. The major differences in providing care for the client with TB versus other clients requiring barrier nursing are
 1. The staff must wear gowns, mask, and gloves.
 2. The client should be in a private room with a special ventilation system.
 3. The client may be placed in a room with other clients requiring barrier nursing protocol.
 4. The protocol of donning and removing isolation garb before entering or leaving the client's room is different.
4. A nurse is assigned to take two clients' vital signs, complete a focus assessment and provide hygienic care, administer meds, and complete a dressing change for a client with an abdominal wound. Which task will have priority with this assignment?
 1. Take vital signs and provide hygienic care on the first client.
 2. Administer medications to the clients.
 3. Complete the dressing change.
 4. Take vital signs on the two clients.
5. All staff must wear disposable particulate respirators (HEPA filter) when
 1. Working with a client in isolation.
 2. There is inadequate room ventilation.
 3. Working with a client with tuberculosis.
 4. There are suspected colonized microorganisms.
6. When removing an isolation gown, steps the nurse should take would be to
 1. Untie the neck strings, remove gloves, and untie waist strings.
 2. Untie front waist strings, remove gloves, and untie neck ties.
 3. Remove gloves, untie waist strings, and wash hands.
 4. Remove gloves, untie neck strings, and wash hands.
7. A nurse is assigned to provide care for an AIDS client. Infection control guidelines specify that a gown should be worn when the nurse
 1. Enters the room to provide client care.
 2. Administers IV medications.
 3. Completes a dressing change.
 4. Administers an IM injection.
8. Gloves are an important component of infection control protocol. Which of the following situations would require that gloves be worn? List all the numbers that apply. _____
 1. When the nurse is in contact with urine.
 2. Suctioning a client who does not have an infectious disease.
 3. Changing an ostomy pouch.
 4. Delivering a food tray to a client with AIDS.
9. Protective eyewear should be worn at all times when the nurse is
 1. Giving personal care to an AIDS client.
 2. Bathing a neonate for the first time.
 3. Drawing cord blood.
 4. Taking a specimen to the laboratory.

10. The RN team leader will assign a healthcare worker to care for a client in isolation. Which team member would be appropriate for this assignment?
 1. LVN/LPN only.
 2. LVN/LPN, CNA.
 3. LVN/LPN, UAP.
 4. LVN/LPN, CNA, UAP.
11. The nurse is assigned to draw blood from a suspected AIDS client. Standard precautions dictate that she should use
 1. Gown, clean gloves, and mask.
 2. Gown and sterile gloves.
 3. Hand hygiene and sterile gloves.
 4. Hand hygiene, gown, and clean gloves.
12. The rationale for isolating a newborn who was born to a mother who had rubella is that
 1. The newborn may be actively shedding the virus.
 2. The newborn is more susceptible to infections.
 3. The child may develop encephalitis, a complication of rubella.
 4. A newborn's autoimmune system is depressed.
13. The nurse is responsible to check that the nursing assistant (UAP) is aware of standard precautions/isolation techniques. If the nursing assistant understands these techniques, she will say that she must wear
 1. Gloves at all times when in contact with any clients, regardless of the diagnosis.
 2. Gloves and gown when in contact with blood or body fluids.
 3. Sterile gloves, gown, and mask at all times when caring for identified AIDS clients.
 4. Mask and gloves at all times when caring for diagnosed AIDS clients.
14. Which of the following is a type of transmission-based precaution?
 1. Droplet.
 2. Respiratory.
 3. Blood.
 4. Body fluids.
15. Two major factors that influence whether an infection occurs in an individual are
 1. Age and general health status.
 2. Underlying disease status and exposure to infectious agent.
 3. Inherent health and immunologic status.
 4. Type of organism and age.
16. When an area becomes inflamed, the substance that is released around the injured site is labeled
 1. Plasmin.
 2. Histamine.
 3. Kinin.
 4. Leukocytes.
17. Which of the following statements is true when evaluating infection control practices?
 1. Gloves should be worn for contact with blood and body fluids of all clients.
 2. Gloves should be changed after contact with blood or body fluid; otherwise, it is not necessary to change them between client care.
 3. Gowns should be worn at all times when caring for clients with drainage.
 4. Healthcare workers with open lesions should wear special gloves when providing client care.
18. The census on the unit is 90% and there are no private rooms available. An elderly client with influenza is admitted. To which of the following rooms would it be appropriate to assign this client?
 1. A double room with another client with the same diagnosis.
 2. A four-bed room with three clients who have had orthopedic surgery.
 3. A double room with an elderly client with a diagnosis of chickenpox.
 4. A double room with a client admitted for impetigo.
19. For an infection to occur, six links or steps must be present. Which of the following is not considered a link?
 1. Infectious agent.
 2. Reservoir.
 3. Portal of entry.
 4. Droplet transmission.
20. The nurse has instituted contact precautions on a client with herpes infection. These precautions would not include
 1. Special particulate (HEPA) filter mask.
 2. Private room or double room with a client with the same illness.
 3. Gloves when providing client care and changing gloves following contact procedures.
 4. Gown if clothing will come in contact with the client, environmental surfaces, or items in the room.

21. The single major risk a client faces when entering a hospital in the United States for any reason is
1. Resistant strain of *Staphylococcus*.
 2. Vancomycin-resistant enterococcus.
 3. Healthcare-associated infection.
 4. Death.
22. Considering the most basic infection control measures, which of the following statements is correct?
1. Wearing gloves eliminates the need to wash hands between clients.
 2. Donning gloves, even with unclean hands, will protect the client.
 3. It is important to wash hands between clients and before and after using gloves.
 4. OSHA stipulates that gloves must be worn for all client contact.
23. The most common healthcare-associated infection is
1. Urinary tract infection.
 2. Infectious diarrhea (*Clostridium difficile*).
 3. Pneumonia (gram-negative bacteria).
 4. Bloodstream infection.
24. A client returns to the unit following neurosurgery for removal of a meningioma. The client has been in intensive care for 2 days and now is assigned to a step-down unit. When completing an assessment, the nurse notes that the client has a fever of 102°F and is complaining of cramps and pain in the stomach. The appropriate intervention is to
1. Repeat the assessment in 12 hours.
 2. Notify the physician.
 3. Do nothing—these symptoms are expected with this condition.
 4. Suggest a stool assay for toxin A or B.
25. A nurse accidentally has had a needlestick in her hand as she pulled an IM needle from the muscle. The first action is to
1. Report the accident to the charge nurse.
 2. Scrub the area vigorously with soap and water for 5 minutes.
 3. Cleanse area with Betadine (povidone-iodine).
 4. Irrigate the wound with sterile water.

INFECTION CONTROL ANSWERS WITH RATIONALE

1. The answer is 3 2 1 4. The first action would be to dispose of “dirty” equipment in a garbage bag before removing protective gear. Then, the nurse would remove gear beginning with the gown (2) and place in garbage bag (1). Finally, the nurse would wash hands (4) and dispose of all “double-bagged” equipment in the dirty utility room and wash hands again.

NP:P; CN:S; CA:M; CL:A

2. (3) There are no special precautions; however, the nurse must strictly adhere to barrier nursing principles and the two clients must be treated separately. Providing care to the abdominal surgery client before the TB client would be appropriate. Proper hand hygiene is essential, but isolation garb is needed only for the TB client.

NP:P; CN:S; CA:M; CL:A

3. (2) Clients with tuberculosis are placed in private rooms with directional airflow, negative-pressure ventilation systems. Negative pressure pulls air away from the hallway and exhausts it out of the room to areas away from the intake vents. The other elements are the same for any client requiring barrier nursing precautions or isolation protocols.

NP:A; CN:S; CA:M; CL:C

4. (4) Taking vital signs on the two clients would be the priority nursing action to determine if there are any emergent problems. Even if one of the clients had TB, the nurse could don gloves and a HEPA filter mask to complete the assignment. Next, the nurse would give the meds (2) that need to be given within a certain time frame. Because changing the dressing (3) might also involve a pain assessment, this would take more time and should probably be done last.

NP:P; CN:S; CA:M; CL:AN

5. (2) Staff must wear disposable respirators when there is inadequate room ventilation. If the room has a directional negative-pressure ventilation system, the staff would not be required to wear a HEPA filter mask, even if the client had TB. These masks are required for drop-let transmission-based conditions.

NP:P; CN:H; CA:M; CL:A

6. (2) Removing the waist strings first is appropriate because when they are tied in front, they are considered dirty. The nurse would remove gloves, untie the neck strings (which are considered clean), and then remove the gown. Only if there were no waist strings in front would the nurse remove the gloves first.

NP:P; CN:S; CA:M; CL:K

7. (3) Whenever a dressing is changed, the nurse could come in contact with body fluids; thus a gown should always be worn. Entering a room (1) and administering IV meds (2) or an IM injection (4) are interventions that do not necessarily require gowning.

NP:P; CN:S; CA:M; CL:C

8. The answer is 1 2 3. Answer (4), delivering a food tray to an AIDS client, would not require the nurse to don gloves. However, correct protocol would require the nurse to wash hands before delivering another tray. The other interventions would absolutely require gloving because the nurse is in contact with body fluids.

NP:AN; CN:S; CA:M; CL:C

9. (3) Protective eyewear should be worn when drawing cord blood, because the blood could easily splash into the nurse's eyes. Gloves should be worn when giving personal care to an AIDS client or bathing a neonate for the first time, but eyewear is not required protocol.

NP:P; CN:S; CA:M; CL:C

10. (4) All members of the team, even unlicensed personnel, can perform some activities of care for a client in isolation.

NP:P; CN:S; CA:M; CL:A

11. (4) The most important protection for the nurse is hand hygiene and clean gloves. She should wear a gown to protect herself, especially if the client is not alert. A mask is advised if the client is coughing.

NP:P; CN:S; CA:M; CL:C

12. (1) These infants continue to shed the rubella virus for up to 18 months postdelivery. Mental retardation, congenital cataracts, and cardiac anomalies can occur as a result of exposure to the virus. The newborn examination should be thorough to check for these potential problems.

NP:P; CN:S; CA:M; CL:A

13. (2) Standard (universal) precautions, a code advocated by the CDC, include protecting oneself when there is any possibility of being in contact with contaminated body fluids or blood. The nurse manager is responsible for ensuring that those on the team understand these precautions.

NP:E; CN:S; CA:M; CL:C

14. (1) Droplet is a type of transmission-based precaution. The other two types are contact and airborne. The remaining answers are not considered types of precautions.

NP:A; CN:S; CA:M; CL:K

15. (3) Inherent health and the health of one's immune system are the two major factors that determine whether an infection will occur. Other factors that have an impact are general health status (1) and underlying disease status (2) (which would weaken the immune system). Neither age nor exposure time to the infectious agent is a major factor.

NP:A; CN:S; CA:M; CL:C

16. (2) Histamine is released, which causes increased vascular permeability. When an area becomes inflamed, cells at the site activate the plasmin, clotting, and kinin systems, which cause the release of histamine around the injured site. Phagocytes are then summoned to the site to combat the infection by ingesting the harmful microorganisms.

NP:A; CN:S; CA:M; CL:K

17. (1) The only completely true statement is that gloves should be worn for contact with blood and body fluids

for all clients. It is always necessary to change gloves between clients for their protection (2). Gowns do not have to be worn (3) if the nurse will not be in direct contact with drainage. Double gloving, but not special gloves (4), may provide more protection if a healthcare worker has an open lesion.

NP:P; CN:S; CA:M; CL:C

18. (1) If a private room is not available, the client should be placed with another client with the same diagnosis where droplet precautions would already be in place. The staff and visitors should be told to stay at least 3 feet away without a mask because large-particle droplets travel only about 3 feet before falling from the air. Orthopedic clients (2) should not be exposed to the flu or chickenpox (3) (which require airborne precautions). Impetigo (4) requires contact precautions, so this client should not be exposed to the flu, and vice versa.

NP:P; CN:S; CA:M; CL:AN

19. (4) Droplet transmission is not considered a link in the six-step process of infection. Droplet is one of the three precautions (the other two are contact and airborne) based on the route of transmission. The additional three links needed for an infection to occur are route of transmission, portal of exit, and susceptible host.

NP:A; CN:S; CA:M; CL:K

20. (1) A HEPA filter mask would work for droplet precautions for a client with tuberculosis or any disease that is spread via droplet (such as diphtheria or pertussis) rather than contact (skin to skin).

NP:P; CN:S; CA:M; CL:C

21. (3) The major risk for any hospitalized client for any reason is developing a healthcare-associated infection. There are more than 2 million infections per year acquired in hospitals, with 99,000 deaths as a direct or indirect result of infections (CDC statistics).

NP:A; CN:S; CA:M; CL:K

22. (3) The only totally correct statement is to perform hand hygiene between clients as well as before and after using gloves. Wearing gloves does not eliminate the need to wash hands (1) and microorganisms can be transmitted (when the hands are unclean) even if gloves are worn (2). Gloves are not necessary for all client contact (4)—just contact that may result in blood or body fluid exposure to the hands.

NP:P; CN:S; CA:M; CL:C

23. (2) The most common cause of healthcare-associated infection is *Clostridium difficile* diarrhea. Twenty to forty percent of hospital clients become colonized within a few days. The second most common cause is pneumonia—gram-negative, gram-positive, and viral.

NP:A; CN:S; CA:M; CL:K

24. (4) The symptoms suggest infectious diarrhea. Up to 40% of hospitalized clients contract this infection within days of entering the hospital. A stool assay is

indicated so that antibiotics or antimicrobial medication can be initiated immediately.

NP:I; C:PH; CA:M; CL:AN

25. (2) Immediate first aid is to scrub the area vigorously. The nurse would then report and write up the accidental needlestick (1). Cleansing the area with Betadine (povidone-iodine); (3) would be appropriate for a human bite. Irrigating with sterile water (4) is appropriate first aid for ocular exposure to blood or body fluid.

NP:I; CN:S; CA:M; CL:C