



NMNEC Concept: Infection

Mega-Concept: Health and Illness

Category: Protection and Movement

Concept Name: Infection

Concept Definition:

Invasion of or alteration in the body's normal immune response system that leads to proliferation of microorganisms that have the potential to cause disease.

Scope and Categories:

Scope: Infection occurs on a continuum from being free from infection, with homeostasis of resident flora or microbes, to an acute invasion of a microorganism that can lead to a chronic disease process if untreated or inadequately treated. When considering an infection, leukocytes found in the blood, secondary immune responses, and tissue-derived leukocytes are primarily responsible for protecting the body (Sabo, 2013).

Categories: Infections can be categorized in many different ways. The following are the most prevalent.

- **Causative Microorganisms:**
 - Bacteria: bacteria exist and interact with the body in a variety of relationships that are beneficial or are not harmful. Infection occurs when the homeostasis is interrupted and when bacteria invade a body system, damage cells, trigger systemic inflammatory responses, or release toxins that are pathologic.
 - Viruses: a virus acts on the cell nucleus, taking over the genetic material within the nucleus and replicating itself, causing a pathogenic response.
 - Fungi: fungal diseases are caused by fungi or yeast-causing microorganisms. Infections from fungi or yeast usually arise if individuals have a deficiency in their immune system or immune response.
 - Parasites/protozoa: parasitic or protozoon infections generally arise in underserved areas related to contamination of food and water.
- **Trajectory or Time Implication:**
 - Acute: the infection appears suddenly and has a short time span of a few days to weeks.



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- Chronic: the infection lasts 12 weeks or longer and cannot be treated or have intervals where the disease is dormant.
- **Extent:**
 - Localized: the infection has not spread and remains close to the site of entry.
 - Disseminated: the infection enters at a single point and then spreads throughout the body, often affecting numerous organ systems.
 - Systemic: the infection has spread throughout the entire body. It may arise from a localized point of entry or be spread through the bloodstream, affecting the entire body, otherwise known as sepsis.
- **Transmission or Occurrence:**
 - Airborne: caused by inhalation of pathogenic organisms in droplet nuclei.
 - Droplet: acquired by the inhalation of a microorganism in the air, especially one added to the air by sneezing or coughing.
 - Contact : transmitted via contact with existing organisms from one person's skin to another or from an object to a person's skin
 - Endogenous: caused by infectious agents that are already present in the body, but have previously been dormant.
 - Health care–associated infections/nosocomial: the offending organism is transmitted or acquired in the health care delivery system.
 - Opportunistic: result from a defective immune system that cannot defend against pathogens normally found in the environment or when resident flora proliferate and infect a body site in which they are normally present or at some other location.
 - Vector-borne insect or animal that serves as an intermediate host: transmission can occur by injection of salivary fluid during biting or by the deposit of feces or other materials on the skin through the bite wound or a traumatized skin area.
- **Regionality of Infection in a Population:**
 - Endemic: restricted or peculiar to a locality or region and in predictable occurrences
 - Epidemic: affecting or tending to affect a disproportionately large number of individuals within a population, community, or region at the same time
 - Pandemic: occurring over a wide geographic area and affecting an exceptionally high proportion of the population



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Populations at Risk:

Infection can affect all individuals, regardless of age, gender, race, socioeconomic status, or geographic location.

Risk Factors:

- Age:
 - Infants: prematurity and low birth weight can contribute to an infant's immature immune system
 - Children: are developing immune responses
 - Older adults: older adults' immune systems take longer to react to the invading organism. Older adults are at risk for having a greater and longer impact from chronic health conditions that may affect how well the immune system is able to fight the infection
- Low socioeconomic status
- Women during pregnancy

Individual Risk Factors:

- Compromised host because of immunodeficiency
- Genetic factors can cause a primary deficiency that is expressed as a compromised immune system
- Secondary deficiencies can contribute to an incompetent immune system, such as malnutrition, stress, or medications
 - Compromised host because of chronic disease and environmental conditions
 - Chronic disease in the host can lead to an increased risk of the affected system, e.g., chronic obstructive pulmonary disease
 - Management of chronic disease can place the host in an environment where the management of the chronic disease or the treatment for an infecting agent places the patient at further infectious risk
 - Intravenous lines
 - Invasive devices
 - Medications
 - Multidrug resistance organisms as a result of treatment(s)
 - Surgery
 - Mechanical ventilation
 - Environmental conditions
 - Overpopulation; exposure to improper or inadequate sanitation; poor



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food, water, and/or air quality

Physiological Processes and Consequences:

- Pathogenicity speaks to the ability of a pathogen to cause disease.
- Epidemiology is the study of how a pathogen is transmitted from one host to another.
- All of the following must be present for an infection to occur
 - A pathogen: causative organism
 - Susceptible host, in this case, human
 - Reservoir: environment in which the pathogen lives and multiplies. It can be a living body or in and on objects, such as water, food, door handles, tables, and health care equipment
 - Portal of entry: the pathway through which a pathogen enters into the body, alteration in tissue integrity (see Tissue Integrity Concept), mucous membranes, gastrointestinal tract, respiratory tract, or intimate sexual contact
 - Portal of exit: a pathogen exits the host via the gastrointestinal tract, saliva, the respiratory system, urine, feces, blood, or skin
- Immune system response is initiated when pathogens invade the body (see Immunity Concept)

Assessment/Attributes:

Infection is assessed and diagnosed using three techniques: subjective history, objective assessment and physical examination findings, and diagnostic tests.

Subjective History: A thorough patient history helps the nurse to determine an individual's risk of infection, recognize symptoms associated with an infection, and determine the factors associated with the presenting infection. A comprehensive subjective assessment includes questions related to the following:

- History of risk factors
 - Exposure to pathogens
 - Travel: recent, especially to underdeveloped areas where there may be exposure to air-, food-, and water-borne pathogens not common in the United States
 - History of prior and/or chronic infections, e.g., HIV (Centers for Disease Control and Prevention [CDC], 2012a)
 - Current or past treatment that would cause immunosuppression, e.g., chemotherapy



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- Chronic disease that affects the immune system response , e.g., autoimmune disease
- Close contact within large groups where transmission of a pathogen is easier, e.g., party, concert, college dormitory
- History of symptomatology
 - Symptoms of inflammation (pain, redness, swelling)
 - Symptoms associated with organ affected, as well as symptoms such as fatigue or malaise, that are a result of generalized stress to the host
 - Assessment of the onset of symptoms, location of symptoms, duration of symptoms, characteristics of symptoms, whether anything aggravates or alleviates the symptoms, whether the symptoms radiate, treatments used related to the symptoms, and the severity of symptoms

Objective Assessment and Physical Examination Findings: Visual assessment of symptoms should support the subjective assessment findings. The objective findings or clinical manifestations of the infection are those associated with the inflammatory process. These can be related to the involved area of infection or be demonstrated on a systemic level. Focused objective assessment is related to the location of the infection and presenting symptoms. Data to assess infection include:

- Fever/calor
- Swelling/edema
- Redness/rubor
- Drainage/exudate: color, consistency, odor
- Respiratory congestion (respiratory infection)
- Diarrhea or constipation (gastrointestinal involvement)
- Malaise
- Lymphadenopathy
- Altered level of consciousness

Diagnostic Tests: Laboratory and diagnostic exams are pivotal in the diagnosis of infections. Laboratory studies are used on any type of body fluid or tissue to determine the infectious agent present in the host. The following are typical laboratory and diagnostic tests used to determine an infection:

- Complete blood count is critical to evaluate the response of the immune system and determine effectiveness of treatment of the infection. White blood cell counts, specifically, the levels of neutrophils, band T lymphocytes, monocytes, and basophils,



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are elevated in the presence of infection. Elevation of specific white blood cells can indicate the causative agent: neutrophils are elevated with a bacterial infection, which will cause a release of immature neutrophils in a response known as a shift to the left, or bandemia; the lymphocytes are elevated with a viral infection; basophils are elevated with parasitic and protozoan infections.

- Culture and sensitivity tests are used to determine the causative agent. Culture and sensitivity can be performed on any body fluid, tissue, or exudate
- C-reactive protein
- Erythrocyte sedimentation rate
- Serologic tests for detection of specific virus (antigens) antibodies
- Radiographic tests may be used to visualize an area of possible infection

Clinical Management: The goal is to eradicate the infection, prevent secondary infections, limit damage to the body, and prevent infection transmission. The nurse is instrumental in using the concept of Health Promotion. Following is how health promotion relates to infection; see the Health Promotion Concept for further information.

- **Primary Prevention on**
 - Environmental alterations to prevent or eliminate the reservoir for pathogens
 - Nutrition
 - Hand hygiene
 - Vaccinations
 - Sexually Transmitted Infections (STIs) prevention
 - Rest and stress reduction
 - Personal protective equipment and isolation precautions. Infection control practices include the following:
 - Basic hand hygiene and standard precautions: the most effective way to decrease the transmission of infection
 - Personal protective equipment
 - Airborne precautions
 - Droplet precautions
 - Contact precautions
- **Secondary Prevention:** Screening is not as effective as primary prevention related to infection. Specific disease screening is important for at-risk populations, e.g., sexually transmitted Infections



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- **Tertiary Prevention:** Used as an interdisciplinary process to eliminate the infection and provide supportive management for the host
 - Primary prevention methods for the compromised host
 - Using primary prevention methods to provide proper nutrition, hydration, and rest to ensure the energy and support the host requires to heal when infected
 - Treatment of infectious process: using data collected from the laboratory and diagnostic tests to guide therapy related to the causative organism
 - Anti-infective medications

Interrelated Concepts:

- **Immunity:** the immune system is the first line of defense against pathogens
- **Inflammation:** the body's response to a causative agent. The agent causing symptomatology triggers the inflammatory response
- **Tissue Integrity:** the skin is the body's largest organ of defense against pathogens entering the host
- **Stress and Coping:** affect the immune system negatively; the immune system response is decreased or delayed, making the host more vulnerable.
- **Nutrition:** adequate nutrition and hydration support and maintain the immune system's response to pathogens.
- **Health Promotion:** integral to preventing and treating the host when an infection is present and is used to implement strategies that will eradicate the spread of a pathogen.

Exemplars

New Mexico Nursing Education Consortium (NMNEC) Required Exemplars:

- **Health Care–Associated/Nosocomial Infections,** as reported by the National Healthcare Safety Network (NHSN) and CDC.
 - Urinary tract infections (UTIs) are the most common type of health care–associated infection. Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter (catheter-associated UTI; CDC, 2012b).
- **Multidrug-Resistant Infections:** More multidrug-resistant infections are being monitored
 - Methicillin-resistant *Staphylococcus aureus* (MRSA): Staph bacteria usually on the skin that is resistant to certain antibiotics called beta-lactams. These antibiotics include methicillin and other more common antibiotics, such as oxacillin, penicillin, and amoxicillin (CDC, 2012b)



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- **Infections Prevalent by Body System Across the Lifespan**

- Respiratory: respiratory syncytial virus
- Systemic: sepsis (Sabo, 2013)
- Cellulitis

Optional Exemplars:

- **Health Care–Associated/Nosocomial Infections**, as reported by the NHSN and health care-associated infections data from the CDC.
 - Central line–associated bloodstream infections result in thousands of deaths each year and billions of dollars in added costs to the U.S. health care system (CDC, 2012b)
 - Ventilator-associated pneumonia is a lung infection that develops in a patient who is on a ventilator. Infection occurs by pathogens entering directly into the lungs via the ventilator tubing (CDC, 2012b)
 - *Clostridium difficile* is a spore-forming, Gram-positive anaerobic bacillus that produces two exotoxins: toxin A and toxin B. It is a common cause of antibiotic-associated diarrhea (AAD). It accounts for 15% to 25% of all episodes of AAD and 14,000 American deaths each year (CDC, 2013b)
 - Surgical site infections: 1-3 out of every 100 surgical patients develop an infection in the area where surgery was performed (CDC, 2012b)
- **Multidrug-Resistant Infections**: More multidrug-resistant infections are being monitored, for example,
 - Vancomycin-resistant enterococci (VRE): enterococci are bacteria that are normally present in the human intestines and in the female genital tract and are often found in the environment. In some instances, enterococci have become resistant to this drug. Most VRE infections occur in hospitals (CDC, 2012b)
- **Infections prevalent by body system across the lifespan**
 - Neurologic: meningitis
 - Eyes: conjunctivitis
 - Ears: otitis media
 - Cardiovascular: endocarditis
 - Gastrointestinal: *Clostridium difficile*, gastroenteritis, hepatitis
 - Genitourinary: cystitis, pyelonephritis
 - Reproductive: *Candida albicans*, *Chlamydia trachomatis*, Group B streptococci, herpes simplex virus, human papillomavirus, *Neisseria gonorrhoea*
 - Respiratory: pneumonia



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- Skin: pressure ulcers, surgical wounds
- Systemic: human immunodeficiency virus, measles, mumps (Sabo, 2013)



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