MEDAVIE HealthEd ÉduSanté

Infectious Diseases

Advanced Care Paramedicine

Module: 04

Section: 05

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Lecture Outline

- Introduction
- Microorganisms
- Contraction, transmission and stages of disease
- Infection control
- Assessment
- Selected diseases
- Preventing disease transmission

Introduction

- Infectious disease
  - Infestation of the body by biological organisms
  - Bacteria, viruses, fungi, protozoans, helminthes
- Patient
  - Early recognition and treatment can make a difference in how patient is treated
- Paramedic
  - Take necessary precautions (BSI, PPE)

Public Health Principles

- Epidemiology
- Identification and investigation
  - Index case
- Prediction
- Prevention

Public Health Agencies

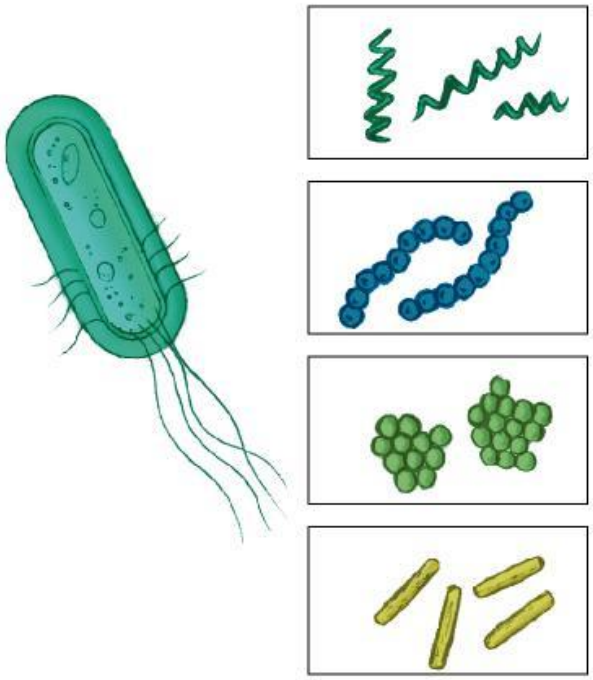
- Population and Public Health Branch (PPHB)
  - Federal group responsible for policies, programs and research
  - Five centres across the country
- Provinces/Territories
  - Responsible for health care delivery during an outbreak
  - Local medical officers of health

Microorganisms

- Most disease causing organisms are microscopic
- Normal flora
  - Organisms that live inside the body
  - Compete with invading pathogens
- Opportunistic pathogens
  - Ordinarily nonharmful bacteria that cause disease under unusual conditions

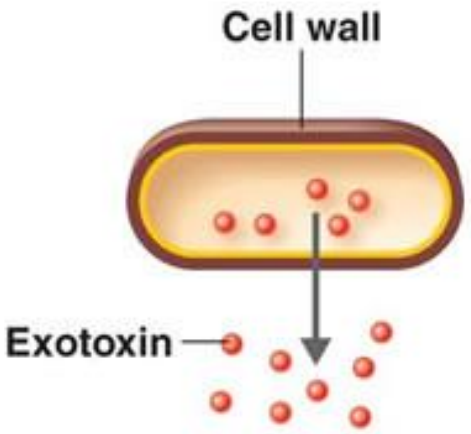
Bacteria

- Single celled organisms
  - Require a host to supply food and a supportive environment
- Classifications
  - Gram negative or positive
  - Cocci or spheres (e.g. staphylococcus)
  - Rods (e.g. enterobacter)
  - Spirals (e.g. spirochetes)

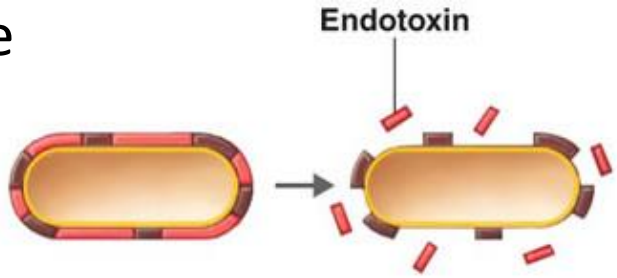


Bacteria

- Exotoxin
  - Proteins produced inside the pathogenic bacteria (most commonly gram-positive bacteria) as part of their growth and metabolism.



- Endotoxin
  - Lipid portions that are part of the outer membrane of the cell wall or gram-negative bacteria.
  - The endotoxins are liberated when the bacteria die and the cell wall breaks apart.



Antibiotics

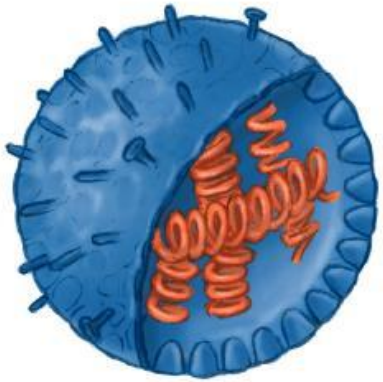
- Bactericidal
  - Capable of killing bacteria
- Bacteriostatic
  - Inhibit bacterial growth and reproduction
- Bacteria can alter cell membrane structure
  - Develop resistance
- Antibiotics alter normal flora
  - May lead to other complications

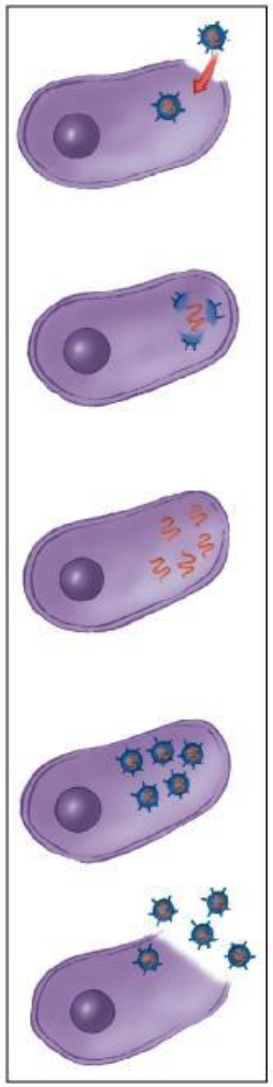
Viruses

- Much smaller
- Cannot reproduce by themselves
- Obligate intracellular parasites
  - Takes over cells protein synthesis mechanism
  - Kills host cell
  - Difficult to distinguish as foreign
- Infection always pathological

Viruses

- Host generally susceptible to a particular virus only once





Other Microorganisms

- Prions
  - Proteins folded so that protease can't act on them
  - Incurable diseases (e.g. Creutzfeldt-Jacob)
- Fungi
  - Plant like
  - Common cause of vaginal infections
- Protozoa
  - Single celled parasite with ability to move
  - e.g. malaria, gastroenteritis

Parasites

- Organism that lives in or on another
- Common cause of disease where sanitation is poor
- Pinworms
  - Tiny worms that live in distal colon
  - Anal pruritis and infection
- Hookworms
  - Passed in stool of infected animals
- Trichinosis
  - Contracted by eating raw or inadequately cooked meat

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Transmission of Disease

- Transmission based on interaction of host, infectious agent and environment
- Direct transmission
  - Person to person
  - Cough, kiss, sneeze, sexual contact
- Indirect transmission
  - Infected persons shed organisms
  - Food water, soil

Transmission of Disease

- Bloodborne
  - Contact with blood or bodily fluids
  - Risk increases with open wounds, active bleeding, increased secretions
- Airborne
  - Through air on droplets
  - Expelled during a cough or sneeze
- Fecal-oral
  - Hand to mouth

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Chain of Transmission

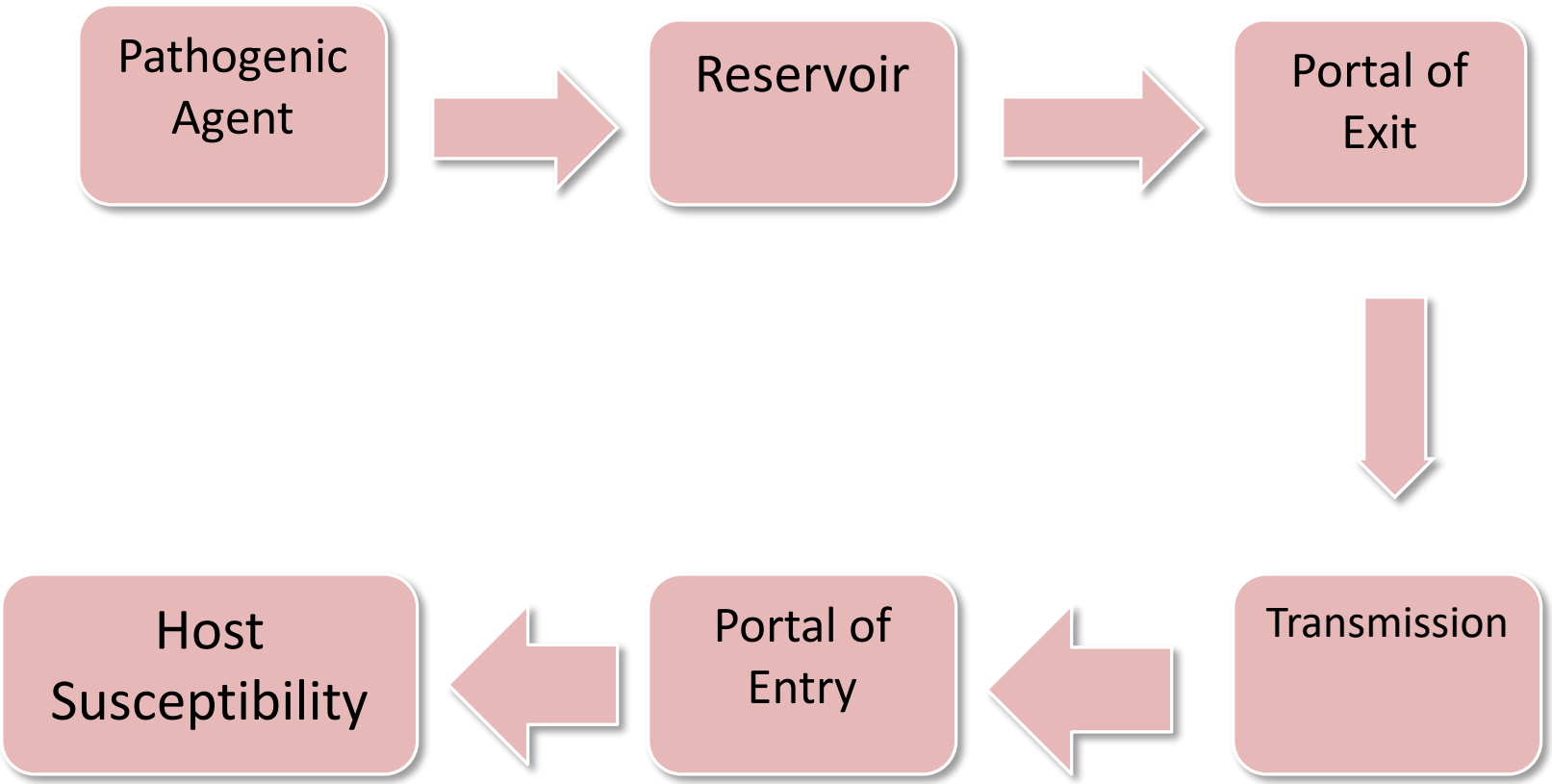


Table 37-1 Modes of Transmission of Infectious Diseases

Disease	Blood-borne	Airborne	Sexual	Indirect	Opportunist	Oral-Fecal
Hepatitis A						✓
Hepatitis B	✓					
Hepatitis C						
HIV	✓		✓			
Influenza		✓	✓	✓		
Syphilis			✓			
Gonorrhea			✓			
Measles		✓				
Mumps		✓				
Strep throat		✓			✓	
Herpes virus	✓		✓	✓		
Food poisoning		✓		✓		✓
Lyme disease	✓					
Pneumonia		✓			✓	

Pathophysiology of Infectious Disease

- Development and/or manifestations of clinical disease depends on several factors including:
  - Virulence (degree of pathogenicity)
  - Number of infectious agents (dose)
  - Resistance (immune status) of the host
  - Correct mode of entry

Chain of Elements

- The pathogenic agent
- A reservoir
- A portal of exit from the reservoir
- An environment conducive to transmission of the pathogenic agent
- A portal of entry into the new host
- Susceptibility of the new host to the infectious disease

Pathogenic Agent

- Pathogens are microorganisms that can create pathological processes in the human host and are classified according to:
  - Morphology
  - Chemical composition
  - Growth requirements
  - Viability

Pathogenic Agent

- Factors affecting any pathogen's ability to create pathological processes are:
  - Its ability to invade and reproduce within a host and the mode in which it does so
  - Its speed of reproduction, ability to produce a toxin, and the extent of tissue damage that it causes
  - Its potency
  - Its ability to induce an immune response in the host

Reservoir

- The environment (reservoir) in which a pathogen lives and reproduces
- The life cycle of the infectious agent depends on:
  - The demographics of the host
  - Genetic factors
  - The efficacy of therapeutic interventions once infection has been established

Portal of Exit

- The mechanism or method by which a pathogenic agent leaves one host to invade another involves a "portal of exit"
  - The portal of exit from the human host depends on the agent and may be single or multiple involving the:
    - GU tract
    - Intestinal tract
    - Oral cavity
    - Respiratory tract
    - An open lesion
    - Or any wound through which blood escapes

Transmission/Portal of Entry

- Determined by the portal of exit, which may be direct or indirect
  - Direct transmission occurs when there is physical contact between the source and the victim
  - In indirect transmission, the organism survives on animate or inanimate objects for a period without a human host
- Portal of entry
  - Refers to the means by which the pathogenic agent enters a new host

Host Susceptibility

- Host susceptibility is influenced by a person's immune response and by several other factors, some of which include:
  - Human characteristics
  - General health status
  - Immune status
  - Geographical and environmental conditions
  - Cultural behaviors
  - Sexual behaviors

Human Response to Infection

- External barriers
  - Flora
    - Enhance the effectiveness of the surface barrier by competing for nutrients with the pathogen
    - Maintain a pH suitable for itself and not the pathogen
    - If displaced to another area may act as a pathogen
  - Skin
  - GI system
  - Upper respiratory tract
  - Genitourinary tract

Human Response to Infection

- Internal barriers
  - Protect against pathogenic agents when the external lines of defense are breached
  - Include:
    - Inflammatory response
    - Immune response

Inflammatory Response

- Inflammation (a local reaction to cellular injury)
- The inflammatory response is generally protective and beneficial
  - May initiate destruction of the body’s own tissue if the response is sustained or directed toward the host's own antigens
- May be divided into three separate stages
  - Cellular response to injury
  - Vascular response to injury
  - Phagocytosis

Immune Response

- White blood cells are the backbone of the immune system
  - Humoral immunity component
    - Time-consuming response
    - Specialized white blood cells (B-cells) eventually differentiate into antibodies
  - Cell-mediated immunity component
    - Time-consuming response
    - T-cells coordinate the activity of other components of the immune system to deal with foreign material
  - Complement System
    - Part of the immune system that can recognize and kill invaders on first sight
    - Doesn’t take time to mobilize specialized responses like the humoral and cell-mediated components of white blood cells

Reticuloendothelial System (RES)

- Composed of immune cells in the spleen, lymph nodes, liver, bone marrow, lungs, and intestines
- Works in conjunction with the lymphatic system to dispose of “garbage” material that results from immune system attack of intruders
- RES structures serve as sites where mature B and T-cells are stored until the immune system is activated by the presence of intruders

Phases of Infection

- Latent period
  - Host cannot transmit infectious agent
- Communicable period
  - Host can transmit infectious agent
- Incubation period
  - Seroconversion and the window phase
- Disease period

Terminology

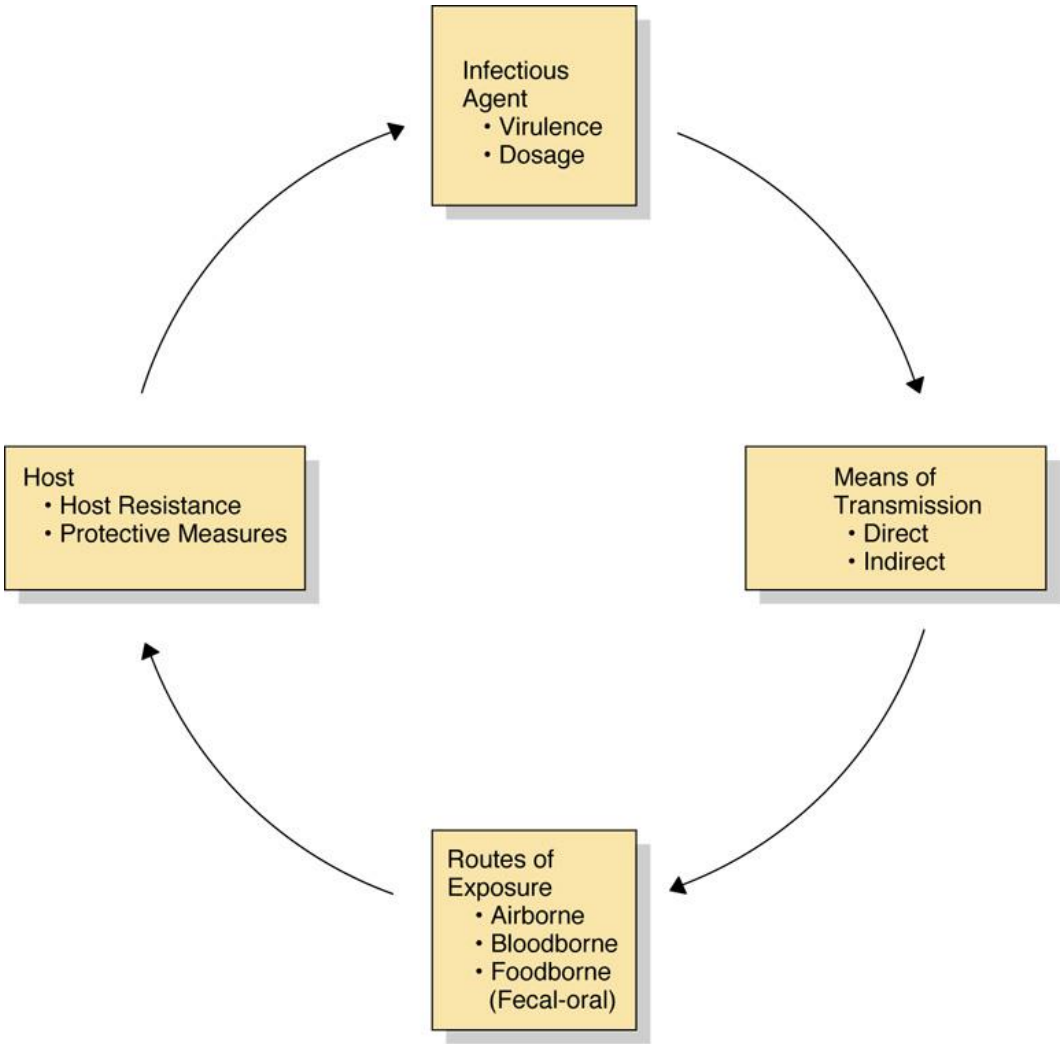
- Convalescent carrier
  - An individual who is clinically recovered from an infectious disease but is still capable of transmitting the infectious agent to others
- Chronic carrier
  - An individual who does not display the symptoms of a disease, but harbors the pathogen which causes it, or has the gene (or genes) for it, and can transmit the disease to others either through interacting with other individuals, or by passing the disease-causing gene (or genes) to offspring
- Nosocomial Infection
  - Hospital acquired infection

Preparation

- Maintain written operating procedures
- Health Canada standards and guidelines
- Adequate original and ongoing training
- PPE
- Treat all personal wounds

Preparation

- Access to personal hygiene facilities
- Exclude providers with infectious disease
- Vaccination and diagnostic tests
- Designated infection control officer
- Identify high risk processes



Infection Can Be Prevented
by Interrupting the Disease Process

Response

- Get as much information as possible before the response
- Prepare for patient contact
  - PPE
  - BSI
- Prepare mentally

Patient Contact

- Isolate all body substances (BSI)
- Wear appropriate PPE
- Only necessary personnel make contact
- Use disposable items whenever possible
- Properly dispose of waste
- Use extreme caution with sharps
- Adhere to infection control guidelines

Table 37-2 Guidelines for Prevention of Transmission of HIV and HBV to Prehospital Personnel

Task or Activity	Disposable Gloves	Gown	Mask	Protective Eyewear
Bleeding control with active bleeding	Yes	Yes	Yes	Yes
Bleeding control with minimal bleeding	Yes	No	No	No
Emergency childbirth	Yes	Yes	Yes	Yes
Blood drawing	Yes	No	No	No
IV insertion	Yes	No	No	No
Endotracheal intubation	Yes	No	Yes	Yes
EOA insertion	Yes	No	Yes	Yes
Oral/nasal suctioning; manually clearing airway	Yes	Yes	Yes	Yes
Handling/cleaning instruments with possible contamination	Yes	Yes	Yes	Yes
Measuring blood pressure	Yes	No	No	No
Giving an injection	Yes	No	No	No
Measuring temperature	Yes	No	No	No
Rescuing from a building fire	Yes	No	No	No
Cleaning back of ambulance after a medical call	Yes	No	No	No

Recovery

- Wash hands immediately after patient contact
- Wash all wounds
- Dispose of all biohazardous wastes
- Bag and label all soiled linen
- Decontaminate all clothing

FIGURE 37-4 Bag all linen, and label it infectious.

Decontamination

- Low level
  - Use of disinfectants
- Intermediate level
  - Water and chlorine bleach
  - Germicides
- High level
  - Required for reusable devices
  - Chemical sterilizing solution
- Sterilization
  - Destroys all microorganisms
  - Autoclave or chemical sterilizing solution

Infectious Disease Exposure

- Immediate reporting
  - Facilitates patient care, risk assessment, protocol changes
- Postexposure
  - Evaluation and treatment
- Confidentiality
  - As per any patient

Assessment

- Ensure BSI procedures
- General indicators of infection
  - Unusual skin signs
    - Fever, weakness, profuse sweating, malaise, anorexia
  - Signs of localized infection
    - Redness, swelling, tenderness, capillary streaking, warmth
  - Presence of a rash or diagnostic skin sign

History

- When signs and symptoms began
- Presence of fever and use of antipyretics or other medications
- Presence of neck pain or stiffness
- Difficulty swallowing
- Similar past symptoms or illnesses

Secondary Assessment

- Evaluate for fever, hypotension, dehydration
- Other signs
  - Skin for temperature, hydration, color, or rash
  - Sclera for icterus
  - Reaction to neck flexion
  - Lymph node swelling or tenderness
  - Breath sounds
  - Hepatomegaly
  - Purulent lesions

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Infectious Disease Exposure

It's the Law Reporting Notifiable Diseases and Conditions

Report as soon as suspected by telephone

- Acute Flaccid Paralysis (AFP)
- Anthrax
- Botulism
- Cholera
- Diphtheria
- Disease occurring more frequently than expected or in a rare or unusual form
- Group A Streptococcal Disease Invasive
- Haemophilus Influenzae Type b Invasive Disease (HIB)
- Hepatitis A
- Influenza Virus of Pandemic Potential
- Measles
- Meningitis (Bacterial)
- Meningococcal Disease Invasive
- Paratyphoid
- Plague
- Poliomyelitis
- Rabies
- Respiratory Outbreak in Long Term Care (LTC)
- Rubella
- Severe Acute Respiratory Syndrome (SARS)
- Shellfish Poisoning (Amnesic, Domoic, Paralytic)
- Smallpox
- Tuberculosis
- Typhoid
- Verotoxigenic E. coli
- Viral Hemorrhagic Fevers (Crimean-Congo, Ebola, Lassa, Marburg, Rift Valley and others)
- West Nile Virus (WNV)

Report by next business day

- Acquired Immunodeficiency Syndrome (AIDS)
- Adverse Event Following Immunization (AEFI)
- Amebiasis
- Brucellosis
- Campylobacteriosis
- Chancroid
- Chlamydia
- Clostridium difficile
- Congenital Rubella Syndrome
- Creutzfeldt-Jakob Disease – Classic (CJD)
- Creutzfeldt-Jakob Disease – New Variant (vCJD)
- Cryptosporidiosis
- Cyclosporiasis
- Encephalitis (Viral)
- Giardiasis
- Gonorrhea
- Group B Streptococcal Disease of Newborn
- Hantavirus Pulmonary Syndrome (HPS)
- Hepatitis B
- Hepatitis C
- Hepatitis D
- Hepatitis E
- HTLV I and II
- Human Granulocytic Anaplasmosis (HGA)
- Human Immunodeficiency Virus (HIV)
- Influenza – Laboratory Confirmed
- Legionellosis
- Leprosy (Hansen's Disease)
- Listeriosis
- Lyme Disease
- Lymphogranuloma Venereum
- Malaria
- Meningitis (Viral)
- Methicillin Resistant Staphylococcus Aureus (MRSA)
- Mumps
- Pertussis
- Pneumococcal Disease Invasive
- Q Fever
- Relapsing Fever
- Rocky Mountain Spotted Fever
- Salmonellosis
- Shigellosis
- Syphilis
- Tetanus
- Toxoplasmosis
- Trichinellosis
- Tularemia
- Vancomycin Resistant Enterococcus (VRE)
- Yellow Fever
- Yersiniosis

Report Notifiable Diseases to Public Health Services

After Hours: To locate the Medical Officer of Health on call, please contact QEII Locating at 473-2222.

South Shore Health
Tel: 543-0850
Fax: 543-8024

South West Health
Tel: 742-7141
Fax: 742-6062

Annapolis Valley Health
Tel: 542-6310
Fax: 542-6333

Colchester East Hants Health Authority
Tel: 893-5820
Fax: 893-2614

Cumberland Health Authority
Tel: 667-3319
Fax: 893-2614

Pictou County Health Authority
Tel: 752-5151
Fax: 893-2614

Guysborough Antigonish Strait Health Authority
Tel: 867-4500 ext. 4800
Fax: 863-5111

Cape Breton District Health Authority
Tel: 563-2400
Fax: 563-2005

Capital Health
Tel: 481-5800
Fax: 481-5889

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