HSS1101 Final Exam Review

Chapter 4

Stress and Stressor

- **Stress** is a mental and physical response of our bodies to the changes in our lives and has been described as a "disease of prolonged arousal"
    - Stress in itself is neither positive nor negative but our reactions to stress can be positive or negative
    - Stress can lead to psychological and social problems including dysfunctional relationships
    - Our reaction to stress can become habits that lead to health enhancing personal growth or to debilitating adverse health effects
    - Stress is a cause of many health problems including migraines, alcohol and drug dependence, gastrointestinal problems, hypertension and other chronic diseases including cancer
- **Stressor** is any physical, social or psychological event or condition that causes our bodies to have to adjust to specific situations
    - Stressor may be tangible such as a parent or a room-mate or intangible such as emotions arising from our relationship or meeting our in-laws for the first time
- **Adjustment** is our attempt to cope with a given situation
- **Strain** is the wear and tear of our bodies and minds caused by stress and stressor
- **Eustress** is positive stress that presents an opportunity for personal growth and satisfaction
- **Distress** is negative stress caused by events such as financial problems, injury, illness, trouble at work, academic difficulties or relationship problems

Limbic System

- **Amygdala**: emotional responses, hormonal secretions, and memory
- **Cingulate Gyrus**: sensory input concerning emotions and the regulation of aggressive behaviour
- **Fornix**: connect the hippocampus to the hypothalamus
- **Hippocampus**: Memory indexer – sending memories out to the appropriate part of the cerebral hemisphere for long-term storage, and retrieving when necessary
- **Hypothalamus**: wakes you up in the morning, gets adrenaline flowing. Important emotional center, controlling the molecules that make you feel exhilarated, angry, or unhappy
- **Olfactory Cortex**: receives sensory information from the olfactory bulb and is involved with the identification of odors
- **Thalamus**: relay sensory signals to and from the spinal cord and cerebrum
- **Limbic system**: responsible for controlling various functions in the body. Some of these functions include interpreting emotional responses, storing memories, and regulating

hormones. The limbic system is also involved with sensory perception, motor function, and olfaction

Working of the Stress Response

- **Autonomic nervous system –** regulates the activity of visceral organs and skeletal muscles
- **Parasympathetic nervous system –** governs restorative processes in the body
- **Sympathetic nervous system –** governs the fight-or-flight response
    - **Sympathoadrenal system:** includes the sympathetic nervous system and the part of the adrenal gland that secretes epinephrine
- **Prefrontal cortex –** higher brain area that signals to the limbic system to cancel the stress response
- Modern stress is considered psychological
    - Rumination – turning a thought over and over in the head
    - Anticipation – forecasting about what might happen

The Hypothalamic-Pituitary-Adrenal (HPA) Axis

- **Negative Feedback Loop**: During stress response the hypothalamus releases the hormone
- **CRH (Corticotropin releasing hormone**), which stimulates the pituitary gland to release
- **ACTH (Adrenocorticotropic hormone**), which stimulates the adrenal gland to release
- **CORT (Cortisol, Glucocorticoids).** Once the levels of CORT increase the hypothalamus and the adrenal glands reduce the secretion of CRH and ACTH; creating a negative feedback loop.

Response to stress

- **Homeostasis** – a balanced state in which all the body's systems function smoothly and equilibrium is maintained
- **Adaptive response** – body's response to restore loss of homeostasis caused by stress
- **General adaptation syndrome (GAS)** – physiological response to stress; has three phases:
    - Alarm phase
    - Resistance phase
    - Exhaustion phase

General Adaptation Syndrome

- **Alarm phase**
    - When exposed to a stressor, stress hormones flow into the body and prepare the body for action
    - When the mind perceives a stressor it triggers an autonomic nervous system response (heart, breathing and glandular function)
- Autonomic nervous system has two branches:
    - Sympathetic nervous system energizes the body to fight or flight by altering the hormonal levels
    - Parasympathetic nervous system slows all the systems stimulated by the stress response

- In normal person these two systems sustain a balanced system because they act in an opposing manner, however in a stressed person this balance is offset
- Hypothalamus signals the adrenal glands to release epinephrine (adrenaline) which helps the body to respond
- Adrenaline increases the amount of blood the heart is pumping, dilates the bronchioles, increases the breathing rate, stimulates the liver to release more glucose and dilates the pupils.
- Hypothalamus triggers the pituitary gland to release adrenocorticotrophic hormone (ACTH) which triggers the adrenal gland to release cortisol, which makes stored nutrients more readily available and leads to release of endorphins which releases pain caused by the stressor
- Body's response to stress During Alarm Phase:
  - More blood goes to muscles
  - Heart rate and blood pressure increases
  - Blood receives more energy producing substances
  - More blood goes to brain
  - Pupils dilate
  - etc

- **Resistance phase**
  - In this phase the body has reacted to the stressor and adjusted in a way that allows the system to return to homeostasis
  - The parasympathetic nervous system helps the body to return to homeostasis by regulating the recent introduction of adrenaline, cortisol and other hormones released during the alarm phase
- **Exhaustion phase**
  - In this phase the body is depleted of energy and the toll depends on the amount of time spent under stress
  - The key to warding off the effects of stress lies in adaptation energy stores which give the mental and physical basis to cope with stress
  - Chronic unresolved stress maintain cortisol levels at a higher level which can lead to immunocompetence, hypertension and other chronic conditions

Exhaustion Phase

- Adaptation energy stores
  - Two levels of adaptation energy stores exist:
    - Deep adaptation energy stores
    - Superficial adaptation energy stores
  - There is little control over the deep adaptation energy stores as they're determined by our genetics
  - Superficial adaptation energy stores surround the deep adaptation energy stores and are more readily available
  - Stress management conserves and replenishes superficial adaptation energy stores to conserve deep stores as depletion of deep stores is theorized to be detrimental

- Superficial adaptation energy stores are restored by aerobic exercise, relaxation, eliminating unnecessary drugs, good nutritional habits, etc.

Sources of Stress

- Changes in situations, events and norm
- Hassles, annoyances and frustrations
- Pressures both within and outside
- Conflict when forced to make difficult decisions
- Overload from too much responsibilities, expectations and higher goals
- Burnout from overload, frustrations and disappointments
- Other forms of stress (discrimination, socioeconomic difficulties including unemployment and poverty)
- Environmental stresses such as natural events, noise, air and water pollution
- Self-imposed stress including personality types, self-efficacy and control

Chronic stressors for university students

- Room-mate conflict
- Homesick
- Friend conflict
- Writing major papers
- Dieting
- Money or financial problems
- Long-distance relationship
- Juggling school and job
- Time management
- Noisy dorm or apartment
- Underweight
- Choice of courses
- Missing distant friends
- Difficult class or instructor
- Not enough sleep
- Family illness
- Loneliness
- Job pressures
- Lack of privacy
- Friends with problems
- Parental or family problems
- Not enough sex or intimacy
- Behind in school work
- Problems with mates
- Not enough exercise
- Academic performance

- Do not fit in or no friends
- Tuition bills or book costs
- Health problems
- Unsure of job future

Assignment on personal stress

- Noisy dorm or roommates
  - Identify the problem
  - Provide solutions you have attempted
  - Identify what you could do
  - Describe what would happen if left unattended
- Living on your own
  - Define the benefits and pitfalls
  - How do you balance them
  - Describe your action plan to minimize stress
  - Why is it necessary to attend to stress

Stress management techniques

- What are the different stress management techniques describe the key features?
- How does change affect stress?
- What are the adverse health effects of stress?
- What are the adverse health effects of anxiety and panic disorder?
- What is agoraphobia?
- State some of the stress prevention techniques?

Management of stress

1. Build skills for stress reduction: often we cannot change the situation or requirements at college, assignments in class and others, but we can change our response to these stressors
   a. Assess your stressor and alter the circumstances and plan ahead
   b. Change your response through practice and emotional control
   c. Learn to cope
   d. Downshift from hectic and pressure-packed lifestyle
      i. Determine your ultimate goal
      ii. Make short-term and long-term plans for simplifying life
      iii. Complete a financial inventory
      iv. Plan health care costs
      v. Select the right career
      vi. Consider options for saving money
      vii. Clear out/ clean out
2. Manage emotional and anger response
   a. Examine self-talk and your emotional response to interactions with others
   b. Anger results when differences occur between our wants, desires, and dreams and what we actually get in life

c. Change the way you think
    i. Worry constructively
    ii. Look at life as being fluid
    iii. Consider alternatives
    iv. Moderate expectations
d. Indulge in physical activity
    i. Exercise
    ii. Relax
    iii. Eat right

3. Manage your time

    a. Handle only one thing at a time
    b. Clean your desk
    c. Find a clean place to work
    d. Prioritize your tasks
    e. Do not be afraid to say no
    f. Avoid interruptions
    g. Reward yourself for being efficient
    h. Be aware of your own time pattern
    i. Use time to your advantage
    j. Break overwhelming tasks into smaller tasks
    k. Enjoy time and use it efficiently

4. Alternative stress management techniques

    a. Hypnosis (focusing in on one thought)
    b. Massage therapy (causes relaxation and thus stress management)
    c. Mediation (focus on breathing patterns to release stress)
    d. Biofeedback (monitors biological processes and determines stress levels)
    e. Support groups
    f. Develop your spiritual side
        - Physical dimension
        - Emotional dimension (faith, hope and love)
        - Social dimension (interacting, listening and communicating)
        - Intellectual dimension

Checklist for change

1. **Assess life stressors**
    a. Have you assessed the major stressors in life
    b. Do you often worry about things that never happen
    c. Do you know what can reduce your stress levels
    d. Do you have a network of friends and family members
    e. Have you developed a plan of action

2. **Assess community stressors**

a. What are the environmental stressors that affect you
b. Could these stressors be changed or can you change the environment
c. Have you developed a plan

Downsides of Stress

- Chronic stress involves over-activation of the **sympatho-adrenal system**.
- Chronic stress stimulates the HPA axis, leading to chronically high cortisol.
- Less often, severe, persistent stress can cause loss of the normal daily rhythm of cortisol secretion and abnormally low cortisol.
- Dysregulation of the hormones and nervous system function increases the risk of a number of diseases.
- **Stress-diathesis model** holds that a combination of genetics and early life events predispose an individual toward disease conditions in the face of sufficient stress.
- Stress impairs
    - academic performance and social life
    - sleep and mood
    - immune function
    - sensitivity to pain
    - fatigue
- Chronic fatigue syndrome - disease whose primary symptom is incapacitation and profound fatigue
- Fibromyalgia - chronic condition characterized by:
    - widespread pain and tenderness
    - fatigue and sleep disruption
    - worsened mental function and depression
- Adversely affects reproduction
    - Men - reduced testosterone and sperm counts
    - Women - irregular menstrual cycles
- Effects on the gastrointestinal system
    - Nausea and vomiting
    - Diarrhea or constipation
    - May increase the risk of
    - irritable bowel syndrome
    - gastroesophageal reflux
    - peptic ulcers
- Affects appetite - Lingering cortisol after a crisis stimulates appetite for sugary, fatty foods
- Increased risk of hypertension, atherosclerosis
- Elevated blood sugar, increased risk of diabetes
- Abdominal obesity
- Temporary disruption of learning and memory
- Posttraumatic stress disorder (PTSD) – associated with significant trauma
- Acceleration of aging

Anxiety and Panic Disorder (PD)

- Are most prevalent in young adults and are caused by excessive worrying (stress) about quality of life in terms of social, personal, and economic consequences
- They are characterized by an "out of the blue" panic attack and affects 1.5-3.5% of the population
- A panic attack is defined as a discrete episode of intense symptoms initiated by the sympathetic nervous system (adrenaline release)
- PD is usually chronic and leads to an impairment on the quality of the patients life
- A panic attack **must include at least four** of the following symptoms
    - Neurological symptoms: dizzy, light-headed, trembling/shaking and fainting.
    - Cardiac symptoms: chest pain or discomfort, heart pounding and sweating.
    - Respiratory symptoms: shortness of breath, feeling of smothering or choking
    - Gastrointestinal symptoms: nausea and abdominal distress
    - Psychological symptoms: depersonalization, fear of losing control, fear of going crazy or dying
    - Miscellaneous symptoms: chills or hot flashes

Agoraphobia

- Panic disorder is usually accompanied by agoraphobia: abnormal fear of being helpless in a situation from which escape may be difficult or embarrassing that is characterized initially often by panic or anticipatory anxiety and finally by avoidance of open or public places
- Agoraphobia aggregates in families due to genetic influences
- Those with panic disorder may fear being away from home, being without the company of a "safe person", physical exertion that patients believe could provoke a panic attack, attending places where escape is not readily available

Breathing and Muscle Relaxation

- Slow deep breathing
    - increases parasympathetic nervous system activity
    - quiets the sympathetic nervous system
- Focus on relaxing the muscles not essential to the task at hand
    - Progressive muscle relaxation

Meditation

- Improves:
    - perceived stress
    - mood and sleep
    - blood pressure
- Mindfulness-based stress reduction (MBSR) builds resilience and reduces stress.
    - Focuses on the sensory details of the present
    - Can be practiced while on the move

Yoga, T'ai Chi, and Qigong

- Hatha yoga combines three antistress components:
  - physical postures
  - controlled breathing
  - meditation
- T'ai chi
  - increases mindfulness
  - decreases perceived stress
  - increases sleep
- Qigong reduces stress, improves quality of life, and relieves muscle tension.

Cognitive Behavioral Stress Management

- Replaces negative thinking patterns and self-defeating behaviors with positive ones.
- Focuses on reducing stress reactivity.
- Reduces negative appraisals.
- Lowers cortisol levels.
- Enhances feelings of competent coping.

Stress management Videos

- http://www.youtube.com/stress management I
- http://www.youtube.com/stress management II
- http://www.youtube.com/tips for students
- http://www.youtube.com/tips for stress management

Addictions and Harmful Habits

- Risk factors of addiction
- Types of addictions
  - Drugs
  - Alcoholism
  - Smoking

Addictions

- Addiction, also known as dependency syndrome, is patterned use that carries with it a dependence on mind/mood altering substances which is usually associated with undesirable effects for the addict although some addictions can be beneficial
- A person with dependency syndrome will usually exhibit some of the following
  - Overuse a substance
  - Avoid cutting down on the over use of a substance
  - Prioritize obtaining the overused substance
  - May spend excessive amounts of time recovering from the after effects following over consumption (hangover)

- Found intoxicated at times when they are expected to fulfill major obligations
- Continue to use the substance despite its negative effects
- Develop a physical tolerance for the substance
- Display signs of withdrawal when the substance is not available

Habits and Addiction

- Habit is a repeated behaviour in which the repetition may be unconscious.
  - It can be annoying and be broken without too much discomfort or by simply becoming aware of it
- Addiction also involves repetition of behaviour, but the repetition occurs by compulsion and considerable discomfort is experienced if the behaviour is not performed.
  - An addiction is a habit that has gotten out of control and has negative health effects

Addictive Behaviours

- Addiction is continued involvement with a substance or activity that produces a positive mood change despite ongoing negative consequences
- Addictions can be perplexing since many potentially addictive activities may eventually enhance the lives of the people who engage in them moderately, but senseless involvement in some of the activities has dire and disastrous consequences
- Commonly identified objects of dependency syndrome include alcohol, drugs, food, sex, relationships, money, work, exercise and gambling
- Chemicals are responsible for the most profound addictions not only because they produce dramatic mood changes, but also because they cause cellular changes to which the body adapts so that it eventually requires the chemical in order to function normally

Addiction Physiology

- Mental, emotional, and behavioral functions occur as a result of interactions between nerves
- They interact with each other by releasing neurotransmitters
- Drugs often mimic neurotransmitters and enhance or suppress a neural signal
- Tolerance to a substance usually occurs following prolonged use of a substance and the body then requires larger amounts of the drug to obtain the desired effects. This usually leads to negative effects
- Withdrawal occurs following the removal of the substance that the body has become dependent on.

Types of Addictions

1. **Money addiction**
   a. Compulsive gambling, spending, borrowing
2. **Work addiction**
   a. Healthy work provides a sense of identity, helps develop our strengths and is a means of satisfaction, accomplishment and mastery of problems

b. Work addiction is compulsive use of work to fulfil needs of intimacy, power and success and is characterized by obsession, perfectionism, rigidity, fear, anxiety, low-self esteem and alienation

3. **Exercise addiction**
    a. Exercise is abused in the same way that alcoholics abuse alcohol
    b. Men and women are at risk of exercise addiction and developing unhealthy exercise patterns
    c. Media images promoting 'six-pack abs' and lean muscular male bodies have influenced society's view of the ideal male

Signes of Addictions

- **Compulsion:**
    - obsessive preoccupation with a behaviour and an overwhelming need to perform it
- **Loss of control**
    - inability to predict whether any isolated involvment with an addictive object or behaviour will be healthy or damaging
- **Negative consequences**
    - physical damage, legal trouble, Financial ruin, academic failure and other severe problems associated with addiction
- **Denial**
    - inability to perceive or accurately interpret the effects of addictive behavior

Risk Factors for Addiction

- **Biological Factors**
    - Unusual early response to substances
    - Attention deficit, hyperactivity disorders
    - Biologically based mood disorders
    - Addiction among biological family members
- **Psychological Factors**
    - Low self esteem
    - Passivity
    - Post-traumatic stress disorder
- **Environmental Factors**
    - Ready access to substance or experience
    - Abusive or neglected home environment
    - Peer norms
    - Membership is an alienated or oppressed groups
    - Life events including chronic or acute stressors

Treatment and Recovery from Addiction

- Intervention
    - Intervention is a planned process of confrontation by people who are important to the addict

    - The purpose is to break down the denial compassionately so that the addict can see the destructive nature of addiction
        - Emphasizing care and concern for the addicted person
        - Describing the behaviour as a cause for concern
        - Expressing the effect of behaviour on the addict
        - Outlining the desired changes in behaviour
- Treatment
- Recovery
- Detoxification
- http://www.youtube.com/addiction management

Questions to enhance learning (Know This shit?)

- What are drugs?
- What do drugs do to humans?
- Name the different types of drugs.
- What are the different methods of administration of drugs
- What are the different types of drug interactions
- Name the different types of prescription drugs
- Name the different types of over the counter (OTC) drugs
- List some of the side effects of OTC
- What are illicit drugs?
- What are designer drugs?
- Name the different types of illegal drugs
- What are psychedelics?
- How does Cannabis affect the brain?
- What is the difference between cocaine and opiates?
- What are club drugs?
- What are amphetamines?

Drugs

- Drugs are substances that have the potential to alter the structure and function of systems in humans
- Drugs physically resemble the chemicals produced naturally within the body
    - Circulate in bloodstream
    - Attaches to specific receptor sites (heart, lungs, liver, kidneys, brain and gonads)
    - Metabolized by liver
    - Metabolites excreted by different organs
- Drugs are addictive and in most cases detrimental to health when used at levels higher than the recommended dose
- Some drugs are psychoactive and alter a person's mood and behavior

Types of drugs

- **Prescription drugs**

    - Can be obtained only with a written prescription
    - The cost of drugs is rising dramatically
- **Recreational drugs**
    - Help people to relax and socialize, and include alcohol, tobacco, coffee, tea, and chocolate products
- **Over-the-counter drugs (OCD)**
    - Can be obtained without prescription
- **Herbal preparations**
    - Substances of plant origin that have specific properties
- **Illicit (illegal) drugs**
    - Substances that are harmful to human health and are controlled by law
    - Illegal to use, possess, cultivate, manufacture or sell
    - Most are psychoactive
- **Others**
    - Commercial chemicals which include paints, glue, cosmetics, gasoline, inks, dyes, etc.

Administrations of Drugs

- **Oral ingestion-** most common form of administration and involves swallowing the substance being used. The drug enters the blood stream slowly and maybe degraded by stomach acids
- **Intravenous injection-** involves using a hypodermic needle for direct administration of a substance into the venous system. Effects of the substance can usually be felt within three minutes
- **Intramuscular injection-** involves the injection of a substance into muscle tissue (usually in the buttocks or upper arm). Favorable mode for introduction of antibiotics and vaccines to ensure a slower, consistent dispersion of the drug into the body
- **Subcutaneous injection-** drug is introduced to the layer of fat directly beneath the skin. The drug is introduced to the body at a rate less than that of an intramuscular injection. Favorable for local anesthetics
- **Inhalation-** the drug is inhaled and enters the blood stream through the alveoli
- **Inunction-** a dermal patch where the substance is absorbed through the skin
- **Suppositories-** drugs mixed with a waxy medium designed to melt at body temperature. Usually inserted rectally or vaginally where the wax melts and the drug enters the blood stream. Effects are usually felt within 15 minutes

Drug Misuse and Abuse

- **Drug misuse** – the use of drugs for a purpose other than it is intended for
- **Drug abuse** – excessive use of a drug
- **Drug interactions** – adverse reaction caused by taking outdated prescriptions, higher than recommended dosages, or multiple drugs simultaneously (polydrug use).
    - Synergism – interaction between two drugs enhancing the desired effects when each is taken separately. Expressed mathematically as 2+2=10
    - Antagonism – unwanted and unpleasant effects observed through drug interaction when two or more drugs act on the same receptors. One drug blocks the other altering its effectiveness (2+2=3)

- Inhibition – effects of a drug are negated by the presence of another drug by making one drug un-absorbable (2+2=2)
- Intolerance – an interaction when two or more drugs produce extremely uncomfortable symptoms (Antabuse®)
- Cross-tolerance - development of physiological tolerance to one drug and reduces the effects of another similar drug

Types of Prescription Drugs

- **Antibiotics** – used to treat bacterial infections
- **Analgesics** – are used as pain relievers
  - Prostaglandin inhibitors
- **Sedatives** – are central nervous system depressants that induce sleep and relieve anxiety. Not regularly used as they are addictive
- **Tranquillizers** – CNS depressants and are used in the treatment of psychiatric illnesses to diminish violent behavior
- **Antidepressants** – are used to treat depression by regulating neurotransmitter levels
- **Amphetamines** – are used as stimulants which suppress appetite and elevate respiration, blood pressure, and pulse rate

Over the Counter Drugs

- Analgesics – used as pain relievers (acetaminophen, ASA)
- Cold, cough and allergy relievers – are most popular
  - Expectorants: loosen phlegm
  - Antitussive: calm the cough reflex
  - Antihistamines: CNS depressants that aid in runny noses, sinus congestion, and reduction of tears
  - Decongestants: reduce nasal congestion
  - Anticholinergics: reduce nasal secretions
- Stimulants – used to heighten wakefulness, alertness (caffeine)
- Sleeping Aids and Relaxants – induce drowsiness and induce sleep but are addictive
- Dieting aids:
  - Laxatives: used for weight loss and can lead to constipation following the discontinuation of their use
  - Diuretics: increase urinary excretion and can lead to electrolyte imbalance

Side Effects of OTC Drugs

Drug	Possible Hazards
Acetaminophen	Bloody urine, skin rash, bruising, and yellowing
Antacids	Reduced mineral absorption

	Reduces effectiveness of anti-clotting medicati
	Inhibit certain antibiotics
	Hypertension
Acetylsalicylic Acid (ASA)	Nausea and stomach bleeding
	Allergic reaction
Cold Medications	Loss of consciousness
Diet Pills	Organ damage
Ibuprofen	Allergic reaction
	Fluid retention and edema
	Liver damage
Laxatives	Reduced absorption of minerals

Illicit Drugs

- These are illegal to possess, produce or sell
    - The 1997 Canadian profile:
        - 23.9% of Canadians have used at least one illegal drug at some point
        - 7.7% of Canadians are current users
- Bill C-8 (controlled drugs and substances act) is a modification of bill C-7 and was passed in 1996. It was created in order to:
    - to reduce or eliminate the harm to individuals, families and communities caused by substance abuse through the deterrence of activities which lead to such harm
    - to provide an integrated drug control regime, incorporating measures that support enforcement in a manner which is consistent with Canada's *Charter of Rights and Freedoms.*
    - to ensure the ready availability of psychoactive substances for legitimate medical, scientific and industrial purposes
    - to fulfill Canada's obligations under the following international treaties:
        - the *Single Convention on Narcotic Drugs* (1961), as amended by the 1972 Protocol
        - the Convention on Psychotropic Substances (1971)

        - the Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (1988)

Illegal Drugs

- Designer drugs are analogues of other illicit drugs and are usually produced by "underground" chemists.
    - They include analogues of phencyclidine (PCP), methlyene dioxymethylamphetamine (MDMA/Ecstasy) both of which are stimulants and cause hallucinations
- Inhalants are usually legal chemicals that when inhaled cause hallucinations, intoxication and euphoric effects. They include:
    - Rubber cement
    - Model glue
    - Paint thinner
    - Illegal Drugs

Types of illegal drugs

- **Cocaine** is derived from the leaves of South American coca shrub (coke, c, snow, flake or blow)
- **Amphetamines** are synthetic agents that stimulate the central nervous system (ecstasy, bennies, dex, meth, speed, crank, uppers, wake-ups)
- **Marijuana** is derived from *Cannabis sativa* or *Cannabis indica* plants (grass, weed, pot, hashish)
- **Opiates** are also called narcotics and are derived from opium which is derived from opium poppy (morphine, codeine, heroin, black tar heroin)
- **Psychedelics** are drugs that distort the processing of sensory information in the brain leading to alter feelings, perceptions and thoughts in the user for it affects the reticular formation in the brain

Psychedelics

- Alter perception, mood and a host of cognitive processes
- The major receptor sites for these drugs are in the part of the brain responsible for processing outside stimuli; this part of the brain is called reticular formation
- These drugs distort the processing of sensory information in the brain causing synaesthesia
- Are considered physiologically safe and do not produce dependence or addiction but have been branded the most dangerous drugs by law officials
- Commonly used psychedelics are LSD, mescaline, psilocybin and psilocin

Hallucinogens

- These drugs create auditory or visual hallucinations
- Some psychedelics are erroneously labelled as hallucinogens
- Clinical effects of hallucinogens include
    - Somatic symptoms: dizziness, weakness, tremors, blurred vision
    - Perceptual symptoms: altered shapes and colors, sharpened sense of hearing

- Psychic symptoms: alterations in mood, distorted time sense, visual hallucinations

Cannabis

- Tetrahydrocannabinol (THC) is the active substance in marijuana and is hydrophobic
- Hashish is derived from thick sticky resin of the plant
- THC has been brewed in tea and baked in bread and brownies but is most often smoked
- Causes blood shot eyes, dry mouth and throat, increased appetite, low blood pressure, mild muscular weakness
- Suspected risks associated with prolonged THC use involve suppression of the immune system, blood pressure changes, impaired memory function, and symptoms associated with smoking tobacco
- Has been used medicinally to control the side effects of chemotherapy and glaucoma

Cannabis and the Brain

- THC acts by working on the cannabinoid receptor (CB_1) and appears to work by inhibiting neurotransmitter release at the synaptic level
- THC has been shown to increase appetite, most likely by interacting with the hypothalamus and is used medicinally by AIDS patients to gain weight
- Used to control nausea and vomiting associated with chemotherapy and relief of pain
- THC induced euphoria is characterized by a sharpened sense of humor, relaxation, and being in a dream like state disconnected from the real world. Intoxicated subjects often have trouble carrying on coherent conversations and may drift into daydreams and fantasies
- Little evidence to suggest that chronic cannabis use leads to adverse effects on the brain
- Synthetic cannabinoids for medicinal use are an active area of research

Cocaine

- Is a white alkaloid powder derived from the leaves of the South American coca shrub and is generally sold on the street as a hydrochloride salt
- Acts through inhibition of presynaptic neurotransmitter transporters by prolonging their effects
- Small doses of cocaine can slow heart rate and large doses can increase heart rate and blood pressure, loss of appetite, convulsions and muscle twitching, irregular heart beat, increased self confidence, decreased fatigue, violent behavior, and death by overdose
- Freebase cocaine is cocaine in its purest form (lacks the hydrochloride salt) and enters the body quicker than the salt
- Crack cocaine is a mixture of cocaine with baking soda that results in a rock that can be smoked. Highly addictive

Heroin and Opiates

- Opiates are derived from the opium poppy (*Papaver somniferum*; the poppy that brings sleep) and causes drowsiness, relieves pain, and induces euphoria
- Opiates include morphine, codeine, and heroin
- They are CNS depressants and are used to lower heart rate, blood pressure, and respiration

- Side effects include weakness, dizziness, nausea, vomiting, euphoria, decreased sex drive, and lack of coordination
- Heroin withdrawal includes the intense desire for the drug, yawning, sweating, sleep disturbance, loss of appetite, irritability, muscle tremors, nausea, hot and cold flashes and crying
- Methadone is a synthetic narcotic similar to opiates that blocks the effects of opiate withdrawal but is addictive itself

MPTP and Parkinson's Disease (PD)

- PD is the third most prevalent neurodegenerative disorder and its incidence increases with age
- It is characterized by the loss of dopaminergic neurons
- Can be induced by the neurotoxin 1-methyl-4-phenyl-1, 2, 3, 6-tetrahydropyridine (MPTP) which is structurally similar to a number of herbicides and pesticides
- Became prevalent when a number of Northern California heroin users came down with symptoms indistinguishable from those of PD
- MPTP is a chemical byproduct of synthetic opiate (meperidine) production

Club Drugs

- The most prominent club drugs are MDMA, gamma-hydroxybutyrate (GHB), flunitrazepam (rohypnol), and ketamine.
- These drugs are popular because of their low cost and convenient distribution as small pills, powders, or liquids that can be taken orally.
- Although alcohol is the predominant “social lubricant”, these drugs are favored over the previously mentioned recreational drugs because they are believed to enhance social interaction.

Amphetamines and MDMA

- Synthetic agents that stimulate the CNS by improving alertness, lessen fatigue, and mood elevation but can become addictive
- Effects sleep patterns, heart and breathing rate, increases blood pressure, and can cause vision problems
- High doses over long periods can cause hallucinations, delusions, and disorganized behavior
- 3, 4 Methylenedioxymethamphetamine (MDMA/ecstasy/hug drug) was developed by Merck in 1914 as an appetite suppressant and never tested in humans. It is structurally similar to mescaline but is less likely to cause psychosis.
- MDMA has become the most common stimulant found in dance clubs and raves (70%) and is usually sold as a small pill in combination with other designer drugs.
- Following an oral dose, the effects of MDMA can be felt within 30-60 minutes and can last for up to eight hours. Effects can be felt quicker if inhaled.
- http://www.youtube.com/watch?v=kQ5SwhtSZoU&p=5777939357E75BAB&playnext=1&index=6

Questions on Alcohol (Know?)

1. How is alcohol synthesized?
2. How is alcohol metabolized in the body?
3. What are the determinants of alcohol toxicity?
4. Who are casual and heavy drinkers?
5. What is binge drinking among males and females?
6. What is a standard drink?
7. What is blood alcohol concentration and what is its significance?
8. Why women are more likely to have higher blood alcohol concentration compared to men
9. What are the acute and chronic effects of alcohol?
10. What are hangovers and what characterize a hangover?
11. What is fetal alcohol syndrome?
12. What are type 1 and type 2 drinkers?
13. What is alcohol poisoning
14. What are the long term effects of alcohol on the body?
15. What is the effect of alcohol on different parts of the body?

Alcohol

- Ethyl alcohol or ethanol is the intoxicating component of alcoholic beverages
- It's produced by yeast under anaerobic conditions during a process in which carbohydrates are converted to alcohol (fermentation)
- It enters the blood stream through the small intestine and less rapidly through the stomach and colon
- It is broken down in the liver into acetaldehyde by alcohol dehydrogenase
- Acetaldehyde is a toxic chemical which can cause nausea, vomiting, and liver damage thus it is broken down into CO_2 and H_2O which are passed out of the body
- A person's blood alcohol concentration (BAC) depends on
    - The amount consumed at a given time
    - The drinker's size, sex, body build, metabolism
    - The type and amount of food in the stomach

Alcoholism

- Alcohol on campus in the US
    - 84% of all students on campus consumed alcohol, of which 28% were heavy drinkers (drank three to four times a week and took four or more drinks at one sitting)
    - Despite this fewer students are drinking in recent years (9.5% in 1980 and 19% in 2001 abstained from alcohol)
    - College students drink:
        - To have fun
        - Because they have nothing to do
        - To cope with stress, anxiety, academic pressures
        - Because of peer influence
- Some facts about college students and drinking in the US

    - Alcohol kills more people below age 21 than all drugs combined
    - One night of heavy drinking can impair the ability to think properly for up to 30 days
    - Alcohol is involved in
        - 29% of dropouts,
        - 38% of academic failures,
        - 64% of violent behaviours
    - Alcohol is involved in
        - more than two-thirds of suicides among college students,
        - one-third of all emotional and academic problems,
        - 90% of campus rapes and sexual assaults and
        - 95% of violent crimes on campus
- Women who drink heavily are 40% more likely to experience unwanted sexual advances than those who drink less
- College students under the age of 25 are more prone to binge drinking
- Binge drinking on campus
- Binge drinking is taking:
        - five drinks in one sitting for men and
        - four drinks in one sitting for women
        - Binge drinkers were:
        - 16 times more likely to miss class
        - 8 time more likely to fall behind in their academic work
- **The Standard Drink**
    - **12 oz or 341ml 5% (Beer, cooler)**
    - **5 oz or 142ml 12% (wine)**
    - **1.5 oz or 43ml 40% (Liquor)**

Effects of Alcohol

- Behavioural effects
    - Blood alcohol concentration (BAC) is the ratio of alcohol to total blood volume. It is used to measure the physiological and behavioural effects of alcohol

BAC (%)	Physiological and physical effects
0.02 - 0.03	No overt effects, slight mood elevation
0.05 - 0.06	Feeling of relaxation, warmth and fine muscle relaxation
0.08 – 0.09	Balance, speech, vision and hearing slightly impaired
0.10	Legal intoxication
0.11 – 0.12	Coordination and balance becomes difficult

0.14 – 0.15	Major impairment of mental and physical control
0.20	Loss of motor control and mental confusion
0.30	Severe intoxication, minimum consciousness
0.40	Unconsciousness, threshold of coma
0.50	Deep coma
0.60	Death due to respiratory failure

Women and Alcohol

- Women are more likely to have a higher concentration of alcohol in blood after consuming equivalent amounts of drinks compared to men:
    - Because women contain more body fat compared to men
    - Women also appear to have half as much alcohol dehydrogenase as in men
    - Alcohol concentration in the blood of women also depends on the hormone levels and intoxication can be higher during pre-menstruation and in women on birth control pill
    - Therefore if a man and a woman drink the same amount of alcohol, the woman will have 30% more alcohol in the blood than the man.

Acute and Chronic Effects of Alcohol

- **Acute effects**
    - The primary effects of alcohol are on the central nervous system, resulting in a decrease in respiratory rate, pulse rate and blood pressure
    - Alcohol causes dehydration of the cerebrospinal fluid leading to mitochondrial dehydration and morning-after headaches
    - Alcohol irritates the gastrointestinal system and may cause indigestion and heartburn if taken on an empty stomach
    - Hangover, is often experienced the morning after the drinking spree
    - Alcohol can interfere with drugs and medication leading to adverse side-effects
- **Chronic effects**
    - Effects on the nervous system – chronic heavy drinking damages the brain leading to deterioration of language skills, logic and mathematical skills
    - Cardiovascular effects – alcohol contributes to hypertension, increased heart rate and cardiac output, however, alcohol decreases coronary artery diseases
    - Liver diseases – the most common ones are cirrhosis and alcoholic hepatitis
    - Cancer – chronic alcoholism has been linked to cancer of the esophagus, stomach, mouth, tongue and liver

- Other effects – chronic alcoholism causes inflammation of the esophagus, chronic stomach irritation, inflamamation of the pancreas

Hangovers/Veisalgia

- Veisalgia: *kveis:* uneasiness following debauchery
- *algia*: pain
- Symptoms include impaired memory, fatigue, lightheadedness, nausea, diarrhea, and concentration difficulties and a hangover has been defined as having two or more of these symptoms
- These symptoms maybe due to a combination of ethanol's main metabolic product acetaldehyde, congeners including MeOH, immune system disturbances, dehydration, and sleep disturbance
- Due to absenteeism and poor job performance, it is estimated that the cost of alcohol costs the U.S employer $\$12\text{-}148\times10^9$ /annum. This is largely attributable to moderate drinkers rather than alcoholics
- Frequent hangovers have been shown to be associated with increased cardiac death in patients not known to have coronary artery disease
- Congeners , (more prominent in brandy, wine, tequila, whiskey, and other dark liquors) increase the frequency and severity of hangovers
- Clear liquors such as rum, vodka, and gin tend to cause hangovers less frequently which may explain why alcoholics prefer these spirits
- Factors that increase the severity of a hangover include lack of food consumption, decreased quality and quantity of sleep, increased physical activity while intoxicated, dehydration, and poor physical health
- Intoxication and hangovers result in in metabolic acidosis
- A hangover cure has not been identified but re-hydration, Liv.52 (Himalaya Drug Co.), and vitamin B_6 (pyritinol) have been shown to reduce the severity

Other Effects of Alcohol

- Drinking and driving is the leading cause of death in traffic accidents.
  - Approximately 40% of all traffic fatalities are alcohol related in the US
  - A driver with 0.10 % is approximately 10 times more likely to be involved in a car accident than a driver who has not been drinking
  - At a BAC of 0.15, the likelihood of dying in a single-vehicle crash is 380 times higher than for non-drinkers
- **Fetal alcohol syndrome (FAS)** – a disorder of the developing fetus that is associated with maternal consumption of alcohol. FAS leads to major physical, mental and intellectual impairments of the infant.
  - FAS is the third most common birth defect, the most common most common nonhereditary cause of mental retardation, and the second leading cause of mental retardation in the US
  - At birth, children with FAS are recognized by their growth deficiency and characteristic facial abnormalities

- Alcohol effects the developing CNS which leads to reductions in general intellectual functioning and academic skills as well as deficits in verbal learning, memory and reasoning, reaction time, balance and motor skills
- Autopsies of FAS children have identified malformations of the brain tissue, failure for certain brain regions to develop, failure for certain cells to migrate during development, and a tendency for death in some tissue of the brain.

The Causes of Alcohol Abuse and Alcoholism

- Biological and family factors
  - Family history of alcoholism
    - Type 1 drinkers have at least one parent of either sex who was an alcoholic
    - Type 2 drinkers are males with an alcoholic father
  - Children with one alcoholic parent have a risk of 52% and with two alcoholic parents a risk of 71%
- Social and cultural factors
  - Social and cultural factors enhance the risk of alcoholism in those without biological or genetic predisposition
  - Life situation and events increase the risk of alcoholism
  - Peer influence and pressure also increase the risk
  - Good social support, peer support and family ties decrease the risk of alcoholism.

Alcohol Poisoning

- Ethanol: metabolites such as acetaldehyde help to distinguish ethanol poisoning from other alcohols.
- EtOH alters neurotransmitter receptors leading to depression of the CNS which can lead to the depression of the respiratory center.
- Acetaldehyde dilates blood vessels which leads to decreased vascular resistance
- Ethylene glycol: is oxidized to nicotinamide adenine dinucleotide by ADH. This is then oxidized to glycolate which is a toxic metabolite that leads to acidosis, heart failure, seizures, and pulmonary edema

Alcohol use and abuse

- Methanol: is oxidized by ADH which produces formaldehyde (smelt on breath and urine) which is oxidized to formate. Leads to demyelination and permanent blindness
- Isopropanol: is twice as toxic as EtOH and is oxidized by ADH to acetone which leads to “fruity breath” due to the elimination of acetone by respiration. Acetone and IsoPrOH lead to CNS depression and comatose.
- What are the limits for alcohol?
- 

Questions on smoking (Know?)

- What percent of Canadian males and females smoke?
- What is tobacco?
- What is second-hand smoke?
- What adverse health effects are associated with smoking?
- What adverse health effects are associated with second-hand smoke?
- What percent of deaths in Canada are associated with smoking?

Smoking

- Smoking is the biggest epidemic in the modern times
- In 1966: 54%of men and 28% of women (42% of Canadians)
- In 2001: 22% of Canadian aged 15 or over were smokers
- Smoking is the most common form of tobacco use
- Tobacco is available in several forms: cigarettes, cigars and pipes for smoking, snuff for inhaling and chewing tobacco for chewing
- Nicotine is the major psychoactive substance in tobacco that is addictive
- Smoking delivers a strong dose of nicotine to the user along with an additional 4,000 chemical substances
- Particulate matter condenses in the lungs to form tar which contains carcinogenic substances such as benzopyrene and phenol
- Smoking inhibits cilia function, suppresses hunger
- Carbon monoxide is another compound that is inhaled by the smoker and leads to formation of carboxyhaemoglobin in the blood.

Exposure to Tobacco Smoke

- Environmental tobacco smoke
    - Mainstream smoke: refers to smoke drawn through tobacco while inhaling
    - Second-hand smoke: refers to smoke from the burning end of the cigarette or the smoke exhaled by the smoker
    - Passive smokers: are those people who breath smoke from someone else's smoking
    - Lung cancer and heart diseases are the major diseases associated with smoking
    - Children exposed to second-hand smoke have a greater chance of developing respiratory problems, cough, wheezing, asthma and chest colds
    - Cigarette, cigar and pipe smoke in enclosed areas present hazard to non-smokers

Harmful Effects of Smoking

- Neurological Disorders:
    - Alcohol and smoking are risk factors for depressive episodes and there is a strong relationship between smoking and psychiatric problems
    - Benefit: epidemiological studies display that non-smokers are more likely to develop PD and AD suggesting that smoking has undefined neuroprotective influences against the development of PD and AD

- Cardiovascular Disease:
    - Smoking has been implicated in the pathogenesis of myocardial infarctions, coronary heart disease, diabetes, and hypertension
- Lung Cancer:
    - Free radicals damage DNA, lipids, and protein which leads to mutations and abnormal cell growth
    - Vitamin A helps the prevention of lung cancer

Adverse Health Effects from Smoking

- Stroke
- Mouth, throat, and esophagus cancer
- Pancreatic cancer
- Bladder cancer
- Chronic obstructive lung diseases
- Lung cancer
- Coronary heart diseases
- Ulcers
- Low birth weight baby
- Cervical cancer

Health Care Costs in Ontario: Smoking

- Tobacco kills 12,000 Ontarians each year, four times more than who die from motor vehicle accidents, suicide, homicide, and AIDS combined
- The treatment of diseases caused by tobacco requires more than 1 million hospital days each year
- Health care expenditures because of tobacco exceed an estimated $1.1 billion annually, while forecasted provincial revenue from tobacco taxes in 1998-99 is $475 million
- Diseases caused by tobacco cost the economy an estimated $2.6 billion each year in lost productivity

More Questions

- Explain how stress, addiction to drugs and alcohol and smoking is a determinant of health
- What role does stress and addiction define and predict health outcomes?
- How is sexuality a determinant of health?

Chapter 5

Social class and health

- The definition of social class differs from continent to continent and from country to country depending on the social structure, governance and political ideology
    - Socialist governments in the developed and developing countries define social structure differently
    - Communist governments identify with a different social structure depending on the political ideology of the government
    - Capitalist governments support a structure purely dependent on the economic profile
- Characteristics of the social class affects health positively or negatively
    - Material resources are compromised by poverty, low-paid work, unemployment, poor housing, poor-working conditions, poor social environment and poor education
    - Lack of material resources lead to poorer health from poor nutrition, overcrowding and ill-ventilation at home, greater exposures at work, lack of health knowledge and lack of access to health care facilities

Social Health

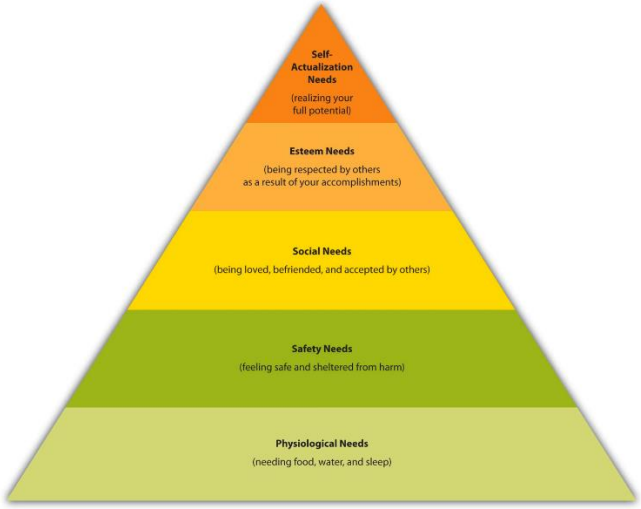
- A socially healthy individual:
    - gets along easily with others
    - has a robust network of supportive friends and family
- The collective societal health affects citizens' well-being
    - A strong social order:
        - provides basic services
        - ensures basic civil rights
- Social skills begin in infancy but are built over a lifetime
- Socioeconomic status - a person's rank within the social hierarchy, determined by:
    - Education
    - Occupation
    - Wealth
    - Living situation (lifestyle)
- Factors that Shape Collective Social Health
    - Family
    - Daily living conditions
    - Work conditions
    - Income
    - Education
    - Health Care
    - Freedom from discrimination
    - Distribution of power
- Indicators of Poor Social Health
    - High homicide and suicide rates

- Food insecurity
- Lack of affordable housing
- Income inequality
- Alcohol-related motor vehicle fatalities

Types of Social Relationships

- **Emotional intimacy**: Feeling of connectedness and closeness
  - **Acquaintances** – people we know but with whom we haven't developed a close friendship
  - **Friends** – Characterized by reciprocal trust, acceptance, loyalty, and affection
  - **Family members** – Help us develop basic social skills
  - **Significant others** – People whom we have a long-term romantic or sexual relationship

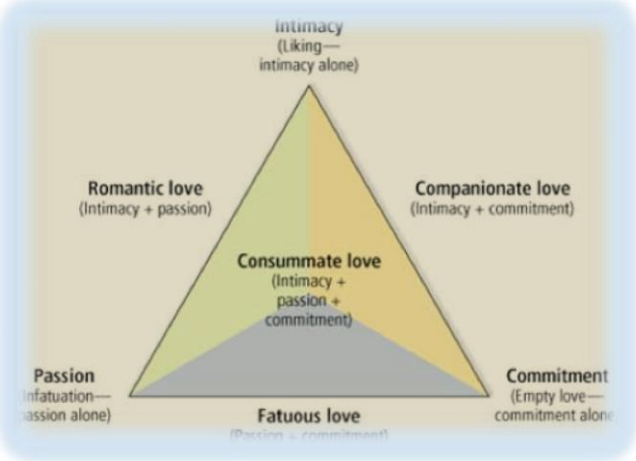
Maslow's Hierarchy of Needs



What are social relationships

- *Social relationships:* Social relationships—both quantity and quality—affect mental health, health behavior, physical health, and mortality risk.
  - Studies show that social relationships have short- and long-term effects on health, for better and for worse, and that these effects emerge in childhood and cascade throughout life to foster cumulative advantage or disadvantage in health.
- *Social isolation* refers to the complete or near-complete lack of contact with people and society for members of a social species. It is not the same as loneliness rooted in temporary lack of contact with other humans.
- *Social integration* refers to overall level of involvement with informal social relationships, such as having a spouse, and with formal social relationships, such as those with religious institutions and volunteer organizations.
- *Quality of relationships* includes positive aspects of relationships, such as emotional support provided by significant others, and strained aspects of relationships, such as conflict and stress.
- Social Relationships refer to the web of social relationships surrounding an individual, in particular, structural features, such as the type and strength of each social relationship. Each of these aspects of social relationships affects health.

Sternberg's Triangular Theory of Love



- **Liking** Intimacy without passion or commitment between the couple
  - Characteristic of most friendships
  - E.g. Most people have many friendships that come and go in the course of their lives. These friendships often involve some level of intimacy, but without passion and without an enduring commitment
- **Infatuation** Passion without intimacy or commitment
  - Emphasis on physiological and emotional arousal
  - Focus on lust without emotional closeness to the person or an enduring commitment
- **Empty love** Commitment without intimacy or passion
  - May occur in old couples who have been married for many years
  - May occur in the early stages of arranged marriages in young couples
  - This might apply to a couple who have been married for many years and who have lost the passion and intimacy in their relationship but nevertheless remain together
  - It could also apply to the early stage of marriage in cultures where marriages are arranged by the parents rather than chosen by the young people themselves (Hatfield & Rapson, 2006; Schlegel & Barry, 1991)
- **Romantic Love** Passion + intimacy, no commitment
  - Partners feel "in love" with one another and experience relationship as intense and satisfying
  - Rarely long-lasting
- **Companionate Love** Intimacy + commitment, no passion
  - Characteristic of some married/long-term couples
  - Characteristic of close family bonds or friendships
- **Fatuous** Passion + commitment, no intimacy
  - Characteristic of "whirlwind" courtship – "Love at first sight"
- **Consummate Love** Intimacy + commitment + passion
  - Characteristic of an ideal relationship

Components that Characterize Relationships

- Companionate - combines Intimacy + commitment
- Fatuous love – an ill-advised combination of passion and commitment
- Romantic love - contains passion and intimacy but lacks commitment
- **Consummate love**: ideal combination of Intimacy, passion, commitment

Influence of Social Connectedness on Health

- Socially isolated young adults cope poorly with stress.
- People with rich social connections live longer, happier, healthier lives.
    - Social capital - value of social networks
- Enhances immune function
    - Improves outcomes in the face of serious conditions
    - Influence of Social Connectedness on Health
- Participation in community organizations correlates with better health in large part because they provide social support.
- Social contagion - Thoughts, moods, and behaviors spread through social networks

Ways to Foster Healthy Relationships

- Find positive role models
- Love and accept yourself
- Expect respect
- Cultivate humor and stay humble
- Have an interest in others
- Practice gratitude

Inverse care law

- Illness and ill-health is usually the greatest in prevalence and seriousness among members of the socio-economic group that is most deprived, yet the rates of referral to hospital or specialist are greatest among the most affluent socio-economic group
- Those who _____
- Inverse care law (Dr. Julian Tudor Hart, 1971)
- The rationale behind the inverse care law is the poorer social class tend to ignore their health until absolutely forced, while the richer social class act early and follow-up their health conscientiously

Gender

- There are observed differences between women and men in their health status and the use of the health care system
    - Men have _____
    - Women have _____
    - Women consult doctors more frequently than men for obvious reasons:
        - Reproductive and contraceptive issues

        - Higher overall morbidity in women
        - Men tend to stay employed longer, ignore illnesses and generally have better overall health

Sex

- Biological determination of male and female
- Combination of sex chromosomes influences hormones secreted during intrauterine life
- **Males –** X and Y Chromosome
- **Females –** X and X Chromosome
- Intersex - conditions that result in reproductive anatomy that's not typically male or female

Gender

- Culturally based characteristics of being male or female
- Gender identity - sense of what it means to be male or female
- **Transgender** - gender identity clashes with social expectations for their biological sex
- **Gender role conflict theory** - explains the ill effects that arise from a disparity between socially accepted gender roles and self-perception

Masculinity and Health

- Traditional attitudes about masculinity correlate with poor health behaviors.
- Potential consequences of trying to conform
    - Psychological stress and maladaptive coping patterns
    - Anxiety and depression
    - Poor cardiovascular health
- Ways in which men respond differently from women
    - Men are more optimistic
    - Men are slower to acknowledge symptoms indicative of disease
    - Men engage in more high-risk activities
    - Men are more reluctant to seek help for personal concerns
- Redefining masculinity can promote men's health
    - Understand that seeking help from others is a measure of courage and strength

Femininity and Health

- Women:
    - Outlive men but experience more disease
    - Visit doctors more often
    - Take more medicines
    - Are more often hospitalized
    - Receive more diagnoses for acute and chronic diseases
    - Are less likely to engage in risky behaviors
    - Are more likely to seek medical assistance

Sexual Relationships

- **Sexual orientation** dictates the types of romantic relationships we seek.
- **Heterosexual** people are sexually attracted to someone of the opposite sex.
- **Homosexual** people feel sexual attraction to people of the same sex.
- **Bisexual** describes sexual behavior in which an individual is attracted to both men and women.

Laws of Attraction

- Physical proximity
- Similarities
- Physical attraction
- Personality
- Economic security
- Emotional security

Types of Sexual Partnerships

- Hooking up
    - Sex without romance
    - Lacks emotional investment
- Dating
    - Overt goal is to do something fun together
    - Sex is often a covert objective
- Cohabitation
    - Living together as the couples are not yet ready to marry or as a prequel to marriage
- Marriage
    - Offers a certain degree of emotional and financial stability and legal rights

Ethnicity (social and cultural factors)

- Ethnicity includes social and cultural influences as well as genetic factors
    - Canada is a multicultural and multi-ethnic country
    - Ethnicity influences lifestyle, diet, socio-economic status and therefore health
    - Genetic differences in different ethnic groups also influence disease incidence
    - Coronary heart diseases, diabetes, hypertension are higher in certain ethnic groups
    - Rates for some cancers are lower in certain ethnic groups compared to others and this is in spite of similarities in lifestyle and dietary habits

Impact of culture or beliefs on health

- Cultural / behavioural / belief based observations
    - Culture includes codes of behaviour, dress, language, rituals and system of beliefs
    - People in different social classes behave differently and have different life expectations and different lifestyles
    - The perceptions of health in poor socio-economic conditions creates an attitude of apathy towards health and health care.

        - Cultural beliefs and attitudes are transmitted through generations through mothers.
        - Mostly the socio-economic conditions stay similar for individuals through generations

Economic and political influences on health

- Economics is the discipline that studies the use of scarce resources and the management of these resources
    - Economic policies can support _____
    - Economic policies could support community programs in health protection and disease prevention
- Politics deals with organization and governance of communities
    - Governments through legislation and campaigns could support and strengthen health care programs
    - Governments through legislation could support _____

Socio-economic influences on health

- Socio-economic factors
    - Social class is a form of social stratification, wherein the society is divided into working class, middle class or upper class
- Socio-economic status is a composite index Summarize social and economic conditions and is applied to individuals and communities
- It measures the sophistication and buying power of individuals and communities
- It measures the placement in social class
- Socio-economic status also influences perception and outlook towards a disease and its outcome

Composition of socio-economic status (SES)

- Social class or residence
    - Low
    - Medium
    - High
    - Elite
- Income
    - Low
    - Medium
    - Rich
    - Super rich
    - Billionaires
- Education
    - Primary

- Secondary
- Post-secondary
- Post graduate

Socio-economic status

- Socio-economic status is a good measure of health status for individual and communities
  - The people in the upper class tend to have better chances in life than people in the bottom class:
    - They live longer (lower mortality)
    - They are less likely to get sick (lower morbidity)
    - They are more likely to seek early medical advice
    - They are more likely to change lifestyle and behaviour
    - They have better diet and nutrition

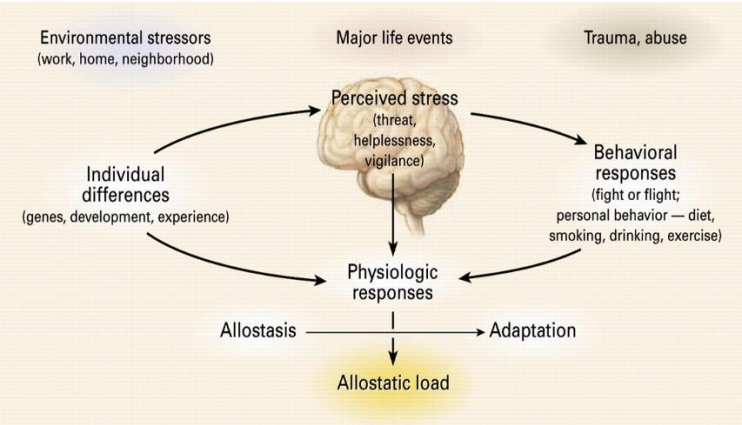
Global economic influences on health

- Socio-economic factors are a major influence on health of individuals
- Socio-economic factors measured through Socio-economic indicies has a major influence on health at the community level
- Health at the community level is measured using indicators such as Infant Mortality Rates (IMR)
- IMR is defined as rates of death in the first year of life per 1,000 live births
- Another indicator of health at the community level is life expectancy at birth
- The influence of socio-economic factors on health is measured using indices such as IMR and life expectancy

The Eco-Social Model

- Three concepts
  - Social factors are generally upstream causes
  - Inter-relationships between factors at different levels, several mediators
  - Lifecourse perspective

Biological Mechanisms



Global economic influences on health

- Poor countries (countries with low GNP) have poor health indicators (IMR and life expectancy at birth) then wealthier countries (countries with high GNP)
- At lower GNP a relatively small absolute difference in GNP (India and Ethiopia) may show the difference between severe poverty and absolute destitution with a corresponding large difference in health indicators
- Countries with higher GNP have more monies to invest and spend on health care, health promotion and disease prevention
- Countries with higher GNP also offer better living conditions to its citizens

Control of economic influences on health

- Economic factors at the individual level have an impact on nutrition, housing and water supplies which in turn influences health
- Governments can influence economic factors negatively or positively for its population
    - Negative influences include taxation of prescription medication
    - Negative influence of the economic factors can have positive influence on health of the community
    - Positive influence includes subsidies and tax rebates on certain commodities and services, such as unleaded gasoline, energy efficient products
    - Positive influence of the economic factors

Economic influences through spending on health care

- Public and private health care expenditures influence health of individuals and community in a number of ways
- The relationship between health care expenditure and health of individuals and community is not linear for there are other factors that need to be considered
- The other factors that need to be considered include culture, lifestyle, health care efficiency, political ideology and governance

Health care expenditures

- High health care expenditures do not lead to lower IMR and higher life expectancy (Switzerland and Italy)
- Greece has lower IMR and higher life expectancy compared with Italy
    - Greece spends the lowest and Italy the highest in the European Union
    - Social and cultural factors and health care efficiency may play a part
- France spends almost double that of UK yet has a higher IMR compared to UK
- Germany and Sweden have similar IMR yet Sweden spends much more compared to Germany

Political influences on health and health care

- Legislation in a number of areas can have an influence on health either directly or indirectly:
    - Legislation on the _____
    - Legislation on minimum wages

- Legislation on smoking ban in public places
- Legislation on _____
- Legislation on workplace hygiene
- Legislation on drinking water and protection of environment
- Legislation on _____

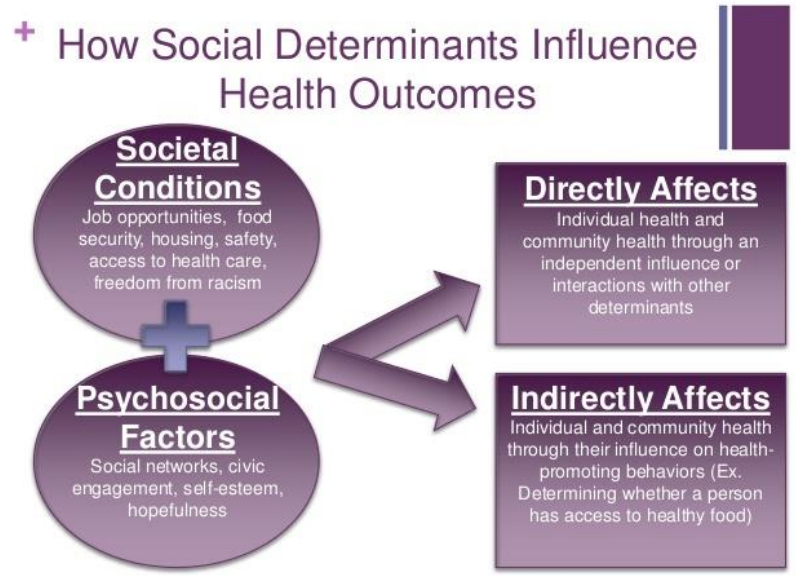
Political influence of social policy

- Social policies are aimed _____ of the individuals and the community
  (to help and support)
- Social policies are usually aimed at the less privileged in society, such as _____
  (Poor, and homeless)
- Social policies may be targeted directly toward the health of the individuals and the community or indirectly through related factors
- Social polices may affect health or health care practices in the country

Social policy towards the betterment of the community

- Income support and other benefits to low income families to improve general wellbeing and health
- Pension, social security and child benefit are other examples of support to individuals and groups of individuals
- Free primary and secondary education to all to improve lifestyle and employability
- Housing standards control the basic tolerable living standards in terms of heating, lighting, security, water supply and sanitation
- Assist people to own houses, for people who own their houses have better living conditions and are healthier compared to people who live in community or rented houses

Social determinants of health



Population health

- *Population refers to a group of individuals, in contrast to the individuals* themselves, organized into many different units of analysis, depending on the research or policy purpose
- Health has been defined in several different ways
- Population health highlights the influential role of social and economic forces in combination with biological and environmental factors, that shape the health of entire populations . . .
- *Others interpret population health primarily as a* goal—a goal of achieving measurable improvements in the health of a defined population. (Kreuter and Lezin 2001)

Population health and public health

- Population health is "the aggregate health outcome of health adjusted life expectancy of a group of individuals, in an economic framework that balances the relative marginal return from the multiple determinants of health" (Kindig 1997).
- *Public health: Activities that a society undertakes to assure the conditions* in which people can be healthy. These include organized community efforts to prevent, identify, and counter threats to the health of the public (Turnock 2004).

Community health

- Community health*: A perspective on public health that assumes community* to be an essential determinant of health and the indispensable ingredient for effective public health practice.
- Wellness*: Life satisfaction or gratification in living (Cowen 1991).*
- Well-being*: Happiness and meaning and self-realization (Ryan and Deci* 2001).

Quality of life

- *Quality of life: A broad construct reflecting a subjective or objective* judgment concerning all aspects of an individual's existence, including health, economic, political, cultural, environmental, aesthetic, and spiritual aspects (Gold, Stevenson, and Fryback 2002).
- *Health-related quality of life: The impact of the health aspects of an individual's* life on his or her quality of life or overall well-being (Gold et al. 1996).

Population Health Outcome Distribution Terms

- Health Inequality*: A generic term designating differences, variations,* and disparities in the health of individuals and groups (Kawachi, Subramanian, and Almeida-Filho 2002).
- Disparity*: Inequality or difference, as in rank, amount, or quality (Adler* 2006; *Webster's 1980).*
- Health Inequality*: Those inequalities in health deemed to be unfair or to* stem from some form of injustice. The dimensions of being avoidable or unnecessary have often been added to this concept (Kawachi, Subramanian, and Almeida-Filho 2002).
- *Variance: (1) Degree of change or difference (Webster's 1980).*

Determinant

- *Determinant:*
    - *Any factor, whether event, characteristic, or other definable* entity, that brings about change in a health condition or other defined characteristic (Last 2001).
    - A primary risk factor (causative factor) associated with the level of the health problem, that is, the level of determinant influences the level of the health problem (Turnock 2004).
- *Cause: Anything producing an effect or result (Webster's 1980).*
- *Factor (or determinant): (1) An event, characteristic, or other definable* entity that brings about a change in a health condition or other defined outcome; a causal role may be implied (Last 2001).
- *Risk factor: An aspect of personal behavior or lifestyle, an environmental* exposure, or an inborn or inherited characteristic that, on the basis of epidemiologic evidence, is known to be associated with health related condition(s) considered important to prevent.

Policy, intervention and knowledge transfer

- *Policy: A guide to action to change what would otherwise occur, a decision* about the amounts and allocation of resources; the overall amount is a statement of commitment to a certain area of concern; the distribution of the amount shows the priorities of decision makers. Policy sets priorities, and guides resource allocation (Milio 2001).
- *Intervention: To come between as an influencing force (Webster's 1980); a* generic term used in public health to describe a policy or program designed to have an impact on a health problem. *Intervention is essentially* identical to *program, a plan or procedure for dealing with some* matter (*Webster's 1980).*
- *Knowledge transfer: The exchange, synthesis, and ethically sound application* of knowledge within complex systems of relationships among researchers and users (CIHR 2004).

Association, causality and variables

- *Association (or correlation): A statistical dependence between two or more* events, characteristics, or other variables. The presence of an association does not necessarily imply a causal relationship (Last 2001). Last also defines *correlation as the degree to which variables change together* (2001).
- *Causality: The relationship of causes to the effects they produce (Last* 2001).
- *Dependent variable: A variable whose value is dependent on the effect of* other variable(s) (independent variable[s]) in the relationship under study (Last 2001).
- *Independent (or predictor) variable: The characteristic being observed or* measured that is hypothesized to influence an event or manifestation (the dependent variable) in the defined area of relationship under study (Last 2001).

Categories of determinants

- ***Social determinant:*** *A proposed or established causal factor in the social* environment that affects health outcomes (e.g., income, education, occupation, class, social support).

- ***Physical environmental determinant****: A proposed or established causal factor* in the natural and built environment that affects health outcomes (e.g., air and water quality, lead exposure, the design of neighborhoods).
- ***Health care determinant:*** *A proposed or established causal factor in health* care that affects health outcomes (e.g., access, quantity, and quality of health care services).
- ***Genetic determinant****: A proposed or established causal factor from the* genetic composition of individuals or populations that affects health outcomes.
- ***Behavioral determinant:*** *A proposed or established causal factor based on* individual personal choices of lifestyle or habits (either spontaneously or in response to incentives), such as diet, exercise, and substance abuse.
- ***Biological determinant****: Often, a biological mediator variable between a* determinant and an outcome, such as the role of endocrine and immunologic processes in stress. In any case, all determinants must have biological mediator variables in order to affect the organism to produce the health outcomes.

Determinants of Health

- **Biological determinant**
  - A biological mediator is a variable between a determinant and an outcome
    - E.g. Endocrine and immunologic processes in stress (psychological determinant)
  - All determinants have biologic mediator variables in order to affect the organism to produce the health outcomes
  - Genetic determinant is a proposed or established causal factor from the genetic composition of individuals or populations that affects health outcomes.
  - E.g. genetic mutations BrcA1/2 and breast cancer
- Behavioural determinant
  - A proposed or established causal factor based on individual personal choices of lifestyle or habits (either spontaneously or in response to incentives), such as diet, exercise, and substance abuse.
- Social determinant
  - A proposed or established causal factor in the social environment that affects health outcomes (e.g. income, education, occupation, class, social support)
- **Environmental (Physical and Ecological) determinants**
  - A proposed or established causal factor in the natural and built environment that affects health outcomes (e.g. air and water quality, lead exposure, the design of neighborhoods).
  - Natural environment refers to ecology
  - Built environment refers to the physical nature of the surroundings
- Health care determinant
  - A proposed or established causal factor in health care that affects health outcomes (i.e. Access, quantity, and quality of health care services)
- Political determinant (additional)
  - A proposed or established causal factor in the political environment that affects health outcomes (i.e. political stability, war, civil unrest, etc.)

Health issues in African Republic

- The WHO says a "silent epidemic" in African countries accounts for 19 of the 20 countries with the highest rates of maternal mortality worldwide and the highest death rate worldwide for babies up to a month old.
- The WHO says in Africa it stands at 43 per 1,000 live births or four times the rate in Europe.
- The WHO has found that some of the continent's biggest problems are getting worse and the rates of death during childbirth and among young children are increasing.
- Although Africa has 11% of the global population it has 60% of the world's HIV/AIDS cases and 90% of world malaria cases, mainly in children under 5.
- While diseases such as polio, measles and leprosy have almost been eradicated, the report acknowledges the growth of "lifestyle" medical conditions such as heart disease, diabetes and stroke.
- Louis Gomes Sambo, WHO's regional director for Africa, says they know what the challenges are, and how to address them, but Africa's fragile health systems represent an enormous barrier.
- He says African governments and their partners must make a major commitment and invest more funds, because African countries will not develop economically and socially without substantial improvements in the health of their people.
- According to the report only 58 percent of the people living in sub-Saharan Africa have access to safe drinking water.

Population Health Frameworks

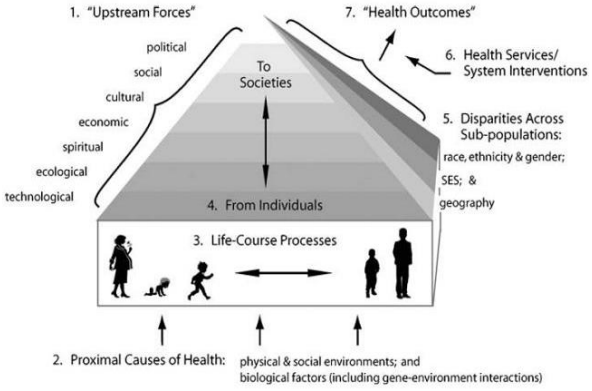
Theoretical Assumptions in Population Health (field of study)

(1) Health outcomes (states) are influenced by multiple determinants that work sometimes separately but most often, interact to exert their influence

(2) Health outcomes are influenced by multiple determinants over the life-course

(3) There are disparities in health outcomes across subgroups of the population (also referred to as health inequalities)

(4) Health interventions that take into consideration the previous (#1-3) assumptions and that target the different sectors and levels of the population are more likely to succeed in improving health outcomes



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Chapter 6

Behavioural and lifestyle determinants

- Healthy behaviour and lifestyle
    - Maintaining balance in life
    - Adequate amount of rest and relaxation
    - Avoiding smoking and excessive amounts of alcohol
    - Avoiding or reducing stress
    - Avoiding addiction related activities
    - Having a positive mental attitude
    - Eating right
    - Weight management and physical activity

Healthy Lifestyle

- Healthy choices and behaviours include:
    - Avoiding stress and stress inducing activities
    - Avoiding addiction related activities
    - Avoiding smoking and smoke infested places
    - Avoiding excessive intake of alcohol
    - Maintaining a positive mental attitude
    - Involving in sufficient and appropriate amount of social life
    - Eating the right food at the right time
    - Drinking adequate amount of water
    - Involving in sufficient amount of physical activity
    - Taking adequate amount of rest and relaxation
- Healthy lifestyle refers to those choices and behaviours an individual makes to better one's health
    - these choices and behaviours the individual's health is positively affected
- Among the many individual factors that affect health, individual choices and behaviours is the most important factor
- Some of these choices and behaviours are conscious efforts on the part of the individual, while others result from positive impact by the family and the community
- Healthy lifestyle of an individual may affect the individual's health actively (a better general health) or passively by reducing the overall morbidity

Healthy Eating Habits

- Eating food is essential to provide body with energy and to maintain the necessary body functions
- Many factors influence what we eat, when we eat and how much we eat
    - Sensory stimulus, such as smell, sight, taste
    - Hunger

    - Social pressures, including family traditions, social events
    - Cultural influences
    - Economic influences
- Finding the right balance between eating to maintain body functions (eating to live) and eating to satisfy our appetites (living to eat) is a problem for many
- Food provides nutrition to the body:
    - In economically richer countries enough and even more nutrition is provided through food, however,
    - In economically poor countries adequate nutrition is a major concern
- Proper nutrition (proteins, carbohydrates, fats, vitamins, minerals and water) is essential for proper functioning of the body
- Obesity indices are rising among the young and the adults:
    - A conservative estimate indicates that over $1x10^9$ people worldwide are obese.
    - The disease burden associated with obesity is also increasing.
        - Obesity related health problems
    - Obesity index can be modified by
        - Effective activity
        - Diet that does not exceed our requirement for **energy**
- Majority of Canadians, like the people in other developed countries, have a '<u>diet of affluence</u>' which is nutritious but also a cause of many diseases and disabilities
- Diet of affluence provides calories in excess of one's need
    - excess calories are stored as fat
- It is necessary to cultivate healthy eating habits so that improvements can be made in certain diet related diseases such as heart diseases, hypertension, chronic obesity and certain cancers
- People in poor and under-developed countries have hunger and malnutrition
    - Are unable to find sufficient nutrition and are malnourished
    - These people do not have sufficient intake of calories as needed for normal functioning of the body; therefore, they are victims of many disease such as vitamin deficiency, blindness, scurvy and poor health
- Food intake is measured in calories
    - A calorie is a unit of measure that indicates the amount of energy we obtain from a particular food
    - Calories are obtained from proteins, fats and carbohydrates but not from water, vitamins and minerals
    - Humans will store unused calories whereas other animals will metabolise unused energy (*ex.* rodents will metabolise 90% of their surplus while *H. sapiens* will store 75% of their surplus).
- Proteins, carbohydrates and fats provide caloric value to the food, while nutrients such as vitamins and minerals provide micronutrients to the body and water hydrates the body and sustains its physiological functions
- Canadians typically get about 30% of calories from fat, 15% from proteins, 22% from complex carbohydrates and 24% from simple sugars
- Fat intake comes from
    - Saturated fats (animal)

    - Trans fats (hydrogenated and polyunsaturated)
- Canada's food guide provides advice to create healthy eating habits, it identifies food groups that need to be taken more regularly and describes quantities and amounts of foods from these food groups that need to be taken on a daily basis
- Canada's food guide was first developed in 1942, it has since undergone a number of revisions to make it a better tool for education in nutrition

Vitamin D Questions

- How much do you need?
- Where can you get it from?
- What can you do to ensure that you get an adequate amount of Vit D?
- Are Vit D supplements an essential part of healthy living?

Eating for Optimum Health

- The digestive process
    - Food provides us with basic chemicals we need for energy and body maintenance. It also provides us with nutrients needed by the body
    - The digestive system breaks down the food with the help of digestive juices and enzymes into chemical compounds that can be absorbed and assimilated by the body through the digestive process
    - **Digestive process** – a process by which food is broken down and either absorbed or excreted by the body

The Components of Digestive System

- **Mouth and saliva**: food is masticated and mixed with saliva, which begins the process of food breakdown
- **Amylase** begins to break down carbohydrates
- **Esophagus**: is a 23-25 cm tube which transfers the food from mouth to the stomach
- **Stomach**: food is mixed with stomach juices and enzymes
    - **pepsin** an important enzyme in the stomach breaks down proteins
- **Small intestines**: is eight meters long and is made up of three sections: the duodenum, the jejunum and the ileum.
    - Each of these sections produce enzymes which break down the food, these enzymes along with enzymes from the liver and pancreas break down proteins, fats and carbohydrates
- **Large intestines:** solid waste consisting of fibres, water and salt are transported to the large intestines which absorbs water and salt and the remainder is passed out

Essential Foods

1. Carbohydrates
2. Proteins
3. Fats
4. Vitamins

5. Minerals
6. Fibres
7. Water

Water

- Between 50-60% of our body weight is water
- Water maintains electrolyte balance and pH balance, also sustains fluid balance and fluidity of blood (*ie.* Is a major component of blood and aids in the transport of O_2 and nutrients)
- An individual needs about six to eight glasses of water per day
- Water requirements also depend on individual's physiological conditions, environmental conditions and rate of perspiration and exhaustion
- Lack of water in the body causes dehydration and death

Proteins

- Proteins are major components of nearly every cell and have been called body builders, because of their role in the development and repair of bone, muscle, skin and blood cells
- Proteins are key elements of:
  - Antibodies that protect us from disease
  - Enzymes that control chemical activity in the body
  - Hormones that regulates body function
- Proteins also aid in transporting iron, oxygen and nutrients to all the body's cells
- An individual (on an average 63 gm for men and 50 gm for women) requires proteins daily, which can be obtained from meat and dairy products
- Proteins are made of <u>smaller molecules called amino acids</u>
- The eight amino acids that a body cannot synthesize in adequate amounts are referred to as <u>essential amino acids</u> and need to be obtained from food
- <u>Complete proteins</u> are those that naturally contain all eight essential amino acids.
- The most common sources of dietary proteins are red meats, poultry, fish, beans, nuts and dairy products
- <u>Incomplete proteins</u> are proteins obtained from plants and these miss one or two of the essential amino acids.
- Proteins are a minor component of our energy budget
- Protein intake has remained fairly constant over time and between populations suggesting that fat and carbohydrate intake is responsible for Western obesity
- Individuals depending on proteins from plants should choose plants foods from different plant groups so that they can obtain all the essential proteins from plant food source
- Proteins can be obtained from plant food:
  - Legumes (beans, peas, and soy-products)
  - Grains (whole grains, corn and pasta products)
  - Nuts and seeds
- People can also obtain <u>proteins jointly from plant food and low fat animal food</u>
  - Low fat animal foods include chicken, fish, turkey and lean red meat
  - Low fat animal product foods include cottage cheese, skimmed milk, egg whites and not-fat dairy products

- Proteins as concentrates
- Whey: isolated from milk by the ion exchange process yielding purified protein; absence of the carbohydrates and fats present in milk
- Casein: also isolated from milk but is not free of carbohydrates nor is it easily absorbed by the body as it is precipitated by gastric acid.
    - This may be beneficial as it leads to long term release of amino acids into the bloodstream
- Soy: isolated from soy beans

Protein Rich Diets

- Are more **satisfying** thus reducing appetite
- Reduce the total amount of **energy** you consume
- Low protein diets are compensated by increased consumption of carbohydrates and fat to meet the bodies energy budget
- Prolonged protein rich diets result in fat loss without the loss of body mass
- Societies with protein rich diets have decreased obesity indices and *vice versa*
- Fat loss is attributed to the low levels of energy released during protein catabolism which occurs in the absence of carbohydrates and fats as an energy source

Essential and Conditionally Essential Amino Acids

- Essential aminoacids
    - Phenylalanine, valine, threonine, tryptophan, isoleucine, methionine, leucine and lysine
- Other essential aminoacids
    - Cysteine, tyrosine, histadine and arginine
- Conditionally essential aminoacids
    - Arginine, cysteine, glycine, glutamine, histadine, proline, serine and tyrosine

Carbohydrates

- Carbohydrates supply energy needed to sustain normal daily activities
- Their consumption has been under close observations due to the increased prevalence of obesity in our culture
- Carbohydrates are easily converted to glucose and best sources of energy for endurance athletes
- There are two major types of carbohydrates:
    - Simple sugars found in fruits
    - Complex carbohydrates found in grains, cereals, dark green leafy vegetables, yellow fruits, cruciferous vegetables (broccoli, cabbage and cauliflower) and certain root vegetables (potatoes)
- **Simple and complex carbs**
    - Glucose and fructose are monosaccharides and contain only one molecule of sugar
    - Disaccharides are covalently linked combinations of two monosaccharides
    - Polysaccharides are complex carbs formed by combining the long chains of saccharides
    - Starch is stored in the muscles and liver in a polysaccharide for called glycogen

Glycemic Index (GI)

- A scale that ranks carbohydrate-rich roods by how much they raise blood glucose levels compared to glucose or white bread following consumption
- The speed at which certain foods can raise your blood glucose levels is referred to as the glycemic response.

Classification	GI range	Examples
Low GI	55 or less	Low carbohydrate levels most fruit and vegetables (except potatoes, watermelon), grainy bre milk, products extremely low in carbohydrates (fish, eggs, meat, nut
Medium GI	56 - 69	Medium carbohydrate levels whole wheat products, brown rice, basmati rice, orange sweet potat
High GI	70 - 99	High carbohydrate levels corn flakes, baked potato, watermelon, some white rices (eg. jasmin candy
	100	straight glucose

Fructose

- The food industry has replaced sucrose with the inexpensive corn-derived sugar fructose in processed foods
- Fructose has been associated with increases in adipose tissue due to decreased satiety following its ingestion
- Elevated levels of fructose can be found in sweeteners, soft drinks, baked goods, condiments, prepared desserts, and other processed foods
- Fructose initiates lipid production thus adipose tissue
- The absence of satiety and lipid production following the ingestion of fructose is an active area of research

Carbohydrates and Weight Management

- Carbs support athletic performance through carbohydrate loading
- Low Carb diets (Atkins Diet, Protein Power, The South Beach Diet)
- **Ketosis** – break down of fats into fatty acids and ketone bodies
- Extensive ketosis produces ketoacidosis which results in loss of lean body mass and damage to body tissue

Ketosis and Ketoacidosis

- **Ketosis:** occurs when liver through lipolysis converts fat into fatty acids and ketone bodies; which are used as energy sources by muscles, nerves and brain
    - Associated with chronic starvation
    - Carbohydrate rich diets vs protein rich diets
        - Glucose vs ketone bodies as sources of energy
        - Ketone bodies decarboxylate into acetone
- **Ketoacidosis**: is severe ketosis because the body fails to adequately regulate keton production causing severe accumulation of keto-acids
    - **Cause the PH** of the blood to drop below 7.2 and is usually caused by diabetes and accompanied by dehydration, hyperglycemia, ketonuria and increased levels of glucagon

Fibre

- Fibres are refered to as 'bulk or roughage' and helps to move the food through the digestive system
    - **Insoluble Fibres:** in bran, whole grain breads, cereals and fruits and vegetables are found to reduce cancer risk
    - **Soluble fibres:** in oat bran, dried beans and some fruits and vegetables are a factor in lowering blood cholesterol levels and cardiovascular risk
    - Fibres are believed to be a remedy for almost anything
        - Protection against colon and rectal cancers
        - Protection against breast cancer (lowers estrogen levels)
        - Protection against constipation
        - Protection against cardiovascular diseases (lowers LDL cholesterol-discussed latter)
    - Consume about 20 to 40 gm per day of dietary fibres (25 gm per day for women and 38 gm per day for men)
        - Eat a variety of foods
        - Eat at least five servings of fruits and vegetables
        - Eat skins of edible fruits and vegetables
        - Get your fibres from natural foods
        - Lack of fibre has been attributed to many of today's chronic diseases
    - Health Benefits
        - Fibres are reported to offer protection against:
            - Colorectal cancer
            - Breast cancer
            - Constipation and irregular bowel movements
            - Diverticulosis
            - Heart diseases
            - Diabetes
            - Obesity

Fats

- Fats play a vital role in maintaining healthy skin and hair, maintenance of body temperature and the proper functioning of the cells
- Fats also help transport fat-soluble vitamins A, D, E and K to cells
- Triglycerides are most common form of fats.
    - Excess calories that are consumed are converted into triglycerides by the liver and stored as body fat.
    - Triglycerides make about 95% of total body fat
- Cholesterol makes up 5% of total body fat and usually accumulate on the inner walls of arteries
- High density lipoproteins (HDLs) are compounds that facilitate the transport of cholesterol in the blood to the liver for metabolism and elimination from the body
- Low density lipoproteins (LDLs) are compounds that facilitate the transport of cholesterol in the blood to the body cells and accumulate on arterial walls
- **Saturated Fats:** are those fats that are unable to hold any more hydrogen in their chemical structure
    - Mostly derived from animal sources
    - Solid at room temperature
- **Unsaturated Fats:** are those fats that have room for additional hydrogen atoms in their chemical structure
    - Derived from plants
    - Liquid at room temperature
    - **Monounsaturated fats:** have room for one hydrogen atom, peanut oil and olive oil are high in this
    - **Polyunsaturated fats:** have room for many hydrogen atoms: corn, sunflower and safflower are high in these. More fluid.
- **Trans fatty acids:** produced when polyunsaturated oils are hydrogenated to make them more solid. They come from the industrial hardening of oils and from ruminant sources.
    - Margarine is made from industrial hydrogenation of vegetable or marine oils and contains TFAs. It is an emulsion of water in liquid oil that is stabilised by a network of fat crystals.
    - TFAs are implicated in certain types of cancers and CHD. Risk of CHD is attributable to IP-TFA rather than R-TFA
    - The hydrogenation of fish oils have been shown to increase LDL levels due to the presence of long-chain *trans*- unsaturated fatty acids (TUFA)
    - Industrial hydrogenation of vegetable and marine PUFAs to produce TUFAs have variable number of positional and geometric isomers making identification of the TUFAs being consumed difficult due to analytical confusion.
    - Unilever invented Becel which is a margarine spread free of TFAs and SFAs.
    - They should not comprise more than 2% of your energy consumption

Methods to Reduce Fat Intake

- Choose fat-free or low-fat food items
- Use oils low in saturated fats (vegetable oils: choose the ones low in saturated fats)

- Choose lean meats, fish and poultry
- Choose fewer cold cuts, sausages and bacon
- Reduce the use of butter, sour cream, margarine and mayonnaise
- Tally the food intake over a day or a couple of days

Omega-3 Fatty Acids

- Omega-3 (w-3) FA incorporated in the membrane of all cells and are precursors for hormones that are beneficial in the defense against disease
- The term w-3 indicates that the first double bond is located between the third and fourth carbon when counting from the methyl end of the molecule
- Fish oils are a good source of w-3 FA and studies have indicated that populations lacking fish in their diet have a higher incidence of cardiovascular disease (Eskimo and Greenland Inuit populations)
- **Benefits:**
  - Lead to an increase in fertility by increasing blood flow to the uterine wall
  - Reduce the risk of premature birth by indirectly relaxing the uterine wall
  - Reduce tumor growth and populations with a high dietary fish component have decreased incidences of breast cancer
  - Increase levels of HDL thus reducing LDL levels
  - Decrease the secretion of LDL
  - Decrease the risk of most cardiovascular diseases (myocardium infarction)
  - Many doctors are suggesting that we eat fish at least two times a week or supplement our diet with fish oil

Omega-6 Fatty Acids

- Omega-6-fatty acids have a carbon-carbon double bond in n-6 position
  - Linoleic acid, arachidonic acid
- Optimal ratio of n-6/n-3 is 4:1 or lower
- Modern Western diets have the n-6/n-3 ratio at 10:1 and some at 30:1

Dietary Intake of Fats and Health

- Dietary fat independently affects heart attack risk.
- The Nurses' Health Study found that eating foods high in
  - saturated fats (meat and dairy fat) and
  - trans fatty acids (margarine, hydrogenated vegetable oil, and many processed foods containing hydrogenated vegetable oil)
- was directly associated with nonfatal heart attacks and deaths from coronary heart disease.
- Consuming foods high in monounsaturated fat, such as olive oil, and polyunsaturated fat, as found in nuts and most vegetable oil, is linked to a decreased risk.
- This same study revealed that margarine consumption increased the incidence of heart attack, particularly among women who had eaten margarine consistently for more than a decade.

- Other studies report a direct association between frequent consumption of meat and butter, and heart attack occurrence.

Vitamins

- Vitamins are essential organic compounds that the body can not generate and aid in growth and help to maintain life and health.
  - Vitamin deficiencies are rare to non-existent in Canada
- Fat-soluble vitamins are absorbed through the intestinal tract with the help of lipids and include Vitamin A, D, E and K
- Water-soluble vitamins are easily dissolved in water and include C and B-complex
- Overuse of vitamin supplements can lead to a toxic condition known as hypervitaminosis
- **Vitamin A** (Retinol): plays essential roles in vision, growth, and development; the development and maintenance of healthy skin, hair, and mucous membranes; immune functions; and reproduction.
  - Sources high in vitamin A include sweet potatoes and carrots.
- **Vitamin D** (Cholecalciferol): can be found in fish and dairy products and is responsible for maintaining Ca and P levels.
  - Vitamin D deficiencies can result in Rickets and osteoporosis.
  - It's not a classical "vitamin" since it can be produced in the skin following a photochemical reaction with a steroid.
- **Vitamin E**: an anti-oxidant that can be found imbedded in the cell membrane.
  - Sources of vitamin E include vegetable oils, nuts, and leafy greens.
- **Vitamin K**: is required for the post-translational modification of proteins involved in blood coagulation.
  - Can be found in green leafy vegetables
- **Vitamin B**: is a family of vitamins that include thiamine, riboflavin, niacin, pyridoxine, biotin, folic acid and cyanocobalamin.
  - They aid in metabolism, healthy skin and muscle tone, enhancing the immune and nervous system, and promote hematopoietic cell growth.
- **Vitamin C** (ascorbic acid): is required for the production of collagen, dopamine, noradrenalin, carnitine and acts as an anti-oxidant.
  - Citrus fruits are a good source of vitamin C and its deficiency leads to Scurvy which is characterized by weakness, joint pain, black-and-blue marks on the skin and gum disease

Minerals

- Minerals are inorganic elements that aid physiological processes with the body, without minerals, vitamins could not be absorbed.
- Macro-minerals are those minerals that the body needs in fairly large amounts and include sodium, calcium, phosphorus, magnesium, potassium, sulphur and chloride
- Trace minerals (micro-minerals) include iron, zinc, manganese, copper, iodine and cobalt and only trace amounts of these minerals are needed. Serious problems may result if excess or deficiencies occur in trace minerals in the body

Macro-Minerals

- Na: required for the control of fluid osmolarity, neural function, and metabolic functions.
  - Excessive amounts of Na have been linked to hypertension and is 50% of table salt.
- Ca: required for bone maintenance, muscle contraction and neural transmission.
  - Dairy products are a good source of Ca.
- P: converted into an energy source
- Mg : is required for the function of several enzymes.
  - Nuts, seeds and spinach are a good source of Mg.
- K: maintains fluid osmolarity and is required for neural firing.
  - Sources with an elevated K content include bananas, avocados, celery, and turnips
- S: is incorporated into amino acids (Met/Cys) and is responsible for disulfide bonds *(ex.* immunoglobulins).

Micro-Minerals

- Fe: responsible for the formation of hemoglobin and facilitates in the transport of O_2 throughout the body.
  - Fe deficiency leads to anemia (lack of red blood cells).
  - Erythropoietin (EPO) is a performance enhancing drug that stimulates the production of red blood cells (not allowed by competitors of the *Tour de France*).
- Zn: is required for the immune response and for enzyme function.
  - Meats are a good source of Zn.
- Mn and Cu: required for enzyme function
- I: required for metabolism and thyroid function

Other Substances in Food

- **Phytochemicals** - nonnutritive chemicals made by plants, provide health benefits to those who eat them
- **Carotenoids** - compounds that act as natural plant pigments
  - Provitamin A carotenoids
- **Polyphenols** - family of phytochemicals
  - Flavonoids - antioxidant and anti-inflammatory
- **Phytoestrogens** - chemicals that mimic body's estrogen

Guidelines for Eating Healthy

- Age and gender define our dietary needs
- For best nutrition, choose foods containing high-fibre, complex carbohydrates and monounsaturated or polyunsaturated fats instead of refined, low-fibre carbohydrates and saturated fats.
- Learn more about nutrition and healthy living. Read the ingredients on all packaged and canned foods you buy. Some contain more fat, sodium, sugar, and preservatives than you expect.
  - Increased consumption of red meat increases the risk of colorectal and prostate cancer

    - Increased consumption of fruits and vegetables decreases risk of stroke and cardiovascular diseases, obesity and smoking related cancers
- Bake or broil food instead of frying it.
- Don't eat more than four egg yolks a week. Egg whites are healthy, but egg yolks are not.
- Have a green leafy salad at least once a day. (Leaf lettuces and spinach are much more nutritious than iceberg lettuce.) Use oily dressings sparingly on the salads or try nonfat dressings.
- Eat fresh foods instead of canned foods.
- Eat more whole-grain products.
- Cook vegetables only slightly or eat them raw.
- Limit the amount of red meat you eat; eat more fish.
- Remove the skin from poultry before eating it.
- Limit fat, cholesterol, sugar, alcohol, salt, and caffeine in your diet.
- Avoid pre-prepared foods as much as possible.
- Limit dining at fast food restaurants. If you do dine there, leave off the bacon, cheese, sour cream, mayonnaise, and fatty salad dressings. Order broiled instead of fried items.

Gender Differences in Nutritional Needs

- Men and women differ in body size, body composition and overall metabolic rates, therefore, they have differing needs for most nutrients
- Women have a lower ratio of lean body mass to adipose tissue at all ages and stages of life
- After sexual maturation, metabolism is higher in men and they burn more calories than women
- Men who eat red meat as a main dish five or more times a week have four times the risk of colon cancer
- Heavy red meat eaters are more than twice as likely to get prostate cancer and nearly five times as likely to get colon cancer
- For every three servings of fruits or vegetables per day men can expect a 22% lower risk of stroke
- High fruit and vegetable intake may lower the risk of lung cancer in smokers from 20 times the risk of non-smokers to only 10 times the risk

Food Safety Concerns

- Food is essential for upkeep and to sustain bodily functions, however, food may cause more harm than good if sufficient attention is not paid to the quality of food and value added food
    - Irradiation
    - Genetically modified food
    - Organic foods
    - Food contamination/additives
        - Biological (listeria, salmonella, E-coli)
        - Chemical (antimicrobials, antioxidants, nitrates, artificial colours, hormones)
    - Food allergies
        - Allergic response (soybeans, nuts, shellfish, eggs, wheat)

Causes of Unhealthy Eating Habits

- **Large-scale agriculture**
  - Good: food became cheaper and more
  - Bad: Mono-cropping of grains, factory farming
- **Government Subsidies**
  - Promote mono-cropping of grains
- **More Chemicals**
  - Artificial colours, tastes and preservatives
  - Endocrine-disruption chemicals in plastic packaging
  - Antibiotics and growth hormones given to animals
- **Others**
  - Refine grains and sugar sweetened foods and drinks
  - Energy bars and drinks as meal subsidies
  - Ads suggesting that processed food is healthier
  - Fresh, real food has become a luxury

Food Additives

- Processed foods contain additives
  - Preservatives extend shelf life by discouraging microbial growth and oxidation
  - Monosodium glutamate (MSG) is a flavor enhancer
  - The Food and Drug Administration requires that all additives be listed on the food label
  - Can trigger migraines in sensitive individuals

Food Allergies and Sensitivities

- **Food allergy** - abnormal immune system response to harmless foods
  - Identified with blood tests and skin tests
- **Food intolerance** - adverse response to food that doesn't directly involve the immune system
- **Celiac disease** - genetically linked autoimmune condition triggered by gluten, a protein found in many grains
  - Triggers immune system to attack lining of small intestine

Finding the Right Balance

- The present generation is either
  - A generation of health and fitness buffs or some exercise a lot, others forsake high fat foods and the rest eat little or nothing to maintain their shape
  - A generation of food victims for they eat more than needed, more often than needed and in bigger portions than ever
- According to a 1995 study, 32% of Canadians are overweight
- Overweight Canadians try several methods to loose weight and get in desirable shape
  - Some exercise and choose appropriate nutrition
  - Others use professional help in loosing weight
  - Others buy off the shelf supplements for quick weight loss

    - Others starve themselves to death
    - Others try different methods and finally give up and accept the inevitable
- Many are convinced that thin is good and they try several different approaches to achieve thin and lean shapes
- Others prefer middle of the road approach and prefer curvaceous shapes and they try to maintain that shape
- There are also those who believe big is better and for various reasons, cannot sustain that shape
- However, the question is how to determine the correct or appropriate body shape and body weight for a given body height.
- Since height cannot be altered in adult life, only weight is an alterable variable in achieving desirable body shape

Eating Disorders

- Eating disorders consist of severe disturbances in eating behaviour, unhealthy efforts to control body weight and abnormal attitudes about one's body and body shape
- Over 90% of the eating disorders occur in women
- Eating disorders are more common in the developed countries than in the developing countries
- These disorders usually begin during adolescence although rare cases occur after the age of 40 years
- Binge eating disorder: is characterized by recurrent binge eating
    - Predominantly occurs in obese patients
- Bulimia nervosa: is binge eating followed by compulsive measures to prevent weight gain such as vomiting
- Occurs ten times more often in women and is characterized by the inability to control the urge to indulge in binge eating
- About 30% of young adult females and 10% of young adult males are reported to have bulimia nervosa
- Treatment: difficult since the afflicted rarely seek help. Therapy in conjunction with antidepressants have been shown to help the condition.
- Anorexia nervosa: usually begins in adolescence and is characterized by determined dieting accompanied by compulsive exercise which is motivated by an intense fear of gaining weight and a severe disturbance in the perceptions of one's body
- Occurs at a frequency of 0.3-1.0% in women and is ten times less frequent in men
- Causes include: genetic influences, perfectionist and compulsive traits, family history of depression and obesity and pressures from peers and culture

Anorexia

- Diagnosis:
    - Refusal to maintain 85% of their normal weight for the age, gender and height
    - Fear of gaining weight although they're well underweight
    - Excessive use of laxatives
- Is usually accompanied by depression (50-75%), anxiety disorders (60%), OCD (40%) and alcohol abuse (12-27%)

- Medical Complications
    - Loss of subcutaneous fat tissue
    - Decreased blood pressure and heart rate
    - Impaired menstrual function
    - Hair loss
    - Hypothermia
    - Osteoporosis
    - Increased rates of miscarriage and lower birth weights
    - Decreased life expectancy and increased rates of suicide

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Chapter 7

Lifestyle as a Determinant of Health

- **Lifestyle** can be defined as: the sum of decisions taken by an individual that have repercussions on their health and wellbeing combines with the opportunities and situations that arise from his or her socio-economic environment
    - Individuals who adopt poor lifestyles and poor behaviours directly increase their health risks and exposure
- Traditional lifestyle factors
    - Eating habits, physical activity and substance abuse
- Recent factors added
    - Social, economic and environmental factors

The Hazards of Sedentary Lifestyles

- Inactivity is one of the most important predictors of chronic illness and premature death, just behind smoking.
- In 2005, physical inactivity was responsible for nearly 1 in 10 deaths, or approximately 200,000 deaths in America
- People aged 30 to 69 that are inactive increase risk of heart attack (~100%) colon cancer (80%), type 2 diabetes (76%), stroke (72%), and breast cancer (56%)
- Price of activity expensive

Inactivity Leads to Physical Frailty

- You can separate bodily processes into two camps: catabolic (tearing down) and anabolic (building)
    - In catabolism, complex molecules (proteins, complex carbohydrates, and fats) are broken down into simple molecules (amino acids, glucose, glycerol, and fatty acids) your cells can use as fuel
    - In anabolism, those same chemical reactions run backward, allowing storage of small molecules as protein fat, and the starchy compound glycogen
- When a person is inactive, many tissues and muscle cells shrink, a process called atrophy

- With advancing age, muscle cells are lost as well, resulting in a state of diminished muscle mass and strength called sarcopenia
- Unstimulated bones begin to dissolve. Moderate bone loss is called osteopenia; severe loss is called osteoporosis
- Hormones such as insulin, testosterone, estrogen, and growth hormone drive these processes. Moderate exercise combined with good nutrition generally promotes anabolic processes and building muscles and bones

General Ratings of body fat percentages by age and sex

Ratings	Males (% Body Fat) (18-30 years)	Females (% Body Fat) (18-30 years)
Athletic	6-10	10-15
Good	11-14	16-19
Acceptable	15-17	20-24
Over fat	18-19	25-29
Obese	20 and over	30 and over

Methods to Determine Body Fat

- Hydrostatic weighing techniques – involves being submerged and weighed in water. Since fat is less dense than lean mass, a caluculation can be made based on water displacement
- Pinched skin Fold measures (PSM) – Involves using the thumb and index finger to pinch fat tissue followed by measuring the size of the pinch. Usually performed on the tricep and a distance thicker than 2.5cm is considered to be over fat
- Skinfold caliper test – Similar to PSM but involves using a caliper and measurements are usually made on the tricep, bicep, upper back and hip. Formulas are then used to asses body fat content.

- Girth and circumference measures – Measurement of girth or circumference at the narrowest point of the waist is made to determine fat content. A waist greater than 102cm in men and 88cm in women indicates increased fat and increased risk of adverse health effects.
- Bioelectrical impedance analysis (BIA) – Involves measuring the resistance of an electrical current being sent throughout the body. The resistance measurement along with age, sex, and determine the amount of lean and fat tissue.
- Dual-energy X-ray absorptiometry (DXA) – Requires a low radiation exposure to measure bone mineral content, lean and fat tissue. Based on computer algorithm and the absorption of the photon beam by the tissue in the body, the body fat can be calculated.

Obesity

- Obesity has risen by 75% since 1980 and ~55% of the adult population is overweight which may be attributed to the availability of calorie dense food.
- 42% of males and 30% of females are overweight in Canada
- Risks include diabetes, stroke, respiratory problems, arthritis, sleep apnea and certain cancers
- The hypothalamus is responsible for the regulation of energy homeostasis. Improper functioning of the hypothalamus can result in obesity

Risk Factors for Obesity: Why are people obese?

1. Hereditary – the genes a person inherits are the major factors in determining overweight, leanness or average weight
2. Hunger, Appetite and satiety – the brain (hypothalamus links the nervous system to the endocrine system) controls hunger, appetite and satiety differently in lean and obese people
3. Developmental Factors – some people have excessive number of fat cells since early childhood and perhaps due to the mother's dietary habits, even before birth (hyperplasia theory)
    a. Hyperplasia theory – the number of fat cells remain the same but their size changes
4. Setpoint Theory – people are predetermined to maintain a certain weight. When not at their predetermined weight the body adjusts its metabolic rate:
    a. Increases the metabolic rate to burn off excess calories when overweight
    b. Decreases it when underweight to survive on minimal calories
5. Psychosocial factors – some people eat for comfort and to hide from problems in life, others eat just for the sake of eating and do it unconsciously, while the rest live to eat
6. Eating cues – some people fall prey to ads and promotions by food industry; fast foods which are high in fat and caloric value seem to be the simple choice for many because of cost and easy access
7. Metabolic changes – the amount of energy your body uses at complete rest is known as your basic metabolic rate (BMR). Almost 60-70% of all calories consumed are used to support BMR (heartbeat, breathing, maintaining body temperature, mental activity)
    a. BMR is inversely age dependent and is higher in males than in females
    b. All calories unused by BMR remain in our body and lead to weight gain and obesity or the excess may be spent during physical activity
8. Lifestyle – among the lifestyle factors the relationship between activity levels and caloric intake is the most important
    a. Physical inactivity and average caloric intake leads to obesity

9. Gender and obesity - men, because of their higher BMR are less likely to gain weight, while women, because of their changing life situations and changing hormone levels and are more likely to gain weight
    a. Secondly because of the nature of work men are more likely to be more physically active than women
    b. Obese woment have lower incomes and are 20% less likely to get married. Obese men are also less likely (11%) to get married
10. Genetic predisposition and thrifty genes – is explored in certain ethnic groups
    a. Pima Indians, First Nations People

Current Molecular Explanations for Obesity

- Neuropeptide Y (NPY) and Agouti-related peptide (Ag RP) interact with the hypothalamus and stimulate food intake
- Leptin: a proteohormone secreted by adipose tissue in proportion to the total amount of fate storage, interacts with the hypothalamus and inhibits the function of NPY and Ag RP. This leads to increase in serotonin levels.
- Elevated levels of the neurotransmitter serotonin in the hypothalamus have been shown to decrease hunger.
- The majority of obese individuals display elevated levels of leptin in their serum suggesting leptin resistance
- Introduction of leptin has resulted in the loss of adipose tissue in test populations.

Methods to Manage your Weight

1. **Control of caloric intake**

    - A calorie is a unit of measure that indicates the amount of energy we obtain from a particular food. Classically defined as the amount of energy released when burned
    - A kg of body fat contains approximately 7500 calories, so every intake of 7500 calories adds 1 kg of body weight, if it is not utilized by increased physical activity
    - If you add a coke (140 cal) to your diet every day and make no changes to your activity levels you will gain 1 kg in 54 days
    - If you walked half an hour each day at a pace of 9 min/km (172 cal) you will lose 1 kg in 44 days

2. **Exercise**

    - Approx 90% of the daily caloric expenditure occurs as a result of resting metabolic rate (RMR)
    - RMR includes BMR plus other non-physically active activities such as digestion, reading, studying, standing, etc.
    - About 10% of the energy balance is spent during exercise or physical activity and is referred to as exercise metabolic rate (EMR)
    - EMR is about 10-20% higher than RMR and accounts for weight loss
    - The number of calories spent by your EMR depends on

        - The amount of muscle mass moved
        - The amount of weight being moved
        - The duration of the activity

2. **Exercise**
    - Obese people will burn more calories performing the same activity as a fit person since the obese person is moving more weight
    - An activity involving both arms and legs will burn more calories than an activity that only involves arms
    - You are **not able** to alter BMR and RMR (which changes as you age) substantially but you can influence and increase EMR by increasing physical activity

3. **Dieting** – could lead to weight loss but it can also lead to physical problems and battered self-esteem. Regaining weight after dieting is often a problem (yo-yo diet). Studies have been conducted that display fluctuations in body weight have negative health impacts
    - Qualitative measurements of food rather than quantitative measurements are more important
    - The safest way for weight loss is to be physically active and conscious of your diet
    - Loosing 1kg a week is healthy

- Methods to manage your weight

3. **Dieting** – could lead to weight loss but it can also lead to physical problems and battered self-esteem. Regaining weight after dieting is often a problem (yo-yo diet). Studies have been conducted that display fluctuations in body weight have negative health impacts
    - Qualitative measurements of food rather than quantitative measurements are more important
    - The safest way for weight loss is to be physically active and conscious of your diet
    - Loosing 1kg a week is healthy
    - **Change in eating habits** – many people eat compulsively and without knowing the contents they're eating. Make a conscious effort to know what you are eating, when and where you are eating will help you to control and alter your eating.
    - Stress can increase or decrease food intake leading to obesity or being under weight respectively
    - Eating smaller portions more often is recommended

4. **Select a nutritional plan**
    - Consider advice from professionals and registered nutritionist
    - Some physicians are better able to advise than others
    - Exercise physiologist

- Other health professionals

5. **Fasting and miracle diets**
    - Low calorie intake or fasting results in the body using protein as a source of energy which leads to rapid weight loss.
    - Depleting the body's lean mass is responsible for reductions in liver tissue, heart muscle, and blood as they are being used as energy sources.
    - Problems with fasting and very low calorie diets are many and may lead to dehydration, diarrhoea, emotional problems, fatigue, loss of lean body tissue, organ failure and death

What is Physical Fitness and Exercise?

- Physical activity means any movement of skeletal muscles requiring extra energy. (Skeletal muscles are those that move your body and maintain your posture when sitting or standing.)
- Exercise is any type of physical activity designed to improve health and physical fitness. More regimented and planned than physical activity, exercise usually involves repetitive actions
- Physical fitness, means a person has the capacity to perform a variety of physical activities and refers to particular set of attributes: a lean physique, a strong heart and lungs, sturdy bones and muscles, and skills such as agility, balance, and speed.[5]
- To be considered physically fit you must obtain some minimum standard for agility, anaerobic power, body composition, flexibility, muscular strength, muscular endurance and cardiorespiratory endurance
- Calories expended in various activities

Components of Health-Related Fitness

- There are two main fitness categories.
- *Skill-related* physical fitness includes agility, balance, coordination, speed, and quick reactions. Such skills might enable you to play a rousing game of tennis.
- Health-related physical fitness more generally improves health. Its five components are body composition, cardiovascular fitness, muscular endurance, muscular strength, and flexibility. The US Department of Health and Human Services (HHS) has established recommendations for each of the components of health-related fitness.

Benefits of physical activity

- It helps control weight
- It helps build and maintain healthy bones, muscles and joints
- It promotes psychological wellbeing
- It helps immune function
- It reduces complications from bone and joint disorders

- It reduces the following:
  - The risk of developing diabetes
  - The risk of developing hypertension
  - The risk of premature heart diseases
  - The feelings of depression and anxiety
  - LDL levels and increases HDL levels

Bone mass

- Bones respond to demands placed upon them, therefore, men and women have much to gain by remaining physically active as they age
- Bone mass tends to be higher in men. For women, it is significantly higher among active women than among sedentary women
- Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue. Moderate bone loss is called osteopenia;
- Osteoporosis is more common among women than among men, because:
  - Women live longer
  - Women have lower peak bone mass than men and
  - Women lose bone mass at a faster rate after menopause

Activity and Weight control

- Level of physical activity has a direct effect upon metabolic rate and keeps it elevated long after the end of the activity
- To lose weight through physical activity, the recommendation is to exercise for at least four days a week for 50 minutes a day
- Some people also suggest reduced food intake along with a regime of physical activity to lose weight, however, severe dieting can reduce your metabolic rate by up to 20% making weight loss difficult
- Regular exercise is reported to reduce the incidence of heart diseases and type 2 diabetes and also the overall death rate

Cardiovascular Health

- Cardiovascular disease is another epidemic that is burdening our health care system
- It is the second leading cause of death in Canada
- Over 350 000 hospitalized each year from heart disease and strokes
- Primary risk factors are all **lifestyle** related
  - Physical Activity

- Diabetes
- Obesity
- And blood pressure

Cardio Respiratory Fitness

- Cardiorespiratory fitness is the ability of the cardiovascular and respiratory systems to deliver oxygen and nutrients to muscles during sustained activity.
- Regular physical activity makes the heart stronger which allows it to pump more blood throughout the body with fewer "beats" and can increase the levels of good cholesterol
- Improves the systolic and diastolic blood pressures
  - Systolic blood pressure – pressure during heartbeats
  - Diastolic blood pressure – pressure between heartbeats

Improving Cardio Respiratory Fitness

- Aerobic exercise or "cardio" improves this type of fitness. The American College of Sports Medicine (ACSM) defines aerobic exercise as "any activity that uses large muscle groups in a continuous, rhythmical fashion, and that is relatively easy to maintain at a consistent intensity." Examples include brisk walking, jogging, swimming, cross-country skiing, cycling, dancing, and pushing a lawn mower.
- Aerobic exercise refers to any exercise performed at moderate levels of intensity for **extended periods of time** (20 to 30 min) and sufficiently vigorous to increase the need for oxygen—without surpassing the ability of the respiratory and cardiovascular systems to supply it.
- A physically fit person has above-average aerobic capacity, which is described as the functional status of the cardio respiratory system; measured as VO_{2max} (maximum volume of oxygen consumed by the muscles during exercise)
- Aerobic capacity is measured by applying a graded exercise test, which involves application of a gradual increase in the workload by a trained person during a defined time. Your cardiovascular fitness is proportional to the amount of O_2 that you can transport to your muscles
- If you begin gasping for air, you've entered the realm of anaerobic exercise. Anaerobic means "without oxygen." It's hard to sustain that kind of exercise, and you're more likely to feel sore afterward. Sprinting and lifting heavy weights represent types of anaerobic exercise.

Aerobic Fitness Programs

- Exercise frequency – begin small and increase gradually
- Exercise intensity – employ moderate intensity and build on as you go keeping in mind your target heart rate, which is a percentage of your maximum heart rate.
- Target heart rate:
  - Maximum heart rate for F: (226-age) and for M: (220-age)

  - Target heart rate is desired percentage of maximum heart rate (60%-70%)
  - For a 20-year old male
    - Maximum heart rate is 220-20 = 200 and,
    - Target heart rate is (220-20)x0.70=140
  - Conversational level of exercise is achieved at 70% of target heart rate
- The recommendation for adults is to participate in at least 2.5 hours of moderately intense aerobic exercise or 1.25 hours of vigorously intense aerobic exercise each week.
- Activities are cumulative during the day and the week and can be added to your total activity load
- Some activities which have a lower intensity should have a longer duration to get the same caloric expenditure. Aim to burn 300-500cals/work out or 1500-2000cals/week
- Benefits of fitness program are obtained only after a period of sustained activity and only minimal effects will be seen initially

Strength and Endurance

- (Muscular) Strength is the amount of force that a muscle is capable of exerting
- (Muscular) Endurance is the ability of muscle to exert force repeatedly without fatiguing
- Strength and endurance can be increased through resistance training programs, which need to be selected depending on the need of the individual
- Weight lifters need strength, hockey players need both strength and endurance, marathon runners need endurance
- Specificity of training program: the effects of resistance exercise training are specific to the muscles being exercised
  - Only the muscles that are exercised respond to the demands placed upon it.
- Resistance exercises build strength by causing tiny tears in muscle cells. The body's repair process adds more muscle tissue. While you don't grow extra muscle cells, each exercised muscle cell thickens—a process called hypertrophy.
- Gender differences: women do not normally develop muscles to the same extent that men do
  - The main reason for this is the differences in physiology and hormones (androgens)
  - Post puberty the physiological differences in males and females are very significant

Types of Muscle Activity

- Skeletal muscles act in three different ways: isometric, concentric and eccentric
- Concentric muscle action – force is produced, while the muscle shortens, by joint movement in a direction opposite to the downward pull of gravity

- Eccentric muscle action – force is produced, while the muscle lengthens, by joint movement in a direction of the downward pull of the gravity
- Isometric muscle action – force produced through tension without any muscle contraction

Anabolic Steroids (AS)

- AS are responsible for increased skeletal muscle protein synthesis and hypertrophy, decreased rates of protein catabolism, satellite cell activation without proliferation, a positive nitrogen balance, stimulating erythropoietin synthesis, and increasing androgen receptors.
- **Adverse** Effects: the long term effects of AS need to be studied but to date, the known effects of using AS has been divided into five general categories

    1. hepatic (liver related)
    2. cardiovascular
    3. dermatological
    4. reproductive/endocrine
    5. psychiatric

Adverse Effects of AS

- **Hepatic:** increased liver enzymes that can lead to jaundice. Levels return to normal in the absence of AS which is one of the reasons AS are taken in cycles. Liver cancer has also been associated with AS use.
- **Cardiovascular:** AS lead to changes in serum lipid profile by increasing LDLs, decreasing HDLs, and increased total cholesterol. Hypertension is also associated with AS probably from increases in blood volume and fluid retention.
- **Dermatological:** AS have been shown to cause acne, oily skin, oily hair, hypertrophy of sebacious glands, and alopecia.
- **Reproductive/Endocrine:** AS creates a negative feedback loop that reduces luteinising hormone (LH) and follicle-stimulating hormone.
- These hormones are required for spermatogenesis; thus leading to decreased sperm density, count, mortality, morphology, testicular atrophy, without change in libido.
    - Compensated by chorionic gonadotropin to stimulate LH and testicular testosterone production. Testosterone can be converted to estrogen leading to the feminisation of men which is characterized by voice pitch and gynaecomastia.
    - In women, AS lead to hirsutism, acne, voice deepening, clitoral hypertrophy, decreased breast mass, decreased menstruation, increased appetite, and male pattern baldness. These effects are usually irreversible.
- **Psychiatric:** AS use at elevated concentrations has been linked to mood changes and aggressive and violent behaviour. Scientific studies of this phenomenon are limited due to ethical reasons.

Fitness Injuries

- Overtraining is the most frequent cause of injuries associated with fitness activities
  - Pay attention to warning signs
  - Vary fitness activities throughout the week
  - Give muscles and joints a rest
- Overuse injuries occur because of cumulative day-after-day stresses placed on tendons, bones, ligaments during exercise.
  - Common overuse injuries are to the leg, knee, shoulder and elbow joints
- Traumatic injuries occur suddenly and violently typically by accident
  - Typical traumatic injuries are broken bones, torn ligaments and muscles, contusions and lacerations

Common Overuse Injuries

1. Planter fasciitis is an inflammation of the planter fascia, a broad band of dense inelastic tissue (fascia) that runs from the heel to the toe on the bottom of the foot.
   - Common symptoms are pain and tenderness under the ball of the foot, at the heel or at both location, noticeable particularly in the mornings
   - Injury can be prevented by stretching the planter fascia prior to exercise and by wearing athletic shoes with good arch support and shock absorbancy
2. Shin splints is a general term for any pain that occurs below the knee and above the ankle and may involve 20 different medical conditions
   - Problems range from stress fractures of the tibia to severe inflammation of the muscle of the lower leg which can interrupt the flow of blood and nerve supply to the foot
   - Sedentary people who start a new weight-bearing exercise program are at the greatest risk of shin-splints
   - Running is another most common cause for shin-splints
   - Prevent shin-splints by wearing athletic shoes with good arch support and shock absorbency
3. Runner's knee describes a series of problems involving the muscles, tendons and ligaments about the knee
   - The most common problem identified as runner's knee is abnormal movement of the kneecap which irritates the cartilage on the back side of the kneecap as well as nearby tendons and ligaments
   - The main symptoms of runner's knee is the pain experienced when downward pressure is applied to the kneecap after the knee is straightened fully

- Additional symptoms include swelling redness, tenderness around the kneecap and a dull aching pain in the center of the knee

Managing your Fitness

- Choose an activity that is simple and suitable to you
- Begin small and build on
- Plan your day and include the activity in the plan
- Ask for support from your friends and family
- Make fitness your priority
- Include fitness in your lifestyle
- Explore opportunities in the community that suit you in terms of social, financial and other aspects
- Develop appropriate attitude
- Develop a plan to physical fitness
- Workouts are often built using the **FITT** acronym, which stands for frequency, intensity, time, and type. You can continue to overload the system by increasing any of the first three variables.
- *Frequency* is how often you do the activity. Recommendations are for three to five days of cardiorespiratory exercise, two to three days of resistance training, and two to three days minimum of stretching.
- *Intensity* reflects how hard you exercise. Earlier you learned that your heart rate provides a good estimate of cardiorespiratory exercise intensity. When you increase the weight you move against, you augment your resistance training—the principle of progressive overload. When you stretch a bit farther, you gain flexibility.

Develop a plan to physical fitness (3)

- *Time* refers to how long you do the activity. If you're doing resistance training or aerobic exercise longer, you're building endurance. Ideally, you can find at least 20 minutes a day to exercise. The HHS recommends a minimum of 150 minutes over a week.
- *Type* has to do with the kind of exercise. Varying the type provides a means for avoiding monotony and overuse injury and for addressing different fitness components. You might practice yoga and Pilates for strength and flexibility, lift weights for your resistance training, and row for your cardiorespiratory training.
- Strategies to avoid harm during physical activity
- Sports drinks have gained popularity with elite athletes and the general public. They contain electrolytes and carbohydrates, mainly in the form of high-fructose corn syrup. Americans generally consume too many simple carbohydrates. Fructose, which sweetens many beverages and other foods these days, seems to be particularly bad for human health.

- However, for athletes, the benefit of fructose in sports drinks is that it enhances the movement of fluid from the small intestine into the bloodstream. The salt in these beverages also stimulates thirst, which helps ensure water is adequately replaced.
- If you're exercising hard for an hour, drink a fluid that provides some carbohydrates. A normal diet will replace salt and other electrolytes. Broth-based soups and tomato juice are both good sodium sources. If you're exercising for longer periods, a sports drink makes sense. In fact, carbohydrate-electrolyte beverages enhance performance more than water during prolonged exercise.

Strategies to avoid harm during physical activity (2)

- Dehydration impairs both physical and mental performance. Loss of fluid and electrolytes seems to increase the likelihood that fatigued muscles will cramp. Signs that you've become dehydrated are urinating less (and producing a darker urine) and losing weight after an exercise session.
- Your exercised muscles also need time to recover. Immediately after you finish exercising, do some gentle stretches, which will help your muscles maintain their normal anatomical length. Another method to help muscles recuperate is called *active recovery*, which entails exercising at a lower intensity level following a more strenuous bout[1]
- Here are some examples. After sprinting for a certain distance, you walk to "cool down" and recover. After a session of resistance training, you can do several repetitions at very low resistance. Or, if you run a 5K or play a rollicking game of Ultimate Frisbee, you can take a brisk walk afterward.

Chapter 8

Population health framework

- In this framework, population health is defined as health outcomes and their distribution in a population.
- These outcomes are achieved by patterns of health determinants (such as medical care, public health, socioeconomic status, physical environment, individual behavior, and genetics) over the life course and affected by policies and interventions at the individual and population levels.

Understanding Population Health Terminology

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- *Population health is a relatively new term, with no agreement about whether it* refers to a concept of health or a field of study of health determinants
- **Population health**
  - *Population refers to a group of individuals, in contrast to the individuals* themselves, organized into many different units of analysis, depending on the research or policy purpose
  - Health has been defined in several different ways
  - Population health highlights the influential role of social and economic forces in combination with biological and environmental factors, that shape the health of entire populations . . .
  - *Others interpret population health primarily as a* goal—a goal of achieving measurable improvements in the health of a defined population. (Kreuter and Lezin 2001)
- **Population health and public health**
  - Population health is "the aggregate health outcome of health adjusted life expectancy of a group of individuals, in an economic framework that balances the relative marginal return from the multiple determinants of health" (Kindig 1997).
  - *Public health: Activities that a society undertakes to assure the conditions* in which people can be healthy. These include organized community efforts to prevent, identify, and counter threats to the health of the public (Turnock 2004).
- **Community health**
  - *Community health: A perspective on public health that assumes community* to be an essential determinant of health and the indispensable ingredient for effective public health practice.
- *Wellness: Life satisfaction or gratification in living (Cowen 1991).*
- *Well-being: Happiness and meaning and self-realization (Ryan and Deci* 2001).
- **Quality of life**
  - *Quality of life: A broad construct reflecting a subjective or objective* judgment concerning all aspects of an individual's existence, including health, economic, political, cultural, environmental, aesthetic, and spiritual aspects (Gold, Stevenson, and Fryback 2002).
  - *Health-related quality of life: The impact of the health aspects of an individual's* life on his or her quality of life or overall well-being (Gold et al. 1996).

Population Health Outcome Distribution Terms

- ***Health inequality****: A generic term designating differences, variations,* and disparities in the health of individuals and groups (Kawachi, Subramanian, and Almeida-Filho 2002).

- ***Disparity:*** *Inequality or difference, as in rank, amount, or quality (Adler* 2006; *Webster's 1980).*
- ***Health inequity****: Those inequalities in health deemed to be unfair or to* stem from some form of injustice. The dimensions of being avoidable or unnecessary have often been added to this concept (Kawachi, Subramanian, and Almeida-Filho 2002).
- ***Variance:*** *(1) Degree of change or difference (Webster's 1980).*
- ***Determinant:***
  - *(1) Any factor, whether event, characteristic, or other definable* entity, that brings about change in a health condition or other defined characteristic (Last 2001).
  - (2) A primary risk factor (causative factor) associated with the level of the health problem, that is, the level of determinant influences the level of the health problem (Turnock 2004).
- ***Cause:*** *Anything producing an effect or result (Webster's 1980).*
- ***Factor (or determinant):*** *(1) An event, characteristic, or other definable* entity that brings about a change in a health condition or other defined outcome; a causal role may be implied (Last 2001).
- ***Risk factor:*** *An aspect of personal behavior or lifestyle, an environmental* exposure, or an inborn or inherited characteristic that, on the basis of epidemiologic evidence, is known to be associated with health related condition(s) considered important to prevent.

Policy, intervention and knowledge transfer

- ***Policy:*** *A guide to action to change what would otherwise occur, a decision* about the amounts and allocation of resources; the overall amount is a statement of commitment to a certain area of concern; the distribution of the amount shows the priorities of decision makers. Policy sets priorities, and guides resource allocation (Milio 2001).
- ***Intervention:*** *To come between as an influencing force (Webster's 1980); a* generic term used in public health to describe a policy or program designed to have an impact on a health problem. *Intervention is essentially* identical to *program, a plan or procedure for dealing with some* matter (*Webster's 1980).*
- ***Knowledge transfer:*** *The exchange, synthesis, and ethically sound application* of knowledge within complex systems of relationships among researchers and users (CIHR 2004).

Association, causality and variables

- ***Association (or correlation****): A statistical dependence between two or more* events, characteristics, or other variables. The presence of an association does not necessarily imply a causal relationship (Last 2001). Last also defines *correlation as the degree to which variables change together* (2001).
- ***Causality****: The relationship of causes to the effects they produce (Last* 2001).

- ***Dependent variable:*** *A variable whose value is dependent on the effect of* other variable(s) (independent variable[s]) in the relationship under study (Last 2001).
- ***Independent (or predictor) variable****: The characteristic being observed or* measured that is hypothesized to influence an event or manifestation (the dependent variable) in the defined area of relationship under study (Last 2001).

Categories of determinants

- ***Social determinant****: A proposed or established causal factor in the social* environment that affects health outcomes (e.g., income, education, occupation, class, social support).
- ***Physical environmental determinant:*** *A proposed or established causal factor* in the natural and built environment that affects health outcomes (e.g., air and water quality, lead exposure, the design of neighborhoods).
- ***Health care determinant****: A proposed or established causal factor in health* care that affects health outcomes (e.g., access, quantity, and quality of health care services).
- ***Genetic determinant****: A proposed or established causal factor from the* genetic composition of individuals or populations that affects health outcomes.
- ***Behavioral determinant:*** *A proposed or established causal factor based on* individual personal choices of lifestyle or habits (either spontaneously or in response to incentives), such as diet, exercise, and substance abuse.
- ***Biological determinant****: Often, a biological mediator variable between a* determinant and an outcome, such as the role of endocrine and immunologic processes in stress. In any case, all determinants must have biological mediator variables in order to affect the organism to produce the health outcomes.

Determinants of Health

- **Biological determinant**
  - A biological mediator is a variable between a determinant and an outcome
    - E.g. Endocrine and immunologic processes in stress (psychological determinant)
  - All determinants have biologic mediator variables in order to affect the organism to produce the health outcomes
  - Genetic determinant is a proposed or established causal factor from the genetic composition of individuals or populations that affects health outcomes.
    - E.g. genetic mutations BrcA1/2 and breast cancer
- **Behavioural determinants**
  - A proposed or established causal factor based on individual personal choices of lifestyle or habits (either spontaneously or in response to incentives), such as diet, exercise, and substance abuse.

- **Social determinants**
  - A proposed or established causal factor in the social environment that affects health outcomes (e.g. income, education, occupation, class, social support)
- **Environmental (Physical and Ecological) determinants**
  - A proposed or established causal factor in the natural and built environment that affects health outcomes (e.g. air and water quality, lead exposure, the design of neighborhoods).
  - Natural environment refers to ecology
  - Built environment refers to the physical nature of the surroundings
  - Determinants of Health
- **Health care determinants**
  - A proposed or established causal factor in health care that affects health outcomes (i.e. Access, quantity, and quality of health care services)
- **Political determinant** (additional)
  - A proposed or established causal factor in the political environment that affects health outcomes (i.e. political stability, war, civil unrest, etc.)

Health issues in African Republic

- The WHO says a "silent epidemic" in African countries accounts for 19 of the 20 countries with the highest rates of maternal mortality worldwide and the highest death rate worldwide for babies up to a month old.
- The WHO says in Africa it stands at 43 per 1,000 live births or four times the rate in Europe.
- The WHO has found that some of the continent's biggest problems are getting worse and the rates of death during childbirth and among young children are increasing.
- Although Africa has 11% of the global population it has 60% of the world's HIV/AIDS cases and 90% of world malaria cases, mainly in children under 5.
- While diseases such as polio, measles and leprosy have almost been eradicated, the report acknowledges the growth of "lifestyle" medical conditions such as heart disease, diabetes and stroke.
- Louis Gomes Sambo, WHO's regional director for Africa, says they know what the challenges are, and how to address them, but Africa's fragile health systems represent an enormous barrier.
- He says African governments and their partners must make a major commitment and invest more funds, because African countries will not develop economically and socially without substantial improvements in the health of their people.

- According to the report only 58 percent of the people living in sub-Saharan Africa have access to safe drinking water.

Population Health Frameworks

Theoretical Assumptions in Population Health (field of study)

1. Health outcomes (states) are influenced by multiple determinants that work sometimes separately but most often, interact to exert their influence
2. Health outcomes are influenced by multiple determinants over the life-course
3. There are disparities in health outcomes across subgroups of the population (also referred to as health inequalities)
4. Health interventions that take into consideration the previous (#1-3) assumptions and that target the different sectors and levels of the population are more likely to succeed in improving health outcomes

1) Health outcomes (states) are influenced by multiple determinants that work sometimes separately but most often, interact to exert their influence

- Social & Economic *social support/capital, social status, income, education*
- Physical environment *built environment, access to facilities/food/healthcare*
- Ecological environment *natural disasters, climate change, air & water quality*
- Political *public policy, legislation, regulation*
- Health care system *health services access and quality of service, wait times, drug plan*
- Individual behaviours *smoking, exercise, diet, substance abuse*
- Biology & Genetics *psycho-bio mechanisms, genetic predisposition*
- Interactions *gene-environment, gene-behaviour, environment-behaviour*

2) Health outcomes are influenced by multiple determinants over the life-course

- Time and timing is important in the associations between exposures (determinants/risk factors) and outcomes at the individual and population levels (Davey Smith, 2007)
- Adverse exposures throughout life increases disease risk
  - e.g. Cardiovascular mortality according to cumulative risk indicator (father's social class, screening social class, smoking, alcohol use)
- Time window of exposure also important (critical-period effects)
  - e.g. Prenatal infection, HPV contraction, lead exposure

3) There are <u>disparities</u> in health outcomes across subgroups of the population (also referred to as health inequalities)

- Health disparities – "differences in health status that occur among population groups defined by specific characteristics…mostly result from inequalities in the distribution of the underlying determinants of health across populations". (PHAC, 2005)
- Inequities - Avoidable and unnecessary inequalities (Kawachi, 2002)
- Vulnerable subgroups include: Low income, low education, Aboriginal persons, immigrants, rural dwellers, the diseased and disabled, etc.

4) <u>Health interventions</u> that take into consideration the previous assumptions and that target the different <u>sectors</u> and <u>levels</u> of the population are more likely to succeed in improving health outcomes

- Health interventions include services, programs, and policy (guidelines, laws and regulations) that affect health of individuals and populations
- Interventions that focus only on one determinant are likely to be less effective if complementary action is not in place which influences a linked factor in another area – interventions need to be both upstream and downstream
- Upstream intervention (act on the features of the social environment)
  - e.g. income distribution, education and social networks
  - Downstream intervention examples include those that focus on changing health behaviours
  - i.e. making nicotine replacement available by prescription and improving community recreation facilities
- Sectors are different areas within government that have specific mandates
  - i.e. environment, health, education, finance, international affairs, industry, agriculture, etc.
- Levels are units or groupings within the population
  - i.e. individual, family, neighbourhood, community, society, etc.
- To improve health, we need a strategic mix of upstream and downstream interventions that consider the determinants of health and that act on the different sectors and levels of the population
- http://www.youtube.com/population health 1
- http://www.youtube.com/population health 2
- http://www.youtube.com/population health 3

Chapter 9

Health indicators and health determinants

Health indicators

- Are measures of health system delivery and access
- Are markers of effectiveness
- The measure the delivery and the use and prepare a report card on health care system
- They measure the health status of individuals indirectly and provide an assessment of quality of health of the individuals
- Are of value to the legislators, health care delivery people and the consumers

Health determinants

- Used to assess health status
- Determine health condition
- Determinants are individual, community or population specific
- Provide an understanding of the status of health and the type of intervention that may be needed to improve health
- They measure the quality of health of individuals and of the community
- They are of value to the health care delivery people and the consumers.

Themes of health indicators

- Access
- Quality
- Health Status and Wellness
- Health determinants
- Age
- Gender
- Lifestyle
- Biological (genetic) determinants
- Family history and heritability
- Socioeconomic status and GDP of the country
- Dietary habits
- Physical activity
- Health care system
- Environment (micro and macro)
- Sociopolitical determinants
- Legislation and governance

Access to health care

- ***Access*** - Measures access to and waiting times for essential health services across the country.

- *Essential health services* encompass a spectrum of primary health care services that provide Canadians with care as soon as possible from multidisciplinary primary health care organizations or teams.
- Patients often experience their initial point of contact and first level of care with the health system when they access primary health care services.
- This includes consultations with family physicians, nurses, nurse practitioners and mental health workers, as well as calls to telephone health information lines and advice received from pharmacists.

Quality of health care

- ***Quality*** - Measures various aspects of the quality of health care services across Canada, such as patient satisfaction and health outcomes.
- Quality care is an essential part of the health care system and helps ensure that Canadians are able to maintain and improve their health.
- In addition to addressing satisfaction with hospital, community-based and physician care, this theme also includes the hospitalization rate for ambulatory care sensitive conditions. This refers to long-term health conditions that can generally be managed outside of a hospital setting, such as diabetes or hypertension.

Health status and wellness

- ***Health Status and Wellness*** **-** Measures the health status of Canadians.
- Health is determined by a number of factors, including the physical environment, working conditions, biological and genetic endowment, and personal health behaviours.
- The private, non-governmental and public sectors also have a pivotal role to play and need to work collaboratively to help Canadians achieve and maintain good health.
- A strong regulatory framework, legislation, health promotion and disease surveillance are examples of what is required to address complex problems such as obesity and health inequities.

Federal government responsibilities

- The Government of Canada supports the publicly funded health care system by:
    - providing funding to provinces and territories through the Canada Health Transfer (CHT) and other transfers targeted to health care
    - supporting health research, health promotion and health protection
    - direct spending initiatives in areas of federal responsibility

Healthy Canadians Report 2008

- *Healthy Canadians 2008* shows health status improvements in several areas:
    - life expectancy, ambulatory care sensitive conditions (chronic conditions that can be managed within the community rather than hospital settings), teenage smoking rates and mortality rates for prostate and breast cancer.
    - Declines have been observed in other areas, such as in body mass index (notably in the obese category), physical activity and incidence and prevalence rates for diabetes

Access to health care

- **Proportion of the population that reports having a regular family doctor**
- This indicator measures the percentage of the population aged 15 and over who answered "yes" to the question: "Do you have a regular family doctor
- **Self-reported difficulty obtaining routine or ongoing health services, health information or advice, immediate care**
- **Self-reported wait times for diagnostic services**
- **Self-reported wait times for specialist physician visits**
- **Self-reported wait times for surgery**
- **Self-reported prescription drug spending as a percentage of income**

Quality of care

- **Self-reported patient satisfaction with overall health care services**
- **Self-reported patient satisfaction with physician care**
- In 2007, 89.8% of Canadians who received care from a physician reported they were "very satisfied" or "somewhat satisfied" with the way physician care was provided.
- **Self-reported patient satisfaction with hospital care**
- In 2007, 79.9% of Canadians who used hospital care reported being "very satisfied" or "somewhat satisfied" with the way their most recent hospital care was provided.
- **Self-reported patient satisfaction with community-based care**
- In 2005, 81.6% of Canadians who used community-based health care reported being "very satisfied" or "somewhat satisfied" with the way community-based care was provided.

Health status and wellness

- **Perceived health**
- **Life Expectancy at Birth**
  Life expectancy at birth in years, by sex, selected countries and years
- **Infant Mortality**
  Deaths per 1,000 live births, both sexes, selected countries and years
- **Low Birth Weight**
  Percentage of live births weighing less than 2,500 g, both sexes, selected countries and years
- **Self-reported body mass index**
- This indicator measures the percentage of adults who reported a height and weight corresponding to a body mass index (BMI) in specified categories ranging from underweight to obese
- **Self-reported physical activity**
- This indicator measures the percentage of the population aged 12 years and older who reported themselves as being either "physically active" or "physically inactive."

List of 70 Indicators Agreed to by Federal/Provincial/Territorial Jurisdictions (Top twelve)

1. Difficulty obtaining routine or ongoing health services **(Featured)**

2. Difficulty obtaining health information or advice **(Featured**)
3. Difficulty obtaining immediate care **(Featured)**
4. Proportion of population that reports having a regular family physician **(Featured)**
5. Patient satisfaction with overall health care services **(Featured)**
6. Patient perceived quality with overall health care services
7. Patient satisfaction with community-based care **(Featured)**
8. Patient perceived quality with community-based care
9. Patient satisfaction with telephone health line or tele-health services **(Featured)**
10. Patient perceived quality with telephone health line or tele-health services
11. Proportion of population reporting contact with telephone health line
12. Hospitalization rate for ambulatory care sensitive conditions **(Featured)**

List of 70 Indicators Agreed to by Federal/Provincial/Territorial Jurisdictions (Bottom twelve)

- Incidence rate for tuberculosis Incidence rate for Verotoxigenic E. Coli
- Reported rate for chlamydia
- Rate of newly reported HIV cases
- Prevalence and incidence rates of diagnosed diabetes among Canadians **(Featured)**
- Exposure to environmental tobacco smoke Perceived health **(Featured)**
- Teenage smoking rates **(Featured)**
- Teenage smoking rates: Proportion of current teenage smokers
- Teenage smoking rates: Proportion of daily smokers
- Physical activity **(Featured)**
- Body mass index **(Featured)**
- Immunization for influenza, aged 65 plus ("Flu Shot") **(Featured)**
- Prevalence of depression

Chapter 10

Environmental influences on health

- The constituents of the environment
- The routes of exposure to contaminants
- Concepts of hazards and risks

- Impact of environment on health
- http://www.youtube.com/watch air pollution
- http://www.youtube.com/watch point of no return
- http://www.youtube.com/watch climate change?

Types of environments that affect health

- Environment is all that is external to the individual and that with which the individual interacts symbiotically
- The global environment that is beyond the control of the individual
- Air pollution, ozone depletion, climate change
- The environment that is controlled and modified by the individual
- Indoor air pollution, tobacco smoke
- Environmental impact on the individual
- Interaction of the individual with the environment should lead to a positive symbiotic and a healthy relationship
- However, pollution alters this positive and health relationship and pollutes both the environment and the individual
- Pollution is caused by a pollutant, which may be a solid, semi-solid, liquid, gas, sub-molecular particles or energy
- Pollutants adversely alter the environment which in turn adversely affects the health and well-being of the individual
- Exposure to the environment without adequate safety precautions could also adversely impact one's health

The Evolution of Environmentalism

- **Environmental health** - a discipline that addresses the many external factors that can potentially affect health
- **Acid rain** - deposition of atmospheric sulfur and nitric acids as precipitation or in dry form
- **Smog** – produced when fog is thickened and darkened by air pollution
- **Fossil fuels** - energy resources derived from ancient plants and animals compressed in the ground for millions of years
- **Degradation** of land from intensive farming and extraction of minerals and ores
- **Ecosystem** contamination from anthropogenic activities
- Water, air and soil has been contaminated from human activities

Routes of exposure

- The major routes of exposure are:
- Air and soil (breathing 10-20 m^3 per day)
- Air, soil, water, agricultural produce
- Water, food (1-2L per day)

Factors affecting the risk of an individual along with environmental determinants

- Age
- Gender
- Disease
- Lifestyle
- Fitness
- Nutrition
- Physiology
- Genes

Environmental pollutants and its impact on health

- Human health, well-being and survival are ultimately dependent on the health of the planet earth
- In modern times the planet is under attack from the assaults
    - by the enormous number of people who live on it (overpopulation), and the wide range of their activities (industries and commerce)
- People are exposed to contaminants in water, air, food and soil to different extents
- It is necessary to assess the impact on human health from pollutants in air, water, land and food
- Exposure to environmental pollutants occurs at different levels and affects individuals to different degrees
    - Ingesting contaminated food and water is dietary exposure
    - Dietary exposure leads to the contaminants be absorbed through mouth, throat, stomach and intestines
    - Contact with contaminated water, soil and air is dermal exposure or inhalation exposure from breathing contaminated air
    - Inhalation of contaminated gas or vapour or air borne particles causes inhalation exposure and the lungs often absorb gases and vapours quickly and efficiently
    - Dermal (skin) contact with contaminants in air, water or soil leads to the contaminants being absorbed through the skin

The ostrich effect

- The hazard is appreciated but the risk is not necessarily acknowledged:
    - Because of the benefits (pleasures) derived from it,
    - Because of other interests or
    - Because of the ostrich effect (it won't happen to me)
    - The effects of smoking are sufficiently well know, but people still smoke or do not stop smoking because of the pleasure they derive from smoking, and because of the ostrich effect.
    - Some do not get lung cancer or any other respiratory diseases but some do and some die of the disease

Causes of environmental pollution

- World population is expanding at an exponential rate much faster in some countries than others
- Economic and population growth justifies industrialization
- Both overpopulation and industrialization leads to environmental degradation resulting in loss of environmental quality and ecological balance, deforestation, global warming, acid rain, environmental pollution (air, water and land pollution)

Overpopulation problems

- Fighting over scarce resources and territory.
- Destroy the habitat of every other species, pushing them to extinction.
- Dealing with the pollution of our industries and fecal waste is compounded by overpopulation.
- Plagues thrive in overcrowded conditions.
- We are rapidly depleting our non-renewable energy reserves.
  - Every person in the developed world consumes 40 times as much as in the developing world.

Population Growth Factors

- **Child Mortality –** More children survive to adulthood due to imporved sanitation, hygene, and access to medical care
- **Education –** Better educated women tend to have fewer children but those children have better survival rates
- **Access to contraceptives –** Couples have fewer children
  - More children survive when births are adequately spaced
  - Fewer women die as a result of pregnancy

Air pollution

- The majority of the air pollutants are caused by industry or transportation
- The major pollutants in air include:
- Particulate matter and sulphur dioxide which are by-products of power station and burning of fossil fuel
- Nitrogen dioxide and carbon monoxide from power stations and motor vehicles
- Greenhouse gasses (NO, NO_2, N_2O) from motor vehicles
- Toxic air pollutents such as lead, cadmium and nickel from refining and burning of fossil fuel
- By products of air pollution include fog and smog.

Effects of air pollution on human health

- Physical effects of air pollution
  - Fog (London Fog 1952, The Meuse Valley Fog 1930, The Pennsylvania Fog 1948) caused by carbon matter and sulphur dioxide

- Smog (Los Angeles, Mexico City) caused by build up of ozone which is produced by the activities of sunlight on volatile organic substances and nitrogen dioxide
- Global warming (worldwide) caused by greenhouse gases (carbon dioxide, methane, sulphur dioxide, nitrogen oxides)
- Ozone depletion (worldwide) caused by halogenated organic compounds

- Direct health effects
  - Increase in respiratory problems and cardio-pulmonary problems
  - Increase in mortality in the elderly
  - Increase in skin and lung cancers
  - Increase in birth defects and decrease in birth weights
  - Increased morbidity in the susceptible population
    - Increase in hospital admissions
    - Increase in clinic visits and physician visits
    - Increase in sale and use of allergy control medications

Air pollution

- Air gets polluted when chemically active compounds enter the atmosphere at a rate faster than the atmosphere can convert or dilute them
- Air pollution may travel long distance and the pollutants may remain in the atmosphere over extended periods of time
- Typical pollutants of the air include:
  - Particulate matter, which includes any particle that remains suspended in air and may be organic or inorganic
    - The size of the particulate matter range from 20 micron to <2 micron of which <10 micron are respirable particles
  - Gases such as carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrocarbons and methane
- There are three types of air pollutions based on chemical characteristics, distribution and sources of the pollutants
  - Greenhouse gases which comes from power plants, industrial furnaces and steel mills and include pollutants such as sulphur dioxide, smoke and particulates
  - Particulate matter which results from complicated chemical reaction in the atmosphere that are driven by the sunlight and the pollutants include oxides of nitrogen, sulphur dioxide and hydrocarbons
  - Toxic air pollutants from point source emissions, which are emissions from chimneys of industries, refineries and power-plants and the pollutants range from particulates to inorganic and organic gases

- During the past decade some of the highest air pollution levels have occurred in cities in the developing countries (Mexico City, San Paolo, Shenyang)

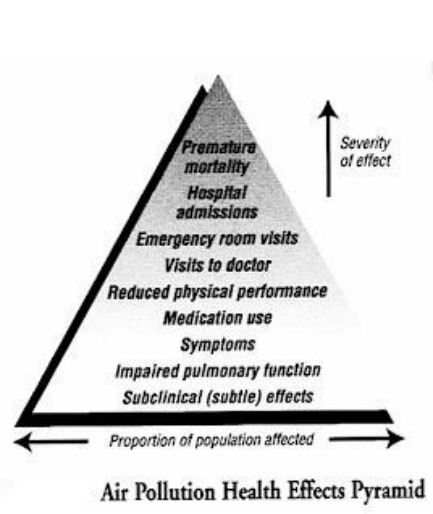
Photochemical air pollution

- In bright sunlight nitrogen oxides hydrocarbons and oxygen interact chemically to produce powerful oxidants like ozone (O3) and **peroxyacetyl nitrate (PAN)**
- These secondary pollutants are damaging to plant life and lead to the formation of photochemical smog. PAN is primarily responsible for the eyeirritation so characteristic of this smog.

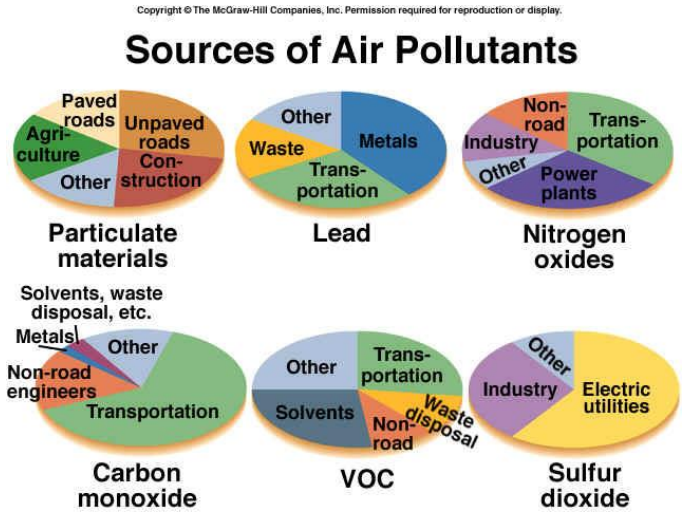
Impact of air pollution on human health

- The toxicology of air pollution is complex because of the nature of the pollutants and chemical reactivity between the pollutants
- In recent years it is believed that air pollution has a much greater impact on human health than it was supposed
- Fine particulate air pollution and ozone are associated with death in the susceptible individuals with certain respiratory conditions
- Air pollutants have also been observed with hospital admissions
- Ozone and other pollutants precipitate adverse reaction in people with cardiovascular problems
- Chronic bronchitis and asthma conditions are worsened with increasing air pollutants

Adverse health effects from air pollution



Air Pollution Health Effects Pyramid



Impact of air pollution on the environment

- Global warming from greenhouse gases (SO_2, CO_2, CH_4, NO_x)
- Global warming will alter the weather conditions melting of polar ice caps, flooding of river systems

- Enhances ozone depletion
- Acid rain from polluting environmental gases (SO_2, NO_x)
- Acid rain is caused by air pollution and is harmful to forests, crops and other plants, poisons and kills aquatic life, destroys the water sources by increasing acidity, increasing concentration of inorganic compounds
- Toxic _____initiated damage to plants
- Ozone depletion leads to increased exposure to ultraviolet radiation (increased incidence of skin cancers, cataracts, suppression of immune system and respiratory problems)

Global warming

- Global warming refers to the phenomenon that average global temperatures are higher today than at any time since global temperatures were first recorded
- Global warming is caused by build-up of greenhouse gases
- Greenhouse gases include:
    - Major - water vapour (36-70%), carbon dioxide (9-26%), methane (4-9%) and ozone (3-7%)
    - Minor – Nitrous oxide, chlorofluorocarbons (CFC) hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride (SF)
- These gases get trapped in a gaseous layer around the earth, which allow solar heat to pass through and than trap that heat close to the earth's surface
- Scientists predict that global warming would produce life-threatening natural phenomena, such as drought, forest fires, flooding, heat waves and hurricanes
- In Canada GHG are produced by:
    - Major industrial sources of greenhouse gas emissions include:
    - power generation facilities that use fossil fuels to produce electricity, heat or steam; integrated steel mills;
    - oil and gas extraction;
    - facilities involved in mining, smelting and refining of metals;
    - pulp, paper and saw mills;
    - petroleum refineries; and
    - chemical producers.
    - Other specific activities contributing to Canada's total GHG emissions include transportation, use of solvents, waste disposal, wastewater treatment, and agriculture-related activities.

Acid rain

- Acid rain is precipitation that has fallen through acidic air pollutants, particularly those containing sulphur dioxides and nitrogen dioxides
- This precipitation, in the form of rain, snow or fog has a more acidic composition that does unpolluted precipitation
- When introduced into lakes and ponds, acid rain gradually acidifies the water
- When acid levels reaches a certain level plant and animal life cannot survive
- Southern Ontario experiences some of the highest concentrations of acid aerosols in North America. At present Ontario has no guidelines for acid aerosols

- A number of studies in Southern Ontario have demonstrated that increases in acid aerosols and ozone positively correlates with increased hospital admissions due to respiratory problems
- Sources of gases contributing to acid rain

Pollution

- Introduction of toxic substances (pollutants) into the environment
- Types: water, air, soil, light, and noise pollution
- **Air quality index** - calculates outdoor air quality for major air pollutants particulate matter, sulfur dioxide, nitrogen oxide, ozone, and carbon monoxide

Air Quality Index (AQI)

Air quality index (AQI) range	Air quality condition	Color
0–50	Good	Green
51–100	Moderate	Yellow
101–150	Unhealthy for sensitive groups	Orange
151–200	Unhealthy	Red
201–300	Very unhealthy	Purple
301–500	Hazardous	Maroon
Note: The EPA divides AQI values into six categories, ranging from good to hazardous air quality. The category called "Unhealthy for Sensitive Groups" refers to children, older adults, and people with heart and lung disease.		

Ozone

- Increased levels in the troposphere
  - Causes respiratory tract irritation and worsens asthma
- Depleted in the stratosphere, where it shields the ultraviolet light from reaching the earth's surface
- The ozone depletion is caused by gases by CFCs, and other ozone depleting gases
  - Chlorofluorocarbons (CFCs), compounds made of carbon, chlorine, hydrogen, and fluorine break up ozone molecules
  - Other ozone depleting gases are methyl bromide, carbon tetrachloride (CCl4), hydrochlorofluorocarbons (HFCs), halons
  - **Ozone hole** - a region of marked thinning in stratospheric ozone

Indoor Air Pollutants

- Tobacco smoke
- Carbon Monoxide
- Formaldehyde
- Lead
- Radon
  - Naturally occurring odorless, colourless, tasteless, radioactive gas that comes from breakdown of uranium
  - Indoor radon ranks second to tobacco smoke as cause for lung cancer

- Asbestos
    - Natural mineral fiber that was used for insulation and as a fire retardant
    - If inhaled, the fibers can cause lung cancer and other chest diseases

Water pollution

- Pollutants and contaminants in water include:
    - Pathogens such as bacteria, parasites, fungi or viruses
    - Chemicals such as mineral salts and organic matter
- Sources of water contaminants include:
    - Landfills and dumps (affluent which contain chemicals, particulates dyes and heat)
    - Agricultural run-off (pesticides, agricultural chemicals used in intensive farming)
    - Sewage, sludge (municipal sewage, other chemicals and particulates)
    - Leakage from ug tanks from waster dumps, industrial spills and underground storage tanks
- Water pollution may be caused by:
    - Agricultural run off
    - Storm runoff from cultivated and uncultivated lands
    - Effluents run off from intensive farming operations and other industrial operations
    - Shipping and dumping of wastes
    - Deposition of aerial contaminants

Human health effects from water pollution

- Water pollution has affected human health in many instances and in a number of ways depending on the pollutants and the period of exposure and the exposed population
    - Contaminated water, contaminates fish and aquatic vegetation
    - Contaminates drinking water sources
        - E-coli episode in Walkerton, Ontario
    - Minimata Bay, Japan; organic mercury in the water lead to contamination of fish which resulted in neurological disorders and deaths in the fish eater
    - Ban on tuna fishing in the Canadian river system in the early 1970s because of contamination of the rivers with mercury
- Chemical and biological contaminants adversely affect human health
    - Organic and inorganic chemicals, metals cause toxicity
    - Waterborne microscopic cysts such as giardia and cryptosporidium can infect people at very low levels
    - Cryptosporidium symptoms include cholera like illness (headache, diarrhoea, abdominal cramps, nausea and vomiting)
    - Chlorination and filtration can remove the pathogens and also the chemical compounds in drinking water
- Distillation involves boiling water and re-condensing the vapour; distillation destroys all the pathogens, but not the chemical compounds which can be removed by filtration

- E-coli in Walkerton is an evidence of water pollution resulting in human disaster

Land pollution

- Industrial and municipal dumping of wastes has created polluted land which is wasted with no agricultural or any other value
- Dumping of radioactive wastes and spent radioactive substances have created problems for the land, water and the environment
- The sources of land (soil) pollution include:
    - Intensive crop farming
    - Intensive animal farming
    - Industrial activity
    - Contaminated water
    - Air pollution and natural events (volcanic eruptions)

Soil pollution

- Soil pollution is caused through:
    - The deposition of heavy metals from transportation and industrial wastes
    - The discharge of industrial effluents, sewage sludge and intensive farming
    - The excessive use of pesticides in agriculture and public health
    - The leaching of hazardous compounds from industrial and municipal waste dumps
    - The intensive use of land for intensive farming and other uses leading to the soil being exhausted and useless

Effects of soil pollution

- Polluted soil could have direct and indirect effects on human health
    - Polluted soils lead to polluted agricultural produce and contamination of the food chain
    - Polluted soils leaches pollutants into rivers and lakes leading to contamination of water bodies and sources of drinking water
    - Polluted soils leaches contaminants into air resulting in increased exposure to contaminants among humans
    - Love Canal, a landfill site near Niagara Falls (1930-1953), adverse human health effects were seen beginning in 1960
    - Long Island in New York has also been in the limelight because of reported adverse health effects in recent time, Long Island was used to dump municipal waste previously and now a housing community sits on it

Impact of land pollution on human health

- Poor soil conditions cannot produce crops or support vegetation or agriculture leading to soil erosion and contamination of the environment

- Pollutants in the soils leach into water sources following rainfall and melting of snow, leading to the contamination of water bodies and the aquatic life
- Pollutants from the soil could also enter the atmosphere depending on the weather conditions leading to air pollution
- Contaminated land sites lead to increased incidence in certain cancers, birth defects, chronic health problems in susceptible population

Recycling and Composting

- Recycling
    - Recovery of useful materials from the trash to use to make new products
    - Reduces the amount of new raw materials needed
- Composting
    - Collecting organic waste and storing it under conditions that promote the breakdown of the material
- **Benefits of Recycling and Composting**
    - Less waste taxing landfill capacity
    - Conservation of the raw materials
    - Reduced energy consumption and pollution involved in collecting and processing raw materials
    - Job creation in recycling and manufacturing industries
    - Strategies to Conserve Resources
    - Novel and emerging pollutants
    - Antibiotics and growth hormones in agriculture

Novel and Emerging Pollutants

- Antibiotics and growth hormones in agriculture
- Biomedical wastes
- Hormone mimics or endocrine disruptors

Chemicals used in intensive livestock farming

- A number of chemicals are used in intensive livestock farming
    - Antibiotics for disease treatment
    - Antibiotics as prophylactic agents
    - Growth hormones to boost growth
    - Hormones (synthetic) to increase milk production and egg production
- Chemicals used in livestock production enter food web and the environment
- Contaminants in food and environment expose humans to these contaminants

Biomedical wastes

- Biomedical wastes come from human or animal health care facilities, medical research, teaching institutions, clinical laboratories and hospitals
- Biomedical wastes also include animal wastes, animal body parts and carcasses infected with pathogenic microoganisms
- Biomedical wastes also include body fluids, human blood and blood products and tissues from diagnostic and therapeutic purposes in hospitals and clinics
- Biomedical wastes if not properly disposed or treated could contaminate the environment and the humans

Endocrine disrupting chemicals

- The endocrine system consists of a network of a variety of ductless glands that produce hormones that control growth, development of secondary sexual characteristics, menstrual cycle and other reproductive functions
- Endocrine disruptors are foreign chemicals that act like hormones and mimic, block or alter proper hormone response
- Synthetic chemicals, which act like endocrine disruptors include pesticides (DDT), industrial chemicals (bisphenol-A), pharmaceuticals (DES) and household chemicals (nonylphenol)
- Endocrine disruptors persist in the environment and accumulate in the wildlife and livestock and the food web
- Chronic exposure to endocrine disrupting chemicals have been observed to affect development and reproduction in fish, birds and other wildlife
    - Low reproduction rates in beluga whales in the Gulf of St. Lawrence
    - Feminization of male alligators hatched in Florida's Lake Appopka
    - Abnormal sexual differentiation and behaviour in bald eagles and gulls from the Great Lakes

What are the emerging environmental threats in Ontario?

- Nuclear fuel
- Coal in generating power
- Wind turbines
- Biomedical waste
- Biological waste
- Radio-active waste
- Nanoparticles
- Others

Exposure and dose

- Exposure to a pollutant occurs when an individual is exposed to a pollutant
- Exposure depends on the concentration of the pollutant and the amount of time an individual is exposed to the pollutant
- Dose is the amount of the pollutant or contaminant that a person has received and/or has retained as a result of the exposure to the pollutant or the contaminant

- The dose an individual receives as a result of exposure to the pollutant is dependent upon
    - Personal characteristics of the individual
    - The nature of the pollutant
    - The intensity of the exposure
    - The duration of the exposure

Human health effects from exposure to a pollutant

- Some of the effects are immediate
    - After effects of smog, fog, etc.
    - Exposure to radiations (ionizing)
    - Exposure to gaseous emission (Bhopal tragedy)
- Other effects are delayed
    - Exposure to noise
    - Exposure to inorganic contaminants (Minimata Bay)
    - Exposure to organic contaminants (tetraethyl lead)
    - Exposure to pesticides (agricultural and vector control staff in public health)

Adverse effects from exposure to pollutants

- The adverse human health effects that result from exposure to a pollutant range from subtle covert changes to severe overt illnesses:
    - Subtle covert changes
        - Hearing loss from exposure to noise
        - Neurological and other diseases from mercury exposure
        - Cancer from exposure to benzene
    - Severe overt illnesses
        - E-coli poisoning through drinking water
        - Asbestosis from asbestos exposure
        - Lung cancer from smoking and uranium mining

Hazard and risk

- Hazard is the potential to cause harm or danger to life or limb
- Risk is the measure of likelihood of harm occurring from exposure to a hazard
- Smoking is a hazard for it can cause lung cancers, bronchitis, emphysema and heart diseases
- The risk of getting any of these diseases depends on a number of individual factors
    - Genetic factors

- Age and gender
- Physiological characteristics of the individual
- Susceptibility of the individual

Chapter 11

Disease burden and prevention

- Chronic diseases
  - Cardiovascular diseases
  - Cancer
- Infectious diseases
  - Pathogens and routes of infection
  - Sexually transmitted infections
  - Acquired immune deficiency syndrome
- Non-infectious diseases
  - Respiratory diseases
  - Neurological disorders
  - Digestion related disorders
  - Musculoskeletal disorders

Disease outbreak

- http://www.mojvideo.com/video-mexican-flu-outbreak-2009-special-report-by-dr-leonard-horowitz/22c50fe6aa0e186f695a

Disease transmission

- Chronic diseases are lifestyle, contaminant or biological agent related diseases, they usually last a lifetime and most are terminal
- Contagious diseases are caused by a contaminant or a biological agent and may be transmitted from person to person
- _____ diseases are caused by a biological agent and can be transmitted from person to person through contact or through an agent
- Non-contagious diseases may be caused by a contaminant and may be chronic or acute in nature but are not transmissible from person to person

Cardiovascular Diseases (CVD)

- CVD are the leading causes of death in Canada

- The cardiovascular system includes the heart, lungs, arteries, arterioles, capillaries, and veins
- The human body contains ~6L of blood which is responsible for transporting nutrients, O_2, waste products, hormones, and enzymes throughout the body, aids in the dispersal of effectors of the immune response, and regulates body temperature and pH
- The average human heart beats 70-80 times per minute while a well conditioned heart need only beat 50-60 times per minute to circulate the same amount of blood. Under stress the heart may beat up to 200 times per minute

Cardiovascular Disease

- Cardiovascular diseases include:
    - Atherosclerosis
    - Coronary heart diseases
        - Myocardial infarction
        - Angina pectoris
    - Arrhythmia
    - Congestive heart failure
    - Diseases present at birth
    - Stroke

Atherosclerosis

- The thickening and hardening of the arteries which is characterized by deposits of cholesterol, metabolic byproducts, calcium, and fibrin in the arterial lining.
- This buildup is referred to as a plaque which can cause hemorrhage or thrombus increasing the chances of a heart attack or stroke
- Plaques develop over time and are more prevalent in certain people and this phenomenon has genetic predisposition
- Smoking enhances the development of atherosclerosis in the coronary arteries, the aorta, and the arteries of the legs

Coronary heart disease (CHD): Myocardial Infarction (MI)

- CHD are caused as a result of artherosclerotic plaque formation in the arteries leading to blocking of arteries
- Angina _____to an area of the heart (coronary thrombosis) and is often brought on by coronary thrombosis (Heart attack)
    - In the case of small blockages, the heart has adapted the ability to provide blood to blocked areas to heal the damaged heart muscle
    - In the case of larger blockages, the heart is unable to provide blood to blocked areas and the heart's oxygen supply is compromised (ischemia).
    - Patients with ischemia often suffer from angina pectoris or chest pains upon physical exertion
    - Symptoms of a heart attack include varying degrees of chest pain, nausea, vomiting, weakness, sweating, and loss of consciousness

- Treatment involves surgery or therapy with nitroglycerin or beta blockers

Angina Pectoris

- _____because of blocked blood supply to the heart and hence lack of supply of oxygen
- Symptoms may range from slight feelings of indigestion to feelings that the heart is being crushed
- The degree of ischemia is proportional to the severity of the block of blood supply and although angina pectoris is not a heart attack, it indicates underlying heart problems
- Can be treated by rest and using drugs that enhance the amount of blood and O_2 being supplied to the heart
- Can also be relieved by nitroglycerin, calcium channel blockers, beta blockers

Arrhythmias

- _____ is irregular heartbeat
- Tachycardia: abnormally increased heartbeat
- Bradycardia: abnormally slow heartbeat
- Fibrillation is a sporadic, quivering heartbeat resulting in a deficiency of the heart to move blood throughout the body appropriately

Congestive Heart Failure

- The result of a damaged or overworked heart muscle leading to a heart that is incapable of circulating blood properly throughout the body
- Characterized by decreased volumes of blood leaving the arteries and decreased blood return from the veins leading to a back up and congestion in the tissues
- This back up leads to heart enlargement and reduced availability of blood for circulation
- Blood builds up in vessels of the legs, ankles, and lungs causing swelling or difficulty in breathing
- Untreated congestive heart failure will lead to death
- Treated with drugs that increase the pumping action of the heart and vasodilators

Congenital and Rheumatic Heart Disease

- Congenital heart disease is present at birth
- Various forms may include slight murmurs caused by valve irregularities or serious complications that can only be corrected by surgery
- Can be caused by exposure to German measles and alcohol during development
- Rheumatic heart disease is attributed to rheumatic fever which is an inflammatory disease that can affect connective tissues of the heart, joints, brain, and skin
- Caused by an unresolved *Streptococcal* infection

Stroke

- Absence of blood supply to regions of the brain which results in the death of the tissue lacking O_2 supply
- Death of brain tissue that is incapable of regenerating leads to speech impairment, memory loss, and defective motor control. When brain tissue that controls heart and lung regulation is lost death is imminent
- Mild strokes are called transient ischemic attacks and lead to dizziness, weakness, and numbness
- Stroke maybe caused by thrombus (blood clot), embolus (wandering clot), or an aneurysm (a bulge in the blood vessel)
- Warning signs of a major stroke include
    - Sudden weakness or numbness of the face, arm, or leg on one side of the body
    - Sudden dimness or loss of vision; usually in one eye
    - Loss of speech or difficulties with talking or understanding speech
    - Unexplained dizziness, unsteadiness, or sudden falls

Biomarkers of CVD

- **Myoglobin:** the oxygen carrying pigment of muscle and is released into circulation after the onset of myocardial necrosis. Not specific to cardiac muscle injury.
- **Creatine Kinase:** responsible for regenerating phospocreatine pools.
- **Troponins:** required for muscle contraction. Certain isoforms are expressed exclusively in cardiac muscle.

Non-modifiable Risks for CVD

- **Heredity:** a family history of CVD increases your risk
    - Lifestyle with heredity increases the risk incrementally
- **Age:** risk increases with age
    - Older men and women are at a increased risk compared to younger men and women
- **Sex:** men are at greater risk
    - Gender bias

Modifiable Risks for CVD

- **Cigarette Smoking:** the risk of developing a CVD is proportional to the frequency of smoking (up to 70% greater risk for smokers). Nicotine increases heart rate making the heart work harder
- **Triglycerides and Cholesterol Levels:** fatty diets increase blood cholesterol levels contributing to atherosclerosis. Increased HDL and decreased level of LDL reduce the risk of CVDs
- **Hypertension:** blood pressure is proportional to the risk of developing a CVD. Can be modified by exercise, diet, weight loss, diuretics, and relaxation
- **Exercise (physical inactivity):** risk for CVDs is greater in sedentary people

- **Diabetes:** leads to increased risk for CVDs due to increased blood lipid levels which can be controlled by diet, exercise, and medication
- **Response to Stress:** stressful situations lead to increased blood pressure. The way these situations are perceived by the individual affects the change in blood pressure

Early diagnosis of CVD

- Electrocardiography (EKG) a record of the electrical activity of the heart measured during a stress test
- Angiography is a technique in which a needle-thin tube is inserted through blocked arteries and a dye is injected and migration of the dye is measured using X-rays
- Positron emission tomography (PET) scan is a three-dimensional imaging of the heart with a radioactive tracer pumped through the heart
- Radionuclide imaging (thalium test)
- Magnetic resonance imaging (MRI)
- Ultrafast computed tomography (CT)
- Digital cardiac angiography (DCA)

Correcting CVD

- Cardiac catheterization: involves the insertion of a catheter into the site of blockage. The catheter is then used to inflate a small balloon which compresses the fatty deposit causing the blockage.
- Advantage: safe and recovery time is short. Disadvantage: the blockage frequently reoccurs within six months
- Thrombolysis: injection of an enzyme that breaks down the plaque causing the blockage. Must be administered within hours of the heart attack to be effective

CVD interventions

- Sam is 55 years old and is told by his doctor that he is at a higher risk for CVD. Discuss the following questions:
    - What should he do to reduce the risk?
    - Why is Sam at an increased risk?
    - What is the worst that can happen if Sam suffers a heart attack?
- Sophie is ten years old and suffers from a weak heart, that is not able to pump blood to her whole body as a result she is always tired, fatigued, out of breath and anemic. Discuss the causes of Sophie's condition and possible interventions?

Hypertension

- Hypertension (chronic high blood pressure) is not a disease but a risk factor for cardiovascular heart disease and stroke
- Hypertension could be essential hypertension (unknown cause) or secondary hypertension (caused by kidney disease, obesity or adrenal gland dysfunction)

- Hypertension is measured by measuring the systolic and diastolic blood pressure
    - Systolic <120 and diastolic <80 is normal
    - Systolic 120-139 and diastolic 80-89 is prehypertensive
    - Systolic 140-159 and diastolic 90-99 is stage one hypertensive
    - Systolic >160 and diastolic >100 is stage two hypertensive

Chronic diseases in Canada

- Cardiovascular diseases (CVD), including heart disease and stroke, are lifelong diseases caused by the interaction of genetic predisposition, health behaviours, and the environment.
- Nine in ten individuals over the age of 20 years have at least one risk factor for CVD. Four in ten have three or more of these risk factors. As the number of risk factors increases, so does the risk of CVD.
- 1.3 million Canadians reported having heart disease diagnosed by a health professional - 5% for ages 12+ years and 23% for age 75 years and older.
- About 300,000 Canadians reported living with the effects of a stroke - 1% for ages 12+ years and 7% for age 75 and older
- In Canada in 2004, CVD was the leading cause of death for Canadians - 72,743 deaths, representing 32% of all deaths.
- In 2004, CVD was responsible for an estimated 246,287 potential years of life lost (the number of years not lived, owing to premature death before age 75)
- The total costs for CVD included $7.6 billion for health care costs (direct costs), and $14.6 billion for indirect costs resulting from lost economic productivity due to disability or death.
- An estimated 65.7 million prescriptions were dispensed for the treatment of CVD - a substantial increase over the 57.4 million prescriptions dispensed in 2005, and 52.5 million prescriptions dispensed in 2003.

Cancer

- General name given to a disease or a range of diseases characterized by cells acquiring mutations that induce them to grow uncontrollably and metastasize without detection by the immune system
- A neoplasm is a mass of undefined tissue that is a result of uncontrolled growth and this clump of cells is a tumour
- Benign tumours are generally harmless unless they obstruct or crowd out normal tissue
- Malignant tumours originate at a primary location (organ site) and have the ability to spread throughout the body (metastasis) where they grow and inhibit the function of the tissue that they are growing in
- It is anticipated that 38% of women and 44% of men in Canada will develop cancer in their lifetime and 24% of these women and 29% of these men will die from cancer
- Prostate cancer in men and breast cancer in women has the highest incidence and lung cancer in both has the highest mortality.
- Colorectal cancer has the third highest incidence in men and women in Canada.

- **Causes of cancer**
    - Exposure to carcinogens
        - Radiations, chemicals, hormonal drugs, immunosuppressent drugs, etc.
        - Occupational carcinogens such as asbestos, benzene, arsenic, pesticides, coal tars, aromatic hydrocarbons, etc.
    - Oncogenes
    - Genetic predisposition including genetic defects
    - Oncogenic viruses
    - Diet
    - Lifestyle
    - Age
    - Ethnicity
- **Risks for cancer**
    - Lifetime risk of cancer is the probability that an individual over the course of lifetime will develop cancer or die from cancer related causes
    - Relative risk of cancer is a measure of the strength of the relationship between risk factors and a particular cancer
    - A male smoker in Canada has a twenty-fold relative risk of developing lung cancer compared to a non-smoker
- **Risk factors of cancer**
    - Lifestyle – certain lifestyles are associated with cancer, such as smoking, alcohol, stress, unprotected sex, etc.
    - Smoking – tobacco smoking is the leading cause of lung and other cancers worldwide
- **Risk factors for cancer**
    - Obesity – the risk of cancer is greater in obese and physically inactive people
    - Relative risk of breast cancer in postmenopausal obese women is 50% higher compared to non-obese
    - Relative risk of prostate cancer in men is 40% higher in obese men
    - Biological factors – the risk of cancer is higher in first degree relatives of patients with cancer of the breast, prostate, colon, uterus, etc.
    - Exposure to certain occupational carcinogens increases the risk of cancer in those exposed
    - Social and psychological factors such as prolonged depression and stress increase the risk of cancer
    - Dietary contaminants such as pesticide residues, certain food colours, sodium nitrate are believed to cause cancer
    - Infections and inflammation are believed to increase cancer risk
    - Viruses such as Hepatitis B and C variants, human papilloma virus and helicobacter pylori are associated with cancers
- **Development of Cancer**
    - Cancer cells often display the loss of entire chromosomes, presence of extra chromosomes, or the fusion between chromosomes that allows the cell to proliferate

- Tumours (primary) arise from normal tissue and can migrate to secondary sites (metastases).
    - Most arise from epithelial tissue (carcinomas) and make up for more than 80% of cancer deaths in the Western world.
    - Tumours that arise from epithelial tissue are known as squamous cell carcinomas
- The development of most cancers requires an extended period of time.

- **Types of Cancer**
    - Carcinoma: occur in epithelial tissues (tissues covering body surfaces and lining body cavities); most common are the cancers of the breast, lungs, intestines, skin, and mouth.
    - Sarcomas: occur in mesodermal or middle layers of tissue such as bones, muscles, and connective tissue; these cancers are less common
    - Lymphoma and myeloma: develop in the lymphatic system (the infection fighting regions of the body)
    - Leukemia: occurs in blood-forming parts of the body particularly cancers of the bone marrow and spleen and are characterized by excessive amounts of white blood cells

Organ based human cancers (1)

- Lung Cancer: symptoms include persistent cough, blood-streaked sputum, chest pain, and recurrent attacks of pneumonia or bronchitis. Can be treated by surgery and chemotherapy depending on the severity. Survival rates of patients are low.
    - Prevention is possible through smoking cessation, avoidance of exposure to occupational and environmental carcinogens
- Breast Cancer: The frequency of breast cancer increases with time. Incidence has risen while mortality rates have decreased. Warning signs include formation of lumps, thickening, swelling, skin irritation, retraction of the nipple, nipple discharge, and tenderness.
    - Breast self-examination with advancing age can facilitate early diagnosis
    - Monitoring weight and enhanced physical activity can help
- Colon and Rectal Cancer: warning signs include bleeding from the rectum, blood in the stool, and changes in bowel habits. Diets high in fat and low in fiber increases risk. Spreads slowly so early detection coincides with good prognosis
    - Prevention strategies include increased physical activity, increased intake of fiber and water
- Prostate Cancer: Symptoms include weak or interrupted urine flow, frequent urination, pain during urination, blood in urine, and pain in the lower back or upper thighs
    - Early diagnosis and treatment improves survival and response to treatment
    - Advancing age, ethnicity, dietary intake of red meat and fat and family history of prostate or breast cancer is believed to increase the risk.
- Skin Cancer: squamous cell skin cancer and malignant melanomas can be caused by over exposure to the sun. Squamous cell skin cancer symptoms include changes in size or color of a

mole, oozing, bleeding, new bumps, itchiness, pain, and tenderness. Large moles increasing in size, shape, and pigment are indicative of a malignant melanoma
    - Exposure to UV radiations in excessive sunlight and tanning beds are believed to increase the risk.
- Testicular Cancer: first noticed as a painless enlargement of the testis. Self-identification is easy and should be done periodically by both young and old
    - Testicular cancer has been increasing in recent years and the risk factors are not definitively identified
- Ovarian Cancer: does not show signs until late in development and signs include enlargement of the abdomen or a feeling of bloating, and digestive disturbances. Risk increases with age with highest frequency in 60 years of age and over and in women that have had children suggesting that estrogen plays a risk factor.
    - The risk factors are not well identified although null parity and increased exposure to hormones (endogenous and exogenous) are believed to increase the risk
- Uterine/Cervical Cancer: usually occur in the endometrium in the body of the uterus and the base of the cervix. Can be detected by the Pap test.
    - Risk factors include smoking and STDs (herpes). Warning signs include bleeding outside of the normal period or persistent vaginal discharge
- Leukemia: cancer of the blood-forming tissue that leads to an increase in white blood cells which dwarf wild type blood cells leading to fatigue, paleness, weight loss, easy bruising, repeated infections, nosebleeds, and hemorrhage.
    - Abnormal white cells crowd out the normal white cells, red cells and the platelets and chronic leukemia develops over a period of time with few signs and symptoms and predominantly occurs in children
- Oral Cancer: develops in the oral cavity, usually the lips, inner cheeks, gums, and floor of the mouth. Linked to the use of tobacco products
    - Tobacco chewing and other oral assaults are believed to increase the risk of oral cancers

Infectious and Noninfectious Conditions

- **Infectious disease risk factors**
    - Heritable and non-heritable
    - Sexually transmitted infections
    - Acquired immune deficiency syndrome
- **Non-infectious disease risk factors**
    - Respiratory infections
    - Neurological disorders
    - Digestion related disorders
    - Musculoskeletal related disorders

Risk Factors for Disease

- The development of disease is facilitated by the presence of an agent (pathogen) causing the disease, availability of a susceptible host and a hospitable environment for the agent to reproduce and infect.

- Other factors that help the disease to progress can be divided into controllable and un-controllable risk factors
- Un-controllable risk factors include:
    - Heredity: being born into a family in which diseases are prevalent increases chances of contracting the same disease (sickle cell anemia)
    - Aging: after the age of 40 we become more susceptible to disease as a result of a weakened immune system
    - Environmental conditions: the presence of chemicals, pollutants, and waste leading to unsanitary conditions leads to a weakened immune system thus increasing the potential to contract a disease
- Controllable risk factors include: stress, nutrition, physical fitness, sleep, illegal substances, and behaviours influence our susceptibility to disease

Pathogens and routes of invasion

- Pathogens are **biological** agents that cause disease that may be transmitted by an infected person to a healthy individual through
    - Contact: Sexual relations, kissing, or by contacting an object containing residual pathogen deposited by the infected individual
    - Inhalation of air containing a pathogen
    - Ingesting food containing a pathogen
    - Animal borne pathogens may be contracted through animal bites and contact with their feces
    - Consumption of contaminated water (waterborne pathogens)
    - Autoinoculation – transmission of pathogen from one part of the body to another

Bacteria and bacterial pathogens

- Bacteria are single-celled organisms, these organisims or the toxins they produce cause the disease
- There are three types of bacteria: cocci, bacilli and spirilla and the some of the common infections they cause are:
    - Staphylococcus are commonly present on the human skin and in some cases staph infection causes acne, boils, styes, and infected wounds
    - Streptococcus infection leads to strep throat, scarlet fever, and rheumatic fever
    - Pneumonia characterized by chronic cough, chest pain, chills, high fever, and pulmonary edema that can eventually lead to respiratory failure. Usually contracted through *Streptococcus pneumoniae* but can be contracted by viral and fungal pathogens
    - *Legionella*: causes Legionnaire's disease which is similar to pneumonia but distinct because it's caused by *Legionella*
    - *Mycobacterium tuberculosis*: causes TB which is characterized by bacterial infiltration of the respiratory system that leads to coughing, weight loss, fever and spitting up blood. Can be spread by coughing and health care workers attending the afflicted are kept under tight monitoring

Virus

- Virus is a small pathogen consisting of a protein structure that contains either RNA or DNA
- It is incapable of carrying out normal cell function of respiration and metabolism and exists only in parasitic relationship with the cell it invades
- Viruses cause viral diseases that have incubation period
    - Some slow-acting viruses can remain dormant in a host for years (HIV)
- Human body in response to infection by some viruses produce interferon which help set up a protective mechanism to aid healthy cells from attack by virus

Viral Pathogens

- Common Cold: contracted through viral infection and are endemic in different parts of the world. There may be up to 100 different viruses that can lead to the common cold.
- Influenza: characterized by aches and pains, nausea, diarrhea, and fever and is detrimental to the very young and old. Three major forms (A, B, and C) and several strains of the influenza virus have been identified. There is little that can be done to treat influenza but vaccines help in preventing influenza.
- Mononucleosis also called mono is caused by Epstein-Barr virus and is characterized by sore throat, fever, headache, nausea, and lethargy. Symptoms of more severe cases include enlarged lymph nodes, jaundice, spleen enlargement, aching joints, and rashes
- Hepatitis is caused by viral inflammation of the liver and is characterized by fever, headache, nausea, loss of appetite, skin rashes, abdominal pain, and jaundice. Three viruses have been identified as causing the disease (Hep A, Hep B and Hep C). Therapy involves prescribing antibiotics and vaccinations are effective in preventing hepatitis
- Mumps: spread by airborne droplets and causes swelling of the salivary glands which leads to swelling of the jaws and necks. Caused by Mumps virus can lead to sterility in men. Vaccination is a good preventive measure.
- Shingles: caused by the *Herpes Varicella-Zoster* virus and leads to skin eruptions that itch, blister, and produce a clear fluid. Also causes fever and lethargy. Vaccination helps in preventing the disease.
- Measles (rubeola): caused by the *Morbillivirus* which leads to an itchy rash and high fever. This is one of the most infectious disease in humans and can be prevented by vaccination.
- Rubella (German measles): airborne transmitted and multiplies in the upper respiratory tract and latter passes into the blood stream. Causes a rash and may damage the fetus of pregnant women rendering the fetus blind, deaf, retarded, or with heart malformations after birth. Caused by Rubella virus.

Other pathogens

- Fungi: hundreds of species have been identified that can lead to infections. Candidiasis (vaginal yeast infection), athletes foot, ringworm and jock itch are common fungal infections.
- Protozoa: eukaryotic microorganisms that lack cell wall
    - Plasmodium is associated with tropical disease - malaria.

    - *Giardia Lamblia* a common waterborne protozoan disease causes Giardiasis also called beaver fever.
- Parasitic worms: largest pathogens and are usually more of a nuisance than a threat.
    - Pinworms and tapeworms infections in humans are reported.
- Rickettsia: bacteria like organisms spread by ticks, lice and fleas and multiplies in small blood vessels causing blockage and tissue death.
    - Causes Rocky Mountain Spotted Fever and Typhus in humans

Prion Diseases

- Prion proteins (PrP^c) naturally occur in several tissue types (cardiac and skeletal muscle, lymphoid tissue, testis, intestinal tract, uterus and leukocytes) but at elevated levels in the animal brain. It's function is a mystery to date and PrP^c KO mice do not display a distinct phenotype but are resistant to prion disease
- Characterized by fatal neurodegeneration that effects human and animals. The hallmark of prion disease is a partially protienase-resistant form of the cellular prion protein (PrP^{Sc})
- The term prion was devised by Stanley Prusiner and is the abbreviation of proteinaceous infectious particle
- They include bovine spongiform encephalopathy (BSE), feline spongiform encephalopathy (FSE), scrapie, chronic wasting disease (CWD), and Creutzfeldt-Jakob disease (CJD)
- To date they are incurable
- PrP^c is a normal glycosylphosphatidyl inositol anchored protein that is highly conserved among mamals
- The secondary structure PrP^c is mainly composed of a-helices whereas PrP^{Sc} is composed of b-sheets which contributes it's protease resistance
- *In vitro* studies display that PrP^{Sc} is capable of converting PrP^c into PrP^{Sc}
- The time from exposure to the onset of symptoms can be measured in decades in humans and take up to a year in mouse models

Defenses Against Infection

- Epidermis is layered to prevent the entrance of pathogens
- Enzymes found in secretions of the body such as sweat and are designed to destroy microorganisms on our skin
- Elevations in body temperature make our body unwelcoming for some microorganisms
- Mucous membranes in the respiratory tract engulf invading pathogens which are swept to areas of exit by cilia
- Secretions from the nose, eyes, and ears contain enzymes that are designed to destroy microorganisms
- Pathogens that pass these first lines of defense are dealt with by the immune system

The Immune System

- Immunity is the ability to resist a pathogens infection. Four classes of pathogens are recognized: viruses, bacteria, pathogenic fungi, and larger eukaryotes termed parasites
- An antigen is a substance that induces an immune response

- When invaded by a foreign substance the body develops antibodies against the foreign substance which recognize the antigen very specifically
- The site of antigen recognition by an antibody is called an epitope
- This mechanism is part of the humoral immune response system
- Adaptive Immune Response: production of antibodies against a particular pathogen and usually lasts the lifetime of an individual as an adaptation to infection with the same pathogen
- Adaptive immunity depends on lymphocytes which are white blood cells developed in bone marrow and the thymus and provide life-long immunity following the exposure to an antigen
- Two types of lymphocytes exist; B lymphocytes (B cells) and T lymphocytes (T cells)
- B cells mature in bone marrow and T cell migrate from bone marrow and mature in the thymus. Once mature they enter the blood stream
- Antigens and lymphocytes encounter each other in peripheral lymphoid tissues such as the lymph nodes, the spleen, and mucosal tissues
- Regulatory T-cells help direct the activities of the immune system and assist other B-cells.
- Helper B-cells activate B-cells, T-cells and macrophages
- Killer T-cells directly attack infected or malignant cells
- Suppressor T-cells suppress the activity of B-cells, killer T-cells and macrophages
- Memory T-cells and B-cells help to bookmark the infection for recurrence
- Lymph nodes are structures that collect extracellular fluid and return it to the blood. They are capable of trapping cells bearing antigens from sites of infection
- Here B cells encounter their antigen and undergo intense proliferation
- The spleen collects antigens from the blood
- Lymphoid tissue includes the tonsils and adenoids
- Lymph nodes, the spleen, and lymphoid tissue all share similar structure and each are involved in trapping antigen from sites of infection and presenting it to lymphocytes thus inducing the adaptive immune response
- Small T and B lymphocytes that have matured but not yet encountered their antigen are referred to as naive lymphocytes and circulate between the blood and the peripheral lymphoid tissues.
- In the presence of an infection, lymphocytes that recognize an infectious agent are arrested in the lymphoid tissue where they are stimulated to proliferate, secrete their specific antibody, and become effector cells which combat the infection
- A fraction of the proliferating lymphocytes differentiate into memory cells which are ready to respond rapidly if the same antigen is encountered later
- Effector B cells secrete antibodies and effector T cells are capable of directly destroying infected cells
- Antigens are accessible to antibodies only in the blood and extracellular spaces and under these circumstances, antibodies coat an antigen and are recognized and phogocytosed by macrophages
- In the case of cells infected with bacteria, parasites, and viruses, blood borne antibodies are incapable of contacting these antigens.

- T cells are responsible for eliminating infected cells
- This is collectively known as the adaptive immune response
- The innate immune response: phagocytic cells of the immune system recognize common antigens present on bacteria. They are engulfed by phagocytes and destroyed. Antibodies are not involved in this response.
- This is also known as cell-mediated immunity

Vaccination

- The deliberate introduction of a inactivated pathogen in order to stimulate an adaptive immune response
- A vaccine has to
    - Be safe
    - Provide protective immunity in a very high proportion of people that receive it
    - Provide long lived immunological memory
    - Be cheap in order to make administration to large populations feasible
    - Diphtheria, pertussis, tetanus, poliomyelities, haemophilus influenza, meningococcal C vaccines are given at 2 months
    - Diphtheria, pertussis, tetanus, poliomyelities, haemophilus influenza, meningococcal C vaccines are given at 4 months
    - Diphtheria, pertussis, tetanus, poliomyelities, haemophilus influenza, meningococcal C vaccines are given at 6 months
    - Measels, mumps, rubella, varicella and pneumococcal conjugate at 12 months
    - Booster doses are given at 18 months, 4-6 years, and 14-16 years

Sexually Transmitted Infections (STIs)

- To date, more than 20 types of STIs have been identified
- Initial symptoms may range from mild discomfort to annoying itching or discharge
- Left untreated, STIs can lead to sterility, blindness, CNS destruction, and death
- The most common modes of STI transmission include vaginal and anal intercourse, oral-genital contact, and hand-genital contact
- STIs thrive in dark moist places and the majority are susceptible to light, excess heat, cold, dryness, and exposure to air
- Condoms and dental dams are effective in reducing the transmission of STIs
    - Decide in advance not to have sex without a condom
    - Never reuse condoms
    - Use a condom properly and never use one if brittle or sticky
    - Apply water based lubricant with spermicide for additional protection
    - Hold condom in place during withdrawal to make sure it does not come off
- _____: *Chlamydia trachomatis* can only live and grow inside other cells and is resistant to penicillin
    - Early symptoms include painful urination and penile discharge in men and yellowish discharge in women

    - Secondary damage resulting from Chlamydia include damage to the prostate gland, arthritis like symptoms, and heart damage in men and inflammation that damages the cervix and fallopian tubes leading to sterility in women
- _____: caused by *Neisseria gonorrhoeae* and infects the urethra, genital tract, pharynx, and rectum
    - Symptoms include a white discharge from the penis which is accompanied by painful urination in males and can lead to sterility in females. The symptoms are asymptomatic in females and infection can persist in cervix, vagina, uterus and fallopian tubes.
- Syphilis: caused by *Treponema pallidum.* The bacteria dies quickly upon exposure to air, dryness, and cold and is generally only transferred through sexual contact but can enter the body through a break in the skin or through other bodily fluid transmissions
    - Primary syphilis: characterized by a chancre full of pathogenic bacteria located at the site of the initial infection. Usually the penis for men but when contracted through oral sex can be found in mouth and throat. For women, the chancre is usually located on the vaginal wall or cervix. This chancre disappears in three to six weeks
    - Secondary syphilis: may occur a month to a year following the disappearance of the chancre and include symptoms including rashes, hair loss, enlarged lymph nodes, fever, headaches, and genital sores. These sores will contain pathogenic bacteria which can spread the disease
- Bacterial spirochetes begin to invade body organs after the secondary stage with rarely showing any signs and symptoms
- _____: also termed "crabs" are parasites that thrive in dark, moist regions of our body and are usually transmitted sexually but can be contracted by laying on sheets or from sitting a toilet seat used by an infected individual. More of a nuisance than anything
- _____: caused by the fungi *Candida albicans* which normally inhabits the vaginal tract of most women but under certain conditions can multiply abnormally. Symptoms include vaginal itching, white discharge, vaginal swelling, and a burning sensation which collectively are called vaginitis. This infection is transmissible to and is easily transmitted between sexual partners
- Venereal Warts also known as genital warts are caused by a group of viruses known as human papilloma virus (HPVs) when the virus penetrates the skin or mucous membrane of the genitals.
- The incubation period is from six to eight weeks and many people have no apparent symptoms of infection, while others may develop a series of itchy bumps on the genitals which range from small to noticeable ones
- Many venereal warts will disappear on their own but the infection can persist and in females lead to cancerous legions and to cancer of the uterus or cervix.
- Herpes: a general term for a family of diseases characterized by sores or eruptions on the skin.
- Herpes Simplex Virus Type 1 (HSV-1): causes cold sores that most people are familiar with. Relapse of HSV-1 are common which is caused by unknown cues
- HSV-2 (genital herpes): Initial symptoms include a burning at the primary site of infection followed by watery blisters full of the virus. Rupture of these blisters can lead to autoinoculation of other body parts; notably the eyes where this virus can lead to blindness. These blisters are also the source of transmission to others. These blisters will disappear and the virus will remain dormant in the body until an opportunistic time to become virulent.

- Genital herpes in pregnant women can cause infection of the baby as it passes through the vagina during birth
- There are currently no drug treatments that cure HSV-2 but can be controlled during the blistering phase

AIDS

- Acquired Immune Deficiency Syndrome (AIDS): caused by infection with the human immunodeficiency virus (HIV) and is a world wide epidemic. HIV enters an individual *via* contact with an infected persons bodily fluids (semen, vaginal fluids, blood) or from HIV infected needles among intraveous drug users.
- HIV rapidly proliferates following the initial infection and the body begins to produce antibodies against it
- AIDS was first suspected of being a disease after reports of opportunistic infections that are usually defended against by the immune system
- HIV is an RNA retrovirus and inserts its genome into the hosts. The target of HIV is T cells (not exclusively) thus immune functions are compromised in those infected with HIV and are unable to battle infections that eventually lead to the patient's demise
- The most effective drugs for treating HIV target reverse transcriptase

Non-infectious diseases

- Non-infectious diseases may not be caused by a pathogen and may not be killer diseases but certainly they gain prominence due to their ability to cause harm and injury
- Lifestyle, dietary habits and environmental pollution are some of the major factors responsible for these diseases
- Education, reasonable changes in lifestyle, behaviours and public health campaign could help prevent and keep the disease under control
- Diseases under consideration include:
    - Respiratory diseases
    - Neurological disorders
    - Digestion related disorders
    - Musculoskeletal disorders

Respiratory Disorders

- Allergic Response: an allergen or antigen induces the production of antibodies specific to the allergen but the body sometimes overreacts by developing an elaborate mechanism against relatively harmless allergens. Common allergens include moulds, animal dander, pollen, ragweed, and dust
- Upon the production of antibodies against an allergen the body triggers the release of histamines which dilate blood vessels, increase mucous secretions, and tissue swelling
- Hay fever: is characterized by sneezing and itchy watery eyes and nose. The common causes of hay fever includes pet dander, dust, pollen and other substances
- Asthma: characterized by wheezing, difficulty in breathing, shortness of breath, and coughing spasms

- Asthma Attack: constriction of the bronchioles which can be triggered by common allergens, anxiety, and stress
- Pollen, dust, animal dander and environmental pollution may trigger asthma attack in the young and the old
- Emphysema: gradual destruction of the alveoli making breathing difficult. Its cause is uncertain but there is a relationship between long-term smoking and air pollution
- Chronic Bronchitis: inflammation of the bronchioles leading to respiratory impairment. Chronic in long-term smokers

Neurological disorders

- Headaches not all headaches are the same and have the same cause. They are primarily caused by dilated blood vessels in the brain from underlying problems and excessive stress and anxiety
    - Tension headaches are caused by muscle contraction or tension in the neck and head
    - Migraine headaches are characterized by pulsating pain on one side of the head in combination with dizzy spells, nausea and intolerance for light and noise
    - Secondary headaches are caused because of an underlying condition which include hypertension, allergies, low blood sugar, common cold, etc. can trigger secondary headaches
    - Seizure disorders are generally caused by abnormal electrical activity in the brain and are characterized by loss of control of muscular activity and unconsciousness

Digestion related disorders

- Diabetes – two million Canadians have diabetes with approximately 10% of the cases with type I diabetes and 90% type II diabetes
    - What causes diabetes is not known but it is associated with insulin production and diabetic people are hyperglycemic
    - Type I diabetes (insulin dependent) usually begins early in life and type II diabetes (non-insulin dependent) begin later in life
    - Type II diabetes can be controlled by weight management and physical activity
- Colitis and Irritable Bowel Syndrome(IBS)
    - Ulcerative colitis occurs in the large intestines when the mucous membranes of the intestinal walls become inflamed. It produces severe stomach cramps, weight loss, nausea, sweating and fever
    - Irritable bowel syndrome causes nausea, pain, gas, diarrhea and cramps after eating certain foods or when the person is under stress
- Peptic ulcer is a chronic ulcer that occurs in the lining of the stomach or the section of the small intestine known as the duodenum
- It is believed to be caused from the infection of *Helicobacter Pylori* and require antibiotics for treatment
- Peptic ulcers run in families and chronic stress, fatty foods and chronic alcoholism are believed to be the risk factors

Musculoskeletal diseases

- Arthritis is a common problem in Canada with more than four million sufferers. Two common forms of arthritis are osteoarthritis and rheumatoid arthritis
    - Osteoarthritis is progressive deterioration of bones and joints associated with aging. It is expected that approximately 85% of Canadians will be affected by osteoarthritis by the age of 70 years.
    - Age and previous injury are precipitating factors but heredity is also a factor. Pain relievers and mild physical activity help to alleviate arthritic pain
    - Rheumatoid arthritis is an inflammatory joint disease that can occur at any age and most commonly between the ages of 20 and 45 years. This disease affects the synovial membrane which helps to lubricate the joints
    - Treatment regime involves pain relief and sometime immunosuppresant drugs
- Low back pain is experienced by about 80% of the Canadians at some point in life. This is the most common problem in the Canadian workforce
- Risk factors of low back pain include:
    - Advancing age
    - Body type
    - Poor posture
    - Poor muscular strength and endurance
    - Psychological factors
    - Occupational risks
    - Stress

Non-infectious diseases in Canada

- Research on non-infectious diseases and seasons in Canada and report on the diseases, causal agents and preventive and therapeutic interventions.
- What are occupational diseases?
- What are the potential health problems associated with Tar Sands
- What are the potential health problems associated with climate change from global warming
- Discuss your risk to chronic diseases as you age.

Chapter 12

Health

- WHO definition of health
    - Health is a state of complete physical, mental and social wellbeing and not merely absence of disease, illness or infirmity
- Health in Canada

- Individual responsibility
- Community responsibility
- Medicare availability
- Employer facilitation

Health care in Canada is publicly funded and privately delivered
It is an insurance policy between the Federal Government, Provinces and the individual

Health Indicators:

1. Health status of residents (wellbeing and health condition)
2. Non-medical determinants of health (factors outside of the health system)
3. Health system performance (health services)
4. Community and health system characteristics (contextual information

Health care spending in Canada in 2008

- Expected to be $171.9 billion @ $5,170 per Canadian
  - US $6,714; Norway $4,520; Switzerland $4,311, Luxembourg $4,303 compared to Canada $3,678 in 2006
- Expected increase of $10.3 billion over 2007; a growth rate of 6.4%
  - 10.7% of GDP in 2008
  - 10.6% of GDP in 2007 and
  - 10.0% of GDP in 2002
- Hospitals account for 28% ($48.1 billion) of the total spending;
  - 17.4% ($29.8 billion) on drugs (prescribed and non-prescribed)
  - 13.4% ($23 billion) for physicians
- Public sector spending is expected to be $120.3 billion (70% of the total spending)
- Provincial spending: BC $5,093; Alberta $5,730; Manitoba $5,555
- In 2006 the spending on infants was $7,891; seniors $9,967 and adults $1,832

Universal Pharmacare

- Drug costs have increased at an average of 10.5 per cent a year since 1985
- Creating a national pharmacare program could slash more than $10.7-billion off Canada's $25-billion-a-year drug bill
- consumers would be better served by a national drug pricing and purchasing system and drug policies aimed at improving access and affordability rather than the current approach where the desire to attract investment in the pharmaceutical sector inflates prices
- As many as eight million Canadians do not have adequate coverage for prescription drugs

Canadian Health Care System

- Canada's health care system has been a work in progress since its inception. Reforms have been made over the past four decades and will continue in response to changes within medicine and throughout society.

- The basics, however, remain the same - *universal coverage for medically necessary health care services provided on the basis of need, rather than the ability to pay*.
- Canada's publicly funded health care system is best described as an interlocking set of ten provincial and three territorial *health insurance plans*.
- Known to Canadians as "medicare", *the system provides access to universal, comprehensive coverage for medically necessary hospital and physician services*.

Canada Health Act (CHA)

- The *Canada Health Act* is Canada's federal health insurance legislation.
- The *Canada Health Act* establishes the criteria and conditions related to insured health care services-the national standards-that the provinces and territories must meet in order to receive the full federal cash transfer contribution under the transfer mechanism, that is, the Canada Health and Social Transfer (CHST).
- The aim of Canada's health care system is *to ensure that all residents of Canada have reasonable access to medically necessary insured services without direct charges*.
- The Canada Health Act, unanimously passed by the Parliament in 1984, aims to ensure that all legitimate residents of Canada have *access to necessary hospital and physician services on a prepaid basis*
- The Canadian health care system evolved into its present form over five decades.
- Saskatchewan, in 1947, was the first province to establish public, universal hospital insurance, and 10 years later, the Government of Canada passed legislation to share in the cost of these services.
- The Canada Health Act replaces
    - the *Hospital Insurance and Diagnostic Services Act* (1957) and
    - the *Medical Care Act* (1968).

Canada Health Act

- **A brief history of Canadian medicare**
- The primary objective of the Canadian Health Care Policy as identified by the Canada Health Act is:
        - *".. to protect, promote and restore the physical and mental well-being of the residents of Canada and to facilitate reasonable access to health services without financial or other barriers"*

Principles of the Canada Health Act

1. Public administration – the administration of the health care insurance plan must be carried out on a non-profit basis by a public authority in the provinces and territories
2. Comprehensiveness – all medically necessary services provided by hospitals and doctors must be insured
3. Universality – all insured persons in the province and territory must be entitled to public health insurance coverage on uniform terms and conditions
4. Portability – coverage for insured services must be maintained when the insured person moves or travels within Canada or travels outside the country

5. Accessibility – reasonable access by insured persons to medically necessary hospital and physician services must be unimpeded by financial or other barriers

- The Canada Health Act bans extra-billing and user charges:
    - No extra-billing by medical practitioners or dentists for insured services under the terms of the health care insurance plan of the province or territory
    - No user charges for insured health services by hospitals or other providers under the terms of the health care insurance plan of the province or territory

Canada Health Act implementation

- The Canada Health Act requires the provinces and territories to plan and implement a provincial or territorial insurance plan which will be publicly funded
- The Canada Health Act also required the provinces and territories to submit the Canada Health Act Annual Reports to the Parliament.
    - The Canada Health Act Annual Report provides information to the Parliament on the operation of the health care insurance plan as it relates to the Act and how the plan has met the criteria and conditions for payment under the Canada Health Act

Federal, provincial and territorial collaboration in health care delivery

- Canada's federal, provincial, and territorial governments collaborate on various health care policy and programming issues.
    - The key vehicle for strengthening partnership and collaboration is the annual Conference of Ministers of Health
    - Canada's ministers of Health discuss a broad range of issues. Ministers of Health and
    - Conference of Deputy Ministers of Health which holds regular conferences and meetings.
- In addition, four advisory committees comprised of senior officials discuss health care issues on an ongoing basis and provide advice directly to deputy ministers. These committees are the:
    - Advisory Committee on Governance and Accountability
    - Advisory Committee on Health Delivery and Human Resources
    - Advisory Committee on Information and Emerging Technologies, and
    - Advisory Committee on Population Health and Health Security

Federal role in health care delivery

- The Federal government is responsible for:
    - setting and administering national principles for the health care system through the *Canada Health Act*;
    - assisting in the financing of provincial/territorial health care services through fiscal transfers;
    - delivering health care services to specific groups (e.g. First Nations and Inuit and veterans), and
    - Providing other health-related functions such as public health and health protection programs and health research.

Provincial, territorial role in health care delivery

- The administration and delivery of health care services is the responsibility of each province or territory, guided by the provisions of the Canada Health Act.
    - The provinces and territories fund these services with assistance from the federal government in the form of fiscal transfers.
- Health care services include insured primary health care (such as the services of physicians and other health professionals) and care in hospitals
    - These costs account for the majority of provincial and territorial health expenditures.
- The provinces and territories also provide some groups with supplementary health benefits not covered by the Act, such as prescription drug coverage.
    - The level and scope of coverage for supplementary benefits varies between jurisdictions.
- Provincial/Territorial Health Insurance Card Links
- Provincial/Territorial Ministries of Health

Individual responsibilities

- Participate in the provincial plan
- Participate in the employer plans or buy additional insurance for supplementary services
- Using the health care services responsibly
    - Financial prudence
    - Needs of others
- Participate in health promotion and disease prevention programs or strategies
- Promoting health and wellness

History of the Canada Health Act

- The present Canadian Health care system has evolved into its present form over a period of four and a half decades
- The following mile-stones have been observed during the journey:
    - Saskatchewan, in 1947, was the first province to establish public universal hospital insurance
    - In 1957, the government of Canada passed legislation (the Hospital Insurance and Diagnostic Services Act) to allow federal government to share in the cost of provincial hospital insurance plan
    - By 1961, all 10 provinces and the two territories had public insurance plan that provided comprehensive coverage for all in-hospital care
    - In 1962, Saskatchewan again pioneered in providing insurance for physicians' services outside hospitals
    - In 1966 the Medical Care Act was passed by the federal government and implemented in 1968, providing national insurance for physician services and
        - by 1972, all provinces and territories had incorporated physicians' services in their insurance plan on a cost sharing basis with the federal government
    - Prior to 1977, federal/provincial cost sharing was 50-50, with the federal government matching every dollar the provinces spent on approved services

    - In 1977, a system of cash grants from the federal to the provincial governments replaced the old system.
- The cash transfer, referred to as the Established Programs Financing (EPF) Act, was based on a formula that included population size, gross national product, and the transfer of specific taxing powers to the provinces
- For the first time federal dollars were also provided for long-term care through the Extended Health Care Services resulting in the development of provincial long-term care facilities and home care programs
- The Established Programs Financing (EPF) Act reduced the federal government's contribution and increased the provincial government's expenditure on health care
- Some of the provinces introduced extra billing and hospital user fees to meet the costs
    - Concern was raised about 'reasonable access' of health care to all the residents
- In 1979, Justice Emmett Hall reviewed the health services and
    - reported that the Canadian health care system ranked among the best in the world
    - However, he also warned that extra-billing by doctors and user fees by hospitals was creating a two-tiered system that threatened the accessibility of health care
- In response to this report, in 1984, the Parliament passed the Canada Health Act to discourage extra-billing by physicians and user fees by hospitals
- In 1986, the block funding legislation (addressing the federal government's cash grants to the provinces) was amended to further reduce the rate of growth of federal contributions
- Additional reductions were announced by the federal government in 1989, 1990 and 1996
- These trends diluted the power of the federal government to prevent the provinces from charging user fees or extra billing
- Then in 1999, the federal government again began the transfer of federal dollars to the provinces for health care after the provincial governments had indicated that they could not sustain the health care costs

Types of services under the Canada Health Act

There are two types of services described within the Canada Health Act:

1. Insured health care services are medically necessary hospital, physician and surgical-dental services provided to insured persons

    - Insured hospital services defined under the Canada Health Act include medically necessary in- and out-patient services such as:
        - Standard or public ward accommodation
        - Nursing services
        - Diagnostic procedures such as blood tests and x-rays
        - Drugs administered in hospital
        - Use of operating rooms, case rooms and anaesthetic services
    - Insured physician services are defined as those medically required and rendered by medical practitioners. The nature of these services are determined by physicians in conjunction with their provincial and territorial insurance plans
    - Insured surgical-dental services provided by a dentist in a hospital, where a hospital setting is required to properly perform the procedure

2. Extended health care services are defined by the Canada Health Act, are certain aspects of long-term residential care (nursing home, intermediate care and adult residential care services) and the health aspect of home care and ambulatory care services

Eligibility under the Canada Health Act

- The following persons are eligible to seek services under the Canada Health Act
    - Insured persons are eligible residents of a province or a territory
    - A resident is defined in the Canada Health Act as:
    - "*.. is a person lawfully entitled to be or to remain*
    - *in Canada, who makes his home and is ordinarily*
    - *present in the province, but does not include a*
    - *tourist, a transient or a visitor to the province*"
    - Persons excluded under the Canada Health Act include members of the Canadian Forces or the Royal Canadian Mounted Police, inmates of federal penitentiaries, First Nations People and members of the Parliament

Requirements under the Canada Health Act

- The Canada Health Act requires the provinces and territories to comply with the nine requirements in order to qualify for the full federal cash contribution:
    - Five program criteria (5) that apply to insured health care services
    - Two conditions (2) that apply to insured health care services and extended health care services
    - Extra-billing (1) that apply to insured health care services
    - User charges (1) that apply to insured health care services

Canada Health Act administration

- Section 22 of the Canada Health Act enables the federal government to make regulations for the administration of the act in the following areas:
    - Prescribing which services to include in the CHA definition of "extended health care services"
    - Prescribing which services to exclude from hospital services
    - Prescribing the types of information that the federal Minister of Health may reasonably require from a province or territory to qualify for a full federal transfer
    - Prescribing how provinces and territories are required to give recognition to the Canada Health and Social Transfers in their documents, advertising or promotional materials

Health care services outside the Act

- Canada Health Act requires that insured health services be provided to insured persons in a manner that is consistent with the criteria and conditions set in the Act
- There are two categories of exclusions for insured services:
    - Services that fall outside the definition of insured health care services
    - Certain services and groups of persons are excluded from the definition of insured services and insured persons

- Non-insured health care services:
    - Non-insured health care services are those services and programs offered by provinces and territories that are outside the scope of the Canada Health Act
    - These services are discretionary and may vary from province to province and include pharmacare, ambulance services, optometric services and dental services
    - These services may be partially, fully or not covered by provincial and territorial health insurance plans
    - Uninsured hospital services for which the patient may be charged include preferred hospital accommodation, private duty nursing services and the provision of telephones and televisions
- Uninsured physician services for which the patient may be charged include telephone advice, provision of medical certificates required for work, school, insurance purposes and fitness clubs
- Non-insured persons – the definition of the Canada Health Act excludes:
    - Members of the Canadian Forces
    - Persons appointed to a position of rank within the Royal Canadian Mounted Police
    - Persons serving a term of imprisonment with federal penitentiary
    - Persons who have not completed a minimum period of residence in a province or territory
    - Person identified under any other Act of the Parliament

How does the health care system work?

- Physicians are usually the initial contact with the formal health care system and they arrange for access to most specialists, hospital admissions, diagnostic testing and prescription drug therapy.
- Canada's health care system relies extensively on primary care physicians (general practitioners) who account for about 51% of all practicing physicians in Canada.
- Most doctors are private practitioners who work in independent or group practices while some work in community health centres, hospital-based group practices or work in affiliation with hospital out-patient departments.
- Private practitioners are generally paid on a fee-for-service basis and submit their service claims directly to the provincial/territorial health insurance plan for payment.

Access to the health care system

- When Canadians need medical care, in most instances they go to their family practitioner or local clinic and present the health insurance card issued to all eligible residents of their province/territory.
    - Canadians do not pay directly for insured services, nor are they required to fill out forms for these services.
    - There are no deductibles, co-payments or dollar limits on coverage for insured services.
- In addition to insured hospital and physician services, provinces and territories also provide public coverage for other health services that remain outside the national health insurance framework.
    - These supplementary health benefits often include prescription drugs, vision care, medical equipment and appliances such as wheelchairs for certain groups such as seniors, the disabled and welfare recipients.

- Supplementary services such as cosmetic surgery are largely privately-financed and Canadians must pay privately for these non-insured benefits.
- Under most provincial laws, private insurers are restricted from offering coverage which duplicates that of the governmental programs, but they can compete in the supplementary benefits market.

The Canada Health Act and Minister of Health

- The Canadian health care system (Medicare) has evolved into a medical care system focused on physician care provided largely in acute care hospitals
- Medicare committed funds to *sick care*, rather than to *health care*
- Physicians controlled approximately 80% of health care costs, even though only 19% of the total health care expenditure was going directly to physicians
- Physicians also largely controlled hospital utilization, prescribing of drugs, and ordering of laboratory tests
- The system is *provider-driven*, rather than *user- or patient-driven*
- The physician centred system shows an acceptance of a medical model of health and illness and identifies health with medicine and implies that the extension and expansion of medical services will be accompanied by better health and also accompanied by rising health care costs
- The Epp letter, written by the Minster of Health, Jake Epp in June 1985, clarifies the criteria, conditions and regulatory provisions of the CHA.
    - These clarifications have been used by the federal government in the assessment and interpretation of compliance with the CHA
- The Marleau letter, written by the Minister of Health, Diane Marleau in Jan 1995, defines the new federal policy on private clinics.
    - The letter provides the federal government interpretation of the CHA as it relates to the issue of fees charged directly to patients receiving medically necessary services at private clinics.
    - According to this letter if the provincial or territorial insurance plans allowed private clinics, the federal government will penalize the province or territories
- The McLellan letter, written by the Minister of Health Anne McLellan in April 2002, outlines a dispute avoidance and resolution process as it will apply to the interpretation of the principles of the Canada Health Act
- The current picture
    - Federal government's reluctance
    - Provincial government's woes
    - Health care needs of the population
- What is the future of Medicare?
    - Sustain it with increased funding
    - Change it and allow tiers
    - Replace it

The Anderson-Newman Model of Health Care Utilization

Predisposing factors	**Enabling factors**	**Need factors**
Demographic factors	**Family factors**	**Health factors**
- Age - Sex - Marital status	- Income - Source of support	- Perceived health - Disability - Chronic conditions
Social structure factors	**Community factors**	**Evaluated symp & diag**
- Education - Race - Occupation - Religion	- Availability of services - Price of services	- Diseases - Dizziness, shortness - Tiredness
Beliefs		
- Health and illness values - Views about the efficacy of health care services		

Canadian Health Care System

- ✓ Canadian health care system is publicly funded and privately delivered in ten provinces and three territories and the plan is known as Medicare
- ✓ The system provides access to universal, comprehensive coverage for medically necessary hospital, inpatient or outpatient physician services
- ✓ The system is referred to as a national health insurance policy which links all the provinces and territories
- Public sector funding amounts to 68% of the total healthcare expenditure while the remaining 32% is financed via supplementary insurance, employer-sponsored benefits or directly out of pocket payments

The funding structure of the Health System in Canada (Slide 50)

- Population aging has contributed somewhat to this increase, but the cost increase is mainly due to increased access to health care, technological advances, and limited incentives to control costs.
- The *proportion* of the budget allocated to various expenditures; even though the total spent on hospitals is rising, the amount spent on prescription drugs is increasing more, so that the proportion of the budget spent on hospitals is declining.
- Health care utilization can change as a result of supply and demand. Both have increased faster in rich countries than in poor for a number of reasons. In terms of supply, governments in wealthy countries have higher incomes with which to pay for services, and technical innovations create a wider range of services.

Health care services and usage

- **Safeguarding the health of Canadians**
- Health Canada collaborates internationally and with its provincial and territorial counterparts to protect the health of Canadians against current and emerging health threats.
- Through its Health Intelligence Network, the Department works with other levels of government and the health care system in the surveillance, prevention, control and research of disease outbreaks across Canada and around the world.
- It also monitors health and safety risks related to the sale and use of drugs, food, chemicals, pesticides, medical devices and certain consumer products.
- In addition, Health Canada negotiates agreements regarding hazardous materials in the workplace, performs medical assessments for pilots and air traffic controllers and conducts environmental health assessments.

Methods to reduce health care costs

Approaches	Examples	Issues raised
Copayments or user fees	Financial incentives for patients to reduce their use	As poverty is a major determinant of health, c fees ensure that those most in need have leas patients delay consultation in the hope of avo could increase subsequent costs. Moreover, u reduce use of services or health care costs ov

Limit resources	Day surgery and ambulatory treatment, both popular with patients, only became common with the closure of hospital beds	Forces efficiencies and innovative methods. Politically difficult. Can increase pressures on other parts of the s unintended consequences. Closure of acute hospital beds increases press home care, and long stay care; more intensive stresses staff and increases cost per bed, thus great as predicted. Wait-lists for non-urgent procedures may exp more expensive care if the condition deterior
Use gate-keepers	Access to secondary care only through primary care.	Generally reduces waste by ensuring that the provider is consulted and by allowing the prim coordination and case management role.

Improve efficiency

Approaches	Examples	Issues raised
Use professionals' skills appropriately	For instance, use nurse practitioners for prevention and routine follow-up, physicians for complex diagnostic and treatment problems.	Some claim that non-physician care is seen as second r people are satisfied with it when it is appropriate. When the tasks of each person are clear and accepted, satisfaction is likely to be improved.
Improve practice	Educate and support patients in self-management of chronic conditions.	Can reduce hospital admissions and emergency room v Current thinking holds that improvement in patient aut health.
	Improve management of chronic conditions.	Timely and appropriate interventions to control the co impact on function, thus reducing need for services

	Use of evidence-based guidelines for optimal management.	Observations on wide variations in practice with little a need suggest that over-treatment could be reduced by However, guidelines also vary and are hard to impose. also be respected.
	Reduce medical error.	Medical error is an important preventable cause of mo system a great deal of time, money, and resources. Sys medical error reduction and quality assurance are effe of care, morbidity associated with error, and reducing

Improve support systems

Approaches	Examples	Issues raised
Information systems	Electronic medical records, portable databases, digital imagery available via a secure network, provision of information on drug costs, etc.	Contribute to reducing duplication of tests, overn interactions, and coordination of care, applicatio generation of data for evaluation of practice. Systems have to be designed with the users and t In certain situations a cheap paper system may b expensive electronic one.
Administrative systems	Call-recall systems for preventive and follow up care.	Improve the uptake of care but there is some con systems may generate unnecessary interventions Running costs should not outweigh advantages o
Financial systems	Make sure that remuneration systems rewards high quality, efficient care.	All remuneration systems have advantages and d 12.6)

When should you seek medical help

- A serious accident or injury
- Any conditions or symptoms that are unusual overtime:
    - Unusual bowel movements
    - A lump in any part of the body
    - Any unexplained pain
    - Fever that is recurrent
    - Sudden weight loss, fatigue and tiredness
    - Shortness of breath and pain while breathing
    - Signs that suggest pregnancy
    - Any sustained deviation from normal health

Choices in medical care

1. Allopathic medicine or traditional western medicinal practices, in theory based on scientifically validated methods and procedures

    - Only about 20-40% of all allopathic treatments have been proven clinically efficacious in scientific trials
    - Primary care practitioner, who provides treatment fro routine ailments, advice on preventive care, gives general medical advice and makes appropriate referrals, is the first (primary) provider of allopathic medicine
    - Medical specialist, is the secondary care provider of allopathic medicine and includes professionals like surgeons, paediatricians, internal medicine specialists, oncologists, etc.
    - Allied health professionals (nurses, physiotherapists, occupational therapists) also provide advice and assist patients in a variety of health related jobs at both primary and the secondary level. Nurses are highly trained and strictly regulated health practitioners who provide a wide range of services for patients and their families:
        - Patient education
        - Counselling
        - Community health
        - Disease prevention
        - Administration of medication
        - Nurse practitioners have training and authority to conduct diagnostic tests and prescribe medications

2. Non-allopathic medicine is non-traditional and is a medical alternative to traditional; this medicine is also referred to as alternative medicine or complementary medicine

        - There are a variety of approaches in non-allopathic medicine and non-allopathic medicine is non-regulated medicine in the western world
        - Some of the approaches in non-allopathic medicine are very old methods and had been used in countries like China, India and Egypt thousands of years ago
        - Many of the people use non-allopathic approaches as their first choice, however, others use non-allopathic approaches only if their allopathic medicine has failed

Non-allopathic medicine practitioners

1. Chiropractic medicine has been practised for over 100 years
    - It is based on the idea that life giving energy flows through the spine via the nervous system
    - Chiropractors use a variety of techniques to manipulate the spine back into proper alignment so that the life giving energy can flow unimpeded through the nervous system
2. Acupuncture is an ancient (over 2000 years old) Chinese art of inserting fine needles at points on the skin that fall along 14 major meridians or pathways of energy (called qi) that flow through the body.
    - These points and meridians are thought to be associated with particular internal organs and bodily functions
    - Proponents believe that the yin and the yang are restored to equilibrium when these points are stimulated
3. Herbal and homeopathic medicine
    - Herbalists practise herbal medicine, which involves using the medicinal qualities of plants or herbs
    - Homeopaths also use herbal medicine as well as minerals and chemicals
    - The basis of their practise is the theory that the administration of extremely diluted doses of potent natural agents that produce disease symptoms in healthy persons will cure the disease in the sick
4. Naturopathy
    - Naturopaths believe that illness results from violations of natural principles of life in modern society
    - Naturopathic treatment uses substances and forces found in nature: water, magnets, gravity, heat, crystals and minerals, herbs and even sun
5. Reflexology (zone therapy)
6. Iridology (light therapy)
7. Aromatherapy (scented candles and oils)
8. Aura-massage therapy (massage using scented oils)
9. Traditional healing practise
    - Folk healing may include beliefs in special healers, prayers and religious practices

Canada's health care system and care providers

- Canada's healthcare system is dominated by traditional western medicine and supported by a large cadre of other health care workers

- Physicians not only have autonomy and control over their work; their medical perspectives are largely accepted as correct
- In addition to the physicians and other workers directly involved with Medicare, there is a range of health care workers who are not part of Medicare:
    - Chiropractors and massage therapists
    - Other health care practitioners (homeopaths, irridologists, etc)
    - Folk healers (traditional healers)

Types of medical practises

- Solo practitioners are medical providers who practise independently of other practitioners
- Group practise is where physicians share their offices, equipment, utility bills and staff costs
- Hospitals and clinics provide a range of health care services which include emergency treatment, diagnostic tests and inpatient and outpatient (ambulatory) care
- Hospitals could be classified as:
    - Profit status (non-profit or for-profit)
    - Ownership (private or public)
    - Specialty (children's', chronic care, psychiatric)

Types of hospitals

- Non-profit (voluntary) hospitals have traditionally been run by religious or other humanitarian groups
- In recent years non-profit hospitals have been run by the government using the provincial insurance plan with taxpayers money under the Health Care System Plan
- For-profit hospitals are few in Canada, but their number is on the rise
- Outpatient (ambulatory) care – treatment that dose not involve an overnight stay in hospital.
    - Many these types of centres are designated as trauma centers and provide first hand specialized treatment round the clock
    - Others are designated as surgicentres, where low risk procedures such as vasectomies, tubal ligation, cosmetic surgery, abortions, etc. are performed

Health care system in Canada

- The Canadian Health care system is based on shared values of equity, fairness, compassion, respect and dignity for all
- The system is now in the midst of a fundamental structuring of health services, health education and social welfare programs through the social union
- The social union framework agreement was signed on February 4, 1999
- It describes a new partnership between governments to strengthen Canada's health care system, eliminate barriers to mobility for Canadians and involve Canadians in the development of social program

Emerging issues in health care

- In 1990, the federal government cut its health care transfer payments to the provinces in stages from 50-50 share to 15-85 share as part of its deficit reduction strategy

- In recent years certain trends have emerged to save costs
    - Shift from centralized governing bodies to regional health authorities
    - A growing shift in emphasis from institutionally focussed care to community-based care
    - Decision making based on need and the best available evidence
    - Funding of health services at sustainable levels

Issues with the health care system in Canada

- Several levels of governments are involved
- Federal government provides services for special groups such as the First Nations people, war veterans, prisoners, etc.
- Limits imposed by federal and local governments has led to downsizing and restructuring of services provided to the residents
    - Provincial governments have been pushing for user fee or user charges in health care
    - Introduction of a two-tier health care system
- Physicians and provincial governments have been in conflict over funding and provision of services

Neglected aspects of the healthcare system

1. Home care

    - Canada's healthcare system is medicalized and institutionalized and focuses on acute, rather than long-term care
    - Community based programs and alternative, non-medical forms of care are neglected in the system
    - Long term or chronic care is also neglected
    - Health care reforms call for an expansion of home care as a type of health care that will be less expensive than the medical care delivered in hospitals
    - Despite growing awareness of the importance of community services, there is no comprehensive coverage for non-hospital, non-physician related services
    - Such services could meet the needs of the chronically ill and provide post-hospital acute care, thereby allowing earlier discharges from hospitals

2. Health maintenance and promotion

    - Because the healthcare system is focused on curing acute illnesses after they occur, there is little recognition of meaningful health promotion or prevention within the system
    - Health promotion involves promoting positive health behaviour and appropriate coping strategy; it also involves the development of a physical and social environment conducive to health
    - The purpose of health promotion is to enable people to gain greater control over the determinants of their own health
    - Health promotion involves the empowerment of individuals, and the process of enabling them to take action to control and enhance their own lives

Healthcare reform

- Characteristics of health care reform
    1. Broadening the definition of health to include social and psychological aspects
    2. Shifting the emphasis from curing illness to promoting health and preventing diseases
    3. Switching the focus to community-based care rather than institutional-based care
    4. Providing more opportunities for individuals to participate with service providers in making decisions on health choices and policies
    5. Improved human resources planning with particular emphasis on alternative methods for remuneration of physicians other than fee-for-services
    6. Enhanced efficiency in the management of services through the establishment of councils, coordinating bodies and secretariats
    7. Increasing funds for health services research, especially in the areas of utilization, technology assessment, program or system evaluation and information systems

The future of Medicare

- The problems
    - Accessibility
    - Relevance and availability of services
    - Funding for services and prescriptions
    - Changing landscape of the population
- The changes
    - Sustain it without changes in service delivery
    - Increase funding and improve and enhance services
    - Create a room for a tiered system (public vs private)