Non-infectious diseases

Causes and Effects

Non-infectious diseases (also known as non-communicable diseases) are not caused by a pathogen and are not contagious. Risk of developing a specific non-infectious disease is influenced by factors such as age, gender, economic, and social conditions, culture, race, lifestyle, environment, genetics, and nutrition.

Many non-infectious diseases are considered to be preventable as they are caused by factors that can be modified.

Genetic diseases

These are caused by mutations of genes or chromosomes of an individual. Each gene codes for the production of a specific protein, which may be structural, an enzyme or a hormone. Genetic disease may also result when cell division by mitosis or meiosis, occurs abnormally, resulting in cells with an incorrect number of chromosomes or abnormal chromosomes.

Single-gene abnormalities

Many single-gene genetic diseases are caused when inheriting mutated genes from parents. Some of these are caused by abnormal recessive and dominant alleles. If the abnormal gene occurs on one of the sex chromosomes (normally the X chromosome), the disease is termed ‘sex-linked’. Diseases caused by gene mutations include cystic fibrosis, albinism, Huntington’s chorea, thalassaemia, Tay Sachs disease, sickle cell anaemia, phenylketonuria, and the sex-linked diseases Duchenne muscular dystrophy and hemophilia.

Chromosomal abnormalities

Some genetic diseases are caused by mutations of the chromosomes that carry the genes. These mutations can take the form of:

- An incorrect number of chromosomes - too many or not enough
- A change to the chromosome itself - a deletion, addition or altered sections. An incorrect number of chromosomes may come about due to:
- Nondisjunction - incorrect separation of chromosomes during cell division. End result of this process is an incorrect number of chromosomes in the zygote.
- Trisomy - when there is one extra chromosome along with the normal chromosome pair and the total number of chromosomes present in the zygote is one more than the diploid number of chromosomes
- Monosomy - when one number of a chromosome pair is missing and the total number of chromosomes in the zygote is one less than the normal diploid number.

- Down syndrome is caused by an extra chromosome 21, Klinefelter syndrome by the presence of three sex chromosomes (XXY) instead of the usual two, and Cri du chat syndrome by deletion of a section of chromosome 5.

**Diseases caused by environmental exposure**

There are many different types of environmental diseases, including:

- Lifestyle diseases, such as cardiovascular disease and diseases caused by substance abuse such as alcoholism and smoking-related diseases
- Diseases caused by physical factors in the environment, such as skin cancer caused by excessive exposure to ultraviolet radiation in sunlight
- Diseases caused by exposure to chemicals in the environment, home or workplace, such as lead poisoning caused by exposure to high levels of lead in the atmosphere, soil and products used in everyday life.

**Lifestyle diseases**

- Arise as a direct result of the way in which individuals live their lives
- Most common are cardiovascular disease, diabetes, cancers, and chronic lung disease.
- Risk factors that lead to the development of these are tobacco use, an unhealthy diet, physical inactivity, and the harmful use of alcohol. Exposure to additives and hormones added to our food products may also have a detrimental effect
- Atherosclerosis - a type of cardiovascular disease, known as ‘hardening of arteries’. Can be caused by things like lack of physical activity, excessive drinking, smoking, salt, red meat, high kilojoule diet, high stress exposure.
- These lifestyle activities, when prolonged, leads to the deposition of lipids (fatty deposits) in the inner walls of arteries. With continued deposition, the internal walls of the arteries are no longer smooth but very rough and thickened, which hinders blood flow and increases blood pressure (hypertension).
- Plaque, a hard, calcified substance, is deposited on the artery walls and further reduces elasticity and blood flow. This further increases hypertension, which can cause cerebral hemorrhage; leakage of blood into brain tissue.
- Blood clots can form, and along with fat build-up and plague, can cause a blockage (occlusion) in the blood vessel.
- If blockage occurs in the coronary arteries (supplying the heart with blood), this may result in cardiac arrest/heart failure.

Physical factors
- Exposure to physical factors in the environment can cause disease.
- Can include UN exposure, or nuclear radiation exposure.
- These physical factors often affect the health of the individual by changing the genetic material in some way, causing problems with the correct functioning of the body.
- UV exposure causes changes in the DNA of skin cells, which can cause continued abnormal cell division.

Exposure to chemicals
- Chemicals exist in the environment, and exposure to these can cause disease, depending on the period and intensity of exposure.
- Pollution, industrial processes, chemicals in the workplace, etc, can be some sources.
- Asbestos is a chemical that historically was present in many products in common use. Even small amounts of asbestos may cause one of the asbestos-related diseases: asbestosis, lung cancer, or mesothelioma. The chance of developing these diseases increases with prolonged exposure to asbestos, and the effects of inhaling asbestos fibres doesn’t become obvious until many years later.
Asbestosis is caused when inhaled asbestos fibres cause an inflammatory reaction in the lung tissue. This leads to scarring and stiffening of lung tissue, which makes breathing harder and reduces oxygen intake by blood. Asbestosis can lead to the development of mesothelioma.

Prolonged exposure to heavy metals in the environment can also cause disease. Many substances that the body doesn’t need can be excreted but heavy metals cannot be easily excreted and will build up with prolonged exposure.

Lead is an ingredient in paint, fuel, used in batteries, soil, water, pottery, toys etc. lead builds up to dangerous levels in the body before there are any noticeable symptoms. Toxic levels of lead can cause:
   - Developmental delays
- Learning difficulties
- Irritability
- Fatigue and sluggishness
- Weight loss and loss of appetite
- Abdominal pain, vomiting and constipation

Nutritional diseases
Maintaining nutrition and a healthy diet is essential for development and growth. Nutritional diseases are caused by imbalance diets and improper amount of nutrients. They can also be caused by psychological conditions that lead to inappropriate diets. Imbalance in diets leads to conditions known as malnutrition.

There are two broad categories of malnutrition:
- Undernutrition - insufficient intake of the correct type of food
- Overnutrition - excessive intake of food

**Undernutrition**

Lack of protein and energy-rich food
- Kwashiorkor - a disease caused by severe lack of protein in diet and results in growth failures, enlarged liver, hair changes, apathy, irritability and increased susceptibility to infectious diseases. It is characterised by a swollen belly, caused by fluid retention (oedema).
- Marasmus - disease caused by gross food deprivation leading to lack of protein and energy intake. Sufferers are extremely underweight and have lost most of their subcutaneous fat.

Lack of vitamins
- A diet lacking a vital nutrient (e.g. a vitamin or mineral), can lead to a nutritional deficiency disease.
  - Vitamin A is important for normal growth, healthy skin, mucous membranes, and normal vision, including night vision. A lack of Vitamin A can lead to blindness, dry skin and increased susceptibility to infection.
  - Vitamin D is produced by the body in a series of reactions initiated by exposure to the sun. children with limited vitamin D exposure can develop rickets, resulting in defective calcification of bones, retardation of growth and deformities. In adults, it can cause osteomalacia, which causes bone problems and weakens muscles. Osteoporosis, the thinning of bones, has some association with inadequate vitamin D.

Lack of minerals
- Iron is a mineral required by the body as an essential component in the molecule hemoglobin, which carries oxygen around the body. A deficiency of iron in the diet is the most common nutritional deficiency and will cause iron deficiency anaemia.
- Iodine deficiency is another mineral nutritional disease, emerged in the past few years. This is partly attributable to the fact that dairy products no longer contain iodine and as a
nation we are consuming less iodised salt. Iodine is needed for thyroxine production, and a deficiency of iodine causes reduced metabolic rate, low body temperature and lethargy.

Eating disorders
- These can arise from sufferers experience an intense fear of putting on weight. The causes vary from person to person and couldn't be influenced by genetic predisposition and a combination of environmental, social, and cultural factors. Sufferers may perceive themselves as overweight even though they are underweight
- Anorexia nervosa - characterised by psychological disorders, excessive weight loss and a distorted body image. They think of nothing but body weight, have an irrational fear of both food and eating. Effects are loss of weight, tiredness, anaemia, impaired digestive function, etc.
- Bulimia nervosa - caused by psychological factors similar to those of anorexia nervosa, with abnormal eating behaviours. It’s characterised by periods of binge eating followed by some method of purging, such as self-induced vomiting. Acid in the vomit causes erosion of tooth enamel, leading to erosion, sensitivity, discolouration and possible loss of teeth.

Overnutrition
Most common type of overnutrition is obesity caused by consuming more kilojoules than energy expended, resulting in an accumulation of fat in the body. BMI > 30 is obesity. It can include increased blood pressure, gallbladder disease, stroke, type 2 diabetes, problems with weight-bearing joints, increased risk of developing certain cancers, and dying early is always a bit of a downer I reckon.

Cancer
- cellular disease occurring when abnormal cells dividing uncontrollably, invading body tissue and spreading to other tissues to disrupt normal functioning.
- DNA repair genes code for proteins that remove damaged DNA and replace them with correct sequence.
- Proto-oncogenes code for proteins that stimulate cell growth and mitosis.
- Tumour suppressor genes code for proteins that slow down or stop cell growth and mitosis.

Types of tumours
- Benign tumours are not cancer, and they don’t spread to other body tissues. Some can be precancerous if not treated (e.g. squamous cell carcinoma, which can spread if untreated.
Malignant tumours contain abnormal cancerous cells that aren’t confined by the boundary of the initial tumour. The area where the initial malignant tumour develops is called the primary tumour.

**Types of cancer**

Type of cancer is usually named after the organ or tissue that the primary humour forms in. several broad groups are

- Sarcoma forms in muscle, or connective tissue such as bone or blood vessels.
- Carcinoma forms in epithelial tissue, such as skin or tissue that lines or covers the internal organs.
- Lymphoma and myeloma form in the lymphatic system and plasma cells of the immune system
- Leukaemia forms in the bone marrow and other blood-forming tissues.
- CNS cancers begin in the brain or spinal cord.

**Causes of cancer**

There is ongoing research, but out understanding is still limited. Risk factors:

- Smoking
- Excessive alcohol consumption
- Lack of physical activity
- Exposure to radiation
- Contracting particular types of viruses
- Exposure to chemicals
- Inheriting mutated genes

**Melanoma: a form of skin cancer**

Melanoma is a disease in which cells in the skin divide uncontrollably due to changes in the DNA of the genes that control cell division. These cells are called melanocytes and contain the pigment melanin, which gives the skin its colour. It can occur anywhere on the skin. It’s malignant, and is confined to one area but when left untreated will increase in thickness, spreading to deeper layers within the skin.

**Incidence, prevalence, and mortality rates**

Noninfectious disease is the cause of 70% of deaths globally, with lifestyle diseases responsible for 63% of these deaths. Data relating to the incidence, mortality, and prevalence of many types of non-infectious disease can be collected and analysed to identify patterns in populations.

The incidence of a disease refers to the number of new cases of that disease reported in a specific time period (usually a year).

The prevalence of a disease is the number of people in a particular population that have been diagnosed with that disease and are still alive at the end of a given time period.

The mortality rate of a disease is the number of deaths due to a particular disease in a specific time period (usually one year). Usually expressed as number per 10,000 population.

The age-standardised is a measure of what the rate would be if the population had a standard age structure. It is a weighted mean of the age-specific rates and is used to that comparisons between populations from different countries or regions can be made.

The data is useful in many ways, including being used to determine:

- The trends associated with particular diseases
- Whether certain groups are more susceptible to particular diseases
- Whether methods in use for preventing and treating the disease are successful
- The pathway for research and areas to concentrate on in terms of public health
- Incidence and mortality rates of melanoma increase with age.
- Incidence rate of melanoma in Australia has steadied, the mortality rate is increasing, and the rate of both is higher for males than females.
- Predominantly dark-skinned populations throughout the world have a lower incidence of melanoma than fair-skinned populations.
- Prevalence of melanoma is increasing in Australia and is greater in the more developed regions of the world.