UNIT 1  EPIDEMIOLOGY OF NON-COMMUNICABLE DISEASES

1.0  INTRODUCTION

Non-communicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally progress slowly. They often have a long asymptomatic period. The 5 common types of non-communicable diseases are coronary heart disease, stroke, cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes. In this unit we shall discuss about various NCDs with reference to burden, causes and risk factors. The details of the diseases and National Health Programmes are discussed in subsequent units of this block.

1.1  OBJECTIVES

After completing this unit, you would be able to:
 enumerate the important non communicable diseases; and
• describe causes and risk factors for the non-communicable diseases

1.2 RISK FACTORS OF NON-COMMUNICABLE DISEASES

The major risk factors for these non-communicable diseases are broadly categorised as given below:

1) Behavioural risk factors
   • Tobacco use
   • Unhealthy diet
   • Physical inactivity
   • Harmful use of alcohol

2) Metabolic risk factors
   • Obesity
   • Raised blood pressure
   • Raised blood glucose
   • Raised blood total cholesterol levels

3) Low birth weight and foetal undernutrition: lets talk about the importance of low birth weights and poor placental supply

4) Ongoing chronic hunger and chronic stress are important.

By eliminating common risk factors, such as unhealthy diet, physical inactivity, tobacco use and excessive use of alcohol and addressing Social determinant is possible to reduce the prevalence of these diseases.

A total of 56 million deaths occurred worldwide during 2012. Of these, 38 million were due to NCDs, principally diabetes, cardiovascular diseases, cancer and chronic respiratory diseases. Nearly three quarters of these NCD deaths (28 million) occurred in low- and middle-income countries. The leading causes of deaths due to NCDs in 2012 globally were:

• Cardiovascular diseases (46.2% of NCD deaths)
• Cancers (21.7% of NCD deaths)
• Respiratory diseases, including asthma and chronic obstructive pulmonary disease (10.7% of NCD deaths)
• Diabetes (4% of NCD deaths)

And these four major NCDs were responsible for 82% of NCD deaths.

In India, Non-communicable diseases (NCDs) contribute to around 5.87 million deaths that account for 60% of all deaths in India.

• Coronary heart disease, Stroke, and Hypertension (45%)
• Chronic respiratory disease (22%),
• Cancers (12%)
• Diabetes (3%).
Four types of NCDs – cardiovascular diseases, cancer, chronic respiratory diseases and diabetes make the largest contribution to morbidity and mortality due to NCDs.

1.3 CORONARY HEART DISEASE (CHD)

Coronary heart disease is also known as ischemic heart disease and includes various other group of disorders as

- Stable Angina
- Unstable Angina
- Myocardial Infarction
- Sudden Cardiac Death

Myocardial infarction is specific for CHD whereas angina and sudden death are not.

1.3.1 Burden of Coronary Heart Disease

According to World Health Report, cardiovascular diseases (CVDs) will be the largest cause of death and disability by 2020 in India. In 2020 AD, 2.6 million Indians are predicted to die due to coronary heart disease which constitutes 54.1% of all CVD deaths.

1.3.2 Risk Factors

As such the etiology of CHD is multi factorial. As some of the major risk factors that impact the occurrence of CHD are modifiable and other are non-modifiable. Presence of any of the risk factor may result into the CHD.

The risk factors are classified as follows.

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<thead>
<tr>
<th>Non-Modifiable Risk Factors</th>
<th>Modifiable Risk Factors</th>
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<tbody>
<tr>
<td>Age</td>
<td>Smoking</td>
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<tr>
<td>Sex</td>
<td>High blood pressure</td>
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<tr>
<td>Family history</td>
<td>Elevated serum cholesterol</td>
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<td>Genetic factors</td>
<td>Obesity</td>
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<td></td>
<td>Stress</td>
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<td>Sedentary lifestyle</td>
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<td>Diabetes</td>
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1.4 HYPERTENSION

Hypertension also known as high blood pressure (HBP), is a long term medical condition in which the blood pressure in the arteries is persistently elevated. High blood pressure usually does not cause symptoms. Long term high blood pressure, however, is a major risk factor for coronary artery disease, stroke, heart failure, peripheral vascular disease, vision loss, and chronic kidney disease.

Classification

1) Primary or essential hypertension – Almost 90% of all the hypertensive cases and the causes are generally unknown.
2) Secondary hypertension—When there is disease process or abnormality is associated with its causation as in diseases of kidney, congenital diseases of aorta and others.

1.4.1 Burden of Disease

The overall prevalence of Hypertension in India ranges between 17 to 40%.

In India, hypertension is the leading NCD risk and estimated to be attributable for nearly 10 per cent of all deaths. Adult hypertension prevalence has risen dramatically over the past three decades from 5 per cent to between 20–40 per cent in urban areas and 12–17 per cent in rural areas. The number of hypertensive individuals is anticipated to nearly double from 118 million in 2000 to 213 million by 2025.

It is estimated that

- 16 per cent of Ischaemic heart disease,
- 21 per cent of peripheral vascular disease,
- 24 per cent of acute myocardial infarctions
- 29 per cent of strokes

Are attributable to hypertension underlining the huge impact effective hypertension prevention and control can have on reducing the rising burden of cardiovascular disease (CVD).

1.4.2 Rule of Halves

The ‘rule of halves’ for hypertension states that: ‘half the people with high blood pressure are not known (“rule 1”), half of those known are not treated (“rule 2”) and half of those treated are not controlled (“rule 3”).’

“Rule 1” portrays the status of awareness regarding the disease and the efficacy of prevailing screening programmes in diagnosing the disease early.

“Rule 2” depicts the status of treatment for hypertension among those diagnosed and the awareness about self-care in prevention of impending complications.

“Rule 3” addresses the status of adequacy in treatment for hypertension.

Risk factors for hypertension:

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<td>Obesity</td>
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<tr>
<td>Sex</td>
<td>Salt intake</td>
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<tr>
<td>Family history</td>
<td>Saturated fat</td>
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<tr>
<td>Genetic factors</td>
<td>Dietary fibre</td>
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<td></td>
<td>Alcohol</td>
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<td>Heart rate</td>
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<td>Physical activity</td>
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<td>Environmental stress</td>
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1.5 CANCER

Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. Possible signs and symptoms include a lump, abnormal bleeding, prolonged cough, unexplained weight loss and a change in bowel movements.

1.5.1 Classification

Carcinoma: Cancers derived from epithelial cells. This group includes many of the most common cancers and include nearly all those in the breast, prostate, lung, pancreas and colon.

Sarcoma: Cancers arising from connective tissue (i.e. bone, cartilage, fat, nerve), each of which develops from cells originating in mesenchymal cells outside the bone marrow.

Lymphoma and leukemia: These two classes arise from haematopoietic (blood-forming) cells that leave the marrow and tend to mature in the lymph nodes and blood, respectively.

Germ cell tumor: Cancers derived from pluripotent cells, most often presenting in the testicle or the ovary (seminoma and dysgerminoma, respectively).

Blastoma: Cancers derived from immature “precursor” cells or embryonic tissue.

1.5.2 Causes

The majority of cancers, some 90–95% of cases, are due to environmental factors. The remaining 5–10% are due to inherited genetics.

Common environmental factors that contribute to cancer death include tobacco (25–30%), diet and obesity (30–35%), infections (15–20%), radiation (both ionising and non-ionising, up to 10%), stress, lack of physical activity and environmental pollutants.

1) Chemicals

Exposure to particular substances has been linked to specific types of cancer. These substances are called carcinogens.

Tobacco smoke is a major cause of lung cancer. It also causes cancer in the larynx, head, neck, stomach, bladder, kidney, esophagus and pancreas. Tobacco smoke contains over fifty known carcinogens, including nitrosamines and polycyclic aromatic hydrocarbons.

2) Diet and exercise

Diet, physical inactivity and obesity are related to up to 30–35% of cancer deaths. Physical inactivity is believed to contribute to cancer risk, not only through its effect on body weight but also through negative effects on the immune system and endocrine system.

Some specific foods are linked to specific cancers. A high-salt diet is linked to gastric cancer. Aflatoxin B1, a frequent food contaminant, causes liver cancer. Betel nut chewing can cause oral cancer. National differences in dietary practices may partly explain differences in cancer incidence.
3) **Infection**

Worldwide approximately 18% of cancer deaths are related to infectious diseases. Viruses are the usual infectious agents that cause cancer.

Oncoviruses (viruses that can cause cancer) include human papilloma virus as an agent responsible for cervical cancer in females.

4) **Radiation**

The radiation exposure, including both ionising radiation and non-ionising ultraviolet radiation, can also contribute to invasive cancer.

Prolonged exposure to ultraviolet radiation from the sun can lead to melanoma and other skin malignancies. Non-ionising radio frequency radiation from mobile phones, electric power transmission and other similar sources have been described as a possible carcinogen by the World Health Organization’s International Agency for Research on Cancer.

5) **Hereditry**

Hereditary cancers are primarily caused by an inherited genetic defect. Less than 0.3% of the population are carriers of a genetic mutation that has a large effect on cancer risk and these cause less than 3–10% of cancer.

1.6 **OBESITY**

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health.

People are generally considered obese when their body mass index (BMI), a measurement obtained by dividing a person’s weight by the square of the person’s height. Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis. As an overall impact obesity leads to the reduced life expectancy.

As of 2008 the WHO estimates that at least 500 million adults (greater than 10%) are obese, with higher rates among women than men.

1.6.1 **Burden of Disease**

**Mortality**

Obesity is one of the leading preventable causes of death worldwide. Grade 1 obesity (BMI 30–35) was not associated with higher mortality than normal weight, and that overweight (BMI 25–30) was associated with “lower” mortality than was normal weight (BMI 18.5–25).

A BMI above 32 kg/m² has been associated with a doubled mortality rate among women over a 16-year period. On average, obesity reduces life expectancy by six to seven years, a BMI of 30–35 kg/m² reduces life expectancy by two to four years, while severe obesity (BMI > 40 kg/m²) reduces life expectancy by ten years.

**Morbidity**

Obesity increases the risk of many physical and mental conditions. These co-morbidities are most commonly shown in metabolic syndrome, a combination of...
medical disorders which includes: diabetes mellitus type 2, high blood pressure, high blood cholesterol, and high triglyceride levels.

1.6.2 Risk Factors

1) **Diet:** The association between fast-food consumption and obesity becomes more concerning. Obese people consistently under-report their food consumption as compared to people of normal weight. Extra food energy comes from an increase in carbohydrate consumption rather than fat consumption. The primary sources of these extra carbohydrates are sweetened beverages. Consumption of sweetened drinks such as soft drinks, fruit drinks, iced tea, and energy and vitamin water drinks is believed to be contributing to the rising rates of obesity.

2) **Sedentary lifestyle:** A sedentary lifestyle plays a significant role in obesity. Worldwide there has been a large shift towards less physically demanding work, and currently at least 30% of the world’s population gets insufficient exercise and are possibly due to mechanised transportation and a greater prevalence of labour-saving technology in the home. In children, there appear to be declines in levels of physical activity due to less walking and the physical education in the school based settings.

3) **Genetics:** Studies that have focused on inheritance patterns rather than on specific genes have found that 80% of the offspring of two obese parents were also obese, in contrast to less than 10% of the offspring of two parents who were of normal weight. Different people exposed to the same environment have different risks of obesity due to their underlying genetics.

1.7 DIABETES

Diabetes is a metabolic disease in which there are high blood sugar levels over a prolonged period. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications.

1.7.1 Types of Diabetes Mellitus

There are three main types of diabetes mellitus (DM):

- **Type 1 DM** results from the pancreas’s failure to produce enough insulin. This form was previously referred to as “insulin-dependent diabetes mellitus” (IDDM) or “juvenile diabetes”. The cause is unknown.

- **Type 2 DM** begins with insulin resistance, a condition in which cells fail to respond to insulin properly. As the disease progresses a lack of insulin may also develop. This form was previously referred to as “non insulin-dependent diabetes mellitus” (NIDDM) or “adult-onset diabetes”. The primary cause is excessive body weight and not enough exercise.

- **Gestational diabetes** is the third main form and occurs when pregnant women without a previous history of diabetes develop high blood-sugar levels.

1.7.2 Burden of Disease

As of 2015, an estimated 415 million people had diabetes worldwide, with type 2 DM making up about 90% of the cases. This represents 8.3% of the adult population, with equal rates in both women and men. As of 2014, trends suggested
the rate would continue to rise. Diabetes at least doubles a person’s risk of early death. From 2012 to 2015, approximately 1.5 to 5.0 million deaths each year resulted from diabetes.

The International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025.

A study reported that diabetes control in individuals worsened with longer duration of the disease (9.9±5.5 years), with neuropathy the most common complication (24.6 per cent) followed by cardiovascular complications (23.6 per cent), renal issues (21.1 per cent), retinopathy (16.6 per cent) and foot ulcers (5.5 per cent).

### Check Your Progress 1

1) Enumerate five common NCDs.

2) List major risk factors for NCDs.

3) Explain rule of halves.

4) List the causes for cancers in general.

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### 1.8 INJURIES AND ACCIDENTS

It is estimated that more than 5 million people die every year in developing countries from road traffic crashes, burns, falls, other types of unintentional injury, violence, and suicide. Millions more are disabled, temporarily or permanently, by injuries.

Injuries are the third cause of mortality among people over five years, with road traffic injuries and violence as the main causes of injury-related deaths.

### 1.9 ARTHRITIS

Arthritis is a form of joint disorder that involves inflammation in one or more joints. The most common form of arthritis is osteoarthritis (degenerative joint disease), a result of trauma to the joint, or with degenerative changes occurring in body with age.

Pain, which can vary in severity, is a common symptom in virtually all types of arthritis. Other symptoms include swelling, joint stiffness and aching around the joint

- Inability to use the hand or walk
• Stiffness, which may be worse in the morning, or after use
• Malaise and fatigue
• Weight loss
• Poor sleep
• Muscle aches and pains
• Tenderness
• Difficulty moving the joint

1.10  EPILEPSY

It is characterised by recurrent seizures, which are brief episodes of involuntary movement that may involve a part of the body (partial) or the entire body (generalised), and are sometimes accompanied by loss of consciousness and control of bowel or bladder function.

In 2013 about 22 million people have epilepsy and almost 80% of cases occur in the developing world.

The most common type of epilepsy, which affects 6 out of 10 people with the disorder, is called idiopathic epilepsy and has no identifiable cause.

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Epilepsy with a known cause is called secondary epilepsy, or symptomatic epilepsy. The causes of secondary (or symptomatic) epilepsy could be:

• brain damage from prenatal or perinatal injuries (e.g. a loss of oxygen or trauma during birth, low birth weight),
• congenital abnormalities or genetic conditions with associated brain malformations,
• a severe head injury,
• a stroke that restricts the amount of oxygen to the brain,
• an infection of the brain such as meningitis, encephalitis,
• certain genetic syndromes,
• Brain tumor.

1.11  BLINDNESS

Visual impairment, also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems not fixable by usual means and the blindness refers to the complete or nearly complete vision loss.

Causes of blindness in India

• Cataract–62.6%
• Refraction error–19.7%
• Glaucoma–5.8%
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- Corneal pathologies – 0.9%
- Others – 11%

The blindness can be classified into two following types:

**Curable blindness**: Blindness in which the damage is reversible by prompt management e.g. cataract

**Preventable blindness**: Blindness that could have been completely prevented by institution of effective preventive or prophylactic measures as on early diagnosis e.g. xerophthalmia, trachoma, and glaucoma.

### 1.12 LET US SUM UP

Overall the non-communicable diseases are responsible for major causes of morbidity, mortality and disability globally and in India also. All these risk factors are preventable and can be addressed at the level of contact with the health care as well as the behaviour change. The chapter focuses on the burden of non-communicable diseases and their risk factors associated with them, such as tobacco use, unhealthy diet, physical inactivity and use of alcohol.

### 1.13 MODEL ANSWERS

**Check Your Progress 1**

1) The 5 common types of non-communicable diseases are coronary heart disease, stroke, cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes.

2) The major risk factors for these non-communicable diseases are broadly categorised as

- Behavioural risk factors
  - Tobacco use
  - Unhealthy diet
  - Physical inactivity
  - Harmful use of alcohol

- Metabolic risk factors
  - Obesity
  - Raised blood pressure
  - Raised blood glucose
  - Raised blood total cholesterol levels

3) The ‘rule of halves’ for hypertension states that: ‘half the people with high blood pressure are not known (“rule 1”), half of those known are not treated (“rule 2”) and half of those treated are not controlled (“rule 3”).’

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“Rule 2” depicts the status of treatment for hypertension among those diagnosed and the awareness about self-care in prevention of impending complications.
“Rule 3” addresses the status of adequacy in treatment for hypertension.

4) The majority of cancers, some 90–95% of cases, are due to environmental factors. The remaining 5–10% are due to inheritance.

Common environmental factors that contribute to cancer death include tobacco (25–30%), diet and obesity (30–35%), infections (15–20%), radiation (both ionising and non-ionising, up to 10%), stress, lack of physical activity and environmental pollutants.

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