UNIT 2 RISK FACTOR MANAGEMENT AND SCREENING

Structure

2.0 OBJECTIVES

After reading this unit, you should be able to:

- define the concept of risk factors in pathogenesis of disease;
- identify the risk factors in older subjects;
- describe the interventions to modify these risk factors;
- discuss the basic concepts of screening; and
- enumerate the screening test applicable to older subject.

2.1 INTRODUCTION

Diseases from a complex interaction between human host, an agent and the environment. These three components constitute the epidemiological triad holds good for most diseases known to us.

It is, however, possible that host factors responsible for a disease state may not be clearly defined. Similarly the "agents" in many diseases are yet to be identified and in many more diseases the environmental factors causing the illness may not be fully understood. In most chronic degenerative and non-communicable diseases the epidemiological triad of host-

agent-environment has not yet been clearly defined. Usually no single etiologic agent causes the disease in such a scenario and multiple causative factors are considered to have role to play. The term 'risk factors' is used to describe certain factors in the person's background or life-style that increase the likelihood of these pathological states.

The concept of risk factors in causation has logically led to detection of diseases early in the course by specifically looking for them.This is done by screening people with risk factor of a specific disease with a diagnostic test.

In this unit you will learn about the role of risk factors in pathogenesis of diseases.Identification of risk factors, screening for early diagnosis and managing risk factors in pre-pathogenesis phase has emerged as an important aspect of preventive medicine as immunization was about 50 years back. The value of such a strategy is extremely important for older subjects who usually have multiple chronic degenerative and non-communicable diseases. In the present unit you will also learn about the various interventions that can be undertaken to modify the risk factors and brief information on their management. Lastly you shall be acquainted with the basic concepts of screening for disease.

2.1 RISK FACTORS IN PATHOGENESIS OF DISEASE

You have already read that disease is an outcome of interplay between the agent, host and environment. Certain factors in the host and the environment can make the person more vulnerable to develop or acquire the disease. It is these factors which we shall discuss here.

2.2.1 Definitions and Basic Concepts

For many diseases the etiology or the agent is yet to be identified, e.g. coronary heart disease (CHD), cancer, mental illness, hypertension etc. In absence of a firmly established disease agent, the etiology of a disease is usually described in terms of risk factors.

The term 'risk factor' has been used in literature with various interpretations.

A risk factor can be defined as an attribute or exposure that is significantly associated with development of a disease. In other words it is a characteristic of a person or his/her circumstances that is linked/associalted with an increased probability of disease.

Some of the concepts regarding risk factors are given below:

- A risk factor can be considered as a determinant that can be modified by intervention, there by reducing the possibility of occurrence of disease.
- The risk factors are observable or identifiable prior to the disease they are associated with.
- Risk factors are usually suggestive and the cause and effect relationship between risk factor and disease is seldom established.
- The presence of a risk factor does not necessarily mean that the disease is present or it will occur in future. Similarly absence of risk factor is also not an immunity against the disease.
- However it is important to note that a risk factor may be the only identifiable or observable market prior to the onset of the disease.
- Risk factors can have an additive or synergistic effect i.e. the presence of more than one risk factor may add up or be multiplicative. For example,smoking and exposure to air pollutants have an additive effect as risk factors for chronic obstructive pulmonary disease (COPD). On the other hand smoking has a synergistic effect with other risk factors such as hypertension and high blood cholesterol as risk factors for CHD, synergistic means that the effect is more than additive.

2.2.2 Classification

Risk factors can be classified according to their association into following categories:

a) **Truly Causative:** When there is a causal association with the disease or condition e.g. smoking for lung cancer.

b) **Contributory:** When it contributes to increase the risk of disease with other risk factors e.g. lack of physical exercise as a risk factor for coronary heart disease.

c) **Predictive:** When it is a risk factor for wide range of conditions e.g. illiteracy for malnutrition in all ages.

Risk factors can also be classified based on their amenability to intervention as modifiable and non-modifiable.

a) **Modifiable:** The risk factor can be changed, i.e. it is amenable to intervention. Modifiable risk factors are smoking, physical activity, obesity, diets. Risk factors like hypertension, raised serum cholesterol etc. can also be modified to certain extent by pharmacologica intervention.

b) **Non-modifiable:** The risk factor cannot be changed; e.g. age, sex, race, family history and genetic factors. These risk factors should alert health care providers about targeting the susceptible group for intervention. For example osteoporosis is more common in old women then men. Thus hormone replacement and supplementation of calcium and vitamin D should be targeted at them.

2.2.3 Identification of Risk Factors

Identification of risk factors is the first step for prevention and control. Risk factors for disease are identified by painstaking epidemiological research using case-control and cohort studies carried out in large populations.

In case-control studies subjects with the index disease are compared with those without it. Essentially case-control studies are retrospective studies with three distinct features:

1) Both exposure and disease occurs before the study.

2) The study proceeds backwards from effect to cause.

3) The control group (are as comparable as possible in their biological and socio-economic characteristics as the cases) is used to support or refute an inference.

The basic design of a case-control study is to divide the cases and controls into four subgroups with presence and absence of the risk factor and the disease in a 2×2 table and statistically determine the odds favoring and the relative risk of occurrence of the disease in presence of the risk factor.

In cohort studies a group of people with a common characteristic or experience within a defined time period (age, occupation, pregnancy, exposure to a drug or vaccine etc.) are observed longitudinally. Essentially cohort studies are prospective studies with three distinct features:

1) The cohorts are identified prior to appearance of the index disease.

2) The study groups have to be observed over a period of time to determine the frequency of disease among them.

3) The study proceeds forward from the cause to the disease.

In cohort study also the population is divided into four subgroups with presence and absence of the putative, etiologic factor and the disease in a 2×2 table and statistically determine the odds favoring and the relative risk of occurrence of the disease in presence of the putative etiologic factor.

Subsequent to identification of the risk factor, it is important to ascertain if the risk can be reduced in a cost effective way and if its reduction would prevent or delay the disease or condition.

Check Your Progress 1

1) Define the term risk factor.

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2) Enumerate different types of risk factor

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2.3 INTERVENTIONS TO MODIFY RISK FACTORS

Multiple approaches of strategies have been suggested to modify the risk factors and there by reduce their impact.

2.3.1 Population Strategy

This strategy is based on mass approach and focusing on the control of risk factors in the whole population and not merely in individuals. This approach is based on the principle that even small changes in risk factor levels in total population can result in significant reduction in morbidity and mortality. As a result mobilization and involvement of the whole community is required to change its life-style practices which is associated with ill health. This can be achieved by several ways:

a) **Health Protection**

Health protection is defined as the provision of normal, mental and physical functioning of the human being individually and in groups. Health protection includes measures for health promotion, prevention of disease, treatment of disease and restoration of health. In reality it can be constructed as an integral part of overall social development programme in collaboration with universal education, safe drinking water, food security and social justice; and other measures for human development.

b) **Health Promotion**

Health promotion has been defined as the process of enabling people to increase control over and to improve health.Health promotion is not against any specific disease but is conceptualized to strengthen the host through several approaches, which include the following:

1) **Health education:** It is an important tool for achieving individual and community health and well being. Health education aims at increasing knowledge and information of people and there by bringing about desired changes in behaviour. A detailed account of health education is provided in Block 2 of this course.

2) **Environmental facilitation**: In order to promote health, people must have an environment, which supports healthy behaviour. Most aspects of environmental facilitation require resources from the individual and community as well as the state. The individual must have the power to seek better environment along with conviction to maintain environmental safety. Facilitating the environment for the elderly is also provided in Unit 1 of Block 4 of this course.

3) **Life style and behavioural change:** Health in late life is reflection of the behaviour and life style practiced in entire life course. Of all the interventions, the most important and most difficult is bringing about changes in life style as well as health behaviour. However for most non-communicable and degenerative disorders like hypertension, type 2 diabetes, the only effective intervention is life style and behavioural change and none of the other public health interventions work.

4) **Nutritional intervention:** The role of dietary factors in pathogenesis of many health problems is now well established. Nutritional interventions in the form of food distribution for vulnerable groups, food fortification and nutrition education are important measures in health promotion.

c) **Specific Protection**

In contrast to health promotion where there is an emphasis on improvement of general health status, specific protection deals with interventions against specific diseases.These

interventions include: i) immunization, ii) chemoprophylaxis, iii) specific nutrient supplementation, iv) accident and injury prevention, v) protection against occupational hazards, vi) protection from carcinogens, vii) control of environmental hazards, i.e.air and water pollution, viii) quality control of consumer products, i.e., food and drugs; and ix) avoidance of allergens.

2.3.2 High Risk Strategy

This strategy involves the identification of people with high risk and then doing intervention. By means of simple tests such as blood pressure, serum cholesterol, blood glucose measurement etc.identification of persons at high risk can be done. Individuals with a history of smoking, CHD, diabetes in the family etc. are also at a higher risk.

Intervention in the form of control of blood pressure, serum cholesterol, smoking cessation etc. has to be done in these individuals. This strategy helps in identification of high-risk individuals and their management but it may not be feasible to identify all in a country like ours. In addition, many individuals may not appear to be high risk and still present with the disease later.

Check Your Progress 2

Enumerate different types of population strategy for management of risk factors.

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2.4 HEALTH RISKS IN OLD AGE AND THEIR MANAGEMENT

As you know that aging is a universal phenomenon. Unfavourable conditions of life and unhealthy life-style accelerate the process of aging. High prevalence of diseases and disabilities and increased operability of dying is an important characteristics of aging. Most of these diseases are, non-communicable and chronic in nature. Though these conditions are not life threatening, in short-term, they do have the potential for disability and functional decline and require long-term care with significant cost implications. We shall discuss the risk factors for such chronic disabling diseases of old age.

2.4.1 Smoking

Smoking is the single most important cause of premature and preventable death and disease in madults.

Cigarette smoke contains more than 4000 substances which are toxic, mutagenic, carcinogenic and pharmacologically active.

Evidence indicates that smoking is associated with an increased risk of mortality from cancers, CHD and stroke. Smokers are also at greater risk of development of chronic conditions like chronic obstructive pulmonary disease, acid peptic disease, loss of physical function and mobility. Smoking is also implicated as a risk factor for osteoporosis. In addition smoking enhances the aging process, age related functional decline and loss of mobility.

Smoking is one of the three determinants of function disability in old age (the other two are obesity and lack of physical exercise).

Smoking Cessation

Evidence indicates that there is a significant benefit in terms of mortality and quality of life in giving up smoking. Within one or two years, older people who give up smoking have a reduced risk of death from all causes.

Despite the knowledge of advantages of smoking cessation, most smokers have difficulty in quitting due to withdrawal symptoms and lack of motivation.

As there are benefits of quitting smoking in old age, all attempts must be made to eliminate smoking.However, if the person cannot quit smoking it should at least be cut down. There are several interventions for smoking cessation which are given in Table 2.1.

Table 2.1: Interventions for Smoking Cessation

1)	Nicotine replacement, the most effective pharmacological intervention to help smoking cessation.
2)	Use of support groups.
3)	Dissemination of information about the long-term and short-term adverse effects of smoking.
4)	Discussions and films.
5)	Techniques for substituting other hand activities.
6)	Ways to avoid temptations such as visualization of the effects, aversion strategies such as keeping a jar full of cigarette butts, self-monitoring by maintaining records of when tempted, what was done, what the circumstances were and so on.
7)	Stimulus control by avoiding situations which cause the person to want to smoke.
8)	Avoidance of stress by relaxation techniques.

Prevention of relapse is the most challenging task in smoking prevention programme and every attempt should be made to continue with the cessation programme after relapse.

2.4.2 Physical Inactivity

Aging is associated with loss of myocytes and muscle mass, along with decline in muscle strength, power and endurance. In addition exercise tolerance, which indicates the cardio-pulmonary capacity also declines with aging. As a result of these changes older people tend to be inactive and sedentary.

Other contributory factors of physical inactivity include chronic cardio-pulmonary disease, obesity, musculoskeletal disease, depression and frailty.

Low functional capacity and reduced physical activity are associated with higher all cause specific mortality rates from chronic diseases such as CHD, diabetes and cancer, On the contrary physical fitness (quantitatively measured) is not only associated with longer survival but also higher survival with increasing age.

Physical Exercise

Regular exercise has proven value in health promotion, which include:

1) Greater survival
2) Protection against cardiovascular disease.
3) Weight reduction
4) Beneficial effect on glucose tolerance and lipoprotein metabolism
5) Protection against osteoporosis
6) Improvement of muscle strength and functional capacity
7) Improvement in psychological well-being.

Physical exercise should be carried out at a frequency of 3 to 5 days per week, between 20 to 60 minutes per session, to achieve the maximum heart rate. Physical exercise in old age is limited by reduced maximum exercise capacity, CHD and chronic degenerative diseases of the musculoskeletal system.

While prescribing physical exercise the physician must evaluate the risks of exercise, potential for fall and accident, medications, nutritional adequacy and motivation. The older person must be advised on self-monitoring of symptoms and signs of CHD and must know when to stop if symptoms appear.

Several types of physical exercises are available. The older person should choose the one, which is enjoyable, easy to perform, convenient and inexpensive.Considering all aspects, brisk walking and stretching exercises seem to be the best for older individuals.

2.4.3 Nutrition

Malnutrition both over-nutrition and under-nutrition is an important health risk factors in old age. Older people are at very high risk of multiple nutrient deficiency, age related decline in food intake, as well as consumption of food that does not give value for money and that can cause obesity and dyslipidaemia. You have already learnt in details about the principles of nutrition in elderly in unit 2 of block 2, course 1. Let us recapitulate some of the principles and briefly dwell on undernutrition and over nutrition as risk factors.

a) **Under Nutrition**

Older people are at high risk of developing under nutrition in poorer societies and poorer segment of all societies due to economic reasons.

The energy requirement declines with age due to reduction in the body mass, body metabolism and physical activity. Yet older people are at high risk of undernutrition due to several reasons, namely:

1) Food is less enjoyable due to changes in taste and smell sensation;
2) Lack of teeth, gum problems and ill-fitting dentures make eating painful;
3) Reduced appetite due to lack of exercise, loneliness, depression, chronic debilitating disease, confusion, forgetfulness, side effects of drugs, alcohol and smoking.

Under-nutrition is harmful to the older person's health leading to frailty, physical dependence and premature death apart from impairment of the immune system, increased risk of infection and poor wound healing. Common nutritional deficiencies include iron, fibre, folic acid, vitamin C, calcium, zinc, riboflavin and vitamin A.

b) **Over-nutrition**

Over-nutrition causes obesity and is associated with hypertension, IHD and diabetes, which are among the commonest health problems in old age.

Obesity is probably not a major problem for developing societies like ours. However there is distinct trend towards development of obesity among urban and affluent segment of the society as a result of life style changes and sedentary work culture.

c) **Nutrition Intervention in Old Age**

It should be ensured that older people are eating nutritious and easily digested diet and have access to food that is tasty and easy to prepare.

A healthy diet varies widely depending on the availability and cultural acceptability of foods. Most traditional Indian diets are now considered to have been close to being ideal, at least for adults and the elderly.

The principles of a balanced diet are similar in all ages. Elderly being a heterogeneous group, prescription of a uniform dietary schedule is difficult. You have already learnt about this in Unit 2, Block 2 of Course 1. However, certain guidelines can be followed to make a balanced.

Guidelines to Healthy Diet

1) **Plant proteins are partial proteins. Two partial proteins must be eaten together to form a complete protein.**
2) **Intake of complex carbohydrates and fibres (roots, fruits, vegetables and beans) should be increased. Complex, high fibre foods help to lower cholesterol, blood pressure and glucose intolerance and prevent constipation. Simple carbohydrates (sugar and deriva tives) should be avoided.**
3) **Calcium and vitamin D in the form of milk, curd, cheese, small fish and certain green vegetables should be increased to compensate for osteoporotic changes.**
4) **Salt intake should be limited.**
5) **Fat intake in all forms should be limited.**
6) **Certain foods with antioxidant property (green, yellow and orange vegetables and fruits such as carrots, sweet potatoes, spinach, tomato and orange) protect against cancers and degenerative diseases.**
7) **Additional supplementation of vitamins and micronutrients may be required in the elderly as there is a higher risk of their deficiency.**

2.4.4 Alcohol Abuse

Alcohol intake in excess increases the potential for diseases such as cardiomyopathy, cirrhosis of the liver, atrophic gastritis, chronic pancreatitis, peripheral neuropathy and dementia, falls and accidents, malnutrition immunosuppression and social isolation.

Discovery of alcohol abuse in an older patient may be difficult.

Alcohol increases the effects of neuroleptic drugs, analgesics and CNS depressants such as sedatives, tricyclic antidepressants, anxiolytics and benzodiazepines and can lead to life threatening complications.

In old age, intoxication from alcohol can occur with relatively small amounts due to decreased metabolism as a result of an increase in body fat, slowing down of liver metabolism and increased sensitivity of brain to the effect of alcohol.

Health care personnel are often not aware of the problem of alcohol abuse among older patients. Misconceptions regarding association of alcoholism with a higher social status, lack of communication skills in asking uncomfortable questions on alcoholism and a fatalistic attitude may lead to missing alcohol abuse in older subjects.

Symptoms of intoxication and withdrawal can be easily mistaken for diseases and age-related physical changes. Several features of alcohol abuse such as memory loss, poor balance, frequent falls and ill health may be ignored as consequence of aging.

2.4.5 Polypharmacy and Adverse Drug Reaction

Older persons require multiple drugs due to the presence of multiple degenerative diseases. As a result there is a high risk of drug interaction and adverse drug reaction.

Pharmacokinetics and pharmacodynamics of drugs are altered in old age due to alterations in absorption from gastrointestinal tract, detoxification in liver, excretion through kidney, composition of body fat and muscle mass and total body water and drug receptor sensitivity.

Drugs which produce adverse reactions are: antibiotics,anti-arhythmic drugs. digoxin, diuretics, non-steroidal anti-inflammatory drugs, anti-Parkinsonian agents, anti-cholinergic drugs, sedatives, anti-depressants, anti-hypertensives, anti-coagulants and psychotropic drugs.

Interventions to reduce adverse drug reactions are:

1) Frequent review of medication;

2) Instructions about possible side-effects;

3) Minimizing the number of drugs used;

4) Limited use of over-the-counter drugs;

5) Remaining alert for common side-effects such as: confusion, delirium, orthostatic hypotension, falls, anxiety, sleep disturbances, constipation, diarrhoea, urinary incontinence and urinary retention.

2.4.6 Decline in Immunity and Immunisation

Older people have dysfunction of all aspects of the immune system. In addition immuno-suppression due to malnutrition, chronic disease, depression and use of multiple medications also affects the health of the older people.

There are three specific immunizations recommended in old age. These are: pneumococcal vaccine, influenza vaccine and tetanus toxoid.

Though all the three vaccines are available in India, only tetanus toxoid is affordable from the point of view of cost. Pneumococcal and influenza vaccines are costly and thus are specifically recommended for those elderly persons in whom pneumococcal and influenza infections are either more frequent or can be dangerous.

Check Your Progress 3

1) Enumerate risk factors affecting the health of the older people.

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2) Enumerate the benefits of life style changes in the elderly.

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3) Enumerate vaccines for older people.

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2.5 RISK FACTORS OF COMMON MORBIDITIES IN ELDERLY AND THEIR MANAGEMENT

You have just learnt in the previous section about the common risk factors presence of which can lead to a number of disease or disorders.Let us now deliberate on a few morbidities which occur commonly in the elderly and are associated with well documented or suspected risk factors.

2.5.1 Cardiovascular Disease

Cardiovascular diseases have emerged as a major cause of death all over the world for older people.After intense epidemiological research several risk factors for cardiovascular disease have been identified. These include:

1) **Hypertension**: Systolic hypertension i.e. systolic blood pressure > 140 mmHg either alone or combined with high diastolic blood pressure i.e.> 90 mm Hg is the most important risk factor for both CHD and stroke.

2) **Dyslipidemia**: High serum total cholesterol and LDL cholesterol, low HDL cholesterol and high LDL:HDL ratio are important determinants of CHD and related death. High serum triglyceride also predisposes to CHD.

3) **Smoking**: Cigarette smoking is an independent predictor of CHD in the elderly.

4) **Obesity and Physical Inactivity**: The relativ e risk associated with physical inactivity is similar to that associated with hypertension, hypercholesterolemia and smoking.

5) **Diabetes**: The risk of CHD is higher among diabetics than non-betics.Diabetics are at a high risk of premature and accelerated atherogenesis because of hyperglycemia, hyperinsulinemia and dyslipidemia.

6) **Psychosocial Factors**: Coronary prone behaviour (type A personality: time urgency and competitiveness) and lower socio-economic status are strongly associated with the risk of CHD in absence of other risk factors mentioned above.

7) **Non-modifiable Risk Factors:** There are four non-modifiable risk factors for CHD.These include: increasing age, male sex, positive family history and race.Incidentally Indians have one of the highest rates of CHD in the world.

Management of Modifiable Risk Factors

You should now be able to understand that reduction in CHD risk can be achieved by:

1) Control of hypertension, hyperglycemia and dyslipidemia by drugs, diet and physical activity.

2) Physical exercise for obesity and physical inactivity.

3) Smoking cessation.

4) Nutritional interventions for control of dietary fat with dietary fibre and balanced intake of saturated and unsaturated fat.

5) Lifestyle modification and adaptation of relaxation techniques.

2.5.2 Osteoporosis

You will be reading about osteoporosis in Unit 5 of Block 6, Course 2. Age related decline in bone mineral density is common in advanced years. Postmenopausal estrogen deficiency state results in a biological disadvantage for women predisposing them to 4 to 8 times higher risk of osteoporosis compared to men. Osteoporosis is usually silent until the medical complication occurs, which in this case is a fracture. The consequences of osteoporosis are devastating in terms of morbidity, mortality and enormous financial burden.

Prevention and management of osteoporosis involves consumption of diet rich in calcium and vitamin D, avoidance of tobacco, alcohol and excess of tea and coffee, brisk and weight bearing physical exercise and hormone replacement therapy for post-menopausal women.

In addition, agents for improving bone mineral density, delaying bone resorpation and precautions for avoiding falls and fractures are essential in all those who have been diagnosed to have osteoporosis.

2.5.3 Accidents

Accidents are associated with pain and trauma of injury; loss of function, prolonged immobility and its complications; fear of future accidents and self imposed isolation; and loss of independence.

Accidents and falls in old age are related to age-related changes in the sensory system and the musculoskeletal system such as poor vision, defective hearing, decline in proprioception, decline in sense of touch and temperature, defective balance and gait and poor muscle strength and co-ordination.

In addition, several other factors increase the probability of falls and accidents in elderly subjects, which include cognitive impairment and dementia, confusion, chronic illness, use of vasoactive drugs and emotional stress.

Prevention of Accidents

A large number of accidents can be avoided by recognizing and compensating normal age-related changes. Several interventions can improve environmental safety, which include use of colours to enhance the older person's vision and depth perception, removal of obstacles, bright lighting, use of flat shoes and availability of stable structures to hold on to in case of an impending fall.

A detailed description of environmental safety has been provided in Unit 1 of Block 2 of this course.

2.5.4 Mental Health

Mental health problems increase with old age. Older people have certain common situation stress which include widowhood and bereavement, care-giver stress and abuse, fear of death, financial

difficulties and loss of independence, inability to cope with changes in living arrangements and previous roles and social isolation. The emotional response to these problems include grief, guilt, loneliness, loss of meaning in life and lack of motivation, anxiety, anger, feelings of powerlessness and depression. In addition organic brain diseases are also extremely common in old age.

One of the greatest problems in interventions for mental ill health are the barriers to accepting mental health problems in old age due to social, attitudinal and organizational factors.

As a health professional dealing with older subjects you have an important role in providing the intervention. The first and the foremost intervention is recognizing the presence of mental illness and counselling the patient and the family to seek treatment.

2.6 BASICS OF SCREENING

The pattern of disease as we come across in a hospital is completely different from that in the community where it usually starts. The patient presents to the hospital with symptoms, which are manifestations of advanced and complicated pathology. In the community on the other hand, most of the disease/pathologies exist usually in the early and pre-symptomatic phase in the milder form, but in much larger volume.

Detecting disease early in its course is a method in disease prevention by the way of early diagnosis and treatment with better prognosis and prevention of disability. Active search of disease among apparently healthy population is termed screening. It is further defined as the search for unrecognized disease or defect by rapidly applied tests, clinical examination or other procedures in an apparently healthy population.

Screening must be distinguished from periodic health examination, which is also a strategy for detection of hidden disease. Screening is inexpensive and can be applied widely. The physician is not required to be involved in carrying out the screening test but only has to interpret the results.

A screening test should not be confused with a diagnostic test. Unlike a diagnostic test, a screening test is applied to healthy people. It is usually inexpensive and tests can not be considered as the basis of starting treatment.

2.6.1 Use of Screening

There are many uses of screening:

a) **Case detection:** Screening can be used for identification of unrecognized disease, not necessarily with the individual's request. People are screened for their own benefit. The initiative is with the health authority with the special obligation of ensuring early etection and treatment of a particular disease. Examples of such screening are: screening for cervical cancer, diabetes mellitus.

b) **Control of disease:** Screening can also be used to detect cases early and get them treaed in order to reduce the burden of illness, reservoir of infection and their by its transmission to others mostly for infectious diseases.

c) **Research:** Screening can be used as a tool in epidemiological research in order to determine the frequency of a condition in the community and its natural history; e.g. CHD or hypertension in a community.

2.6.2 Types of Screening

Screening can be of three types: a) mass screening, b) high risk screening, and c) multi-phasic screening.

a) **Mass Screening:** In mass screening a whole population or a subgroup of it (e.g. all adults, all older women) is screened for a disease. It is offered to all, irrespective of the degree of the risk for individual. Mass screening is costly, requires infrastructure and this cannot be applied as a common public health tool.

b) **High Risk Screening:** In high risk or selective screening, the test is applied selectively to a high-risk group. The high-risk group is usually defined on the basis of earlier epidemiological research, e.g. screening of CHD among smokers, hypertensives or those with sedentary life style and high cholesterol levels. Such type of screening is much more cost effective.

c) **Multi-phasic Screening:** In multi-phasic screening, two or more screening tests in combination are applied for several common diseases to large number of people at one time rather than to carry out separate screening tests for single diseases. It usually includes a health questionnaire, clinical examination and a range of measurements and investigations.

2.6.3 Criteria for Screening

The utility of a screening depends on several factors which need to be systematically addressed before the process is initiated. These include the following:

a) The disease:

1) should be an important health problem with high prevalence leading to clinic illness or disability
2) should have awell understood natural history
3) should have a recognizable latent or early asymptomatic phase
4) should be detected by the screening test in the asymptomatic phase
5) should have easily available confirmatory or diagnostic test
6) should have effective and agreed treatment
7) should have a better prognosis following early diagnosis and early treatment and the expected benefits from early diagnosis and treatment must be cost effective.

b) The screening test:

1) should not be painful, discomforting or embarrassing
2) should be acceptable to masses
3) should be reliable and consistent on repetition
4) should have high degree sensitivity and specificity depending on the nature of disease
5) should have high predictive value (positive or negative) depending on the nature of disease
6) should have acceptable range of error (intra observer, inter observer and biological and technical)
7) should have clear guidelines to deal with borderline results.

2.7 SCREENING FOR DISEASE IN OLD AGE

There are no universally agreed list of diseases for which older people should be screened for. The following is a list of possible conditions and tests, which are available at the present state of knowledge:

Breast cancer	:	Mammography
Cataract	:	Clinical examination of the eye
Cervical cancer	:	Pap smear
Colo-rectal cancer	:	Stool occult blood
Coronary heart disease	:	Risk analysis, ECG, stress ECG
Deafness	:	Clinical evaluation and audiometry
Dementia	:	Mental state examination (by MMSE)
Diabetes mellitus	:	Blood glucose estimation
Diabetic retinopathy	:	Fundoscopic examination and fluorescin angiography
Dyslipidemia	:	Lipid profile
Glaucoma	:	Intraoccular pressure by tonometry
Hypertension	:	Blood pressure recording by sphygmomanometer
Lung cancer	:	Chest x-ray
Osteoporosis	:	Bone densitometry after risk assessment
Prostate cancer	:	Rectal examination, blood prostate specific agent levels

You can very well consider that the list is very large and requires enormous resources (man power, equipment, chemicals and time). As a physician in primary and secondary care facilities however you can make a short list of conditions which are common in area and use a set of screening tests which are inexpensive and easily available. We suggest you must consider screening older people for the following conditions: hypertension, diabetes mellitus, cataract and cervical cancer which is usually beneficial for them.

Check Your Progress 4

1) Enumerate the situation stresses in old age.

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2) Define screening

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3) Enumerate the uses of screening.

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4) Describe the characteristics of an ideal screening test.

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2.8 LET US SUM UP

Establishing the cause of disease or pathology is the first step towards its prevention and treatment. Aetiopathogenesis of most communicable diseases are well established after years of scientific research. However, the causation of chronic, non-communicable and degenerative diseases which are often seen in older patients is mostly uncertain. As a result, we tend to look for possible associations for these diseases and term them as risk factors. After establishing the risk factors, prevention and management of diseases are carried out. The logical step after establishing the risk factors is looking for hidden diseases among people with these risk factors by simple and inexpensive tests known as screening tests. Well planned screening for secific diseases are of great value in early diagnosis and treatment of diseases and in preventing disability and avoidable morbidity. The risk factors of diseases in old age include smoking, physical inactivity, alcohol abuse, malnutrition, hypertension, dyslipidemia, diabetes, disease prone personality, osteoporosis, increased susceptibility to accidents, adverse drug reactions, mental ill health and decline in immunity. For most of these conditions, scientifically established

interventions are now available. Screening for diseases in old age needs to be planned in a cost-effective manner. Though there are several diseases, which should be screened, it is recommended that older people should be routinely screened for hypertension, diabetes, cataract and cervical cancer, which is extremely beneficial to the population.

2.9 KEY WORDS

Life Style : A concept often used to denote the way people live. It reflects a whole range of social values, attitudes and activities.

Screening : Search for unrecognised disease or defect by means of rapidly applied tests, examinations or other procedures in apparently healthy individuals.

2.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Risk factors are defined as characteristics, attributes or exposures that significantly increase the likelihood of the disease.
2) A risk factor can be causative, contributory or predictive when cause and effect relationship is considered. However in terms of risk factor modification it can be modifiable or non-modifiable.

Check Your Progress 2

Population based intervention for risk factors management include: health protection health promotion and specific protection.

Check Your Progress 3

1) Risk factors affecting the health of the older people are smoking, physical inactivity, poor nutrition, alcohol, multiple drug intake and decline in immunity.
2) Life style changes help in prevention of hypertension, CHD, obesity, diabetes, osteoporosis and several cancers. It improves cardio-respiratory function and protects against disability.
3) Older people need to be vaccinated the pneumococcal vaccine, influnza vaccine and tetanus toxoid.

Check Your Progress 4

1) Situational stresses in old age include widowhood and bereavement, financial insecurity, fear of death and disease, loss of status and alterations in living arrangements, non-adaptability to changing roles.
2) Screening is defined as active such of disease among apparently health population for detection of hidden diseases early in its course.
3) Screening can be used for detection of cases, control of disease, epidemiological research and health education.
4) A screening test should not be painful, discomforting or embarrassing. It should be reliable and consistent on repetition. It should have high degree of sensitivity and specificity as well as predictive value. The intra-observer inter-observer, biological and technical variation should be within an acceptable range. There should be clear guidelines for dealing with borderline results.

2.11 FURTHER READING

Park, K. (ed.), *Park's Text Book of Preventive and Social Medicine*, 16th Edition.

Validity and Predictive Value of a Test

Validity of a Test

Validity has two components sensitivity and specificity. Both must be considered while assessing the accuracy of a test. Sensitivity and specificity are expressed as percentages. These are usually determined by applying the test to one group of persons having the disease and to a reference group not having the disease as demonstrated in the following table.

	Disease Present	Disease Absent
Test positive	a	b
Test negative	c	d

The letter 'a' denotes those individuals found positive on the test who have the condition beings studied i.e. they are 'true positives'. Group 'b' includes those who have a positive result but do not have the disease, i.e. they are 'false positive'. Group 'c' is constituted by those who have the disease but a negative test i.e. 'false negatives' while 'd' consists of persons who do not have the disease and the test is also negative i.e. 'true negatives'.

Sensitivity: It is the ability of a test to identify correctly all those who have the disease or condition. It is defined as proportion with the condition who test positive for it. It is given by the formula :

$$\frac{a}{a+c} \text{ i.e. } \frac{\text{true positive}}{\text{true positive + false negative}}$$

It is an improtant issue in evaluating the benefits of a screening test. If the test has poor sensitivity a large number of those with the disease will be falsely reassured that they do not have the disease. If sensitivity is high, it has a low false negative rate i.e. the test does not falsely give a negative result in patients who have the disease.

Specificity: it is the ability of a test to identify correctly those who do not have the disease. It is defined as proportion without the condition who test negative. It is given by the formula

$$\frac{d}{b+d} \text{ i.e. } \frac{\text{true positive}}{\text{true negative + false positive}}$$

A highly specific test will test positive in very few of those who do not have the condition i.e. it will have a low false positive rate. A test with low specificity will misclassify and mislabel many healthy people as having the condition. This may cause anxiety, unnecessary investigation and even unjustified treatment.

Consider the example of results of pap smear for predicting cervical cancer by comparison with the results for cervical biopsy.

Cervical Biopsy

		Cancer	No Cancer	Total
	Positive	96	250	346
Pap Smear	Negative	4	250	254
	Total	100	500	600

Sensitivity of Pap smear = 96/100=96%
Specificity of Pap smear = 250/500=50%

Thus the test is highly sensitive but poorly specific.

Predictive Value of a Test

The performance of a screening test is also measured by its predictive value. It reflects the diagnostic power of the test.

The positive predictive value is the probability of a disease in a patient with a positive test result. It is given by the formula true positive/(true positive + false positive).

Negative predictive value is the probability of not having the disease when the test results are negative. It is given by the formula true negative/(true negative + false negative).

In the given example, positive predictive value is 96/ (96 + 250) =27.7%

In other words the likelihood that a woman with a positive pap smear will also have a positive biopsy specimen i.e. have cervical cancer is 27%.

Negative predictive value is 250/(4 + 250)=98.4%

That is the likelihood that a woman with a negative pap smear will also have a negative i.e. biopsy specimen i.e.not have cancer of cervix is high.

As you can see from the example, the predictive value of a test is not a property of test alone. It is determined by the sensitivity and specificity of the test and the prevalence of the disease in the population being tested. Higher the prevalence,the higher is the predictive value. In diseases of low prevalence, a large number of false positive results are produced.