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GUIDELINES FOR MEDICAL OFFICERS

Prevention and Management of Cardiovascular Diseases, Diabetes and Stroke

CENTRE FOR CHRONIC DISEASE CONTROL

PUBLIC HEALTH FOUNDATION OF INDIA
Developed for the National Programme on Prevention and Control of Cardiovascular diseases, Diabetes and Stroke
Developed under the GOI-WHO collaborative programme (2008-09)
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Chronic diseases like cardiovascular diseases, diabetes and stroke are preventable. Even in individuals with manifest disease, lifestyle changes and drug therapy can result in reduced deaths, disability and help affected individuals lead a normal life.
Introduction
Non-communicable diseases (NCD), or chronic diseases include cardiovascular diseases, diabetes, stroke, most forms of cancers and injuries. Such diseases mainly result from lifestyle related factors such as unhealthy diet, lack of physical activity and tobacco use. Changes in lifestyle, demographic profile (aging population), urbanization, globalization and other socio-cultural changes, lead to sharp increases in the prevalence of NCD. These diseases by and large can be prevented by making simple lifestyle changes.

Magnitude of NCD burden in India
During the year 2005, NCD accounted for 53% of all the deaths in the age group 30-59 years in India. Of these, 29% were due to cardiovascular diseases; It is estimated that, by 2020, cardiovascular disease will be the largest cause of disability and death, as a proportion of all deaths in India. In 2003 alone, in India, there were approximately 30 million people suffering from coronary heart disease.

Diabetes which is a major risk factor for chronic disease on it own causes increased death and disability. According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India is currently around 40.9 million and is expected to rise to 69.9 million by 2025, unless urgent preventive steps are taken. Similarly, 118 million people were estimated to have high blood pressure in the year 2000 which is expected to go up to 213 million in 2025. Not only this, Indians succumb to diabetes, high blood pressure and heart attacks 5-10 years earlier than their western counterparts, during their most productive years. This leads to considerable loss of productive years, to the country. It has been estimated that, by the year 2030, India will lose approximately 17.9 million potentially productive years which is higher than the expected combined loss in China, Russia, USA, Portugal and Brazil. This translates into a huge economic loss as high as 237 billion dollars by the year 2015. Development of diabetes and heart attacks at an early age is largely because of environmental causes such as low consumption of fresh fruits and vegetables along with other unhealthy diet, increasing use of tobacco, and higher prevalence of sedentary life-style.

To prevent and contain the projected increase in the burden of Non-Communicable Diseases, Ministry of Health and Family Welfare, Government of India, has launched the National Programme on Prevention and Control of Diabetes, Cardiovascular diseases and Stroke (NPDCS) on 4th January, 2008 on a pilot basis.
Objectives
The pilot phase has been planned with the objectives of providing an integrated action plan for health promotion, chronic disease prevention and control strategies. The programme activities have been grouped into the following three main components:

i. Health promotion for the general population to prevent occurrence of CVD.
ii. Preventing diseases and complications in those with high risk.
iii. Assessing the prevalence of risk factors.

The activities under each of these components are outlined in Figure-1. The subsequent sections of the book are aimed at disease prevention of the high risk and provide simple guidelines for detection and management of individuals with CVD, diabetes, high blood pressure, dyslipidemia and stroke.

What are cardiovascular diseases?
Cardiovascular diseases (CVD) are a group of disorders of the heart & blood vessels. These include:

- Coronary heart disease – diseases of blood vessels supplying the heart muscle – which may result in heart attacks (myocardial infarction) and chronic angina.
- Cerebrovascular disease - diseases of blood vessels supplying the brain, which can result in stroke or brain attack.
- Peripheral arterial disease – diseases of blood vessels supplying the limbs, which can result in pain on walking, intermittent claudication, non healing ulcers and gangrene.
- Deep vein thrombosis & pulmonary embolism – blood clots in the leg veins, which can dislodge and obstruct the pulmonary arteries leading to acute pulmonary embolism.

Of these, coronary heart diseases, cerebrovascular diseases (Stroke) and peripheral
arterial disease are the major groups of diseases in India resulting in substantial death and disability. In addition, India has the largest number of individuals with type-2 diabetes in the world. India is thus being called the diabetes capital of the world.

What gives rise to cardiovascular diseases and diabetes?
Cardiovascular diseases and diabetes are caused by risk factors like tobacco use, low fruit and vegetable intake, physical inactivity, high blood pressure, dyslipidemia (high levels of total cholesterol, LDL-cholesterol, and triglycerides and low levels of HDL-Cholesterol) overweight/obesity (both generalized and central), diabetes and psychosocial stress.

Other putative but not well proven factors include air pollution, food preservatives, adulterants, artificial color and indoor smoke from solid fuels. Alcohol consumption, specifically binge drinking, leads to acute hypertension, stroke and in some individuals atrial fibrillation and cardiomyopathy.

Some attributes of risk factors for CVD and diabetes
• Risky lifestyle behaviors are responsible for the risk factors. Risk factors are cumulative and operate on a life course perspective. (i.e. they influence the risk throughout the life course. For example childhood obesity is a major risk factor for adult obesity and consequently diabetes and CVD).
• Normally, for all practical purposes it is seen that these risk factors occur together. A person who has high blood sugar level may also have high blood pressure, dyslipidemia and central obesity.
• Risk factors operate in a continuum. This means that even within ‘normal ranges’, individuals with higher levels have higher risks than those with lower levels. For example individuals with systolic blood pressure of 135 mmHg have a higher risk of CVD, stroke and future death than those with 120 mmHg even though both are within ‘normal’ range. This applies to all the risk factors of CVD and Stroke
• The risk factors are additive. This means that concurrent small elevations of risk factors are much more harmful than isolated elevation of single risk factors. For example, in the Framingham Cohort, risk for CHD, at follow-up was compared between two groups.

Group A: Had individuals with isolated single risk factor elevation. E.g. They had Serum Cholesterol >245 mg%, systolic blood pressure between 118-124 mmHg & were non-smokers

Groups B: Had individuals with small elevations of multiple risk factors: Serum cholesterol between 203-220 mg%, systolic blood pressure 132-141 mmHg & were smokers).
Today's risky behaviours are tomorrow's risk factors. Today's risk factors are tomorrow's disease (see figure 1). Primary and secondary prevention of chronic diseases and their common risk factors provide the most sustainable and cost-effective approach to chronic disease prevention and control.

The risk of CHD events in the group B with multiple risk factors (though of a smaller degree) was five times greater than in group A.
What can Lifestyle Modifications do?

Appropriate changes in lifestyle among individuals and families can prevent disease,
Prevent progression of pre-existing disease,
Prevent complications of cardiovascular disease,
Reduce the need for multiple drugs,
Decrease the doses of drugs and reduce costs,
And
Help people lead a normal life even in presence of the disease.
Therapeutic Lifestyle Modification for the Management of Coronary Heart Disease, Diabetes and Stroke
While specific management of these diseases is discussed later, it is important to emphasize the importance of lifestyle modification. Lifestyle modifications include quitting all forms of tobacco use, adopting a healthy diet and maintaining a physically active lifestyle

If successfully done, these measures themselves may reduce the dose of drugs. Additionally, in individuals with mild hypertension and mild diabetes, lifestyle modification can eliminate the use of drugs for a number of years.

Below is a detailed description of the benefits and how to impart and advice lifestyle changes in individuals with coronary heart disease and diabetes. In addition, these recommendations are equally applicable for prevention of CVD and diabetes in healthy individuals as well.

A. Counseling on Healthy Diet

**Fruits and vegetables:**
Fruits and vegetables contain the magic mix of micro and macro nutrients, anti-oxidants, vitamins, flavonoids, fiber and phytochemicals! Daily regular consumption of fruits and vegetables lower the risk of high blood pressure, stroke, coronary artery disease, cancer, diabetes & other chronic diseases. They also enhance the body’s immune system, prevent acute diseases and delay aging. In people with high blood pressure, consumption of fruits and vegetables can lower the blood pressure. Therefore, eating plenty of fresh, seasonal, locally available fruits, vegetables and local berries (at least of 450-500 gms which is equal to approximately 5 servings*) to prevent heart attacks, strokes, diabetes, blood pressure and many other diseases! No single fruit or vegetable provides all of the nutrients that are needed to be healthy. The key lies in eating a variety of different fruits and vegetables.

The patient should be encouraged to choose a variety of locally available and affordable fruits, vegetables and berries. This should include dark-green leafy vegetables; yellow, orange, and red fruits, vegetables and berries; purple and deep red fruits such as tomatoes; and citrus fruits. Whole fruits are preferred over fruit juices as juices are devoid of natural fibre. Further, commercially available packed fruit juices are never advised as they contain added sugars, artificial flavours and preservatives besides providing unwanted concentrated calories with little nutrition and fiber and adding to the excess energy intake. Fresh fruits and berries are better than fresh juices and fresh juices are better than processed/packed juices.

* 1 serving is equal to a cup of cut fruits/vegetables or 80-100 grams
Seasonal locally available berries are as healthy as expensive fruits
Whole Grains: Whole grains protect the Whole body!

Encourage and promote the use of locally available whole grains and whole pulses. High consumption of whole grains (as compared to refined grains) is associated with a 35% reduction in risk of heart diseases, stroke and type-2 diabetes. People who eat 3 servings of whole grains everyday have been shown to:

- Reduce the risk of heart diseases by 25-36% and stroke by 37%.
- Reduce the risk of developing Type-2 diabetes by 21-27%
- Reduce the risk of digestive system cancers by 21-43% and hormone related cancers by 10-40%

Patients should be encouraged to use locally available whole grains and whole pulses. For example the bran in the atta should be retained and not sieved. Maida, being the superfine powder of wheat, lacks fibre and hence should be avoided. Whenever possible, non-processed atta and locally available millets such as ragi, bajra and jowar should be encouraged.
NUTS: Power of Prevention in Nuts

NUTS including peanuts and fruit seeds protect the heart and improve the blood lipid profile. Nuts lower the LDL cholesterol levels by 7 - 16%. Nuts and fruit seeds (for e.g. melon seeds, watermelon seeds etc) are an excellent source of omega-3 fatty acids, alpha-linolenic acid, anti-oxidants, calcium, phytochemicals, vitamins, flavonoids, minerals like selenium and magnesium. Nuts promote heart health, skin health, prevent allergies, and strengthen the immune system and healthy lipid levels in the blood.

In addition, nuts are a good source of dietary fibre, essential fatty acids and plant protein. They also contain vitamins, such as folic acid, niacin and vitamins E and B6 and a range of minerals, including iron, magnesium, copper, zinc, selenium, phosphorus and potassium. Phytochemicals are biologically active components which have important health properties.

All nuts are relatively high in fat and calories and as a result, earlier, they were not regarded as potential components of a healthy diet. However, most of the fatty acids in nuts are monounsaturated. Scientific research has shown that replacement of saturated fatty acids in the diet by monounsaturated or polyunsaturated fatty acids can lower blood levels of LDL cholesterol. Addition of small quantities (15-30 gms) of nuts (non fried and non-salted) or fruit seeds to ones diet is health promoting and protective against heart diseases.

Even consumption of a few (5-10) pods of peanuts, almonds or walnut may be very useful. However excessive consumption can lead to weight gain. One has to be cautious that most of the commercially available nuts are salted and oil fried and are deleterious to health because of their added high salt and oil content.
Unhealthy Oils and Fats

Oils and fats in the diet determine the level of cholesterol synthesized in the body. Fried foods, red meat, dairy products which are high in fat/oil content accelerate the process of atherosclerosis (accumulation of fatty deposits on the inner lining of arteries) by altering the profile of cholesterol in the body. Unhealthy oils reduce High-density lipoprotein cholesterol (HDL-c) and increase Low-density lipoprotein cholesterol (LDL-c) and triglycerides. Such changes are clearly associated with excess risk of CVD.

Maintaining an optimal and healthy profile of fats/oil is the key to a healthy diet. In sedentary people, as a thumb rule, the maximum quantity of oils consumed by an adult person from all sources of foods should not exceed 500-750 ml in a month. This includes cooking oil, frying oil, butter, and other sources of visible added fat/oil. Fat consumed in the house per person needs to be measured and controlled. If there are four members in a household the approximate quantity of fat/oil/butter (all together) bought and consumed per month should not be more than 2 kilograms.

Oils which are liquid at room temperature are preferable to those that are solid at room temperature. Vegetable oils rich in mono-saturated and polyunsaturated fats (sesame oil, sunflower oil, mustard oil, soya oil, rice bran oil, groundnut oil) are preferable. A mixture of oils is preferred to single type of oil. Our old tradition of making different food items in different oils works well. Trans fats have to be avoided. Vanaspati contains trans fats. These are also formed when oils are repeatedly heated to high temperatures, for e.g. while deep frying. In addition the intake of fried foods, dairy products (ghee, ice creams, chocolates), biscuits, fast foods, namkeens, bakery items and red meats should be limited.
B. Counseling on Physical Activity

What are the benefits of physical activity?

- Physical activity relaxes and lowers cholesterol (LDL cholesterol) and triglycerides in the blood. It is the best way to increase HDL cholesterol (good cholesterol) in the blood.
- It lowers blood pressure.
- It prevents diabetes by improving glucose control in diabetes by increasing insulin sensitivity. It helps to bring the glucose levels close to normal.\textsuperscript{16}
- Regular physical activity is important for promoting weight control or weight loss. Exercise helps burn calories, producing weight loss.
- By its effects on several risk factors physical activity reduces the risk of myocardial infarction, stroke, diabetes, colon and breast cancers.\textsuperscript{11-18}
- In addition, it is the best remedy for stress
How to do it?
It was earlier felt that physical activity had to be performed at a single stretch of 30 minutes to be effective. However, research has shown that physical activity can be spread out over the day. Thus 10 minutes of moderate activity performed three times a day can add up to 30 minutes of physical activity. Moderate activity is equal to a brisk walk that can cover an equivalent of 1 Km in 10-12 minutes.

Practical tips for counselling patients on physical activity
(This is for individuals who are largely sedentary, white collar workers, housewives etc. and may not apply to people who perform hard labour or those who work directly in the fields)
• Exercise should be ideally planned by setting a time for it every day. Exercise should be performed at a time that is best and most convenient for each individual. Gradually increase, in the duration and intensity, is recommended.
• Simple measures include walking up a couple of flights of stairs rather than taking the lift. It is best to avoid taking the lift up to 3 floors.
• It is preferable to do household work, like washing of clothes, sweeping and swabbing and taking on more responsibilities at home, like buying the groceries and doing other errands.
• If possible and available, sports like swimming and outdoor activities are recommended.
• Walk around the house during television commercials to burn a few extra calories.
• Try to walk or use a cycle to go to work or to the market.
• If bus is the mode of transport, then getting off the bus one to three stops earlier than one’s stop and walking home will make a person light without making the purse lighter.
• If using a car, parking the car at the farthest end of the parking lot, shopping centres, cinema halls etc is desirable.
• Exercise breaks are preferable to coffee/tea breaks.
• Finding an exercise partner: Exercise is more fun with company.

Telling the patients when not to exercise
• If the blood pressure is 200 mm systolic or 110 mm diastolic or more. In such a situation the blood pressure needs to be controlled first.
• If the patient has advanced eye disease such as near blindness or nocturnal blindness due to diabetic retinopathy or retinal detachment.
• If the plasma glucose levels are more than 250 mg/dl. In such a situation blood glucose needs to be controlled first.
• Following recent (within 6 weeks) heart attack or stroke
• If the patient has uncontrolled angina (class II and above).
What is Moderate-intensity and Vigorous-intensity Physical activity?

The intensity of different forms of physical activity varies between people. The intensity of physical activity depends on an individual's previous exercise experience and their relative level of fitness. Consequently, the examples given below are provided as a guide only and will vary between individuals.

**Moderate-intensity Physical Activity**
Requires a moderate amount of effort and noticeably accelerates the heart rate
Examples of Moderate-intensity exercise include:
- Brisk walking
- Dancing
- Gardening
- Household and domestic chores
- Active involvement in games and sports with children/walking (briskly) domestic animals
- General building tasks (e.g. roofing, thatching, painting)
- Carrying / moving moderate loads (<20kg)

**Vigorous-intensity Physical Activity**
Requires a large amount of efforts and causes rapid breathing and a substantial increase in the heart rate
Examples of vigorous-intensity exercise include:
- Running
- Walking / climbing briskly up a hill
- Fast cycling
- Aerobics
- Fast swimming
- Competitive sports and games (e.g. traditional games, football, volleyball, hockey, basketball
- Heavy shoveling or digging ditches
- Carrying / moving heavy loads (>20kg)

**Recommended Amount of Physical Activity**

**Adults (18-65 years old)**
- 30 minutes of moderate-intensity physical activity 5 days per week; OR
- 20 minutes of vigorous-intensity physical activity 3 days per week; OR
- An equivalent combination of moderate / vigorous-intensity physical activity; AND
- 8-10 muscular strengthening exercises (8-12 repetitions) at least 2 days per week.

**Older Adults (65+ years old)**

Same recommendations as described for adults (outlined above) with due consideration for the intensity and type of physical activity appropriate for older people; AND

- Exercises to maintain flexibility; AND
- Balance exercises.

Telling the patient how to exercise

It is important to warm up before exercising. It will prevent injury and aching in the next day. It is advisable to build up fitness gradually and slowly, by starting with gentle movements. While exercising, it is important to exercise at a level that will improve fitness without over-exerting. As a rule of the thumb, exercise should always be performed at a location where easy assistance if needed will be available. Exercise should be stopped immediately if the body suddenly sends out warning signals such as severe pain, tingling, severe breathlessness, giddiness.

Dance is a wonderful physical activity, it is also a stress reliever!
C. Counselling on Tobacco

Some Facts:

- In India, 900,000 people die due to tobacco related diseases per year.
- In India, tobacco contributes to 56.4% and 44.9% of cancers in men and women, respectively and India has the largest number of oral cancer cases in the world.
- Tobacco smoking accounts for 82% of chronic obstructive lung disease in India. Tobacco also increases the risk of lung tuberculosis. Prevalence of TB is about 3 times as great among the ever-smokers as among the never-smokers. The heavier the smoking, either cigarettes or bidis, the greater the prevalence of TB among smokers. Mortality from TB is 3 to 4 times as great in ever-smokers as in never-smokers.
- About half of the teenagers who use tobacco will eventually be killed by it. Avoiding tobacco adds 20 years to the life of a teenager.
- It is estimated that India as compared to any other country will have the fastest rise in tobacco related deaths each year. Bidi smoking is as harmful cigarette smoking. Tobacco chewing also increases the risk of CVD. Combined chewing of tobacco and smoking increases the risk of CVD substantially.

- **Tobacco use leads to:** heart and blood vessel diseases including Myocardial Infarction (Heart Attack), Angina (Chest Pain), sudden Cardiac Death (Unheralded sudden death), Stroke (Brain Attack), Peripheral Vascular Disease (Gangrene of legs), Impotence and Aortic Aneurism. It has recently been implicated in the development of Diabetes and Metabolic Syndrome.
- **Sub-mucous Fibrosis (Leukoplakia):** Tobacco use is one of the principal causes for this medical condition, Leukoplakia which is characterized by the occurrence of white patches inside the mouth or tongue, especially in the mucous membranes inside the mouth. Low birth weight is known to increase the risk of adult coronary heart disease, hypertension and diabetes.
- **Effect on pregnancy, passive smoking on the baby:** Smoking and exposure to environmental tobacco smoke during pregnancy has a hazardous impact on the fetus, such as low birth weight and intrauterine fetal growth retardation. It adversely influences postnatal growth and development.
**Benefits of giving up tobacco**
The risk of heart attack starts decreasing within 24 hours after giving up tobacco. Within one year the risk of heart attack reduces by almost 50%. At five years, the risk of a heart attack/stroke is similar to a non-smoker.

**Tips for stopping tobacco**
These tips need to be contextually and culturally adapted by the physician while advising the patient.

- Not letting cigarettes, hukka, paan and jarda to be easily available. The patient should be advised to keep the cigarettes/jarda, paans in a place where they have to make a real effort to get them. For example, another room of the house, places where they don’t go very often, locked in a cupboard etc. Every time they wish to smoke/eat jarda/ paan they should have to make a conscious effort, get up, walk and get it. They should be advised to hide ashtrays, cigarettes, hukka, paan, jarda. Out of sight, out of mind. A simple, yet helpful tip.
- Patients should be encouraged to figure out their “triggers” to smoke, or consume paan/jarda/hukka and ways to cope with them. For example, for many it the company of people who smoke/eat jarda/paan. In the initial period of attempting to quit they should try and be away from smokers/paan eaters/ jarda eaters or at least when they smoke or eat pan/jarda. If the trigger is tension, working late, or simply oneself or gain a bit of extra energy, individuals should be advised some alternative such as chewing gums, peppermints, lozenges, cloves, cardamom etc.
- The recommended 4 Ds to overcome the craving for smoking/tobacco are:
  - To do something else;
  - To delay the next gutka / bidi / cigarette;
  - To attempt deep breathing; and
  - To drink water.
- Setting a stop date.
- Encourage to find a support person.
- Trying and making plans for the first day without cigarettes/paan/jarda.

**Other simple measures include**
- Using positive self-talk!
- Self Reward!
- Practicing relaxation techniques (yoga, walking, meditation, dancing, music etc.) every day!
- Limiting the intake of caffeine and alcohol.

In highly motivated and selected individuals pharmacological measures are advocated. This will require a referral to a tertiary centre.
Prevention and Management of High Blood Pressure
**Introduction**

Abnormally elevated blood pressure is a pathological condition which increases the work load on the heart. This condition is termed as high blood pressure or hypertension. Based on the etiology, high blood pressure is of two types:

**Primary/essential**

Primary or “essential” hypertension has no known cause, however many of the above said lifestyle factors are associated with this condition. This constitutes majority of the high blood pressure in the world today.

**Secondary**

Secondary hypertension is caused by some other medical conditions/problem or the use of certain medications. Secondary hypertension is seen only in very few individuals in the community. The causes of secondary hypertension include:

- Kidney diseases: Reno-vascular disease and Chronic renal disease
- Endocrine disorders: Hyperthyroidism, Cushing’s syndrome and Pheocromocytoma
- Sleep disorders
- Coarctation of the aorta
- Non specific aorto-arteritis

Some of these causes are often curable, and many others treatable.

**What are the risk factors for high blood pressure?**

- Lack of physical activity (or sedentary lifestyle).
- Obesity or being overweight
- Increased abdominal fat
- High sodium intake/high salt intake
- Excess alcohol consumption.

**Criteria for diagnosing high blood pressure**

The table-1 provides a classification of blood pressure for adults ages 18 and older. The classification is based on consistent elevation during two or more properly measured BP readings in sitting position. (Refer appendix for how to measure).

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (Top number)</th>
<th>Diastolic (Bottom number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Less than 120</td>
<td>Less than 80</td>
</tr>
<tr>
<td>Pre-hypertension</td>
<td>120-139</td>
<td>80-89</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>Stage 1 140-159</td>
<td>90-99</td>
</tr>
<tr>
<td></td>
<td>Stage 2 160 or higher</td>
<td>100 or higher</td>
</tr>
</tbody>
</table>

Source: JNC VII classification
Management of Hypertension

Screening for detection of high blood pressure cases can be carried out at primary health care level even by non-physician health workers. The management of high blood pressure can be initiated with an initial risk assessment followed by the management of uncomplicated cases of high blood pressure at PHC level and referral of complicated cases to CHC/sub-district level.

The Risk assessment should cover

- Assessment of medical history
- Physical Examination
- Laboratory Investigation

Assessment of medical history

Ask for:

a. Risk factors
   - Lack of physical activity (or sedentary lifestyle).
   - Obesity or being overweight
   - Abdominal obesity
   - High sodium intake/high salt intake
   - Excess alcohol consumption

b. Family history
c. Symptoms of consequences of hypertension
d. Frequent intake of pain relieving drugs (NSAIDS)
e. Steroid intake for asthma
f. Breathing difficulty particularly on exertion
g. Swelling of feet
h. Urinary difficulties, history of passing stones in the past

Physical examination

Physical examination should include

a. BP measurement at least in one upper and one lower limb (Refer Appendix- for the procedure)
b. Measurement of Body weight and height to obtain BMI
c. Measurement of Waist circumference
d. Palpating all peripheral pulses
e. Auscultation for bruit (renal, carotid, abdominal and others)
f. Eye evaluation if ophthalmology facility is available

Laboratory Tests

Essential:  
- Blood Sugar
- Urine analysis for proteinuria
Desirable: (at CHC/sub-district/district level hospitals depending upon the available facilities for laboratory investigations)

- Haemogram,
- Serum creatinine
- Serum sodium and potassium levels
- Lipid profile
- Complete Urine analysis
- Electrocardiogram(ECG)
- X-Ray chest

Based on risk assessment, the management of high blood pressure cases can be initiated. The management should include the following:

- Therapeutic life-style management

Life style advice is advocated for the first six month after the diagnosis of high BP in the following situations:

- If the BP is less than 160/100 mm of Hg
- There is no diabetes, co-existing heart disease stroke or peripheral vascular disease
- No evidence of LVH on ECG
- Absence of urinary proteinuria and
- Serum creatinine <1.6mg/dl

**Drug Therapy**

**Whether a person requires medicines for his high blood pressure and which medicine is best for the patient would depend on:**

- The blood pressure reading
- Whether the high blood pressure has already affected target organs in the body such as heart, kidneys, eyes and arteries
- Concurrent medical conditions such as diabetes, heart disease, kidney disease and other risk factors like use of tobacco, obesity and high blood fat levels(lipid profile) etc.
- Other considerations will be age, gender (male/female) and body weight.
Treatment Goals

1. Initial aim should be to obtain blood pressure level less than 130/85 mms of Hg
2. Ideally the aim should be to get to blood pressure levels of less than 120/80 without bothersome side-effects.
3. Don’t accept blood pressure levels of 140/90 mms of Hg or more
4. Maintain healthy blood pressure throughout the person's lives
5. Prevent and control risk factors which could give rise to high blood pressure.
6. Always make sure that risk factors are controlled.
7. Prevent and control risk factors which could increase risk of complications due to high blood pressure.

Drugs should be chosen from the following groups:
- ACE-Inhibitors
- Calcium channel blockers
- Diuretics
- Angiotensin II receptor blockers
- Beta blockers
The best scheme for initiating and treating patients with high blood pressure has been provided recently by the British Heart Foundation. This is chosen as current evidence and a simple algorithm (Box-4) has been provided. In the Indian context, diuretics (hydrochlorthiozide), calcium channel blockers (amlodipine) and ACE inhibitors (Enalapril) are relatively cheap. Drug therapy should be started in individuals at the time of diagnosis if they have blood pressure more than 160/100mmHg (despite non-pharmacological interventions) or if the blood pressure is more than 140/90 in diabetic subjects or end organ damage such as proteinuria, high blood urea, ECG evidence of left ventricular hypertrophy, presence of heart diseases and evidence of retinopathy. In all other individuals life style modification should be tried for atleast six months before initiating drug therapy.

**Box 4**

**ABBREVIATIONS**

- A - ACE Inhibitor
- C - Calcium-channel blocker
- D - Thiazide-type diuretic

**Source:** National Institute for Health and Clinical Excellence (NICE), UK clinical guideline 34- Hypertension

**Medicines are tailored depending on the following factors**

- Blood pressure level
- Patient characteristics (like age, body weight, occupation.)
- Co-existing risk factors
- Type and extent of target organ damage
- Other associated diseases
- Affordability

It is better to start with calcium channel blockers (specifically if the person is older than 55 years) and ACE inhibitors (if less than 55 years). Recheck the BP in 2 weeks. If the BP is not under control adding a diuretic (Hydrochlorthiazide 12.5 mg a day) may be helpful. Normally, this should bring the BP under control. If the BP is not controlled by the combination of Amlodipine 10mg + Hydrochlorthiazide 25mg a day OR Enalapril 10mg and
Hydrochlorthazide 25mg a day, a referral to a higher center may be necessary.

The summary of services for hypertension management, appropriate at each levels of care is depicted in table -3.
1. A 60 year old man with a history of smoking 1 pack bidi/ day has intermittent claudication of left lower leg with a claudication distance of 200m. His blood pressure is 150/90 mmHg in the right arm. Blood tests reveal a blood sugar (fasting) of 110 mg/dl, total cholesterol of 240mg/dl and HDL cholesterol of 40mg/dl.

a. What is your diagnosis?
b. What investigations would you suggest?
c. What should be the prescription?

This person needs aggressive lifestyle measure as the first line of therapy. Motivate, educate and impart context and culture specific skills to the patient.

Important life style measures are delineated below.

- Quit smoking and all other forms of tobacco.
- Reduce salt in the diet and increase the amount of fresh fruits and vegetables.
- He needs to switch to whole grain and whole pulses from refined grains and refined pulses and to include small quantities of (30-50 gms) unsalted, non-fried nuts or fruit seeds in his diet.
- Avoid foods rich in transfats and saturated fats (e.g. Deep fried foods, samosas, vadas, biscuits etc)
- He needs to do exercises with his feet (raising his feet up and down when lying down, also known as Bergeurs exercises). In addition walk 200 meters at a time.
- Fasting sugar too is borderline and he needs to be counselled on his diet to restrict calorie dense foods and refined carbohydrates. This would help his blood pressure, blood cholesterol and blood sugar to improve and his claudication distance won’t deteriorate further and in fact may improve. It is critical that feet care for diabetes needs to be imparted (refer to the box—on feet-care). The treating physician at every visit needs to check for the pulses in the feet, sensation in the feet and examine the feet for cracks, injuries, toe infections etc.
- A small dose of Aspirin (75-162 mg) may be added.

If clear evidence of Peripheral vascular disease is present (absence of pulses) or after 3 months he does not improve then a small dose of Amlodipine (>60 years) should be added. His post-prandial blood sugar needs to be repeated and blood pressure should be monitored every 3-6 months. If he is found diabetic by post prandial Blood Sugar assessment, he should be appropriately followed up. Statins (preferably the cheapest, either Simavastatin 20mg or Atorvastatin 10mg, should be added and total cholesterol reduced to <160mg/dl.

First do baseline assessment then once a year he may be refereed to the CHC for ECG, fundus, serum creatinine, urea, sodium, potassium, and urinary protein. If despite adequate lifestyle changes, claudication distance gets worse, then specialist’s opinion with Doppler of the feet needs to be considered.
2. A 30 year old man is detected to have a blood pressure of 160/96 during medical screening for a governmental job. He has no family history of premature coronary artery disease and is a non-smoker. On examination he has a BMI of 27 kg/m2 with a waist circumference of 95 cm. His blood investigations reveal a blood sugar of 106 mg/dl and total cholesterol of 220 mg/dl with HDL cholesterol of 35 mg/dl and triglycerides of 300 mg/dl.

a. What is your diagnosis?

b. What investigations would you suggest?

c. What should be the prescription?

Since the patient is young one needs to look at secondary causes. He may need referral to the CHC. Feel the femoral and other pulses (if weak consider coarctation of aorta or non specific aorta arteritis). If available at the PHC or at the CHC level, get serum potassium, urea and renal Doppler to rule out kidney, endocrine or renovascular causes. Despite being young the most likely cause would be essential hypertension. Lifestyle modification would be the first line of therapy. Since he has a BMI of 27, there is a likelihood that once he loses weight and introduces other lifestyle changes, his blood pressure and other risk factors like lipids and fasting sugar would improve. He needs to cut salt in his diet (avoiding papads, pickles, adding extra salt to cooked food and salads, avoiding salted biscuits can be a good start) and increase the amount of fresh fruits, vegetables, berries, whole grains and whole pulses, nuts and fruit seeds. If after 6 months he does not improve then a small dose of ace-inhibitor could be added and life style changes needs to be continued.

3. A 50 year old man known hypertensive on treatment with 50 mg of Atenolol has a blood pressure of 140/90 mmHg. Blood sugar (fasting) 150 mg/dl and (postprandial) of 200 mg/dl. His total cholesterol is 220 mg/dl with HDL cholesterol of 35 mg/dl and triglycerides of 220 mg/dl. His ECG suggests old inferior wall MI.

a. What is your diagnosis?

b. What investigations would you suggest?

c. What should be the prescription?

Again in this case, reinforce life style changes: decrease in high salt foods, use flowing oils, elimination of trans-fats and saturated fats in the diet and restriction of calorie dense foods with an increase of fresh fruits, vegetables and berries, whole grains, nuts/fruit seeds consumed each day. His exercise levels needs to be assessed to ensure that he is doing a minimum of 30 minutes of walking, 5 days
a week. His kidney functions by way of serum creatinine, urea, sodium and potassium, and retina (fundus examination) need to be checked, at the CHC.

Additional, medications need to be instituted. A small dose of aspirin (65 mg or 125 mg), an ace-inhibitor, a beta-blocker and a statin, if available needs to be added. He needs to be reassessed after 3 months. If aspirin for some reason is contraindicated then clopidogrel, if available, needs to be considered. His blood sugars need to be assessed every 3 months, and if not controlled by lifestyle modification then metformin 500 mgs at bedtime can be added to control his fasting first. If fasting is normalized with lifestyle modifications without medicines but his postprandial blood sugars are high then metformin can be added with breakfast. Remember, any patient on anti-diabetes medication (be it tablets or insulin) need to be counselled and educated on symptoms and management of hypoglycemia.
Prevention and Management of Diabetes
What is diabetes?
Diabetes is a disease in which the body does not produce or properly use the hormone insulin. The body needs insulin to convert sugar, starches and other foods into energy. Impairment of insulin secretion and action in the body leads to abnormally elevated levels of glucose in blood, a condition classically termed as diabetes.

What are the different “types” of diabetes?
Diabetes is classified into three types namely Type 1 Diabetes, Type 2 Diabetes and gestational diabetes. A description of each of these types is give below while guidelines for management elaborated in the following sections are specific to type 2 diabetes.

Type 1 diabetes (T1DM): usually occurs in younger people, children and adolescents. The diagnosis of T1DM can be made throughout childhood but it is more likely below 15 yrs of age. The onset is usually acute and severe and insulin is required for survival. Type 1 diabetes results from autoimmune destruction of the beta cells in the pancreatic islets. Family history of diabetes is rare in T1DM. Presence of features of associated autoimmunity (autoimmune disorders, vitiligo) and absence of obesity and acanthosis nigricans are characteristics of T1DM. In addition, urine of T1DM patients with uncontrolled hyperglycemia is positive for ketone bodies.

Type 2 diabetes (T2DM): is the commonest type of diabetes. It usually occurs after the age of forty years but occurs frequently even at lower age among Indians. T2DM was previously known as non-insulin dependant diabetes mellitus. The onset is usually insidious and may be mild to severe. The family history is usually positive and strong. Obesity, metabolic syndrome and acanthosis nigricans are usually seen in these patients while there is no evidence of autoimmunity. Further, there is no insulin dependence till late in the course of disease.

Two principal defects individually or in combination give rise to T2DM. The first defect is resistance to the action of insulin, wherein tissues require a higher dose of insulin to function compared to normal individuals. The other defect is relative dysfunction of pancreatic beta (B) cells. Hence, when the demand of insulin is high, as seen in individuals with insulin resistance, insulin supply cannot meet up to the demand and a relative deficiency of insulin sets in. This results in elevation of blood sugar level from the normal levels and individuals pass through intermediary stages, namely impaired glucose tolerance (IGT) and impaired fasting glucose (IFG), before progressing to T2DM (see figure). Usually
in T2DM, both defects occur concurrently. Insulin resistance can be corrected with lifestyle changes like physical activity, dietary modifications and loss of excess body weight, especially in people who are obese. Such changes also reduce the demand on the pancreatic cells to produce insulin. Therefore, early in the natural history of disease, lifestyle intervention can, by improving insulin sensitivity, halt or delay the progression to T2DM.

**Gestational diabetes:** It is diagnosed when diabetes is detected for the first time during pregnancy. Although, gestational diabetes disappears after the delivery, such women are at higher risk for T2DM, later on in life.

**When is a person at high risk for diabetes?**
- If he/she is of above the age of 45 years
- If he/she is overweight (BMI more than 23kg/m²).
- If he/she is physically inactive, that is, he or she exercises less than 3 times a week.
- If he/she has high blood pressure.
- If he/she has impaired fasting glucose or impaired glucose tolerance.
- If his/her triglyceride and/or cholesterol levels are higher than normal.
- If his/her parents/siblings or grandparents have or had diabetes.
- If she delivered a baby whose birth weight was 4 kgs or more.
- If she has had diabetes or even mild elevation of blood sugars during pregnancy.

**When to suspect diabetes?**
- Symptoms of uncontrolled hyperglycemia: excess thirst, excess urination, excess hunger with loss of weight
- Frequent infections
- Non-healing wounds
- Unexplained lassitude
- Fatigue
- Impotence in men

**Criteria for diagnosing T2DM**
The criteria for diagnosing T2DM, as defined by the World Health Organization in 1999, are depicted in table-4.21

<table>
<thead>
<tr>
<th>Criteria for Diagnosis of T2DM (Using venous blood samples*)</th>
<th>2-hour Post-Glucose Load (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus</td>
<td>&gt;=126</td>
</tr>
<tr>
<td>Impaired Glucose Tolerance</td>
<td>&lt; 110</td>
</tr>
<tr>
<td>Impaired Fasting Glucose</td>
<td>&gt;=110 to &lt;126</td>
</tr>
<tr>
<td></td>
<td>&gt;=200</td>
</tr>
<tr>
<td></td>
<td>&gt;140 to &lt;200</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

*WHO Definition 1999*
Management of Diabetes

Management of T2DM should be initiated as soon as diagnosis is established even if the patient is asymptomatic. Initial assessment and management of the patients has to be carried out at the Community Health Centre (CHC) level or at secondary care level. Management of T2DM comprises of an initial assessment, initial management and follow-up visits. Each of these components is elaborated here.

1. Initial assessment of individuals suspected of having T2DM needs to include a risk assessment consisting of:
   - History and physical examination;
   - Assessment of blood glucose level;
   - Presence of CVD risk factors (lipid profile); and
   - End-organ damage (urine for protein/ ECG/ fundus examination).

Assessment of history and physical examination of the patient is elaborated in table-5.

<table>
<thead>
<tr>
<th>INITIAL ASSESSMENT OF PATIENTS WITH DIABETES</th>
</tr>
</thead>
<tbody>
<tr>
<td>History (Ask for)</td>
</tr>
<tr>
<td>Symptoms of hyperglycaemia</td>
</tr>
<tr>
<td>Duration since onset of symptoms</td>
</tr>
<tr>
<td>Precipitating factors such as recent infections, stress, change in dietary habits or physical activity levels</td>
</tr>
<tr>
<td>Symptoms of Micro- and Macro-vascular Complications: visual disturbances, edema, breathlessness, angina, intermittent claudication, numbness, paraesthesiae</td>
</tr>
<tr>
<td>Hypertension, pre-existing cardiovascular diseases</td>
</tr>
<tr>
<td>Drug history</td>
</tr>
<tr>
<td>Diet</td>
</tr>
<tr>
<td>Physical Activity: type, frequency</td>
</tr>
<tr>
<td>Family History</td>
</tr>
<tr>
<td>- Diabetes and complications</td>
</tr>
<tr>
<td>- Age at onset</td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
</tr>
</tbody>
</table>

| Physical Examination (Look for)             |
| Weight                                     |
| Body Mass Index                            |
| Waist circumference, Waist-hip ratio       |
| Acanthosis nigricans *                     |
| Blood pressure                             |
| Peripheral pulses                          |
| Feet: calluses, ulcers, prominent veins, edema, injuries |
| Fundus examination#                        |
| Cardiovascular system                      |
| Peripheral nervous system                  |
| Thyroid                                    |

* Acanthosis nigricans is a brown to black, poorly defined, velvety hyperpigmentation of the skin, usually present in the posterior and lateral folds of the neck, the axilla, groin, umbilicus, and other areas. This occurs due to insulin spillover (from excessive production due to obesity or insulin resistance) into the skin which results in its abnormal growth, and the stimulation of color producing cells. The most common cause would be insulin resistance, usually from type-2 diabetes mellitus.

# Details of Fundus examination are provided in a later section
2. Initial management includes:

- Pharmacotherapy for the management of hyperglycaemia and any other co-morbid conditions e.g. high blood pressure, dyslipidemia etc.;
- Therapeutic lifestyle management (please refer the earlier section); and
- Diabetes patient Education and counseling by dietician

**T2DM: Principles of Management**

Lifestyle management (diet and physical activity) accompanied by drug therapy or insulin are the cornerstone of diabetes management. Diabetes patient education forms the cornerstone of diabetes management. The basic principles in the management of type-2 diabetes are:

- **Modify Lifestyle:** diet and physical activity
- **Reduce insulin resistance through weight reduction, specifically reduction of fat mass**
- **Pharmacological treatment (if inadequate control):**
  - Sulfonylureas/ Metformin
  - Treatment for high blood pressure:
    - ACE-Inhibitors, Calcium channel blockers such as amlodipine and diuretics such as hydrochlorothiazide
  - For details refer the section on hypertension
  - Lipid control with statins

The targets of control in Diabetes management are depicted in the Box-6.

**Pharmacotherapy**

**BIGUANIDES (Metformin)**

**Mechanism of Action:** Insulin sensitizer

**Dose:** The dose of metformin varies from 250mg to 2000mg/day. Since patients may complain of nausea and gastric irritation, the dose can be administered after a major meal. Dose of metformin can be titrated based on blood glucose monitoring at intervals of 2-4 weeks. Currently the preferred approach is to start the patient on metformin and increase the dose to at least 1g/day. If despite this dose, optimum glucose control is not achieved, a sulphonylurea should be added (see box-6 for targets of control.

**GLYCOXYLATED HAEMOGLOBIN (HBA1C)**

A fraction of hemoglobin in the RBCs is found to be in a glycosylated form i.e. has glucose attached to it. The HbA1C level is proportional to average blood glucose concentration over the previous two to three months and therefore is an excellent indicator of how well the patient has managed his/her diabetes over the last four weeks to three months. Glycated hemoglobin is recommended for monitoring blood sugar control in diabetic patients.

American Diabetes Association (ADA) recommends an HbA1c goal of less than 7% for people with diabetes in general.
Advantages
- No weight gain; some patients may experience weight loss. Hence metformin is useful in a large majority of patients who are overweight
- No hypoglycaemia
- For monotherapy in obese patients
- Can be combined with other anti-hyperglycaemic agents including insulin

Contraindications
- Renal (Creatinine ≥ 1.5mg% in men; Creatinine ≥ 1.4mg% in women) / hepatic disease
- Cardiac / respiratory insufficiency; other hypoxic condition
- Severe infections
- Alcohol abuse
- History of lactic acidosis
- Use of I/V radiographic contrast media
- Pregnancy
- Temporarily withhold: surgery, acute illness
- Caution: Phenformin is a banned drug and is not recommended.

SULPHONYLUREAS (Glibenclamide)
- The dose of glibenclamide varies from 2.5-20mg/day given in one or two doses. The dose can be titrated based on blood glucose monitoring at intervals of 1-2 weeks
- General rule: glucose lowering effect plateaus after half-maximal recommended dose
- APPROVED INDICATIONS: monotherapy; in combination with metformin and insulin
- Caution: Hypoglycemia can occur most likely to effect among elderly, those with worsening renal function and among those with irregular meal schedules

Insulin therapy
To decide the type of treatment required, glycaemic control needs to be closely monitored particularly while opting for insulin therapy. The most important test to monitor glycaemic control in individuals with diabetes is glycated haemoglobin (HbA1C). Most commonly, patients after being managed for a variable number of years with the above oral hypoglycaemic agents, fail to maintain adequate glycaemic control (Glycated Hemoglobin-HbA1C>7%; see box-8 for a description on HbA1C). Insulin therapy is indicated in such subjects. In subjects with an HbA1C value >10%, insulin is the best option for achieving adequate control, even if the patient is only on a single OHA. Guidelines for the treatment of T2DM with insulin are depicted in table-6.
Table 6

<table>
<thead>
<tr>
<th>Current HbA1C (%)</th>
<th>Present treatment</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-10</td>
<td>Single OHA</td>
<td>Single OHA, add second OHA (e.g. metformin/glitazone and sulphonylurea)</td>
</tr>
<tr>
<td>7-10</td>
<td>Two OHAs</td>
<td>Start basal insulin (preferable) or add third OHA (e.g. metformin, sulphonylurea and glitazones)</td>
</tr>
<tr>
<td></td>
<td>OHA and basal Insulin</td>
<td>Split-mix insulin (2 injections/day); stop OHA</td>
</tr>
<tr>
<td>&gt;10</td>
<td>Single or 2 OHAs</td>
<td>Split-mix insulin (2 injections/day)</td>
</tr>
<tr>
<td>&gt;10</td>
<td>Not on treatment</td>
<td>Initiate insulin therapy. May be able to change to OHA if the decompensating event was temporary (e.g. infection/stress) or after ‘glucotoxicity’ has decreased</td>
</tr>
</tbody>
</table>

Glitazones may not be among the drugs under government supply. They may be prescribed based on judgment of the physician.

Insulin regimen

Physician has to decide the insulin regimen based on the degree of hyperglycaemia, the education and motivation level of the patient, age, economic status and presence or absence of complications. Three simple regimens are elaborated here that can be chosen by physicians by assessing the subjects. (This section is adopted from National Medical Journal of India22; Reproduced with permission)

**Basal insulin regimen:** When adding insulin to patients on OHA, with HbA1C levels of 7%–9% (patients who have predominantly fasting hyperglycaemia), a simple approach is to start with a single injection of intermediate acting insulin at bedtime and to continue the OHA during the daytime. The most commonly used intermediate acting insulin is Insulin NPH. This schedule reduces fasting hyperglycaemia and is convenient for the patient though it is most effort intensive.

**Split-mix insulin:** If glycaemic control on OHA is very poor (HbA1C >10%), or if the basal insulin fails to achieve the glycaemic target (HbA1C <7%), then split-mix insulin should be started. This consists of twice daily regular and intermediate insulin. Sulphonylureas are
stopped when such a schedule is initiated but metformin can be continued. The insulins may be premixed (usually in the ratio of 30% regular and 70% intermediate) or mixed separately in a syringe. The former has the advantage of convenience while the latter has the advantage that the doses of regular and intermediate insulin can be separately adjusted according to the glucose levels. In instances, where the patient is educated and self-adjusting his insulin doses, he can vary the proportion and dosage of regular and intermediate acting insulin based on his glucose levels and proposed meal size.

**Basal bolus regimen:** Many patients, especially those who are obese, may not be controlled with twice daily split-mix insulin regimens. These patients will require regular insulin thrice daily (before each meal), in addition to basal insulin (twice daily intermediate). This is the most physiological insulin regimen and also allows for the greatest flexibility through the most effective intervention.

<table>
<thead>
<tr>
<th>INSULIN REGIMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Insulin</td>
</tr>
<tr>
<td>• Basal insulin (NPH) is given as a single dose in the evening; NPH may also be given in 2 doses: morning and evening</td>
</tr>
<tr>
<td>• Initial dose is 10-12 units/day (0.1-0.2 units/kg/day); higher doses are given to obese individuals</td>
</tr>
<tr>
<td>• Monitor fasting glucose</td>
</tr>
<tr>
<td>• Insulin is increased every 1-2 weeks by 2-4 units until fasting glucose is 80-130 mg/dl</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Split-mix Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mixture of short-and intermediate-acting insulins or pre-mixed (30:70) insulin before breakfast and dinner</td>
</tr>
<tr>
<td>• Initial dose is 0.5–0.6 units/kg/day (higher dose in obese individuals)</td>
</tr>
<tr>
<td>• 2/3rd of total dose in morning and 1/3rd in evening</td>
</tr>
<tr>
<td>• 2/3rd of each dose as intermediate and 1/3rd as regular insulin</td>
</tr>
<tr>
<td>• Monitor fasting and pre-meal glucose (target 80-130 mg/dl); post-meal and 2 a.m. glucose less frequently</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basal bolus regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Regular (or rapid-acting) insulin before main meals and intermediate (or long-acting insulin) once or twice daily</td>
</tr>
<tr>
<td>• 50% of the total daily insulin is given as intermediate or long-acting insulin; 50% in divided doses as regular/rapid-acting insulin before each meal</td>
</tr>
<tr>
<td>• Monitor fasting and pre-meal glucose; post-meal and 2 a.m. glucose less frequently.</td>
</tr>
</tbody>
</table>

**Initiating insulin therapy**
At the time of initiation of insulin, it is important to review the diet and, if necessary, to ask the patient to meet a dietician. The diet should be appropriate for the patient’s body weight and physical activity, divided according to the insulin schedule and low in saturated fats. In addition, the patient should be strongly advised to exercise regularly, e.g. a brisk walk for 30 minutes daily.
Insulin should be initiated at a low dose and slowly titrated to higher doses. This helps to prevent hypoglycaemia. For patients starting on a single dose of basal insulin, a dose of 10–12 units at bedtime may be initiated. The dose can then be gradually increased by 2–4 units every week until fasting glucose levels come into the normal range or the patient experiences hypoglycaemia at night*. For patients using a split-mix regimen, the total initial dose of insulin can be 0.5–0.6 units/kg. Here it is important to monitor both fasting and pre-meal glucose levels. While fasting glucose can be measured at a laboratory, regular monitoring of blood glucose ideally requires self monitoring using a glucometer. Patients who can afford them should be encouraged to self monitor.

The final dose is often close to 1 unit/kg or higher (in obese individuals). Whenever split-mix insulin is prescribed, the day’s calories should be divided into 3 meals and 2 small snacks between meals (to prevent hypoglycaemia). To prevent early morning hypoglycaemia, some patients may also need a bedtime snack. Patients should be aware that the dose of insulin will change over time.

*Foot note: Education on hypoglycaemia is a critical component of all diabetes patient education. All patients with diabetes on any form of anti-diabetes medication, oral or insulin, need to be educated on the recognition and treatment of hypoglycaemia. All the patient’s family members who stay with him should also know the symptoms of hypoglycaemia and how to treat it. The health care professionals at the PHC or CHC need to take the initiative in educating the patient and his family members. Hypoglycaemia is discussed in detail later.

Storage of insulin

The insulin vial needs to be stored in the butter compartment of refrigerators. They should not be stored in the freezer or deep freeze. Insulin, if frozen, loses its bioactivity and should be discarded. During traveling at high temperatures, the insulin vial can be stored in a plastic bag which in turn needs to be transported in a flask with ice.

The insulin vials should be refrigerated. Extreme temperatures (<36 or >86°F, <2 or >30°C) and excess agitation should be avoided to prevent loss of potency, clumping, frosting, or precipitation. Specific storage guidelines provided by the manufacturer should be followed. In cold places and in winter, insulin in use may be kept at room temperature to limit local irritation at the injection site, which may occur when very cold insulin is injected.

In villages and other locations where refrigerator facilities are not available, the insulin vial can be put in a plastic bag, which in turn should be stored in earthen urns (matka, or ghadha which are generally used for storing drinking water). At least half the urn needs to be filled with water.
Ensure that there is water in the urn at all times. The urn should be covered with an earthen lid (sakora, dhakkan). A wet cotton cloth needs to be thrown on top of it. This urn then needs to be kept preferably in a cool place, where there is enough circulation of fresh air. The urn (matka, ghadha) needs to be changed every year. New urns are more porous as the moss and other things may clog the pores in old urns. Scientific studies have shown that the bioactivity of the insulin stored in urns is maintained and is no different from those stored in the refrigerator.

**Injection techniques**

**Preparing to inject**

The hands and the injection site should be clean. Wash hands with soap and water. The top of the insulin vial should be wiped with 70% isopropyl alcohol/spirit swab. For all insulin preparations, except rapid- and short-acting insulin, the vial or pen should be gently rolled in the palms of the hands (not shaken) to resuspend the insulin. An amount of air equal to the required dose of insulin should first be drawn up and injected into the vial to avoid creating a vacuum. For a mixed dose, putting sufficient air into both bottles before drawing up the dose is important. When mixing rapid- or short-acting insulin with intermediate- or long-acting insulin, the clear rapid- or short-acting insulin should be drawn into the syringe first.

After the insulin is drawn into the syringe, the fluid should be inspected for air bubbles. One or two quick flicks of the forefinger against the upright syringe should allow the bubbles to escape. Air bubbles themselves are not dangerous but can cause the injected dose to be decreased.

Lightly grab a fold of skin between the thumb and index finger (it is something like a thick pinch). In the Indian context, for most individuals, < 23 BMI, inject at 45° degree angle and at 90° angle for overweight and obese individuals. The angle depends on the thickness of the subcutaneous fat. It may be 45° for the thigh but 90° for the abdomen. The needle should go into the loose fat below the fat layer beneath the skin. There should be very little or no pain while injecting. If there is pain then you should be alerted that you may be injecting into the dermis. Thin individuals or children can use short needles or may need to pinch the skin and inject at a 45° angle to avoid intramuscular injection, especially in the thigh area. Routine aspiration (drawing back on the injected syringe to check for blood) is recommended but not necessary. The needle should be embedded within the skin for 5 seconds after complete depression of the plunger to ensure complete delivery of the insulin dose.
**Injection site and rotation**

Insulin may be injected into the subcutaneous tissue of the upper arm and the anterior and lateral aspects of the thigh, buttocks, and abdomen (with the exception of a circle within a 2-inch radius around the navel). Intramuscular injection is not recommended for routine injections. Rotation of the injection site is important to prevent lipohypertrophy or lipoatrophy. Rotating within one area is recommended (e.g., rotating injections systematically within the abdomen) rather than rotating to a different area with each injection. This practice may decrease variability in absorption from day to day. Site selection should take into consideration the variable absorption between sites. The abdomen has the fastest rate of absorption, followed by the arms, thighs, and buttocks. Exercise increases the rate of absorption from injection sites, probably by increasing the blood flow to the skin and perhaps also by local actions. Areas of lipohypertrophy usually show slower absorption. The rate of absorption also differs between subcutaneous and intramuscular sites. The latter is faster and, although not recommended for routine use, can be given under other circumstances (e.g., diabetic ketoacidosis or dehydration). Whenever possible, insulin should be self-administered by the patient.

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**Abdomen and thigh are the preferred sites for insulin injection.** Insulin may be injected into the subcutaneous tissue of the upper arm and the anterior and lateral aspects of the thigh, buttocks, and abdomen (with the exception of a circle within a 2-inch radius around the navel). The possible sites are marked. Rotation of the injection site is important to prevent lipodystrophy.

---

**When to recommend hospitalization**

- Uncontrolled infections;
- Severe cellulitis,
Diabetes patient education and diet counseling

Patient education on diabetes management and life style modifications is the corner stone of effective diabetes control and management and prevention of complications. If a ‘diabetes educator’ is available then the patients and their families must visit him/her. At PHC level, nurses/multipurpose health workers can be trained to undertake this activity. At sub-district and district level hospital, dietician/counselor and nurses can under take diabetes patient education. Counseling on diet need to be provided by a trained dietician at district and sub-district level hospital. Patient education topics that can be covered in the initial visit and follow-up visits are depicted in the table-8.

### Table 8

<table>
<thead>
<tr>
<th><strong>Initial Visits</strong></th>
<th><strong>Follow-up Visits</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>What is Diabetes?</td>
<td>Importance of Glycaemic Control</td>
</tr>
<tr>
<td>Why does it occur?</td>
<td>Prevention of Complications</td>
</tr>
<tr>
<td>Lifestyle measures: Diet, Exercise</td>
<td>Foot Care (see box-9)</td>
</tr>
<tr>
<td>Detailed lifestyle advice</td>
<td>Eye care (see page)</td>
</tr>
<tr>
<td>Use of Oral Drugs</td>
<td>Newer modalities of treatment</td>
</tr>
<tr>
<td>Advice on identifying signs and symptoms of hypoglycaemia and hyperglycaemia and their management</td>
<td>Marriage Counseling</td>
</tr>
<tr>
<td>Patient should be informed about the importance of factors other than glucose control: cholesterol, blood pressure, stopping smoking, tobacco, etc</td>
<td>Pre-conceptional counseling regarding the importance of good glucose control prior to pregnancy</td>
</tr>
<tr>
<td></td>
<td>If on insulin-injection techniques, storage and rotation of sites</td>
</tr>
</tbody>
</table>

**Follow-up visits**

**Annual assessment** of the patients has to be carried out at CHC/secondary care level for follow-up of blood glucose, urinary microalbuminuria, fundus examination, blood lipids, creatinine, feet examination and patient education.

Primary care physicians need to follow up the diabetic patients regularly for compliance with medicines, lifestyle management, body weight record, blood glucose control, blood pressure control and control of other risk factors.

- Unresponsive UTI or other deep seated infections including bad diabetic foot needing intravenous antibiotics,
- Recurrent UTI not responding to oral antibiotics,
- Presence of ketones in urine
FOOT EXAMINATION

Foot care advice to the patients

Inspect your feet daily for cracks, blisters, infections, and injuries. You may be able to see a problem before you feel it. If you can’t see the bottoms of your feet easily, use a mirror. A magnifying glass also may help you see better. If you can’t check your own feet, have someone else do it for you.

Cleanse your feet daily as you bathe or shower, using warm water and mild soap. Dry your feet with a soft towel making sure to dry between the toes. Don’t use hot water. You may burn your skin as you may not be able to feel the hotness of the water.

Moisturize dry skin by using oil. If it causes redness or irritation, discontinue its use and inform your doctor. If you are currently using a cream or lotion that keeps your skin soft and free of cracks, continue using it.

Clip toenails straight across. Use a nail cutter; don’t use a scissor and also smooth down the edges. If you can’t easily reach your feet for have thick nails, have someone experienced trim your nails.

Always wear something on your feet (socks, slippers, shoes) to protect from injury - even in your house.

Choose soft good shoes. Let them be a size bigger that what you feel is appropriate. Wear socks made of cotton (in summer) or wool (in winter).

Treat minor breaks in the skin promptly. Cleanse the area with soap and water, dry, and cover with clean gauze. Observe for signs of infection such as redness, swelling, warmth, pain or drainage. Don’t put weight on the foot that has an injury.

See your doctor to check your feet during your regular visits for diabetes care. Take off your shoes and socks at every visit.
Precautions on footwear in patients with diabetes
The foot-wear should be comfortable. Prior to beginning a walk one should feel inside the footwear with hands and look for any hard/sharp objects which may injure the toes/feet. Wearing a size bigger than the regular size is recommended. A slipper/shoe should be used all the time even at home. Nylon socks should be avoided.

Eye Care in diabetes
The Retina/fundus of all diabetes patients need to be checked at least once a year by a trained ophthalmologist even if there are no eye symptoms and the vision is 6/6. The patient needs to be accordingly referred for the same to the CHC, where ophthalmologist is available. Early retinal problems don’t show up as visual symptoms and a good vision should not mean that a fundus examination is not required.

Diabetes can damage blood vessels throughout our bodies. The vessels in the eyes seem especially vulnerable to damage. In the early stages of retinopathy, fluid can leak from small blood vessels in the retina. If this leaking occurs in the macula, then objects may appear blurry. However early damage can be diagnosed through a retina/fundus examination and the blood vessels can be sealed with laser and vision can be saved and preserved.

Proliferative retinopathy is an advanced form of retinopathy. Proliferative retinopathy occurs when abnormal blood vessels grow on the retina and sometimes into other parts of the eye. If these vessels bleed into the vitreous - the clear fluid in the center of the eye, light can’t reach the retina and vision can become cloudy. The blood may be slowly reabsorbed and vision can return to normal but if the bleeding continues, vision may be cloudy until the problem is treated.

Tissue can also grow along with the abnormal blood vessels, distorting vision or making objects appear blurry. Over time, the tissue can shrink, pulling the retina away from its base.

If the blood doesn't reabsorb or if the tissue affects vision, the vitreous may need to be surgically removed to avoid loss of vision. All these problems of the eyes can be prevented if prevention is started early and a regular fundus examination is done.
Empower the Patient to Prevent and Treat Hypoglycemia
All patients on any form of hypoglycemic or diabetes medications—tablets or insulin, should, at all times, carry about 20 gms of sugar in their pocket or purse or locket, with them. Candies, or sweet peppermint or a small chocolate or small piece of chikki, or sweet raisins or a small laddu, or a glass of juice are the other options. Education and empowerment of the patient and family are critical for prevention and treatment of hypoglycemia.

What is hypoglycemia?
Hypoglycemia is the clinical syndrome that results from low blood sugar. The symptoms of hypoglycemia can vary from person to person, as can the severity. Classically, hypoglycemia is diagnosed by a low blood sugar with symptoms that resolve when the sugar level returns to the normal range.

Who is at risk for hypoglycemia?
Most patients on anti-diabetes medication would at some time experience symptoms of hypoglycemia. Patients on insulin and who are on intensive blood sugar control are at a high risk of hypoglycemia. Changes in daily physical activity levels or a change in diet, or both, or missed meals, or sporadic enhanced physical activity, are common reasons for hypoglycemia. Despite our advances in the treatment of diabetes, hypoglycemic episodes are often the limiting factor in achieving optimal blood sugar control. Patients and their families need to be counseled and educated on recognizing and treating hypoglycemia.

While patients who do not have any metabolic problems can complain of symptoms suggestive of low blood sugar, true hypoglycemia usually occurs in patients being treated for diabetes.

Symptoms of Hypoglycemia
The patient may experience, severe weakness, unable to think clearly, experience a severe headache, may start trembling even start shaking, sweating. He may become unconscious, and rarely, if severe, there may be convulsions.

At times the patient may not be able to express coherently but others may identify confusion/irrational behaviour, slurred speech and irrelvent talk with sweating and tremors. Any one or more of the above symptoms may be manifest. Bystanders(spouse, relatives, friends etc) with the patient may require to intervene to ask the patient to eat something.
Patients, who are used to home blood sugar monitoring should try and check their blood sugar when there are symptoms to confirm that indeed the blood sugars were low.

How should hypoglycemia be treated?
Time is precious in the management of hypoglycemia. The earlier the hypoglycemia is treated, the better it is. Early recognition and treatment prevents a severe attack and also prevents cognitive decline. Repeated severe prolonged hypoglycemia episodes in patients can cause the cognitive functions of the brain to decline over time and can be very demoralizing for the patient. Thus, education of patients is crucial for the prevention of hypoglycemia.

The Hypoglycemia Kit
Every patient who is on anti-diabetes medications (pills or insulin) must have a hypoglycemia home kit which must contain the following ingredients.

- A steel/plastic glass
- 250 gms of sugar
- Two steel spoons.
- 100 cc or 200 cc syringe(without the needle). The needle of the syringe is not required

All these should be stored in a plastic or cardboard box with a large label on top “Hypoglycemia Home Kit”. Although the ingredients appear simple but they all need to be together, in one place, accessible to all, at any time. Every Primary Health Center should have a hypoglycemia kit. Every patient must have it at their homes.

Action: what needs to be done?
If the patient is conscious, and the symptoms are very mild then the patient can be asked to drink a glass of milk, have a bowl of curds or eat something, whatever is available. If the patient is conscious, and the symptoms are more severe, he can be given 10-15 gms of sugar to suck in the mouth. He should start feeling better in 5 minutes. This should be followed by some complex carbohydrates, for example, any of the following can be given—roti, rice-dal, whole grains, snacks, nuts, sandwich, corn cob roasted, a handful of nuts, a glass of milk, yogurt/curds, a small piece of coconut etc.
Management of an unconscious patient
The patient should be made to lie down on a flat surface and should be given the lateral position. The lateral position is given so that there is no aspiration. Make sure the tongue has not fallen back into the throat. Open the hypoglycemic kit. Take a small quantity of water (100-200 ml) in the steel glass. Add 10-15 heaped spoons of sugar and shake/stir vigorously with the spoon. Keep adding sugar and shaking/stirring vigorously, till no more sugar dissolves. – in other words make a saturated solution of sugar with water. Then pull in/suck(by pulling the flange) some saturated solution in the syringe (without the needle). Then drop by drop, drip the few drops of the solution through the syringe on the inside of the cheek which is in the extreme lateral position. The solution will gradually trickle into the pharynx and go in without any aspiration taking place. Keep dripping drop by drop inside the lateral cheek. In 5-10 minutes the patient should gain consciousness. After the patient gains consciousness make sure he is given some complex carbohydrates to eat—roti, or sandwich, or rice-dal, or some dry snacks or a handful of nuts.

This technique can also be used at the primary care center too!(if facilities to give IV glucose/dextrose saline are not readily available). Every primary health center should also have a hypoglycemia kit. For the PHC kit, in addition to the above, there needs to be a scalp vein, and 50% injectable dextrose/glucose for intravenous administration, stat.

All paramedics need to be trained to handle hypoglycemia
At the CHC, if glucagon is available, it should be used. In an unconscious patient glucagon can be injected anywhere –subcutaneous, intramuscular and intravenous. In patients with intensive blood sugar control, and in those who can afford it, glucagon can be prescribed for home as a first aid in the hypoglycemia home kit to treat severe hypoglycemia.

Preconception counselling
Counselling on pregnancy must start before conception. All women with diabetes must know that they should not conceive till their blood glucose is well controlled for at least 2-3 months before conception as ascertained by HbA1C. Hyperglycemia at conception increases the risk of complications during pregnancy as well as congenital defects in the foetus.
Checklist for preventing of diabetes complications

Every 3-6 months the patient should have a physical review by the physician. Checklist for the follow-up is as follows:

- Test blood sugar levels
- Test glycosylated haemoglobin levels (HbA1C) (if facilities are readily available)
- Examine feet for sensations and circulation; Also for calluses, dryness, sores, infections, injuries
- Check blood pressure
- Check body weight
- Help the patient to give up tobacco, if he/she continues to use tobacco
- Reinforce of life style measures- increase physical activity levels and improve diet (please refer the earlier section on therapeutic lifestyle management).

A summary of services for diabetes management, appropriate at each levels of care, is depicted in the *table 9* below:

<table>
<thead>
<tr>
<th>Services</th>
<th>Secondary care level</th>
<th>CHCs</th>
<th>PHCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening for Diabetes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>History and Physical Examination</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Initial Assessment</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Diabetic Patient Education</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pharmacotherapy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiation</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Follow-up</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Foot care</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Eye care</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Annual Assessment</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Pre-conception Counseling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Marriage Counseling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Case Study 1: Diabetes

Female patient aged 47 years, weight 65 Kgs, BMI 29 kg/m², waist 110 cms, FBG 140 mg/dl, Postprandial Blood Glucose 190 mg/dl

This lady is 47 years old and overweight, and was diagnosed with T2DM 4 years ago. Although her doctor recommended lifestyle modifications, she found it hard to stick to her diet and exercise plan, she has an Hba1C value of 8.7% and elevated fasting blood glucose levels.

We will now look at some potential treatment options to help her achieve effective glycemic control as quickly as possible.

What would you do next?
• Suggest diet, exercise & review after a month
• Initiate Metformin therapy with lifestyle changes
• Initiate Sulfonylurea

Here are some options to help our patient achieve her target HbA1C levels. As she had not adhered well to diet and exercise, we could try and improve outcomes using this approach.

What her physician did:
• Initially added Metformin 500mg once daily at night and suggested lifestyle modification. (Hypocaloric diet to lose weight (eat 200-400 calories less than what the body requires each day, increase intake of fresh fruits, vegetables, nuts, whole grains and whole pulses). Physical activity should include a minimum of 30 minutes of walking 5 times a week. The duration of exercise should be increased to 45 minutes a day or more with the aim of helping her lose weight. Called for review after 15 days.
• After 15 days FBG – 125mg/dl & PPBG – 160mg/dl
• Dose titrated to Metformin 500mg twice daily
• At the end of 3 months of therapy
• FBG – 100mg/dl, PPBG – 145mg/dl & Hba1C – 6.8%

So here we can see how this patient’s diabetes was actually managed and her current glycemic profile.

At every visit, diabetes education needs to be imparted/reinforced. Weight needs to be recorded. The patient’s feet need to be examined for pulses, sensations, injuries, cracks, nail infections etc. The blood pressure needs to be checked. Any history suggestive of hypoglycaemia needs to be investigated and food and medication accordingly adjusted.
Whenever the patient is referred to the CHC, kidney functions through a serum creatinine, urea, sodium potassium, urinary protein, fundus examination and an ECG need to be done.

Case Study 2

- Male patient aged 38 years, weight 50 kgs, smoker, cholesterol 220, Triglycerides 250, LDL 130, HDL 40.
- BMI 21kg/m², waist 84 cm, FBG 200 mg/dl, Postprandial blood glucose 260 mg/dl

What are the Options?

- Suggest lifestyle changes: Appropriate diet as discussed earlier along with a minimum of 30 minutes of walking 5 times a week
- Initiate Metformin therapy with lifestyle changes
- Initiate Sulfonylurea therapy with appropriate advice on Diet
- Start with a combination therapy of SU+MET
- Smoking cessation

What did the physician do?

- Initiated therapy with Glimepiride 1mg and titrated at regular intervals
- At the end of 3 months:
  - HbA1C 7.1
  - FBG 102 mg/dl

At every visit, diabetes education needs to be imparted/ reinforced. Weight needs to be recorded. The patient’s feet need to be examined for pulses, sensations, injuries, cracks, nail infections etc. The blood pressure needs to be checked. Any history suggestive of
hypoglycaemia needs to be investigated and food and medication accordingly adjusted.

The patient needs to be referred to the CHC every year. At the CHC, the kidney functions through a serum creatinine, urea, sodium potassium, urinary protein, fundus examination and an ECG need to be done.

Case Study 3

Uncontrolled on oral agents

- Female patient aged 47 years
- T2DM diagnosed 7 years ago
- Poor compliance with diet and exercise regimen
- Current Treatment Metformin 500 mg bd & Glimepiride 3 mg od
- BMI : 25 Kg / m²
- Weight : 65 Kgs
- HbA1C : 8.7 %
- FBG : 160 mg/dl
- PPBG : 210 mg/dl

This lady is 47 years old and overweight, and was diagnosed with T2DM 7 years ago. Although her doctor recommended lifestyle modifications, she found it hard to stick to her diet and exercise plan. Her doctor prescribed a course of metformin and glimepiride, at recommended doses, to help control her blood sugar more effectively. Despite treatment with two oral antidiabetes agents, she has an HbA1C value of 8.7% and elevated fasting blood glucose levels.

We will now look at some potential treatment options to help her achieve effective glycemic control as quickly as possible.

What can be done?

- Reinforce diet and exercise
- Uptitrate existing oral anti-diabetes drugs.
- Add another oral anti-diabetes drug.
- Initiate basal insulin therapy

What did the physician do?

- Since her fasting sugars are raised, there is a likelihood that once the fasting sugar was corrected then other sugars would also get corrected. The physician initiated insulin NPH (intermediate acting) 8 units/day at bedtime.
- He then titrated the insulin dose every 3 days until the FBG was <110 mg/dL.
- HbA1C : 6.5 %
- FBG : 110 mg/dl
- PPBG : 170 mg/dl
Prevention and Management of Overweight/Obesity
What is overweight and obesity?

Obesity is often defined as a disease condition in which excess body fat has accumulated to such an extent that health may be adversely affected.

A graded classification of overweight and obesity helps in identifying individuals and groups at increased risk. Most common tools of assessment are Body Mass Index (BMI), Waist Circumference (expressed in centimeters) and Waist hip ratio (WHR). BMI is defined as weight in kilograms divided by the square of the height in metres (kg/m²).

The BMI, which describes relative weight for height, is significantly correlated with total body fat content while waist circumference is associated with abdominal fat content and is the most practical anthropometric measurement for assessing abdominal fat content.

Health Risks associated with overweight and obesity

Increase in body weight, during one’s adult life, even if, within the ‘normal’ levels of BMI, confers a high risk in this population. Recent studies have shown that Indians have a significantly greater proportion of body fat than Western populations at any body weight. Consequently, the healthy levels of BMI and upper body adiposity are significantly lower for Asian Indians.

People who develop excess body fat especially if a lot of it is at the waist are more likely to develop heart disease and stroke even if they have no other risk factors. This condition is referred as abdominal obesity or central obesity. It is best measured by waist circumference or by waist-hip ratio. The presence of abdominal obesity along with high glucose and high blood pressure with low levels of ‘good’ cholesterol (HDL-cholesterol) leads to an insulin resistant state called metabolic syndrome. The metabolic syndrome has been demonstrated to enhance the risk of heart diseases, stroke and certain cancers (breast & colon) by two fold. Excess weight increases the heart’s work load. It also raises blood pressure and blood cholesterol and triglyceride levels, and lowers HDL (“good”) cholesterol levels and increase the likelihood of development of diabetes and stroke. A number of studies have found association of obesity with incidence of cancer, particularly hormone dependant and gastrointestinal cancer.

Health benefits of Weight reduction and maintaining an optimal body weight

There is strong evidence that weight loss in overweight and obese individuals reduces risk factors for diabetes and cardiovascular disease (CVD). Weight loss reduces blood pressure in both overweight hypertensive and non-hypertensive individuals; reduces serum triglycerides and increases high-density lipoprotein (HDL)-cholesterol; and generally produces some reduction in total serum cholesterol and low-density lipoprotein (LDL)-cholesterol.
On an average for each 1% reduction in weight leads to a fall of 1 mmHg systolic and 2 mmHg diastolic blood pressure. More than 10-20% reduction in weight loss among obese individuals with diabetes results in marked improvement in glycaemic control and sensitivity to insulin. Loss of abdominal fat may be more important in improvements in diabetic control than weight loss. Weight loss also reduces blood glucose levels in overweight and obese persons without diabetes. Similarly a 10kg loss can produce a fall of 10% in total cholesterol levels, a 15% decrease in LDL levels, a 30% decrease in triglyceride and an 8% increase in HDL level.

For Indians the BMI should be between 18 and 22.9. (Exceptions are children, pregnant and lactating mothers and athletes/sports men).

High calorie foods should be eaten in moderation. Their intake should be decreased.
**Risk factors for overweight/Obesity**

**Unhealthy diet:** Excess consumption of diet rich in fats and sugar results in an imbalance between energy intake and energy spent in the body. Such unhealthy diet results in building up of adipose tissues in the body resulting in weight gain and obesity. In addition, genetic, environmental, and other factors may all play a part.

**Physical Inactivity:** Physical activity due to the increasingly sedentary nature of many forms of work and lack of leisure time physical activity culminates in an energy imbalance between calories consumed on one hand, and calories expended on the other hand resulting in weight gain and obesity.

---

**Table 12**

<table>
<thead>
<tr>
<th>Generalized Obesity (Assessing using Body Mass Index)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Men/Women : 18 – 22.9 kg/m²</td>
</tr>
<tr>
<td>Overweight</td>
<td>Men/Women : 23 - 24.9 kg/m²</td>
</tr>
<tr>
<td>Obesity</td>
<td>Men/Women : &gt;=25 kg/m²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abdominal Obesity (Assessing using Waist Circumference)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Men : &lt;=90 cm</td>
</tr>
<tr>
<td>Abdominally Obese</td>
<td>Women : &lt;=80 cm</td>
</tr>
<tr>
<td></td>
<td>Men : &gt;90 cm</td>
</tr>
<tr>
<td></td>
<td>Women : &gt;80 cm</td>
</tr>
</tbody>
</table>

**Diagnosing overweight/obesity**

Based on observational studies it has been suggested that the normal BMI values in Asian Indian adults to be between 18 – 22.9 kg/m². Individuals in the range of 23-24.9 kg/m² are said to be overweight, while obese subjects have a BMI of 25 kg/m² or more.

**Management of Overweight/obesity**

- Adopting a health diet
  - Refer the section on ‘Therapeutic lifestyle management’
- Regular physical activity
  - Refer the section on ‘Therapeutic lifestyle management’

**People with desk jobs/sedentary jobs need to exercise**
Prevention and Management of Dyslipidemia
What is Dyslipidemia?

Dyslipidemia is characterized by elevation of plasma cholesterol, triglycerides (TGs), or both, or a low (level of) high density lipoprotein (HDL) level that contributes to the development of atherosclerosis.

Cholesterol is a fatty substance (lipid) that is present in cell membranes and is a precursor of bile acids and steroid hormones. Cholesterol exists largely as LDL-cholesterol, VLDL cholesterol, and HDL cholesterol. Along with triglycerides they are tightly packed in a central core and surrounded by surface lipoprotein particles. Several large epidemiological investigations of human populations incriminate high levels of cholesterol as being atherogenic.

The positive relationship between serum cholesterol levels and the development of first or subsequent attacks of CHD is observed over a broad range of LDL-cholesterol levels; the higher the level, the greater the risk. Prospective study data suggest that the risk of CHD plateau at lower cholesterol levels, but this apparent plateau has disappeared in larger studies. In other words the risk of CHD is continuous at all levels of blood cholesterol therefore any definition is weighted based on risk-benefit and cost-effectiveness ratio and management is based on individualized risk of CHD.

Risk factors for high blood cholesterol in the general population are

- Overweight and obesity
- Physical inactivity
- High saturated fat and cholesterol in diet
- Trans fatty acid intake
- Very high-carbohydrate diets (>60 percent of total energy)
- Cigarette smoking
- Excess alcohol intake
- Other diseases (T2DM, hypothyroidism, chronic renal failure, nephrotic syndrome)
- Certain drugs (corticosteroids, protease inhibitors for HIV, beta-adrenergic blocking agents, estrogens)
- Genetic factors

Definition of High Blood Cholesterol

The definition of abnormal blood cholesterol is as indicated in the table-10. These are based on the Adult Treatment Panel (ATP) III

<table>
<thead>
<tr>
<th>Classification of Blood Lipid Levels for Therapeutic Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Lipids</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Total Cholesterol</td>
</tr>
<tr>
<td>Desirable</td>
</tr>
<tr>
<td>Borderline High</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Among Indians, based in the normal mean levels of cholesterol, it is preferred to have total cholesterol less than 160mg/dl</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
</tr>
<tr>
<td>Optimal</td>
</tr>
<tr>
<td>Near Optimal</td>
</tr>
<tr>
<td>Borderline High</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Very High</td>
</tr>
<tr>
<td>Serum Triglycerides</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Borderline High</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Very High</td>
</tr>
<tr>
<td>Serum HDL Cholesterol</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

For Indians, it is desirable to have the total cholesterol levels <160 mg/dl, which is the mean level found in the rural population.
recommendations of the USA as there are no indigenous Indian prospective epidemiological data on risks of high blood cholesterol on CHD. Low HDL cholesterol is an important risk factor for CHD while high HDL cholesterol has a protective effect and is considered a negative risk factor.

Management of High Blood Cholesterol

Management of high blood cholesterol would depend on the overall risk profile of an individual. The broad guidelines to decide the modalities of management would be based on ascertaining whether the patient:

- has established Cardiovascular Disease like a previous heart attack/stroke/angina/peripheral vascular disease.
- has diabetes
- has other CVD risk factors (hypertension/smoking/age/obesity)

Treatment Goals

PHC Level

- All patients with established CVD or diabetes should be counseled about non pharmacological treatment and also initiated on statins (Atorvastatin/Simvastatin).
- Other patients should be counseled about non pharmacological treatment

CHC Level

- All patients with established CVD or diabetes should undergo a lipid profile (where a detailed profile is not available total cholesterol should be done). They must be counseled about non pharmacological treatment and also initiated on statins (Atorvastatin/Simvastatin) to achieve a LDL cholesterol of less than 100 mg/dl or a total cholesterol of less than 200 g/dl. Patients not achieving these goals with statins alone or developing complications due to them should be referred to a higher centre.
- Other patients with 2 or more CVD risk factors should undergo lipid profile/total cholesterol testing. They must be counseled about non pharmacology treatment. The goal of treatment in them should be to achieve LDL< 130mg/dl and total cholesterol<240mg/dl.
- Patients with one or no risk factors should be counseled about non pharmacology treatment only.
Major CVD risk factors

- Age (men >45 yrs; women >55 yrs)
- Hypertension
- Premature CHD in first degree relative (Men <55 yrs; Women <65 yr)
- Smoking

Non Pharmacological Therapy

- Maintain healthy body weight and waist circumference
- Moderate intensity physical activity
- Smoking/Tobacco cessation
- Low saturated fat intake (<7% of total calories)
- Low cholesterol intake (<200 mg/day)
- Omit trans fatty acid (eg. Vanaspati) containing products in the diet
- High fibre diet (20-30 gm/day). The fibre should be from natural sources

Drug Treatment

Several classes of hypolipidemic drugs are available. However, statins are by far the most widely used first line drugs.

<table>
<thead>
<tr>
<th>SUMMARY OF STATINS</th>
<th>Effect of statins, contra indications, side effects and starting dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid effects</td>
<td>LDL cholesterol -18–55%</td>
</tr>
<tr>
<td></td>
<td>HDL cholesterol -45–15%</td>
</tr>
<tr>
<td></td>
<td>Triglycerides -7–30%</td>
</tr>
<tr>
<td>Contraindications</td>
<td>Active or chronic liver disease</td>
</tr>
<tr>
<td>Major side/adverse effects</td>
<td>Myopathy, increased liver transaminases</td>
</tr>
<tr>
<td>Usual starting dose</td>
<td>Lovastatin - 20 mg</td>
</tr>
<tr>
<td></td>
<td>Simvastatin - 20 mg</td>
</tr>
<tr>
<td></td>
<td>Atorvastatin - 10 mg</td>
</tr>
</tbody>
</table>
Guidelines for Management of Post Myocardial Infarction and Chronic Stable Coronary Disease
The management of chronic coronary artery disease (chronic stable angina) and individuals post myocardial infarction, acute coronary syndrome (ACS) or unstable angina (UA) differ only marginally. However the treatment of an acute episode of acute MI, ACS and UA merits special consideration. Irrespective of the type of ailment and levels of care, the patient has to strictly adhere to a healthy lifestyle which is elaborated in the Box-6.

Management of ACS/MI/UA

At PHC
- Confirm clinical diagnosis (if ECG available)
- Measure BP and pulse rate
- Relieve symptom with sublingual nitrates (Always in supine position)
- Give one tablet aspirin 325 mg to be chewed
- Refer to a higher centre quickly
- Do not delay transfer by ordering any unnecessary investigations

At CHC
- Confirm diagnosis if not done already
- If the patient presents within 12 hour of symptom onset, start streptokinase 1.5 million units/IV over a half an hour period if CCU or defibrillator are available. Otherwise refer to the nearest centre where such facilities are available.
- Start β blockers if there are no contraindications such as bronchial asthma at the lowest dose of metaprolol 12.5 mg BD. If there is no precipitous fall in BP and Heart Rate (HR), increase upto 100 mg a day till the HR is around 60/minute. Add or prescribe clopidogrel at 75 mg/day if the patient can afford.
- Start with Atorvastatin 20 mg a day from the first day irrespective of the weight, level/availability of previous lipid profile.
• Add Enalapril 1.25 mg as the first dose on the second day. If there is no hypotension increase to 2.5 mg and then to 5-10 mg/day to maintain a BP above 100 mmHg systolic and 70-85 mmHg diastolic.

Secondary Prevention
Primary component of secondary prevention strategy is drug therapy which comprises the following drug groups (mentioned below) that has to be continued virtually life long. In addition, lifestyle management has to be emphasized and strictly adhered to.

Mandatory Drug therapy at discharge (if there are no specific contra indications) include:
• Aspirin
• Blockers (preferably metoprolol)
• ACE-I (preferably the cheapest, which is enalapril)
• Statins (Simvastatin or Atorvastatin)

Clopidogrel (75mg/day) may be added if the patient can afford the cost of therapy and can be discontinued after 9 months

Life style management
Please refer to the section on ‘Therapeutic lifestyle management’ for details.

Recommended drug therapy after discharge from the hospital
1. Aspirin: At a dosage of 75-162 mg/day and continued indefinitely in all patients unless contraindicated. Generally bedtime, after dinner, avoid taking on an empty stomach.
2. **Statins:** Statins are recommended in all patients irrespective of their lipid status initially, with an aim to get LDL cholesterol <70mg/dl or total cholesterol <160mg/dl, six weeks after a heart attack. Suggested examples are Atorvastatin 20mg or Simvastatin 20mg initially. Measure lipid profile at six weeks and depending on the level of the cholesterol or LDL-Cholesterol increase or decrease the dose of stains. It is better to start with a lower dose and increase it over a period of time. The common side effects are muscle aches and pains. If not severe, they subside over a period of time. However, in the event of severe pain the drug should be stopped and the individual referred to a higher centre. If facilities are available liver functions test (or at least SGOT and SGPT) and CPK should be measured and if they are more than two times normal the drug should be discontinued.

3. **Beta-blockers:** Beta blockers are advocated in all patients who have had Myocardial infarction (MI), Acute Coronary Syndrome (ACS), or Left Ventricular (LV) dysfunction with or without heart failure symptoms and exertional angina unless contraindicated to achieve resting heart rates of 60 beats/min. Metaprolol is preferred and its usual dose is 50-100mg/day in divided doses or Metoprolol long acting 50-100mg once a day. Other choices include Atenolol or Nebivolol. The common side effects are fatigue, impotence and exacerbation of latent bronchial asthma.

4. **ACE Inhibitors:** Should be used in all patients unless contraindicated. (ARBs may be considered in patients intolerant to ACE-I). The common side effect is cough. Serum creatinine should be done 2-4 week after the initiation of therapy and at least yearly, thereafter. Treatment should be initiated with the lowest dose (Captopril 12.5 mg or Enalapril 1.25 mg and stepped up to the highest dose of Enalapril 10mg daily in two divided doses)

5. **Sublingual Nitrates [SOS]:** Recommended in exertional angina.
Prevention and Management of Stroke
What is a Stroke?
A stroke means that part of the brain is suddenly damaged. If an artery in the brain becomes blocked by a thrombus, it causes a stroke. If an artery in the brain leaks, then too, it damages the brain and causes a stroke.

Atheroma is also known as ‘atherosclerosis’ or ‘hardening of the arteries’. Patches of atheroma are also called ‘plaques’ of atheroma. Patches of atheroma are like small fatty lumps that develop within the inside lining of arteries (blood vessels). The thrombus usually forms over some atheroma.

A temporary lack of blood supply to a part of the brain results in a Transient Ischemic Attack (TIA).

Prevention of Strokes
Stroke can be prevented by controlling high blood pressure, avoiding tobacco use and leading a healthy life style. Simple tips include the following:

• Keeping blood pressure well under control
• In case of positive family history of stroke yearly evaluation of risk factors such as hypertension and diabetes
• Eating healthy (plenty of whole grains, fruits and vegetables in the daily diet)
• Avoiding refined flours, sugars and foods rich in trans fats such as biscuits, deep fried foods etc.

Risk Factors for Stroke
There are several risk factors which predispose individuals to develop a stroke. These are the following:

Lifestyle risk factors (that can be prevented or changed)
• Smoking
• Lack of physical activity (a sedentary lifestyle)
• Obesity
• An unhealthy diet
• Excess alcohol consumption

Treatable risk factors
• Hypertension (high blood pressure).
• High cholesterol blood level.
• High triglyceride (fat) blood level.
• Diabetes.
• Kidney diseases causing diminished kidney function.

Educate the patients that if there are stroke symptoms, including sudden weakness of the face or a limb, a blurring of vision, dizziness, or an intense headache, he/she should seek immediate medical attention.
PRACTICAL ADVICE TO PATIENTS ON HOW STROKES CAN BE PREVENTED

Know the blood pressure. Have the blood pressure checked at least once a year, and, if it is elevated, treat it diligently, to keep it under control.

• Stop the use of both smoking and non-smoking forms of tobacco.

• It is preferable to avoid alcohol due to several other ill effects on health. However, for individuals who consume alcohol the consumption should be moderate (daily consumption of not more than a glass of wine or 30-50ml of hard drinks such as whisky, brandy or similar products with high alcohol content).

• Avoid binge drinking. It is a major risk factor for stroke because it can acutely elevate blood pressure.

• Include exercise in the daily routine.

• Consume a low-salt and a low-fat diet.

• Prefer whole grains and whole pulses and eating 10-40 gms of unsalted non-fried nuts everyday.

• Identify circulatory problems that could increase the risk of stroke and Atrial fibrillation.

• Screen for hypercholesterolemia. If more than 200mg/dl, lower it by lifestyle changes like regular exercise and changes in the diet along with statins.

• Control diabetes, if present, concurrently.

• Avoid deep vein thrombosis. If a patient is recovering from an illness or a surgery and is in bed, then make sure he/she exercises the legs by raising it up and down 10-15 times every day.
Management

Patients of stroke presenting within 6 hours of onset of symptoms should be referred to a secondary care for initial assessment and management. The follow-up of patients presenting with a completed stroke not requiring acute care (such as respiratory distress) can be managed at the PHC level.

Identification of an acute event

- Sudden onset of weakness of one half of body or one part of body
- Sudden onset of inability or difficulty in speech
- Sudden onset of imbalance
- Sudden onset of blindness
- Sudden onset of dizziness or spinning
- Sudden severe headache
- Seizures
- Sudden loss of consciousness

All patients with above symptoms should be examined by qualified medical practitioners

Guidelines for stroke treatment at a secondary health care level

- If available a plain CT scan should be done in all cases; contrast if indicated.
- Secure the airway by keeping the patients head to a side; if breathing is compromised assisted ventilation to be provided and circulation should be maintained by securing a good IV line and infusing 5% dextrose.
- Elevated blood pressure should be managed by nitroprusside, labetalol (under monitoring) or captopril in titrated doses. In most places only captopril will be available and this can be given sublingually too. The BP should not be brought down rapidly. The systolic should be around 140 mmHg and diastolic between 80-90 mmHg.
- Avoid cerebral decongestants (mannotol, glycerol) unless there is evidence of raised Intra-Cranial-Pressure with signs of decerebration.
- Provide supportive care to prevent deep vein thrombosis by prophylaxis with 5000 units heparin BD (or equivalent units of low molecular weight heparin if available and affordable).
• Acute rehabilitation includes proper positioning, dysphasia management, passive movements of limbs, bowel/bladder care with active involvement of family members

**Guidelines for referral to a tertiary health care level**
• If CT shows significant pressure effect, or middle cerebral artery (MCA) dense sign suggesting massive infarction, refer to tertiary centre
• If CT shows intra-parenchymal hemorrhage with midline compression, or a cerebellar infarct or hemorrhage refer to higher centre.
• If CT shows primary subarachnoid hemorrhage refer to higher centre

**Guidelines for follow-up of stroke at all levels**
• First follow up at 2 weeks. Follow up to be kept at 3 or 6 monthly intervals depending on individual merits of the case.
• Look for functional recovery,
• Check blood pressure and blood sugars,
• Monitor compliance with rehabilitation measures.
• Continue Aspirin. Use of clopidogrel or combination antiplatelet agents such as low dose aspirin plus extended release dipyridamole to be instituted on individual merits of the case after risk stratification at the secondary or tertiary care centers. Cardioembolic strokes will need oral anticoagulants with monitoring of prothrombin time.
• Dietary and lifestyle modification. Counseling regarding vocational guidance and eventual return to work
Guidelines for stroke prevention:

1. Identification of those at high risk
   Ask for
   • High blood pressure,
   • History of heart disease,
   • History of TIA,
   • Past history of stroke
   • Diabetes,
   • Tobacco users,
   • Family H/O increased risk for vascular disease,
   • Obesity- sedentary life style,
   • On oral contraceptives,
   • Hyperlipidemia,
   • Family history of stroke

   Individuals belonging to the above category are at a higher risk for stroke. Such individuals have to undertake preventive measures for stroke. Refer the section on ‘Therapeutic lifestyle management’ for lifestyle changes. Subjects with established vascular diseases have to take extra precautions as described below.

2. Primary prevention in high risk individuals

   Subjects having high blood pressure
   • Such subjects need lifelong management of high blood pressure
   • Restrict foods which are high in salt
   • Regular physical activity,
   • Drug therapy as required (refer the section on hypertension)
   • Identification of the cause of hypertension in younger patients and treating them

   Diabetes
   • Adopting a healthy diet
   • Regular physical activity
   • Drug therapy (refer the section on diabetes)
   • Avoid tobacco in any form

   Heart disease
   • Refer to section on coronary artery diseases
Measuring Blood Pressure

- Healthcare professionals taking blood pressure measurements need adequate initial training and periodic review of their performance.
- Healthcare providers must ensure that devices for measuring blood pressure are properly validated, maintained and regularly recalibrated according to manufacturers’ instructions.
- Where possible, standardise the environment when measuring blood pressure: provide a relaxed, temperate setting, with the patient quiet and seated and with their arm outstretched and supported.
- If the first measurement exceeds 140/90 mmHg, take a second confirmatory reading at the end of the consultation.
- Measure blood pressure on both of the patient’s arms with the higher value identifying the reference arm for future measurement.
- In patients with symptoms of postural hypotension (falls or postural dizziness) measure blood pressure while patient is standing (patient should be standing for more than one minute). In patients with symptoms or documented postural hypotension (fall in systolic BP when standing of 20 mmHg or more) consider referral to a specialist.
- Refer immediately patients with accelerated (malignant) hypertension (BP more than 180/110 mmHg with signs of papilloedema and/or retinal haemorrhage) or suspected phaeochromocytoma (possible signs include labile or postural hypotension, headache, palpitations, pallor and diaphoresis).
- To identify hypertension (persistent raised blood pressure, above 140/90 mmHg), ask the patient to return for at least two subsequent clinics where blood pressure is assessed from two readings under the best conditions available.
- Measurements should normally be made at monthly intervals. However, patients with more severe hypertension should be re-evaluated more urgently.
- Consider the need for specialist investigation of patients with unusual signs and symptoms, or of those whose management depends critically on the accurate estimation of their blood pressure.
PROCEDURE FOR MEASURING BLOOD PRESSURE

- Standardise the environment as much as possible:
  - relaxed temperate setting, with the patient seated
  - arm out-stretched, in line with mid-sternum, and supported.
- Correctly wrap a cuff containing an appropriately sized bladder around the upper arm and connect to a manometer. Cuffs should be marked to indicate the range of permissible arm circumferences; these marks should be easily seen when the cuff is being applied to an arm.
- Palpate the brachial pulse in the antecubital fossa of that arm.
- Rapidly inflate the cuff to 20 mmHg above the point where the brachial pulse disappears.
- Deflate the cuff and note the pressure at which the pulse re-appears: the approximate systolic pressure.
- Re-inflate the cuff to 20 mmHg above the point at which the brachial pulse disappears.
- Using one hand, place the stethoscope over the brachial artery ensuring complete skin contact with no clothing in between.
- Slowly deflate the cuff at 2–3 mmHg per second listening for Korotkoff sounds.
  - Phase I: The first appearance of faint repetitive clear tapping sounds gradually increasing in intensity and lasting for at least two consecutive beats: note the systolic pressure.
  - Phase II: A brief period may follow when the sounds soften or ‘swish’.
  - Auscultatory gap: In some patients, the sounds may disappear altogether.
  - Phase III: The return of sharper sounds becoming crisper for a short time.
  - Phase IV: The distinct, abrupt muffling of sounds, becoming soft and blowing in quality
  - Phase V: The point at which all sounds disappear completely: note the diastolic pressure.
- When the sounds have disappeared, quickly deflate the cuff completely if repeating the measurement.
- When possible, take readings at the beginning and end of consultations.

Source: NICE clinical guideline 34
Appendix – 2

Measuring Waist Circumference

- Record the measurement of the circumference at a level midway between the lower rib margin and iliac crest in cms to the nearest 0.0 or 0.5 cm. Example: If the exact measurement is 87.7 cm, code the item 87.5cm.
- The circumference should preferably be measured on subjects while they are semi-clothed, i.e. waist uncovered with the subjects wearing underclothes only. If it is not possible to follow this procedure, the alternative is to measure the circumference on subjects without heavy outer garments with all tight clothing, including the belt, loosened and with the pockets emptied.
- Participants should stand with their feet fairly close together (about 12-15 cm) with their weight equally distributed on each leg. Participants should be asked to breathe normally and at the time of the reading of the measurement asked to breathe out gently. This will prevent subjects from contracting their muscles or from holding their breath.
- A plastic metric tape should be used. The tape should be held firmly and its horizontal position should be ensured. It is recommended that the observer sits beside the participant while the readings are taken. The tape should be loose enough to allow the recorder to place one finger between the tape and the subject's body. The importance of the tightness of the tape should be emphasized in training.
- The length should be rechecked against a standard measure at least once a month and replaced as appropriate.
- The two sides of the tape should be differently coloured or have a scale only on one side. If the tape is uniformly coloured, with readings on both sides, one side should be blanked out.
Appendix – 3

Measuring Body Mass Index (BMI)

Height and weight measurement

Measuring height accurately:

- Height is measured in conjunction with the weight measurement. It may precede or follow this procedure.
- The height rule must be taped vertically to a hard flat surface, with no moulding (skirting board), with the base at floor level. A carpenter’s level should be used to ensure vertical placement of the rule.
- The floor surface must be hard (tile, cement, etc.) and must not be carpeted or be covered with other soft materials. If only a carpeted surface is available, a wooden platform should be laid down to serve as a floor.
- The subject is asked to remove his/her shoes/footwear and heavy outer garments.
- To measure height, the participant should stand with his/her back to the height rule. The back of the head, back, buttocks, calves and heels should be touching the upright, feet together. The top of the external auditory meatus (ear canal) should be level with the inferior margin of the bony orbit (cheek bone). The position is aided by asking participant to hold the head in a position where he/she can look straight at a spot, head high, on the opposite wall.
- Place the triangle on the height rule and slide down to the head so that the hair (if present) is pressed flat.
- Record information on survey form to the nearest centimetre. For example, if 187.4, record as 187; if 187.5, record as 188; if 187.6, record as 188.
- Self-reported heights are not acceptable. Only persons who are immobile (e.g. amputees) may self-report their heights.

Measuring weight accurately

- The floor surface on which the scale rests must be hard and should not be carpeted or covered with other soft material.
- The scale should be balanced with both weights at zero and the balance bar aligned.
- The subject should have removed his/her shoes/footwear and heavy outer garments (jacket, coat, sweater etc.).
- The subject should stand in the centre of the platform as standing off-centre may affect measurement.
- The weights are moved until the beam balances (the arrows are aligned).
• The weight is read and recorded on the form. Record weights to the nearest 200 g.
• Self-reported weights are not acceptable in mobile persons. Only participants who are immobile (e.g. amputees) may self-report their weights. Participants must not read the scales themselves.

**NOTE:** Check for the zero level every day before starting measurement everyday. Check the scales using standard weights at least monthly and whenever the scales are installed at a new location. If the error is more than 1 kg the measurements taken since the scales were last checked should not be used. Check for the zero level every day before starting measurement and immediately afterwards.

The Body Mass Index is calculated by dividing the body weight expressed in kilograms by the square of height expressed in metres.

$$
BMI = \frac{\text{Weight (Kgs)}}{\text{Height}^2 \text{ (Metre)}}
$$
### Normal values and their Cut-offs of Anthropometric and Biochemical parameters relevant to cardiovascular diseases and Diabetes

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cut-points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference (Normal)</td>
<td>Less than or equal to 90 cm in men</td>
</tr>
<tr>
<td></td>
<td>Less than or equal to 80 cm in women</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>Normal : 18.0-22.9 kg/m²</td>
</tr>
<tr>
<td></td>
<td>Overweight: 23.0-24.9 kg/m²</td>
</tr>
<tr>
<td></td>
<td>Obesity: &gt;=25 kg/m²</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Less than 140 mmHg</td>
</tr>
<tr>
<td>Systolic</td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td>Less than 90 mmHg</td>
</tr>
<tr>
<td>Blood glucose level</td>
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<tr>
<td>Optimal</td>
<td>Less than 110mg/dl</td>
</tr>
<tr>
<td>Impaired fasting glucose</td>
<td>Between 110-126mg/dl</td>
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<tr>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Fasting</td>
<td>Less than 126 mg/dl</td>
</tr>
<tr>
<td>2-hr post Glucose load</td>
<td>Less than 200 mg/dl</td>
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<tr>
<td>HbA1C</td>
<td>Less than 6%</td>
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<tr>
<td>Total Cholesterol</td>
<td>Optimal: &lt;160 especially in the presence of other risk factors</td>
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<tr>
<td></td>
<td>Desirable: &lt;200</td>
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<tr>
<td></td>
<td>Borderline: 200-239</td>
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<tr>
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<td>High: &gt;240</td>
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<tr>
<td>LDL-Cholesterol</td>
<td>Optimal: &lt;100</td>
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<tr>
<td></td>
<td>Near Optimal: 100-129</td>
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<tr>
<td></td>
<td>Borderline High: 130-159</td>
</tr>
<tr>
<td></td>
<td>High: 160-189</td>
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<tr>
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<td>Very High: ≥190</td>
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<tr>
<td>Triglyceride</td>
<td>Normal: &lt;150</td>
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<td></td>
<td>Borderline High: 150-199</td>
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<td>High: 200-499</td>
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<tr>
<td></td>
<td>Very High: ≥500</td>
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<tr>
<td>HDL-Cholesterol</td>
<td>Less than 40 mg/dl in men</td>
</tr>
<tr>
<td></td>
<td>Less than 50 mg/dl in women</td>
</tr>
</tbody>
</table>

Table 13
Appendix – 5

Reference List


(25) http://www.ktl.fi/publications/monica/manual/part3/iii-1.htm#s4-6
# List of Experts who participated in the National Level Workshop for Medical Officers under NPDCS

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Name and Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Sudha Ramana</td>
</tr>
<tr>
<td></td>
<td>Director of Medical Education (Academic) Govt. of Andhra Pradesh</td>
</tr>
<tr>
<td>2</td>
<td>Dr. G. C. Doley</td>
</tr>
<tr>
<td></td>
<td>Addl. Director of Health Services, Office of Director of Health Services Assam</td>
</tr>
<tr>
<td>3</td>
<td>Dr. K. C. Das</td>
</tr>
<tr>
<td></td>
<td>Jt. Director of Health Services, Jt. Director of Health Services, Assam</td>
</tr>
<tr>
<td>4</td>
<td>Dr. N. C. Hazarika</td>
</tr>
<tr>
<td></td>
<td>Director, State Institute of Health &amp; Family Welfare, Assam</td>
</tr>
<tr>
<td>5</td>
<td>Dr. H. K. Das</td>
</tr>
<tr>
<td></td>
<td>Scientist C, Division of Clinical Research, RMRC(ICMR), NE Region, Dibrugarh (Assam).</td>
</tr>
<tr>
<td>6</td>
<td>Dr. P. K. Borah</td>
</tr>
<tr>
<td></td>
<td>Regional Medical Research Centre, ICMR, NE Region, Assam</td>
</tr>
<tr>
<td>7</td>
<td>Dr. Pushpa K. Belani</td>
</tr>
<tr>
<td></td>
<td>State Nodal Officer for NPDC, Gandhi Nagar, Gujarat</td>
</tr>
<tr>
<td>8</td>
<td>Dr. B. B. Patel</td>
</tr>
<tr>
<td></td>
<td>District Nodal Officer, NCD Cell, General Hospital, Gandhi Nagar</td>
</tr>
<tr>
<td>9</td>
<td>Dr. Vasudeva Murthy</td>
</tr>
<tr>
<td></td>
<td>Directorate of Health &amp; Family Welfare Services, Bangalore, Karnataka</td>
</tr>
<tr>
<td>10</td>
<td>Dr. V. Mohanan Nair</td>
</tr>
<tr>
<td></td>
<td>Director and CEO, Indian Institute of Diabetes, Thiruvananthapuram, Kerala</td>
</tr>
<tr>
<td>11</td>
<td>Dr. J. G. Sanil Kumar</td>
</tr>
<tr>
<td></td>
<td>MLCD, Kerala State Institute of Health and Family Welfare, Thiruvananthapuram</td>
</tr>
<tr>
<td>12</td>
<td>Dr. Bindu Singhal</td>
</tr>
<tr>
<td></td>
<td>Training coordinator, State Institute of Health Management and Communication (SIHMC), City Center, Madhya Pradesh</td>
</tr>
<tr>
<td>13</td>
<td>Dr. Ashok Sharma</td>
</tr>
<tr>
<td></td>
<td>Director Public Health, Bhopal, Madhya Pradesh</td>
</tr>
<tr>
<td>14</td>
<td>Dr. Ajit Dubey</td>
</tr>
<tr>
<td></td>
<td>Medical Specialist Victoria Hospital, Jabalpur, Madhya Pradesh</td>
</tr>
<tr>
<td>15</td>
<td>Dr. Anand Krishnan</td>
</tr>
<tr>
<td></td>
<td>Associate Professor, Centre for Community Medicine, All India Institute of Medical Sciences</td>
</tr>
<tr>
<td>S.NO</td>
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<td>Dr. Ritvik</td>
</tr>
<tr>
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<td>All India Institute of Medical Sciences, New Delhi</td>
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<tr>
<td>17</td>
<td>Dr. Baridalyne N.</td>
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<tr>
<td></td>
<td>Centre for Community Medicine, All India Institute of Medical Sciences</td>
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<tr>
<td>18</td>
<td>Dr. Nikhil Tandon</td>
</tr>
<tr>
<td></td>
<td>Professor of Endocrinology &amp; Metabolism, All India Institute of Medical Sciences</td>
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<tr>
<td>19</td>
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<td>Asst Professor of Cardiology, All India Institute of Medical Sciences</td>
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<td>Dr. V. Padma</td>
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<td>21</td>
<td>Prof. K. Srinath Reddy</td>
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<td>President, Public Health Foundation of India</td>
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<td>22</td>
<td>Dr. D. Prabhadaran</td>
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<td>Executive Director, Centre for Chronic Disease Control, New Delhi</td>
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<td>Dr. Shifalika Goenka</td>
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<td>25</td>
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<td>Sh. R. L. Chongthu</td>
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Guidelines for Medical Officers
Simple but effective treatments are known to prevent occurrence of angina, myocardial infarction and stroke among those with risk factors such as smoking, hypertension and diabetes and prevent complications among those with established disease. However nearly a third to half of such patients are not given such treatments. Also, prevention is not commonly emphasised. This book provides doctors both at primary and secondary care level scientific guidelines and practice recommendations to prevent and manage cardiovascular diseases, diabetes and stroke.