Module 3.1*

Prevention and management of cardiovascular diseases in primary health care

*This module will be updated when the risk (R) module of the HEARTS Technical Package is finalized.
WHAT’S INSIDE

- Introduction
- Learning outcomes
- Topics covered
- Competency
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- Background information
INTRODUCTION

A large proportion of people with high cardiovascular risk remains undiagnosed. Those diagnosed have insufficient access to treatment. When a diagnosis is made, it is frequently at a late stage of the disease, when people become symptomatic and are admitted to hospitals with acute myocardial infarction, stroke or other complications, and when costly high-technology interventions are required for treatment. Improved access to effective interventions at the primary health care level will have the greatest impact on halting and reversing the progression of the disease and preventing complications such as heart attack, stroke, kidney disease, heart failure, amputation and blindness. This module has been prepared for primary health care workers to assess the 10-year risk of cardiovascular diseases (CVDs) through the WHO/International Society of Hypertension (ISH) risk chart, and improve early diagnosis, management and appropriate/timely referral of patient with CVDs.

LEARNING OUTCOMES

At the end of the session, participants will be able to do the following:

- Explain the basic pathophysiology and symptoms of CVDs (coronary heart disease and stroke).
- Explain the rationale and apply the WHO/ISH risk chart for patient management.
- Describe the basic principles of management of CVDs at the primary health care level and ensure timely referral to a higher centre.

TOPICS COVERED

- Concept, rationale and goal of cardiovascular risk assessment.
- WHO/ISH risk chart and risk score for patient management.
- Criteria for conducting CVD risk assessment.
- Limitation of CVD risk assessment.
- Pathophysiology and risk factors of CVDs.
- Types of CVDs (coronary heart disease [CHD], cerebrovascular disease, peripheral vascular disease).
- Approach to the assessment of chest pain at the primary health care level.

COMPETENCY

Ability to calculate CVD risk and interpret the meaning of 10-year CVD risk.
TEACHING AND LEARNING ACTIVITIES

Total session time: 120 minutes

Activity 1. Basics of common CVDs: 15 minutes

Step 1. Ask participants the following questions and write the responses on a flipchart/whiteboard.

- Coronary heart disease
- Stroke and transient ischaemic attack (TIA)
- Hypertension.

Step 2. Present the powerpoint slides with the following contents.

- Basic pathophysiology
- Types of common CVDs
- Other CVDs.

Activity 2. Concept, rationale and goal of cardiovascular risk assessment: 15 minutes

Step 1. Ask the participants:

- to list the main risk factors for CVD
- to describe the primary interventions to reduce CVD risk.

Step 2. Present the powerpoint slides with the following contents.

- Importance of CVD risk assessment and early detection
- Concept, rationale and goal of cardiovascular risk assessment.

Activity 3. WHO/ISH CVD risk charts: 20 minutes

Step 1. Refer to the workbook and discuss the following case.

You have two patients in the clinic on a Monday afternoon, with enough resources to treat only one patient with medications. Which of these patients do you treat first and why?
### Risk-based management: case study

<table>
<thead>
<tr>
<th>Ms Bao</th>
<th>Mr Kamao</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 years old</td>
<td>50 years old</td>
</tr>
<tr>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>Smoker</td>
</tr>
<tr>
<td>Not diabetic</td>
<td>Not diabetic</td>
</tr>
<tr>
<td>Systolic BP = 159mmHg</td>
<td>Systolic BP = 138mmHg</td>
</tr>
<tr>
<td>Total Cholesterol = 4mmol/L</td>
<td>Total Cholesterol = 7mmol/L</td>
</tr>
</tbody>
</table>

**Step 2.** Ask the participants to identify the similarities and dissimilarities, and ask them which patient they would want to treat and why.

*Key points:* Patients at higher risk should get treatment first. To evaluate risk appropriately, there is a need to consider all risk factors. For Ms Bao, the single risk factor is elevated BP. For Mr Kamao, multiple risk factors include male gender, smoking, high systolic BP and high cholesterol.

**Step 3.** Tell them look at the WHO/ISH prediction charts.

**Step 4.** Calculate the risk score.

**Step 5.** Discuss the answer using the risk chart.

**Step 6.** Summarize the session.
Figure 1: WHO/ISH risk prediction chart for SEAR D. 10-year risk of a fatal or non-fatal cardiovascular event by gender, age, systolic blood pressure, total blood cholesterol, smoking status and presence or absence of diabetes mellitus.

This chart can only be used for countries of the WHO Region of South-East Asia, sub-region D, in settings where blood cholesterol can be measured (see Table 1).
**Activity 4. Using a risk-based approach to CVD management:**

**30 minutes**

Step 1. Divide participants into convenient groups.

Step 2. Ask groups to work on the following case studies in the workbook and assess:

(i) the CVD risk;

(ii) provide a treatment plan.

Case 1. A 50-year-old female, non-smoker, non-diabetic with a systolic BP (SBP) of 170 mmHg and total blood cholesterol 6.5 mmol/L visits the clinic. Risk prediction (10-year risk of fatal or non-fatal cardiovascular events) is 20–<30%.

Case 2. A 62-year-old male, a smoker and diabetic, visits the clinic. His recent fasting blood sugar value is 180 mg/dL and cholesterol is 7 mmol/L. His blood pressure is 160/88 mmHg.

Case 3. A 65-year-old male, smoker, without diabetes but with an SBP of 160 mmHg and total blood cholesterol of 7.5 mmol/L comes to the clinic.

Case 4. A 55-year-old female, non-smoker and diabetic, comes to the clinic. Her recent fasting blood sugar is 200 mg/dL and cholesterol is 8 mmol/L. Her blood pressure is 150/88 mmHg.

Step 3. Invite volunteers from each group to present the cases and discuss with the whole group.

**Activity 5. Patient communication on the basics of CVDs:**

**15 minutes**

Step 1. Invite two participants, one will role-play as a patient and other one as a health-care provider.

Step 2. The patient will ask questions as described in the exercises below and the health-care provider is expected to answer the patient correctly in simple language.

**Exercise 1: Knowledge of the cardiovascular system (CVS)**

A patient has asked you to explain why the heart is referred to as a pump. In your own words, please describe the structure and function of the different components of the CVS such as blood, blood vessels and the heart itself. Be sure to explain how blood flows through the various chambers of the heart and through the rest of the body.
The heart has four chambers (two atria and two ventricles). The atria receive incoming blood from the body (right atrium) and lungs (left atrium). Blood then travels actively and passively to the ventricles (more muscular chambers) that pump blood to the lungs (right) and body (left).

The right side of the heart receives deoxygenated blood from the body (via two veins – the inferior vena cava and superior vena cava) and pumps the blood to the lungs via the pulmonary arteries.

The left side of the heart receives oxygenated blood from the lungs via the pulmonary veins and pumps to the rest of the body via the aorta.

**Exercise 2: Knowledge of CVD**

Some patients may think that CVD is present only when someone has a heart attack. Please provide a short description of the different types of CVD such as acute coronary syndrome, angina and congestive heart failure (CHF), and some of the common signs and symptoms of these diseases. Try to keep your explanation to the level of a patient and simplify scientific concepts.

- CVD may be present long before a patient has a heart attack. This is because the build-up of plaque in the arteries supplying the heart occurs over time due to risk factors.
- Angina and heart attack (myocardial infarction) are clinical manifestations of coronary heart disease (CHD). Stroke, CHF and peripheral vascular disease (PVD) are other manifestations of atherosclerotic disease.
- Some common signs and symptoms of CVDs are chest pain, shortness of breath, fatigue and leg pain due to poor blood supply to the limbs.

**Exercise 3: Atherosclerosis as the underlying pathology of CVDs**

Patients need to understand that the immediate cause of heart attack and stroke is accumulation of plaque within the vessel walls over a prolonged period of time. Explain to the patient in a simple and clear manner how atherosclerosis leads to CVD. Make sure that you describe the development of atherosclerosis and how it causes CVD.

- Atherosclerosis is a condition that affects the arteries and leads to plaque formation. Plaque is made up of cholesterol deposits and other processes, with inflammation playing an important role.
- Acute coronary syndrome (heart attack) and acute stroke are usually due to rupture of plaque, which leads to thrombosis, with partial or complete obstruction of the artery.
Activity 6. History-taking related to CVD, stroke and kidney disease: 15 minutes

Step 1. Ask participants to work in pairs and take the patient’s history related to CVD, stroke and kidney disease using the questionnaire below.

Questionnaire to investigate probable angina/heart attack, stroke/TIA, diabetes and hypertension

Angina or heart attack

1. Have you ever had any pain or discomfort or any pressure or heaviness in your chest?
2. If so, do you get the pain in the centre or left side of the chest or left arm? Or do you get sudden epigastric pain or shortness of breath? If no, no need to ask the next 5 questions; if yes, proceed to the next question.

Ask the following questions:

3. Do you get it when you walk at an ordinary pace on level ground or when you walk uphill or hurry?
4. Do you slow down if you get the pain while walking?
5. Does the pain go away if you stand still or if you a take a tablet under the tongue?
6. Does the pain go away in less than 10 minutes?
7. Have you ever had severe chest pain across the front of your chest lasting for half an hour or more?
If the answer to questions 3 or 4 or 5 or 6 or 7 is yes, the patient may have angina or may have had a heart attack and needs referral.

**Stroke and TIA**

8. Have you ever had any of the following: difficulty in talking, weakness of the arm and/or leg on one side of the body or numbness on one side of the body?
   - Yes
   - No

If the answer to question 8 is yes, the patient may have had a stroke or TIA and needs referral

**Diabetes**

Diabetes (high level of blood sugar) is not a CVD but it increases the risk of developing heart attack and stroke. For this reason, a patient with diabetes is at high risk. It is mandatory to ask ALL patients if they have been diagnosed as having diabetes.

9. Has your doctor ever told you that your level of blood sugar is high? Are you taking any medication for diabetes?

If the answer to question 9 is yes, the patient may have diabetes and needs further evaluation and management.

**Hypertension**

10. Do you have high blood pressure? Are you taking medications?

If the answer to question 10 is yes and the blood pressure is elevated, the patient needs further evaluation and management.

**Current history**

- Ask the reason for today’s visit.
- Ask specifically about:
  - Chest pain/tightness
  - Breathlessness
  - Palpitations
  - Headache; dizziness; vision problems
  - Difficulty in talking
  - Weakness of an arm and/or a leg
  - Numbness on one side of the body
  - Swelling of the feet and lower legs
  - Swelling of the face; puffiness of the eyes
  - Increased thirst; increased urination/nocturia
  - Unexplained loss of weight
  - Cough
  - Fever
  - Sexual problems
  - Women: currently pregnant or breastfeeding
- Ask if there are any other issues the patient would like to discuss.
- Have you had any pain or discomfort or any pressure or heaviness in your chest?
- Do you get the pain in the centre or left side of the chest or left arm?
- Do you get it when you walk uphill or hurry?
- Do you slow down if you get the pain while walking?
- Does the pain go away if you stand still or if you take a tablet under the tongue?
- Does the pain go away in less than 10 minutes?
- Have you ever had severe chest pain across the front of your chest lasting for 30 minutes or more?
### Previous medical history
- Heart attack/angina/other heart diseases
- Stroke/TIA
- Kidney disease
- Other illnesses (specifically, conditions that can affect control of diabetes mellitus and hypertension, e.g. TB, HIV)
- Hospitalizations
- Episodes needing urgent medical care
- Allergies
- Diabetes

### Family history
- Parent, brother or sister with premature* cardiovascular disease (heart attack, stroke, angina, TIA), diabetes or kidney disease  
  *Occurring before 55 years in males and 65 years in females

### Medicines
- Current medications (all medications, including over-the-counter/herbal/traditional remedies/recreational drugs)
- Adherence to medications
- Side-effects

### Risk factors (questions to be adapted to the local context)

#### Tobacco
- Have you used tobacco during the past 12 months
- Were you regularly exposed to secondhand tobacco smoke in the past 12 months?

#### Alcohol
- Did you drink any alcohol in the past 30 days? If yes, how often and how many units per day?

#### Diet
- Do you eat at least 5 servings of fruit and vegetables (excluding starchy root crops) daily?  
  (1 serving = ½ cup cooked vegetables or 1 cup raw vegetables; one orange, apple, banana, mango)
- Do you eat red meat, fried foods, canned or other processed foods on most days?
- Do you eat fish at least 3 times per week?
- Do you have sugary drinks (soda, juice, sweetened milk) on most days?

#### Physical activity
- Do you do physical activity of moderate intensity for at least 30 minutes per day on 5 days of the week or for 2.5 hours per week?
- Do you spend more than 5 hours sitting down every day?
1. A risk of 20–<30% means which of the following?
(a) Level of risk low
(b) Level of risk moderate
(c) Level of risk high
(d) Level of risk very high

2. When do the coronary arteries primarily receive blood flow?
(a) During inspiration
(b) During diastole
(c) During expiration
(d) During systole

3. Which of the following ages is indicated to assess for CVD risk in primary health care?
(a) Any patient above 18 years of age
(b) Any patient above 30 years of age
(c) Any patient above 40 years of age
(d) Any patient above 50 years of age

4. Which of the following conditions most commonly results in CAD?
(a) Atherosclerosis
(b) Diabetes mellitus
(c) Myocardial infarction
(d) Renal failure

5. Atherosclerosis impedes coronary blood flow by which of the following mechanisms?
(a) Plaques obstruct the vein
(b) Plaques obstruct the artery
(c) Blood clots form outside the vessel wall
(d) Hardened vessels dilate to allow the blood to flow through
6. **Which of the following risk factors for coronary artery disease cannot be corrected?**
   
   (a) Cigarette smoking  
   (b) Diabetes mellitus  
   (c) Heredity  
   (d) Hypertension

7. **The condition where plaque builds up in the arteries of your body is called:**
   
   (a) Hypotension  
   (b) Hypertension  
   (c) Valvular stenosis  
   (d) Atherosclerosis

8. **Modifiable risk factors that increase the risk of acute myocardial infarction include all of the following, except:**
   
   (a) Hypertension  
   (b) Smoking  
   (c) Food allergies  
   (d) Lack of physical activity

9. **Symptoms of heart attack can include:**
   
   (a) Pressure in the chest  
   (b) Dizziness, arm pain  
   (c) Palpitations, shortness of breath  
   (d) All of the above

10. **Female, 52 years old, presented to your centre with chest pain. What is your provisional diagnosis, further evaluation and management?**

11. **Male, 48 years old, known hypertensive, presented to your centre with difficulty in speaking. What is your provisional diagnosis, further evaluation and management?**
Frequently asked questions on use of country-specific WHO CVD risk charts

1. **What are CVD risk prediction charts?**

   The risk of an individual having a heart attack or a stroke depends on risk factors such as age, sex, smoking status and levels of blood pressure, blood cholesterol and blood glucose. The risk prediction charts provide a simple way of calculating the approximate combined risk due to all these risk factors. It is expressed as a 10-year risk of developing a heart attack or stroke.

2. **How were the WHO CVD risk prediction charts developed?**

   The charts were developed by developing country-specific risk equations based on the average risk factor profile (average rates of blood pressure, blood cholesterol etc.) and rates of cardiovascular events (average rates of heart attacks and strokes) in the population. The risks of non-fatal and fatal heart attack and non-fatal and fatal stroke were modelled and combined to predict individual risk.

3. **How can these charts be used to improve the effectiveness of CVD risk management?**

   Using these risk prediction charts, an individual can be classified as being at high, intermediate or low risk for heart attack or stroke in the following 10 years. If an individual has high CVD risk, the guidelines recommend more intensive counselling and treatment, often including medications. This is because it is urgent to lower the individual’s risk in order to prevent a heart attack or stroke. On the other hand, if risk is low, interventions may be less intensive, such as general counselling for healthy lifestyle.

4. **Why were the charts updated?**

   Data on risk factor prevalence and cardiovascular mortality changes over time. Thus, if the charts are not updated, they may no longer reflect a country’s current risk status. Furthermore, given the country-to-country variation within each of the 14 WHO epidemiological sub-regions on the previous set of charts used, country-specific rather than regional charts were developed in the update in order to increase accuracy.

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HEARTS: Technical package for cardiovascular disease management in primary health care
5. **How will these guidelines and charts help low- and middle-income countries in particular?**

The main problem in low- and middle-income countries is the shortage of health care resources. Nonetheless, even with limited resources, effective action can be taken to prevent heart attacks and strokes if resources are used for population-wide, cost-effective interventions, targeting those who are in imminent danger of heart attack or stroke.

6. **Why is treating risk factors such as raised blood pressure and blood lipids cost effective for low- and middle-income countries but only if interventions target high-risk individuals?**

Currently, individuals are often treated based on the presence or absence of a single CVD risk factor such as high blood pressure or high blood lipids. This approach works when these risk factors are markedly elevated. Otherwise, although the approach appears simple, it can result in committing a patient with only a small CVD risk to many years of drug therapy or, conversely, neglecting to treat those with an overall higher risk. Further, the single risk factor approach does not take into account the continuous relationship between blood pressure, blood glucose, blood cholesterol and CVD risk.

The single risk factor approach is not cost effective or affordable for many low- and middle-income countries, and patients from lower socioeconomic categories. For example, in a hypothetical population of 1 billion (about 500 million adults) with a 20% prevalence of hypertension, about 100 million people will require treatment. If the annual cost of providing treatment is a modest US$ 20 per person per year, about US$ 2 billion will be required annually to provide medicines for hypertension alone. In reality, the prevalence of hypertension as well as the cost of drugs to treat it is often even higher.

7. **What are the limitations of these charts?**

Due to paucity of data, estimates from several cohort studies have been used to determine CVD incidence and mortality. Thus it is possible that in some areas, CVD risk may be over- or underestimated.

8. **Are the alternative BMI charts only for use when cholesterol cannot be measured?**

The alternative BMI charts are meant to be used only in settings where assay of cholesterol is not possible. These charts are less accurate than those used when information about a patient’s cholesterol is available. Nonetheless, they provide an option for classifying a patient based on their risk of having a heart attack or stroke. The charts can be used as a screening tool for identifying individuals who require further investigations.
9. **If the charts are not perfect, is it safe to use them?**

While the charts are not perfect because of the paucity (quantity and quality) of data available, they are safe to use for the purpose of broad risk stratification that will guide risk management.

10. **When can treatment decisions be made without the charts?**

These charts may underestimate the risk in certain patients such as those with:

- persistently raised blood pressure $\geq 160/100$ mmHg; or
- blood cholesterol $\geq 8$ mmol/l; or
- established ischemic heart disease; or
- diabetes with renal disease.

All patients in these categories need intensive lifestyle interventions and appropriate drug therapy. They do not need risk stratification using charts for treatment decisions.

11. **What are WHO’s recommendations for individuals who want to decrease their risk of CVD?**

Stop tobacco use. Maintain a healthy body weight through daily physical activity and a healthy diet, including a regular intake of fruits and vegetables. Maintain healthy blood pressure, blood glucose and blood cholesterol levels according to medical advice. If medicines have been recommended, take them as prescribed by a health-care worker.

**Additional reading resources**

Prevention and management of cardiovascular diseases in primary health care

Activity 1: Step 2

Blood supply to heart and brain

Coronary arteries

Cerebral arteries
Prevention and management of cardiovascular diseases in primary health care

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**Atherosclerosis - underlying process of CVDs**

- Artery
- Plaques form in lining of artery
- Plaques grow, lining of artery damaged
- Plaque rupture
- Blood flows into body
- Blood flows into body

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**Risk factors for CVDs**

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic risk factors (Down stream)</td>
<td>High blood pressure</td>
</tr>
<tr>
<td></td>
<td>High blood cholesterol</td>
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<tr>
<td></td>
<td>Heart disease</td>
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<tr>
<td></td>
<td>Diabetes or high level of sugar in blood</td>
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<td></td>
<td>Overweight and obesity</td>
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<td></td>
<td>Previous history of heart attack or stroke</td>
</tr>
<tr>
<td>Behavioural risk factors</td>
<td>Smoking</td>
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<td></td>
<td>Heavy alcohol consumption</td>
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<tr>
<td></td>
<td>Unhealthy diet</td>
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<td></td>
<td>Physical inactivity</td>
</tr>
<tr>
<td>Age and sex, family history</td>
<td>The risk of heart disease increases for men after age 45 and for women after age 55 (or after menopause)</td>
</tr>
<tr>
<td></td>
<td>The risk of stroke increases with age and males are at higher risk compared to females.</td>
</tr>
</tbody>
</table>

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**Cardiovascular diseases**

**CVDs due to atherosclerosis**

- Ischaemic heart disease or coronary artery disease
- Cerebrovascular disease (e.g. stroke)
- Diseases of the aorta and arteries, including hypertension
- Peripheral vascular disease (PVD)

**Other CVDs**

- Heart failure
- Congenital heart disease
- Rheumatic heart disease
- Cardiomyopathies (diseases of the heart muscle)
- Cardiac arrhythmias.

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Prevention and management of cardiovascular diseases in primary health care
Activity 2: Step 2

Rationale of cardiovascular risk assessment

- Risk-based treatment involves identification of those at high risk from combination of multiple risk factors.
- CVD risk assessment helps to:
  - Identify individuals at high risk that can benefit from intensive primary prevention efforts (counselling and drug therapy)
  - Motivate such individuals to comply with treatment
  - Goal is to decrease events in high-risk individuals through appropriate management

Multiple risk factors

Risk Factors CO-EXIST & cumulative effects of multiple factors may be SYNERGISTIC.

- Sedentaryness
- Raised blood pressure
- Smoking
- Thick waistline - central adiposity
- Unhealthy diet
- Raised blood sugar
- Harmful use of alcohol
- Raised blood lipids

Prevention and management of cardiovascular diseases in primary health care
Why is risk based management important?

Risk-based management: If each scoop costs $50 equally, which treatment tub is the most cost-effective?

While there are people at high risk even in lower age groups, given the limited resources, it is better to use the resources in a group where there is most likelihood of finding high risk subjects. As resources improve, age limits can be changed. Otherwise all resources can be used in a population where the yield is low. Decreases in age thresholds for cardiovascular risk assessment depend on national context.

Lowering the threshold (such as age) for treatment means that more events can potentially be averted, however this means more cost for the health system.

Risk based management goals

Risk-based management goals and objectives

Goal:
Prevent first or recurrent heart attacks and strokes in people with CVD risk factors

Sub-goals:
- Reduce individual cardiovascular risk level
- Prevent or slow the progression of target organ damage
- Minimize complications

Risk based management objectives

- Quit tobacco use or do not start the habit
- Reduce alcohol consumption to less than 4 units per day
- Achieve physical activity level of at least 150 minutes per week or 30 minutes on 5 days per week (through leisure activities, daily tasks or work-related activity)
- Maintain health BMI and waist circumference or reduce to healthier level
- Control blood pressure
- Control blood glucose
- Lower total blood cholesterol and LDL cholesterol
- Take antiplatelet therapy if necessary
How to estimate CVD risk

- A 10-year CVD risk is defined according to:
  - Age
  - Sex
  - Smoking status (current smokers OR those who quit smoking less than 1 year before the assessment)
  - Blood pressure (measured)
  - Total cholesterol (measured)
  - Diabetes status (previously diagnosed OR a fasting plasma glucose concentration >7.0 mmol/l (126 mg/dl))
  - History of CVD (heart attack, chest pain from heart disease or stroke)
- Using WHO/ISH risk prediction chart

How do you use the charts to assess cardiovascular risk?

- Before applying the chart to estimate the 10-year cardiovascular risk of an individual, the following information is necessary:
  - Presence or absence of diabetes
  - Gender
  - Smoker or non-smoker
  - Age
  - Systolic blood pressure
  - Total blood cholesterol (if in mg/dl divide by 38 to convert to mmol/l)

Risk levels

- The colour of the cell indicates the 10-year risk of combined myocardial infarction and stroke risk (fatal and non-fatal) as shown below.

- 10-year combined myocardial infarction and stroke risk (fatal and non-fatal)
  - Green <10%
  - Yellow 10% to <20%
  - Orange 20% to <30%
  - Red 30% to <40%
  - Deep Red > 40%
Conditions in which CVD risk may be higher than indicated by the charts

- already on antihypertensive therapy
- premature menopause
- approaching the next age category or systolic blood pressure category
- obesity (including central obesity)
- sedentary lifestyle
- family history of premature coronary heart disease (CHD) or stroke in first degree
- relative (male < 55 years, female < 65 years)
- raised triglyceride level (>2.0 mmol/l or 180 mg/dl)
- low HDL (high density lipoprotein) cholesterol level (<1 mmol/l or 40 mg/dl in males, <1.3 mmol/l or 50 mg/dl in females)
- raised levels of C-reactive protein, fibrinogen, homocysteine, apolipoprotein B or Lp(a), or fasting glycaemia, or impaired glucose tolerance
- microalbuminuria (increases the 5-year risk of diabetics by about 5%) (38, 83, 85)
- raised pulse rate
- socioeconomic deprivation.