Module 3.3

Management of type 2 diabetes in the primary health care level
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INTRODUCTION

Diabetes is a chronic, metabolic disorder characterized by raised levels of blood glucose (or blood sugar), which leads to serious damage to the heart, blood vessels, eyes, kidneys and nerves over the time. The starting point for living well with diabetes is an early diagnosis, as the longer a person lives with undiagnosed and untreated diabetes, the worse their health outcomes are likely to be. This module has been prepared for primary health care workers to enable them to make an early diagnosis, manage and refer patients with diabetes appropriately and in a timely manner. This module includes the pathophysiology, signs and symptoms, diagnosis and management of diabetes. It also contains details of the basic clinical examinations, prevention strategies for diabetes, blood glucose measurement with a glucometer and insulin use techniques.

LEARNING OUTCOMES

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

- Explain the basic pathophysiology, signs and symptoms of type 2 diabetes.
- Describe the management of type 2 diabetes, including suspicion and recognition of hypoglycaemia and hyperglycaemic symptoms.
- Prescribe first-line drugs for diabetes according to the evidence-based guidelines.
- Provide advice on drug adherence and self-care to prevent/delay diabetic complications.

TOPICS COVERED

- Risk factors, pathophysiology, signs and symptoms and types of diabetes.
- Screening and diagnostic tests.
- Organizing screening and early detection.
- Pharmacological management and lifestyle modification.
- Complications of diabetes (diabetic foot, diabetic retinopathy and renal complications) and their prevention.
- Diabetic emergencies and hyperglycaemic conditions.
- Patient communication for self-care.
COMPETENCY

- Ability to screen, diagnose and manage diabetes using the evidence-based guidelines and communicate effectively with patients to enable self-care.

TEACHING AND LEARNING ACTIVITIES

Total session time: 140 minutes

Activity 1. Understanding diabetes and its diagnosis: 25 minutes

Step 1. Ask a participant to share a case story of diabetes he/she has managed in his/her practice.
- How was the case diagnosed, managed and followed up?

Step 2. Ask the participants to share their responses to the following questions and note them on a flipchart/whiteboard:
- What is screening for diabetes?
- What are the pros and cons of opportunistic and organized screening of diabetes?
- What are diagnostic criteria of diabetes?
- Discuss the challenges of adhering to diagnostic criteria in a tertiary hospital versus a remote (primary) health centre.

Step 3. Present the powerpoint slides with the following contents:
- types of diabetes, risk factors, signs and symptoms
- diabetes screening
- diagnostic criteria of diabetes.

Step 4. Review the case story and discuss the questions that follow.
A 50-year-old female who suffered from thirst, polyuria and weight loss came to a rural primary health care centre. The health worker, suspecting diabetes, tested for blood sugar with a glucometer, the only test available at the laboratory facility in the health centre. Her random blood sugar was 230 mg/dL. The nearest hospital with a laboratory facility is a 2-hour drive from the health center.
- If you were the health-care provider, what would you do to establish her diagnosis?
- If the same patient lived and presented at the nearest hospital, would the steps for confirming the diagnosis differ? Explain.
Discussion points

Since the random blood sugar is >200 mg/dL, it may be practical to advise the patient to come for a repeat fasting blood sugar test to confirm. If her fasting blood glucose is >126 mg/dL, the patient can be diagnosed as having diabetes. If the patient lived and presented at the nearest hospital, she could be advised to undergo a fasting plasma glucose and an oral glucose tolerance test.

Activity 2. Demonstration of the use of a glucometer: 15 minutes

Step 1. Present the powerpoint slides on how to use a glucometer.

Step 2. Ask two participants to volunteer to demonstrate the blood test using a glucometer.

Step 3. Ask the other participants to note down the mistakes in the technique.

Step 4. Discuss the other participant’s points and explain how to improve it.

Step 5. Emphasize on the key issues.

Activity 3. Management of diabetes using the evidence-based guidelines: 30 minutes

Step 1. Divide the participants into convenient groups. Provide the evidence-based guidelines on diabetes management to all participants.

Step 2. Ask the groups to read the guidelines and discuss the key messages and ambiguities in the guidelines.

Step 3. Invite the groups to come forward to explain the key messages and ambiguities.

Step 4. Present the powerpoint slides on the management of diabetes.
**Management of type 2 diabetes** in the primary health care level

**Screening for chronic complications**
- Measure blood pressure at every scheduled visit, review medication as per hypertension protocol
- REFER for dilated-pupil retinal exam upon diagnosis, and every two years thereafter, or as per ophthalmologist recommendation
- Examine feet for ulcers at every visit, REFER to higher level of care if ulcer present
- Assess risk of lower limb amputation annually (foot pulses, sensory neuropathy by monofilament, presence of healed or open ulcers, calluses), REFER to higher level of care if ulcer present or pulse absent
- REFER to higher level of care if proteinuria annually.

**Management of acute complications**

**Severe hypoglycaemia** (plasma glucose <50 mg/dl or 2.8 mmol/l) or signs
- If conscious, give a sugar-sweetened drink
- If unconscious, give 20–50 ml of 50% glucose (dextrose) IV over 1–3 minutes.

**Severe hyperglycaemia** (plasma glucose >18 mmol/l (325 mg/dl) and urine ketone 2+ or signs and symptoms of severe hyperglycaemia intravenous drip 0.9% NaCl 1 litre in 2 hours; continue at 1 litre every 4 hours, REFER to hospital.)

**Goal for glycaemic control**

- Fasting ≤7.0 mmol/l (126 mg/dl)

*refer to table on diagnostic values for other tests which can be used to diagnose diabetes.
*If they are more affordable than insulin, DPP4 inhibitors, SGLT2 inhibitors or pioglitazone can be used before insulin in cases of treatment failure with metformin and glitazone. Introduce and titrate insulin treatment according to local practices.
**HbA1c should be used where available. Consider less stringent glycaemic control in patients with frequent severe hypoglycaemia, advanced complications, serious comorbidities and/or limited life expectancy.
Step 5. Ask the participants to refer to diabetes management protocol and complete the management plan for the exercise provided in the workbook.

<table>
<thead>
<tr>
<th>Case study</th>
<th>Management plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 52-year-old female newly diagnosed diabetes with a fasting sugar of 150 mg/dL</td>
<td>✪ Initial assessment of the patient (history and physical examination), calculate 10-year CVD risk score, lifestyle modification, start with metformin 500 mg once daily (titrate the dose according to the treatment guidelines)</td>
</tr>
<tr>
<td>A 60-year-old diabetic male on metformin 1000 mg bd. On his recent visit, his random blood sugar (RBS) was 300 mg/dL.</td>
<td>✪ Calculate 10-year CVD risk score ✪ Lifestyle modification ✪ Add sulphonylurea</td>
</tr>
<tr>
<td>A 70-year-old male with hypertension and on diabetes treatment for 10 years. His recent blood pressure was 170/100 mmHg and fasting blood sugar (FBS) was 100 mg/dL. Drug history – amlodipine 10 mg once daily, metformin 500 mg 8 hourly.</td>
<td>✪ calculate 10-year CVD risk score ✪ Diabetes with comorbidities ✪ His blood pressure is not controlled (add enalapril 5 mg once daily (refer to the hypertension guidelines) ✪ His blood sugar is controlled but reduce the dose of metformin to twice daily because of old age.</td>
</tr>
</tbody>
</table>

Activity 4. Comprehensive foot examination: 15 minutes

(If possible, participants should be informed in advance to come appropriately prepared for possible foot examination)

Step 1. Ask about the importance and frequency of foot examination recommended for a diabetic patient.

Step 2. List the responses on a flipchart/whiteboard.

Step 3. Present the powerpoint slides on how to conduct a foot examination and calculate the risk score.

Step 4. Divide participants into pairs and ask them to examine each other’s feet and do the risk score (supervised by facilitator).

Step 5. Summarize the activity by explaining the dos and don’ts for prevention of diabetes foot.
Activity 5. Patient education, prevention and management of diabetic emergencies: 30 minutes

Step 1. Ask the participants to read the case below.

Case study 1
A 50-year-old male with diabetes for 1 year came to the clinic with a fasting blood sugar of 150 mg/dL. He is taking metformin 500 mg 12 hourly.

- Discuss the possible cause of uncontrolled diabetes.
- How would you manage the complications of diabetes?

Step 2. Ask the participants to prepare a comprehensive checklist for providing advice to the patient on preventing the complications of diabetes.

Step 3. Invite two volunteers to act as a patient and a health worker. The health worker uses the checklist to provide advice.

Step 4. Summarize the role-play by emphasizing the key points on the prevention and management of diabetic emergencies through powerpoint slides on the management of complications of diabetes.

NOTE: The facilitator should cover the following:
- diet (advise dietary modification)
- compliance (advise drug adherence)
- infection and stress conditions (find out and treat)
- drugs causing hyperglycaemia, e.g. steroids (stop)
- add gliclazide 80 mg once daily and titrate after one week if not controlled.

Case study 2
A 68-year-old lady with diabetes for 3 years came to the clinic with a reduced level of consciousness and a random blood sugar of 50 mg/dL.

Discuss the diagnosis and management of the above case.

Answers of case 1 and case 2
Case study 1

If symptomatic (nausea, vomiting, abdominal pain, rapid breathing), urine ketones > +2– i/v drip 0.9% NaCl 1 litre in 2 hours; continue at 1 litre every 4 hours, refer to a higher centre.

If symptomatic, ketones < +2– start with gliclazide 80 mg bd, counsel on diet modification, physical activity and medicine adherence, reassess in 3–5 days. If there is no improvement, refer to a higher level of care. If improved, continue gliclazide, diet modification, physical activity and review after 2 or 3 months.

Case study 2

Severe hypoglycaemia (plasma glucose <50 mg/dL or 2.8 mmol/L or signs):

- If conscious, give a sugar sweetened drink (15 gm of carbohydrate such as sugar, honey, sweetened juice).
- If unconscious, give 25 mL of 50% glucose (dextrose) iv over 1–3 minutes, reassess in 15 minutes; if still low, 10% dextrose water drip.
1. **What are the signs and symptoms of diabetes?**
   (a) polyuria
   (b) weight gain
   (c) thirst
   (d) vision changes
   (e) diarrhoea

2. **What are the risk factors for diabetes?**
   (a) first-degree relative with diabetes
   (b) hypertension
   (c) malaria
   (d) malnutrition
   (e) overweight

3. **What are the complications of diabetes?**
   (a) kidney damage (nephropathy)
   (b) eye damage (retinopathy)
   (c) constipation
   (d) heart damage (coronary heart disease)
   (e) brain damage (stroke)

4. **What are the diagnostic criteria of diabetes?**
   (a) urine sugar +3
   (b) fasting blood sugar >100 mg/dL
   (c) fasting blood sugar >126 mg/dL
   (d) random blood sugar >140 mg/dL
   (e) random blood sugar >200 mg/dL

5. **What are the first-line drugs for managing diabetes?**
   (a) metformin
   (b) gliclazide
   (c) pioglitazone
   (d) sitagliptin
   (e) acarbose
BACKGROUND INFORMATION

What is diabetes?

Diabetes is a disorder 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 its 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?

Classification of diabetes

The classification of diabetes includes four clinical categories:

- Type 1 diabetes, due to β-cell destruction, usually leading to absolute insulin deficiency;
- Type 2 diabetes, due to a progressive insulin secretory defect in the background of insulin resistance;
- Gestational diabetes mellitus, which is diabetes diagnosed during pregnancy that is not clearly overt diabetes;
- Other specific types of diabetes due to other causes, e.g. genetic defects in β-cell function, genetic defects in insulin action, diseases of the exocrine pancreas (such as cystic fibrosis), and drug- or chemical-induced diabetes (such as in the treatment of HIV/AIDS or after organ transplantation).

Type 1 diabetes (T1DM). This usually occurs in younger people, children and adolescents. The diagnosis of T1DM can be made throughout childhood but it is more likely below 15 years 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. A family history of diabetes is rare in T1DM. The presence of features of associated autoimmunity (autoimmune disorders, vitiligo) and absence of obesity and acanthosis nigricans are characteristics of T1DM. In addition, the urine of T1DM patients with uncontrolled hyperglycaemia may be positive for ketone bodies.

Type 2 diabetes (T2DM). This is the commonest type of diabetes. It usually occurs after the age of 40 years. T2DM was previously known as non-insulin-dependent diabetes mellitus. The onset is usually insidious and may be mild to severe. A family history is usually positive and strong. Obesity, metabolic syndrome and acanthosis nigricans are usually seen in these patients and there is no evidence of autoimmunity. Further, there is no insulin dependence till late in the course of illness.

Gestational diabetes: Gestational diabetes develops during pregnancy (gestation). Gestational diabetes causes high blood sugar that can affect pregnancy and the baby’s health. Expectant women can help control gestational diabetes by eating healthy foods, exercising and, if necessary, taking medication.

In gestational diabetes, the blood sugar usually returns to normal soon after delivery. However, they have a very high risk of developing type 2 diabetes within the next 5–10 years.
Blood sugar tests are taken to measure raised blood sugar levels, which are a risk factor for diabetes. Increased blood glucose or hyperglycaemia is the most common sign of diabetes. Diabetes is an important risk factor for cardiovascular disease (CVD).

Blood cholesterol tests are taken to measure the total cholesterol and high-density lipoprotein (HDL) cholesterol levels. High levels of cholesterol in the blood are also a risk factor for CVD.

**Type 2 diabetes mellitus: management**

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

1. **Initial assessment.** Individuals suspected of having T2DM need to be subjected to risk assessment, which includes:
   - 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 of the eye).

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

<table>
<thead>
<tr>
<th>History (ask for)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms of hyperglycaemia</td>
</tr>
<tr>
<td>Duration since onset of symptoms</td>
</tr>
<tr>
<td>Precipitating factors like recent infections, stress, change in dietary habits or physical activity level</td>
</tr>
<tr>
<td>Symptoms of micro-/macrovascular complications: visual disturbances, oedema, breathlessness, angina, intermittent claudication, numbness, paraesthesia</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 and frequency</td>
</tr>
<tr>
<td>Family history of diabetes</td>
</tr>
<tr>
<td>- Diabetes and complications</td>
</tr>
<tr>
<td>- Age at onset</td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Physical examination (look for)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Body mass index</td>
</tr>
<tr>
<td>Waist circumference, waist–hip ratio</td>
</tr>
<tr>
<td>Acanthosis nigricans</td>
</tr>
<tr>
<td>Blood pressure</td>
</tr>
<tr>
<td>Peripheral pulses</td>
</tr>
<tr>
<td>Feet: calluses, ulcers, prominent veins, oedema, injuries</td>
</tr>
<tr>
<td>Fundus (retinal) examination</td>
</tr>
<tr>
<td>Cardiovascular system</td>
</tr>
<tr>
<td>Peripheral nervous system</td>
</tr>
<tr>
<td>Thyroid</td>
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</tbody>
</table>

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 colour-producing cells.

(2) Initial management includes:
- pharmacotherapy for the management of hyperglycaemia and any other comorbid condition, e.g. high blood pressure, dyslipidaemia, etc.;
- therapeutic lifestyle management; and
- patient education and counselling for drug adherence and self-care.

**Type 2 diabetes mellitus: principles of management**

Lifestyle management (diet and physical activity) accompanied by drug therapy or insulin is the cornerstone of diabetes management. Apart from this other concurrent complications should be addressed. The basic principles in the management of T2DM are as follows:

(1) Modify the lifestyle: diet and physical activity
(2) Reduce insulin resistance through reduction in weight, specifically reduction of fat mass
(3) Pharmacological treatment (if inadequate control):

*metformin/sulfonylureas*
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(4) Treatment of high blood pressure:

Angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARB)s, calcium-channel blockers such as amlodipine and diuretics such as hydrochlorothiazide

For details, refer to the section on hypertension.

(5) Lipid control with statins.

Pharmacotherapy

- Biguanides (Metformin)
  - Mechanism of action: insulin sensitizer

Dose

The dose of metformin varies from 250 mg to 2000 mg/day. Since patients may complain of nausea and gastric irritation, the dose can be administered after a major meal. The 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 1 g/day. If despite this dose optimum glucose control is not achieved, a sulphonylurea should be added.

Advantages

- no weight gain; some patients may experience weight loss. Hence, metformin is useful in the large majority of patients who are overweight
- no hypoglycaemia
- for monotherapy in obese patients
- can be combined with other antihyperglycaemic agents, including insulin.

Contraindications

- renal diseases (creatinine ≥ 1.5 mg% in men; creatinine ≥ 1.4 mg% 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
- ketoacidosis
  - temporarily withhold: surgery, acute illness

Caution: phenformin is a banned drug and is not recommended.
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Side-effects

Nausea, vomiting, diarrhoea, abdominal pain, taste disturbance, anorexia

- Sulphonylureas

Glibenclamide

- The dose of glibenclamide varies from 2.5 to 15 mg/day given in one or two divided doses. The dose can be titrated based on blood glucose monitoring at intervals of 1–2 weeks.
- General rule: the glucose-lowering effect plateaus after half the maximum recommended dose.
- Approved indications: monotherapy; in combination with metformin and insulin
- Caution: hypoglycaemia can occur most likely among the elderly, those with worsening renal function and those with irregular meal schedules.

Glicazide

Dosage: initially 40–80 mg daily, adjusted according to the response, up to 160 mg as a single dose, with breakfast, higher divided doses, maximum 320 mg daily

Contraindications: in ketoacidosis, acute porphyria, pregnancy, breastfeeding

Side-effects: gastrointestinal disturbances (nausea, vomiting, diarrhoea and constipation), hypoglycaemia, weight gain, disturbance in liver function (cholestasis, hepatitis and hepatic failure). Rarely allergic skin reaction.

Metformin is presented here as the first-line drug in the treatment of diabetes.

Sulfonylurea is recommended as the second-line treatment, and human insulin as the third-line treatment. Patients may require two or three drugs. Although there are other drug classes to treat diabetes, including thiazolidinediones (TZDs), DPP-4 inhibitors, SGLT2 inhibitors and GLP-1 receptor agonists, these medicines tend to be more costly, with limited evidence of superior effectiveness. They may, however, be considered in rare cases when treatment with metformin, sulfonylurea and insulin is not possible.

Screening for albuminuria and urine ketones

Urine protein (albuminuria). About a third of those with diabetes also have kidney-related diseases. A test that measures the amount of protein in your urine, called microalbuminuria, will show varying amounts of albumin (the main protein in your blood) in urine. Without treatment, kidneys could be damaged and eventually fail.

Urine ketones. People with diabetes are at risk for a ketone build-up in their blood. If left untreated, people with type 1 diabetes are at risk for developing a condition called diabetic ketoacidosis (DKA). It is also possible for people with type 2 diabetes to experience DKA in certain circumstances as well; however, it is rare.
Urine sample collection

Screening for urine albumin (or protein) can be done using a test strip or the urine can be transported to a laboratory for analysis.

Materials required
- Plastic container with lid pre-labelled with patient ID, name, age and sex of the participant;
- Zip-closable plastic bag.

The urine samples will need to be shipped to a previously identified location that is in possession of an analyser, and the results transmitted back to the PHC after analysis.

Additional reading resource

2. ADA 2017 guideline for diabetes
3. HEARTS evidence based treatment protocol
Management of type 2 diabetes in the primary health care level

Activity 1: Step 3

What is diabetes?

- Impairment of insulin secretion and action in the body leads to abnormally elevated levels of glucose in blood, a condition classically termed as diabetes.
- Chronic progressive disease
- Damages heart, blood vessels, kidney, nerves
- Preventable to a large extent
Types of diabetes

- Type 1 (10%): Exact cause unknown, it is due to β-cell destruction, leading to absolute insulin deficiency; more likely below 30 years of age; requires insulin for survival
- Type 2 (>90%): due to an inadequate insulin secretory response on the background of insulin resistance
- Gestational diabetes
- Other specific types (less common)

Diabetes risk factors

- First-degree relative with diabetes
- History of gestational diabetes
- History of CVD
- Hypertension
- Dyslipidaemia
- Overweight (South-East Asians develop diabetes at lower BMI)
- Physical inactivity (Exercise less than 3 times/week)
- Polycystic ovarian syndrome
- Age
- Race/ethnicity

Diabetes symptoms

- Polyuria (excessive production or passing of urine)
- Polyphagia (excessive hunger)
- Polydipsia (excessive thirst)
- Unexplained weight loss
- Vision changes
- Fatigue
Diabetes screening criteria (WHO PEN)

- Age 40+ years and above
- who are overweight (BMI >25) or obese (BMI >30) (or follow national guidelines)
- Waist circumference (>90 cm in women, >100 cm in men)
- Known hypertension
- History of premature CVD in first degree relatives
- History of DM or kidney disease in first degree relatives

Diabetes diagnosis

- Use fasting plasma glucose to screen and diagnose diabetes.
- Criteria for the diagnosis of diabetes
  
  Fasting plasma glucose $\geq$ 126 mg/dL (7.0 mmol/l)
  or
  2-hour plasma glucose $\geq$ 200 mg/dL (11.1 mmol/l) during an OGTT
  or
  HbA1c $\geq$ 6.5% (48 mmol/mol)

Classic diabetes symptoms random plasma glucose
  200 mg/dL (11.1 mmol/l)

Diagnosing diabetes on point-of-care devices (only if lab measurement not available, WHO-PEN)

- Point of care devices report capillary plasma value
  - fasting $\geq$ 7.0 mmol/l
  Or/and
  - 2-hour after oral glucose 75g load $\geq$ 12.2 mmol/l*
  Or/and
  - Random $\geq$ 12.2 mmol/l*
- A positive test should be repeated on another day if there are no symptoms or obvious metabolic decompensation
- Diagnostic cut off points in venous plasma (laboratory) are different from the capillary plasma value for 2-hour post-load ($\geq$ 11.1 mmol/l) and random values ($\geq$ 11.1 mmol/l)
Gestational Diabetes diagnosis

To do Oral Glucose Tolerance test (OGTT)
A. At 24-28 weeks gestation in women not previously diagnosed with overt diabetes
B. 75-g OGTT; Measure plasma glucose at fasting and at 1 and 2 hours.
C. GDM diagnosed when plasma glucose exceeds:
   - Fasting: 92 mg/dL (5.1 mmol/l)
   - 1h: 180 mg/dL (10.0 mmol/l)
   - 2h: 153 mg/dL (8.5 mmol/l)

Activity 2: Step 1

How to use glucometer

- What you need to test your blood glucose
  - Glucometer
  - Lancet device
  - Vial of test strips
  - Lancets
- Before you start
  - You may need to set the date and time on the meter
  - Wash and dry your hands thoroughly with warm water.
  - Insert a new test strip into your meter. Place the end of the strip with the 3 contact bars as far into the meter as it can go.
  - Your meter will turn on automatically and display a number code.
  - Check the code to make sure it matches the number code on the vial of test strips.
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**How to use glucometer**

- Step 1: Get a blood sample
- Step 2: Apply blood to strip
- Step 3: Read the result: Your meter will count down and display the result of your blood glucose level.
- For accurate measurement follow below instructions:
  - Participant has to be in a fasting state for at least eight hours (participant can have water in fasting period but not tea)
  - Puncture either middle or ring finger
  - Do not squeeze the finger when taking blood
  - Do the control solution test regularly

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**Activity 3: Step 4**

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**Monitoring glycaemic control**

- Two primary techniques available for health providers and patients to assess effectiveness of management plan on glycemic control
- HbA1C

<table>
<thead>
<tr>
<th>HbA1c</th>
<th>&lt;7.0% (&lt;53 mmol/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preprandial capillary plasma glucose</td>
<td>80–130 mg/dL (4.4–7.2 mmol/L)</td>
</tr>
<tr>
<td>Peak postprandial capillary plasma glucose</td>
<td>&lt;180 mg/dL (&lt;10.0 mmol/L)</td>
</tr>
</tbody>
</table>
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Warning about oral hypoglycaemic agent (OHA)

- **Metformin**
  - Side Effects - nausea, vomiting, diarrhoea
  - Contraindication
    - if serum creatinine > 1.5 mg/dL → omit metformin
    - if serum creatinine can not be measured → look for presence of oedema /puffy face → indication to omit metformin.

- **Gliclazide**
  - Side Effect - weight gain, hypoglycemia

Guidance on prescribing insulin

- **Step 1: If A1C ≥7.0 % (or FPG ≥130 mg/dl)**
  - After a trial of metformin 1000 mg twice per day plus gliclazide 80 mg twice per day
  - Initiate bedtime basal insulin (or NPH) starting at 10 units/day or 0.1–0.2 units/kg.

- **Step 2: Adjust basal insulin dose:**
  - Increase 10–15% or 2–4 units/day every three days based on fasting finger sticks until goal is reached. Goal is FPG 70–130 mg/dl (3.9–7.2 mmol/l)
  - For hypoglycaemia (FPG ≤70 mg/dl), decrease dose by 4 units or 10–20%

- **Step 3: IF A1C ≥7.0% (or FPG ≥130)** for more than 3 months after initiation of basal insulin:
  - Consider short-acting insulin or regular before meals or refer to a special for multiple daily injections.

Control of blood pressure

- Hypertension treatment is indicated when SBP ≥130 and/or DBP ≥80 mmHg

- **Medication adherence**
  - Assess adherence and discuss barriers at every visit.
  - Reconcile clinician’s medication list with patients list, adjust dose, and eliminate unneeded medications.
  - Prescribe once-daily medications, less expensive generics, and longer-lasting supplies of medicine whenever possible.
  - Provide tools such as pill boxes and medication logs to help patients remember to take their medications.
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Checklist for preventing of diabetes complications

- Every 3-6 months the patient should have a physical review by a physician
- Test plasma glucose 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
- Help the patient to give up tobacco, if he/she continues to use tobacco
- Reinforce life style measures – increase physical activity level and improve diet

Referral criteria

- Newly diagnosed DM for further investigation
- Any proteinuria
- DM with blood glucose > 14 mmol/l despite maximal metformin with or without sulphonylurea
- Newly diagnosed DM with urine ketones 2+ or in lean persons of < 30 years (suspected with diabetic ketoacidosis)
- Patients with plasma glucose levels >= 18 mmol/l (325 mg/dl) and all patients with suspected DKA or HHS
- DM with severe infection and/or foot ulcers
- DM with recent deterioration of vision or no eye exam in 2 years

Clinical practice recommendations

- A1c measurements every three to six months; every six months if stable on unchanged treatment
- Blood pressure at every visit, treatment as per hypertension protocol
- Fasting lipid panel annually if available
- Weight and BMI at every visit
- Foot exam for amputation risk annually, or every visit if high-risk
- Aspirin for patients with CVD
Clinical practice recommendations

- Annual urine protein dipstick (microalbuminuria dipstick if available to calculate albumin to creatinine ratio) and serum creatinine measurement (GFR calculation) for CKD screening.
- Dilated pupils retinal exam every two years if treatment available
- Diabetes self-management education to reinforce treatment goals
- Provide counselling around lifestyle change, including diet, physical activity and smoking cessation

Prevention of blindness and lower limb amputation

- Diabetic retinopathy is a cause of loss of vision worldwide
- Recommendation: Person with type 2 diabetes should be screened for diabetic retinopathy by an ophthalmologist every two years
- Diabetes is the leading cause of non-traumatic lower limb amputation
- Lifetime risk of developing foot ulcers in person with diabetes is 15%
- What should be done?
- Patient education on foot hygiene, nail cutting, treatment of calluses, appropriate foot wear
- Assess risk of feet ulcers (inspection, pin-prick sensation)

Activity 4: Step 3
Foot examination

- It includes:
  - History
  - Inspection of foot for deformity or ulcer
  - Neuropathy assessment through monofilament test, tuning fork test, and ankle reflex
  - Palpation of pulse

Patient history

- Stump the patient barefoot:
  - Numbness and tingling in the feet?
  - Burning sensation: is it worse at night or at need?
  - Pain in the feet or legs when walking that is limiting mobility?
  - Leg or foot symptoms when mobile, related immediately with sitting or bending forward?
  - History of foot ulcers?
  - Swelling in the feet or legs?
  - Are the feet hot or cold?

Foot inspection (abnormal finding)

<table>
<thead>
<tr>
<th>Finding</th>
<th>Inspection</th>
<th>Neurological assessment</th>
<th>Vascular assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ulcer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulcer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color change due to infection</td>
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</tbody>
</table>
Management of type 2 diabetes in the primary health care level

Monofilament test

Sites to be tested with monofilament test

Use of monofilament for neuropathy

Tuning fork test

- The tuning fork should be applied perpendicularly with constant pressure
- If the patient is unable to sense the vibrations on the big toe, the test is repeated more proximally (malleolus and tibial tuberosities)

Palpation of arteries

- Palpation of dorsal pedis: Feel in the middle of the dorsum of the foot just lateral to the tendon of extensor hallucis longus (extensor tendon of the great toe)
- Posterior tibial artery: Midway between medial malleolus and tendon calcaneus
Foot examination screening assessment sheet

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot ulcer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk factors for foot ulceration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mono-filament undetectable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton wool undetectable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tibial posterior artery absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dorsal pedis artery absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot deformity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of joint mobility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs of abnormal pressure such as callus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discolouration on dependency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor foot hygiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate footwear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous ulcer/amputation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Foot care advise to patient

- Inspect your feet daily for cracks, blisters, infections. 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 feet, have someone else to do it.
- Cleanse feet daily as you bathe or using warm water and mild soap. Dry your feet with to dry. Don’t use hot water. As 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 or lotion that keeps your skin soft and of cracks, continue using it.
- Clip toe nails straight across. Use a nail cutter not scissor.

Foot care advise to patient

- Always wear on your feet (socks, slippers, shoes) to protect from - even in your house.
- Choose soft shoes. Let them a size bigger that what you feel is appropriate. Wear
- 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 you doctor to check your feet during your regular for diabetes care. Take off shoes and at every visit.
Activity 5: Step 4

Emergencies in diabetes

- Severe hypoglycemia
  - Loss of consciousness and coma, and life threatening
- Hyperglycemic emergencies (diabetic ketoacidosis/DKA)
  - Characterized by fluid and electrolyte depletion and hyperglycaemia, acidic breathing (rapid, deep, sign, pauseless breathing), Urine ketone body> +2
  - At PHC usually difficult to diagnose but learn to suspect and refer

Hypoglycaemia (iatrogenic complication)

- **Symptoms**: Dizziness, sweating, hunger, convulsion, irrational behavior, unconsciousness, convulsions
- **Sign**: PG< 70 mg/dl (3.9 mmol/l)
- **Treatment**: drink 1-2 teaspoons of sugar (if the patient is able to swallow) or IV 50% glucose (2) ampules stat
- **Severe hypoglycemia**: Unconscious diabetic patients on hypoglycaemic agents and/or blood glucose ≤50 mg/dl (2.8 mmol/l)
- **Treatment**: 20 to 50ml of 50% glucose (dextrose) over 1 to 3 minutes. If not available substitute with any hypertonic glucose solution. Provide food as soon as the patient can ingest food safely
Hyperglycaemic emergencies

**Diabetic ketoacidosis (DKA)**
- Frequent symptoms: nausea, vomiting, abdominal pain
- Plasma glucose >=13.9 mmol/l (250 mg/dl) but can be lower
- Blood pH <7.30, urine ketone body>12
- Acidotic breathing (rapid, deep, pauseless breathing) in severe DKA
- Sensorium changes range from alert to stupor/coma

**Hyperosmolar hyperglycaemic state**
- Plasma glucose usually >=33.3 mmol/l (600 mg/dl)
- Sensorium seriously altered (stupor, coma)
- Blood pH>7.3 (no acidosis), urine ketones negative

**Treatment of DKA and HHS**
- Urgent referral to hospital with infusion of isotonic saline (0.9% NaCl) at a rate of 1000 ml in the first 2 hours, continue with 1000ml every 4 hours

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**Patient education topic to be covered in initial and follow up visit**

<table>
<thead>
<tr>
<th>Initial Visits</th>
<th>Follow-up Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is Diabetes?</strong></td>
<td>Importance of Glycemic 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 5.1.3)</td>
</tr>
<tr>
<td>Detailed lifestyle advice</td>
<td>Newer modalities of treatment</td>
</tr>
<tr>
<td>Use of Oral Drugs</td>
<td>Marriage Counseling</td>
</tr>
<tr>
<td>Advice on identifying signs and symptoms of hyperglycaemia and hyperglycaemia</td>
<td>Pre-conceptional counseling regarding the importance</td>
</tr>
<tr>
<td>and their management</td>
<td>of good glucose control prior to pregnancy</td>
</tr>
<tr>
<td>Patient should be informed about the importance of factors other than glucose</td>
<td></td>
</tr>
<tr>
<td>control: cholesterol, blood pressure, stopping smoking, tobacco, etc</td>
<td></td>
</tr>
</tbody>
</table>

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**Dietary advise for diabetes**

- The dietary recommendations for people with diabetes are the same as for non-diabetics - a healthy diet
- Eat plenty of vegetables
- Have sufficient fibre in your diet
- Cut down on sugar
- Cut down on processed meat
- Eat fish regularly
- Cut down on energy dense, processed food - such as crisps, cakes, biscuits and pastries
- Cut down on alcohol
- Cut down on salty processed foods
Physical activity for diabetes

The recommendations for people with diabetes would be the same as for people without and be compatible with the person's physical condition.

- 30 minutes exercise/day
  - (can break to 10 minutes each)
  - 5 days/week
  - Total 150 minutes

Use of insulin injection

- Gather your insulin supplies
- Prepare the insulin vials
- Inject air into the insulin vial
- Draw up the insulin
- Check the syringe for air bubbles
- Remove the needle from the vial

Management of type 2 diabetes in the primary health care level
### Insulin storage

- **Insulin** that is not in use should be stored in the refrigerator.
- If refrigeration is not possible, it can be kept at room temperature [15-25 degrees C] for 28 days.
- The in use vial may be kept at room temperature [15-25 degrees C] for 28 days.
- Do not store your insulin near extreme heat or extreme cold.
- Never store insulin in the freezer, direct sunlight, or in the glove compartment of a car.
- Check the expiration date before using, and don’t use any insulin beyond its expiration date.
- Examine the bottle closely to make sure the insulin looks normal before you draw the insulin into the syringe.