This guideline has been officially launched in 2012 and received the honorary signature of:

Dr. Ahmed bin Mohammed Al Saidi
Minister of Health

Sayyidah; Dr. Noor bint Bader Al Busaidi
President of Oman Diabetes Association

Professor Jean Claude Mbanya
President of the International Diabetes Federation
**Contributors:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Noor Al-Busaidi</td>
<td>Senior Consultant Adult Endocrinologist (NDEC-Royal H.)</td>
</tr>
<tr>
<td>Dr. Mohammed Al-Lamki</td>
<td>Senior Consultant Adult Endocrinologist (Royal H.)</td>
</tr>
<tr>
<td>Dr. Ali Al Mamari</td>
<td>Senior Consultant Endocrinologist (SQUH.)</td>
</tr>
<tr>
<td>Dr. Fatma Al-Zadjali</td>
<td>Senior Consultant Adult Endocrinologist (Diwan clinic)</td>
</tr>
<tr>
<td>Dr. Hilal Al-Musailhi</td>
<td>Senior Consultant Adult Endocrinologist (NDEC-Royal H.)</td>
</tr>
<tr>
<td>Dr. Ahmed Hamed Al-Wahaibi</td>
<td>Senior Consultant, Family Physician (DGHA)</td>
</tr>
<tr>
<td>Dr. Ahmed Mohammed Al-Furqani</td>
<td>Consultant Adult Endocrinologist (AFH)</td>
</tr>
<tr>
<td>Dr. Mohammed Said Al-Harthi</td>
<td>Senior Consultant Adult Endocrinologist (AFH)</td>
</tr>
<tr>
<td>Dr. Saud Mohammed Al-Harthi</td>
<td>Senior Consultant Adult Endocrinologist (Nahdha H.)</td>
</tr>
<tr>
<td>Dr. Salim Said Al-Qassabi</td>
<td>Senior Consultant Adult Endocrinologist (Nahdha H.)</td>
</tr>
<tr>
<td>Dr. Aisha Al-Sinani</td>
<td>Senior Consultant Pediatric Endocrinologist (Royal H.)</td>
</tr>
<tr>
<td>Dr. Saif Al-Yaarubi</td>
<td>Senior Consultant Pediatric Endocrinologist (SQUH)</td>
</tr>
<tr>
<td>Dr. Sulaiman Zahar Al-Shereiqi</td>
<td>Senior Specialist in Public Health &amp; Health Administration (NDEC)</td>
</tr>
<tr>
<td>Dr. Ali Al-Moqbali</td>
<td>Consultant Adult Endocrinologist (NDEC-Royal H.)</td>
</tr>
<tr>
<td>Dr. Simon Rajaratnam</td>
<td>Senior Consultant Adult Endocrinologist (NDEC-Royal H.)</td>
</tr>
<tr>
<td>Dr. Bernadette Punnoose</td>
<td>Senior Consultant Obs/Gyne (Royal H.)</td>
</tr>
<tr>
<td>Dr. Nada Hareb Al-Sumri</td>
<td>Senior Specialist Family &amp; Community Medicine (Dept. NCD)</td>
</tr>
<tr>
<td>Dr. Jamila Taiseer Al-Abri</td>
<td>Director, Dept. Family &amp; Community Health</td>
</tr>
<tr>
<td>Dr. Deepa Manoharan</td>
<td>Medical Officer (NDEC-Royal H.)</td>
</tr>
<tr>
<td>Dr. Fatima Ibrahim Al-Hinai</td>
<td>Senior Specialist, Dept. of Family &amp; Community Health</td>
</tr>
<tr>
<td>Dr. Samiya Al-Ghanami</td>
<td>Senior Specialist, Dept. of Nutrition</td>
</tr>
<tr>
<td>Fahad Al-Shamsi</td>
<td>Podiatrists (NDEC)</td>
</tr>
<tr>
<td>Safiya Al-Ajmi</td>
<td>Podiatrist (SQUH)</td>
</tr>
<tr>
<td>Alya Al-Kiyumi</td>
<td>Podiatrist (NDEC)</td>
</tr>
<tr>
<td>Wisam Al-Riyami</td>
<td>Podiatrist (NDEC)</td>
</tr>
</tbody>
</table>
Acknowledgement:

The Director of the National Diabetes and Endocrine Center wishes to thank Dr. Qassim Al Salmi; the director general of Royal Hospital for his support and to thank the previous teams of editors of the first and the second editions of the Diabetes manual, and the following names:

Dr. Said Al Lamki, Dr. Ahmed Al Busaidi, Dr. Salim Al Saqri, Ph (Mrs) Batool Jaffer Sulaiman, Ph (Mrs) Nussaiba Habib Mohammed, Ph (Mrs) Amal El Said, Ms. Zeyana Al Ghaithi, Ms. Najma Al Balushi, Ms. Khadija Al Amri, Ms. Muna Al Ghaithi, Ms. Siham Al Maskari, Mr. Sulaiman Al-Riyami and Ms. Zakiya Al Ghabishi.

Suggested Citation:

Diabetes Mellitus Management Guidelines
Ministry of Health
Sultanate of Oman

These Guidelines are updated periodically
Comments and suggestion concerning its contents are encouraged and could be sent to

The National Diabetes and Endocrine Center
Royal Hospital
P.O.Box 1331, Postal Code 111, Sultanate of Oman
Tel. +968 24-211272, Fax. +968 24-211270
Email: ndec.oman@gmail.com
List of abbreviations:

ACE Angiotensin converting enzyme
ADA American Diabetes Association
ANC Antenatal care
Anti-GAD Anti-glutamic acid decarboxylase antibodies
ARB Angiotensin receptor blocker
B.G Blood Glucose
BMI Body mass index
BP Blood pressure
CHD Coronary heart disease
CHF Congestive Heart Failure
CIMT Carotid intima-media thickness
CKD Chronic Kidney Disease
CRP C-Reactive Protein
CVD Cardiovascular disease
DGHA Directorate General of Health Affairs
DM Diabetes mellitus
DN Diabetic nephropathy
DPP-4 Dipeptidyl Peptidase-4
DSME Diabetes self-management education
ECG Electrocardiography
EMR Eastern Mediterranean Region
FBG Fasting Blood Glucose
GCT Glucose challenge test
GCC Gulf Cooperation Council
GDM Gestational diabetes mellitus
GLP-1/GLP-1 RA Glucagon-like Peptide-1 Receptor Agonist
HbA1c Glycated haemoglobin
HDL High density lipoprotein
HHS Hyperosmolar hyperglycaemic state
HLA Human lymphocyte antigen
HONK Hyperglycaemic hyperosmolar non-ketotic state/coma
ICA Islet cell antibody
IFG Impaired fasting glucose
IDF International Diabetes Federation
IGT Impaired glucose tolerance
IHD Ischaemic heart diseases
INF-α Interferon alpha
IVF/I.V/iv Intravenous fluid
IVUS Intravascular Ultrasound
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>Low density lipoprotein</td>
</tr>
<tr>
<td>MMP-9</td>
<td>Matrix Metalloprotinase-9</td>
</tr>
<tr>
<td>MNT</td>
<td>Medical nutrition therapy</td>
</tr>
<tr>
<td>MUFA</td>
<td>Monounsaturated fatty acid</td>
</tr>
<tr>
<td>NCD</td>
<td>Non-communicable diseases</td>
</tr>
<tr>
<td>NPH</td>
<td>Neutral Protamine Hagedorn</td>
</tr>
<tr>
<td>OCs</td>
<td>Oral Contraceptives</td>
</tr>
<tr>
<td>OGTT</td>
<td>Oral glucose tolerance test</td>
</tr>
<tr>
<td>OHA</td>
<td>Oral hypoglycaemic agents</td>
</tr>
<tr>
<td>PAI-1</td>
<td>Plasminogen Activator Inhibitor-1</td>
</tr>
<tr>
<td>PHC</td>
<td>Primary health care</td>
</tr>
<tr>
<td>PUFA</td>
<td>Polyunsaturated fatty acid</td>
</tr>
<tr>
<td>RBG</td>
<td>Random Blood Glucose</td>
</tr>
<tr>
<td>S.C</td>
<td>Subcutaneously</td>
</tr>
<tr>
<td>SMBG</td>
<td>Self-monitoring of blood glucose</td>
</tr>
<tr>
<td>SQUH</td>
<td>Sultan Qaboos University Hospital</td>
</tr>
<tr>
<td>TG</td>
<td>Triglycerides</td>
</tr>
<tr>
<td>U&amp;E1</td>
<td>Urea and Electrolytes test 1</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
Table of Contents:

Preface 9

SECTION 1: INTRODUCTION
Global Situation 10
National Situation 10

SECTION 2: CLASSIFICATION AND DIAGNOSIS
Classification of Diabetes Mellitus 11
Diagnostic criteria and cut-off points 11

SECTION 3: TREATMENT PLAN FOR ALL TYPES OF DIABETES
Blood glucose targets 14
Components of the diabetes treatment plan 15
   1. Education 15
   2. Diet, nutrition and weight management 15
   3. Exercise/physical activity 18
   4. Smoking cessation 18
   5. Medicinal therapy and description of common medications in diabetes: 18
The recommendations for glycaemic control and initiation of therapy 22
Self-Monitoring of Blood Glucose (SMBG) 22
Glycated haemoglobin (HbA1c) 23
Glycaemic Management 23
   Step 1: Mono-therapy 24
   Step 2: Dual Therapy 25
   Step 3: Triple therapy 25
   Step 4: Insulin plus the Dual Therapy 26
Starting Insulin and Dose adjustment 26
Management of Dyslipidaemia 27
Management of hyper-triglyceridemia 28
Management of diabetes in special situation (Ramadan) 28

SECTION 4: ACUTE COMPLICATIONS OF DIABETES MELLITUS
A. Hypoglycaemia 30
   Symptoms and Signs of Hypoglycaemia 30
   Hypoglycaemic unawareness/ Asymptomatic hypoglycaemia 30
   The risk factors for hypoglycaemia in diabetes: 31
   Treatment recommendations: 31
   Prevention of further attacks of hypoglycaemia: 33
B. Diabetic ketoacidosis in adults (DKA) 33
   Signs and symptoms of DKA: 33
   Diagnostic criteria for DKA: 34
   Management of DKA in adults: 34
C. Hyperglycaemic Hyperosmolar State (HHS) /Hyperglycaemic hyperosmolar non ketotic state/coma (HONK) 34

SECTION 5: CHRONIC COMPLICATIONS OF DIABETES MELLITUS
1. Diabetic eye diseases 36
2. Diabetic nephropathy 36
   Definition of nephropathy: 36
   Nephropathy diagnostic steps: 38
   Management of nephropathy: 38
Preface:

The national health surveys over the past three decades have shown increasing prevalence of diabetes mellitus in Oman. A more recent National Health Survey (2008) has shown diabetes to have increased significantly to 12.3% and with increasing prevalence of risk factors such as obesity and physical inactivity which remained at high rates. Currently, the Ministry’s spends a substantial proportion of its budget on chronic disease management, which includes diabetes mellitus and its cardiovascular and renal complications. This increasing financial burden is challenging the sustainability of Oman’s health care system. Chronic illnesses such as diabetes, hypertension, ischemic heart disease and obesity, and its lifestyle risks such as unhealthy diet, physical inactivity and increase in tobacco use, present the main challenges for the health professionals in the 21st century.

Towards integrating and improving the quality of health care provided to people with diabetes, the Ministry has published its 1st clinical practice guidelines in 1996, followed by the second edition in 2003. This has helped the primary health care physicians to provide good standards of diabetes care. This new edition comes not only as a guide for the health professionals but as an addition to the development of patient care. We are optimistic about this guideline and the expected training that will follow in advancing the clinical care delivered to citizens and residents of Oman. At the same time we encourage the development of the other arm of “the preventive services” through various intervention programs such as the early detection screening and the public health management of risk factors.

I would like to thank all the members of the National Diabetes Management Service Development Committee for their guidance and thank the technical taskforce which formulated these guidelines, which will continue to guide the health professionals for many years to come.

Dr Ahmed bin Mohammed Al-Saidi
Minister of Health
Section 1: Introduction

Global situation

The International Diabetes Federation (IDF) has estimated that 366 million people are currently living with diabetes. On the other hand, the World Health Organization (WHO) estimated that over 3.4 million people have died from complications of high blood glucose in one year. It also projected that around 80% of these deaths occurred in low and middle income countries and the death from diabetes is expected to double in the next 25 years if all countries do not implement prompt action in the management and prevention of this disease. Several countries of the Eastern Mediterranean Region (EMR) are among the top ten countries with the highest prevalence in diabetes with the regional prevalence ranging from 7% in Egypt to over 20% in some of the Gulf Cooperation Council (GCC) countries.

National situation

Diabetes has emerged as a major and growing health problem in the Sultanate of Oman. The socio-economic development, over the past four decades, has led to rapid proliferation of educational establishments, hospitals and other medical institutions, private and commercial transport system and commerce. These were accompanied by characteristic cultural changes including changing dietary patterns (high fat, high salt and calorie dense diet), decreased physical activity and the emergence of non-communicable diseases as the dominant feature of ill-health in the community. Among them, diabetes mellitus is now the second prevalent non-communicable disease in Oman.

The first National Diabetes Survey was conducted in 1991 and showed that the prevalence of diabetes in adults aged 20 years and over was 8.3%. Subsequent surveys showed that the prevalence is increasing and it reached 12.3% in 2008. In 2000, the National Health Survey showed that the prevalence of diabetes was 11.6% and that of impaired fasting glucose (IFG), was 6.1%. The results of the three surveys are summarized in table 1 below.

Table 1: Prevalence of diabetes and pre-diabetes in Oman

<table>
<thead>
<tr>
<th>Variable</th>
<th>Criteria</th>
<th>Year of study</th>
<th>Male</th>
<th>Female</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fasting plasma glucose (1999 WHO criteria - ≥ 7 mmol/L)</td>
<td>1991&lt;sup&gt;1&lt;/sup&gt;</td>
<td>NA</td>
<td>NA</td>
<td>8.3%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Fasting plasma glucose (≥ 7 mmol/L)</td>
<td>2000&lt;sup&gt;2,3&lt;/sup&gt;</td>
<td>12%</td>
<td>11.4%</td>
<td>11.6%</td>
</tr>
<tr>
<td></td>
<td>Fasting plasma glucose (≥ 7 mmol/L)</td>
<td>2008</td>
<td>12.4%</td>
<td>12.1%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Pre-Diabetes</td>
<td>Impaired Fasting plasma glucose (≥ 6.1 &amp; &lt; 7 mmol/L)</td>
<td>1991</td>
<td>NA</td>
<td>NA</td>
<td>5.7%</td>
</tr>
<tr>
<td></td>
<td>Impaired Fasting plasma glucose (≥ 6.1 &amp; &lt; 7 mmol/L)</td>
<td>2000</td>
<td>NA</td>
<td>NA</td>
<td>6.1%</td>
</tr>
<tr>
<td></td>
<td>Impaired Fasting plasma glucose (≥ 6 &amp; &lt; 7 mmol/L)</td>
<td>2008</td>
<td>5%</td>
<td>3.8%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>
Classification of Diabetes Mellitus

Diabetes is a group of metabolic diseases resulting from defects in insulin secretion and or insulin action leading to hyperglycaemia. It is associated with polyuria and polydipsia. The chronic hyperglycaemia leads to long-term damage of various organs in the body.

**Classification of Diabetes:**

1. Type 1: diabetes mellitus (DM)
2. Type 2: diabetes mellitus (DM)
3. Drug or chemical-induced diabetes i.e. Glucocorticoid, Interferon alpha
4. Endocrinopathies i.e. Cushing’s syndrome, acromegaly.
5. Genetic defects (in β-cells function or insulin action)

**Type-1 diabetes mellitus:**

- Accounts for 5-10%
- Acute onset
- Can present at any age, commonly childhood and adolescence.
- Characterised by classical symptoms (weight loss, polyuria and polydipsia)
- Prone to ketoacidosis
- Majority have positive anti-GAD, Islet cell antibodies.

**NOTE:** When the diagnosis of type-1 diabetes is uncertain by clinical presentation, we recommend antibody testing. If Islet cell antibody (ICA) or glutamic acid decarboxylase antibodies (anti-GAD) are positive, the patient should be presumed to have type-1 diabetes.

**Type-2 diabetes mellitus**

- Accounts for 90%
- Characterised by:
  - Obesity (Global or abdominal)
  - Features of insulin resistance

**Diagnostic criteria and cut-off points**

The person with diabetes mellitus may or may not present with symptoms of diabetes i.e. polydipsia, polyuria, polyphagia, weight loss, unexplained fatigue, blurred vision etc. Diagnosis is established using the following cut-off values (Fig: 1)
Section 2: Classification and Diagnosis

For Diabetes
- FBG ≥ 7 mmol/L
- RBG ≥ 11.1 mmol/L (with clinical symptoms)
- HbA1c ≥ 6.5%

For Pre-Diabetes
- IFG (5.6 – 6.9 mmol/l)
- IGT (7.8-11.0 mmol/l)
- HbA1c (6.0-6.4%)

NOTE: If the results of two different tests are discordant, repeat the test with the abnormal result and the diagnosis is made on the confirmed test.

• Example: If FBG <7mmol/l and HbA1c >6.5% repeat HbA1c, if the repeated test is >6.5% then this person should be considered to have Diabetes.

Risk factors for Diabetes Mellitus:
- BMI ≥ 25 kg/m2
- First degree relative (father, mother or sibling) with diabetes mellitus
- History of gestational diabetes mellitus or delivering a baby weighing > 4 kg
- Hypertension (BP ≥140/90mmHg)
- Dyslipidemia (abnormal total cholesterol and/or HDL and/or LDL cholesterol and/or triglycerides)
- History of IFG or IGT on prior testing.
- Acanthosis Nigricans.
- Schizophrenia
- Polycystic ovarian syndrome
- Vascular disease (coronary, cerebrovascular, peripheral)

Screening for Diabetes Mellitus
The following algorithm describes three circumstances for initiating screening for diabetes:

1. Screening individuals who presented with classical symptoms
2. Screening eligible clients aged 40 years and above once every 3 years through the national NCD screening program (For details; refer to the national NCD screening manual)
3. Opportunistic screening of high risk individuals
Figure 1: Diabetes screening and Diagnosis

For Diabetes
- FBG ≥ 7 mmol/l.
- RBG ≥ 11.1 mmol/l (+ clinical symptoms)
- HbA1C ≥ 6.5 %
- OGTT – 2hrs ≥11.1 mmol/l

For Pre-Diabetes
- IFG (5.6 – 6.9 mmol/l)
- IGT (7.8 – 11.0 mmol/l)
- HbA1c (6.0 – 6.4%)
Interdisciplinary team care for diabetic patients should include primary care physicians, diabetic nurses, dieticians, pharmacists, psychologists and podiatrists. It is essential in this collaborative and integrated team approach that individuals with diabetes assume an active role in their care. The management plan should be formulated as a collaborative therapeutic alliance among the patient and family, the physician, and other members of the health care team. A variety of strategies and techniques should be used to provide adequate education and development of problem-solving skills in the various aspects of diabetes management. Implementation of the management plan requires that each aspect is understood and agreed to by the patient and the care providers and that the goals and treatment plan are reasonable. Any plan should recognise diabetes self-management education (DSME) and on-going diabetes support as an integral component of care. In developing the plan, consideration should be given to the patient’s age, school or work schedule and conditions, physical activity, eating patterns, social situation and cultural factors, and presence of complications of diabetes or other medical conditions.

**Blood glucose targets**

The table below sets out the recommended targets for metabolic control and the control of the other cardio-vascular risk factors for people with diabetes. Every effort should be made to treat to targets.

**Table 2: Targets for good metabolic control in diabetes**

<table>
<thead>
<tr>
<th>Indicator/test</th>
<th>Target for most non-pregnant adults with diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plasma glucose (mmol/l)</strong></td>
<td>Fasting: 4.4-6.9</td>
</tr>
<tr>
<td></td>
<td>2h-Postprandial: &lt; 10.0</td>
</tr>
<tr>
<td><strong>HbA1c (%)</strong></td>
<td>&lt; 7</td>
</tr>
<tr>
<td><strong>LDL</strong></td>
<td>Without CVD: The primary goal is an LDL cholesterol &lt; 2.6 mmol/l.</td>
</tr>
<tr>
<td></td>
<td>With overt CVD: A lower LDL cholesterol goal of &lt; 1.8 mmol/l, is an option. If the LDL-C targets are not reached on maximal tolerated statin therapy, a reduction in LDL cholesterol of &lt;30–40% from baseline is an alternative therapeutic goal.</td>
</tr>
<tr>
<td><strong>HDL</strong></td>
<td>&gt;1mmol/l</td>
</tr>
<tr>
<td><strong>TG</strong></td>
<td>&lt;1.7mmol/l</td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>18-24.9</td>
</tr>
<tr>
<td><strong>Blood pressure (mmHg)</strong></td>
<td>Systolic: &lt;140</td>
</tr>
<tr>
<td></td>
<td>Diastolic: &lt;80</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td>Non-Smoker</td>
</tr>
</tbody>
</table>
NOTE: Every effort should be made to shift patients from the “borderline” to the “good” control category. Patients with persistently poor metabolic control should be referred back to the tertiary diabetes care facility.

Components of the diabetes treatment plan

The treatment of all types of diabetes principally consists of the following:

1. Education
2. Diet, nutrition and weight management
3. Exercise
4. Smoking cessation
5. Medication (Oral hypoglycaemic drugs, Insulin and others)

1. Education

Education should include the following:

- Definition and types of diabetes
- Education about the importance of good metabolic control and its relationship to complications
- Hypoglycaemia and hyperglycaemia: symptoms, causes, and treatment
- The importance of diet and exercise in any treatment plan
- Practical skills like injection technique and self-glucose monitoring
- Types and action of insulin, if patient is on insulin
- The importance of self-management and self-monitoring
- Interpretation of the results of glucose monitoring and adjusting the dose of insulin
- Importance of not smoking, or cessation of smoking if already a smoker
- Explain the harmful effects of alcohol if the patient consumes it
- Preconception counselling
- Importance of annual review for screening of complications.

2. Diet, nutrition and weight management

Broad recommendations of the dietary intakes are given below:

Carbohydrates:

- Should constitute 50-55% of the total calorie intake
- 85% of carbohydrates should come from starchy foods such as breakfast cereals, breads, rice, pasta, potatoes, wheat, legumes (beans, lentils) and vegetables
- 10-15% can come from simple sugars
Section 3: Treatment plan for all types of diabetes

Fats:
- Should be restricted to <30% of the total calorie intake; they should comprise <10% saturated fats, 10% polyunsaturated fats, 10% monounsaturated fats
- Cholesterol consumption should be limited to 300mg/day or less.

Proteins:
- Should provide 10-15% of the total calorie intake
- Adults require 0.8g/kg/day, pregnant women require 1.1g/kg/day and children require 1-2.2g/kg/day
- Patients with nephropathy should have a protein intake of 0.6-0.8g/kg/day

Main principles to remember
A. Advice people with diabetes to eat small regular meals (people with type 1 diabetes may require snacks in addition to their regular meals).
B. Include starchy food at each meal. They should try to eat similar amounts from day to day, in order to maintain steady blood sugar level and encourage people with diabetes to choose starchy foods from the following groups below:

<table>
<thead>
<tr>
<th>Bread:</th>
<th>Khubz Omani (yabees, Rakhal), sliced / toasted, lebnani, nan, chapatti (paratas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasta:</td>
<td>Spaghetti, macaroni shells, tagitalie, noodles</td>
</tr>
<tr>
<td>Cereals:</td>
<td>Sugar free cornflakes, branflakes, porridge /oats, muesli</td>
</tr>
<tr>
<td>Potatoes:</td>
<td>Boiled or roasted</td>
</tr>
<tr>
<td>Rice:</td>
<td>Boiled rice is better than fried rice</td>
</tr>
</tbody>
</table>

C. Encourage them to cut down and/or avoid sugar and sugary foods such as, chocolate, sweets, pastries, sugar-based biscuits and sweetmeats such as halwa and baklawa.

D. A teaspoon of pure natural honey may be taken with starchy foods such as R'kha'al or bread and preferably after a meal. Taking more than one teaspoon or taking honey on an empty stomach should be discouraged.

E. Advise them to choose from high fibre varieties of foods, such as legumes, pulses, beans, whole-meal (brown) breads and cereals, fruits and vegetables. This is beneficial, because it increases the bulk of the food and reduces hunger. It also slows down the rise of sugar levels after a meal

F. All fruits and vegetables are high in fibre. They are also a rich source of vitamins and minerals and should be encouraged to be consumed in moderation. Eating the entire fruit is better than drinking the fruit juice. However, if juice is taken, it should not to be taken on an empty stomach, as it sharply raises blood glucose levels. Aim for 5 portions (400-500 grams) of fruits and vegetables a day, without peeling off the skin.
Section 3: Treatment plan for all types of diabetes

One portion consists of any one of the following:

<table>
<thead>
<tr>
<th>Whole fresh fruits</th>
<th>1 orange, 1 apple, 1 pear, 1 banana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large fruits</td>
<td>1 slice melon, 1 slice pineapple, ½ grapefruit, ½ (100g) mango</td>
</tr>
<tr>
<td>Small fruits</td>
<td>3 pieces ratab, 2 pieces dates (tamar), 12 grapes, 12 cherries, 2 kiwis, 2 plums, 3 apricots</td>
</tr>
<tr>
<td>Salad</td>
<td>1 (100g) small bowl</td>
</tr>
<tr>
<td>Fruit juice (maximum one per day)</td>
<td>1 small glass (120ml), 1 small pack (120ml)</td>
</tr>
<tr>
<td>Vegetables</td>
<td>2 (30g) tablespoons</td>
</tr>
</tbody>
</table>

G. Advice patients to cut down on fats and fatty food such as crisps, nuts and foods fried in oils such as, samosas. Encourage them to eat lean meat instead of red meat, baked chips instead of fried chips and margarine instead of butter, they should remove the skin before cooking the chicken.

H. Encourage them to avoid consuming a lot of salt (recommended amount <5gms (1 teaspoon) per day) and salty food, such as, nuts, crisps and tinned food products. Advice patients not to add salt on the table before tasting the meal. Encourage them to use a variety of seasoning such as spices (baharat), Maggie (low salt) and pepper instead of salt. Encourage them to cut down on fast foods and pickles which contain high amount of salt

Ideas for dessert

People with diabetes may take the following foods as a dessert option (in limited quantities)

- Any variety of fresh fruits or mixed fruits eg. watermelon, melons (Shamam), oranges, tangerines, kiwis, cucumber, cherries and bananas (250grams per serving)
- Yoghurts (roub)/ laban – low fat/ sugar free/ natural fruit Desserts on special occasions (weddings, Ramadan, Eid celebrations) given they have good control of their diabetes. It is recommended to reinforce the importance of consuming sweets in small amounts and not on an empty stomach, as it may cause a sudden increase in blood glucose levels.
- Milk puddings made with reduced or half the sugar eg. um Ali, custard, rice pudding, vermicelli (seweya, sha’eria, balale’t, tambi) or faluda. Cut down or halve the amount of sugar during baking.
- Plain tea, biscuit, butter puffs, ginger biscuits and plain digestives are allowed instead of creamy, sugar-based biscuits. Two biscuits a day from any of the mentioned varieties may be taken with tea.
- Honey or sweetmeals like halwa may be taken in moderation.

Other points to remember

- Alcohol: advice your patients to abstain from alcohol, it contains high calories and contributes to weight gain.
- Do not advice patients to buy products labelled as ‘products for diabetes’. Although such products have low sugar, they are high in calories (contain fructose and/or sorbitol) and do not play an important role in the control of the patients’ glucose levels. They are expensive and have no advantage over normal food.
Section 3: Treatment plan for all types of diabetes

Alternative sweeteners
They are safe to use and should be used in moderation in people with diabetes.
- Nutritive sweeteners Include sucrose, fructose, honey, corn syrup, sorbitol, xylitol, dextrose, and maltose. They have no advantage or disadvantage over sucrose (table sugar).
- Non-nutritive sweeteners include saccharine, aspartame, acesulfame K, sucralose. They are approved by the Food and Drug Administration (USA) as safe to use

3. Exercise/physical activity
The person with diabetes should be advised to:
- Start activities slowly like walking 30 minutes per day five days in a week and increase gradually over a 6-8 week period.
- Wear proper footwear to prevent foot ulcers, infections and callus.
- Consume carbohydrates e.g. an apple or a banana 30-60 minutes before exercise.
- Check blood glucose before exercise.
- Carry sugar-containing foods during and after exercise.
- Maintain good hydration during and after prolonged exercise.
- Reduce medication prior to exercise when necessary (insulin in type 1 diabetes).
- Avoid strenuous exercise for those with proliferative retinopathy because it may precipitate vitreous haemorrhage.

NOTE: WHO recommendations for physical activity 30 minutes of walking per day five days in a week

4. Smoking cessation
There is increased morbidity and risk of premature death associated with the development of macro and micro vascular complications among diabetic patients who are also smokers.
It is recommended that:
- All diabetics should be advised to avoid smoking
- Cessation counselling must be provided to diabetics who are smokers.
- Referral to smoking cessation clinic (whenever available) should be discussed with the patient after assessment for behavioural readiness to quit smoking.

5. Medicinal therapy and description of common medications in diabetes:
The medicinal therapy helps the patient control his/her blood glucose (i.e. glycaemic control) to minimize the risk for developing diabetes complications. The following section is dedicated to elaborate on the recommendations for glycaemic control and treatment of hyperglycaemia. Tables 3, 4 and 5 below summarize some important information about the common glucose-lowering therapies and types of insulin and their pharmacodynamics.
### Table 3: Advantages and disadvantages of current glucose-lowering therapies in type-2 diabetes

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Main advantages</th>
<th>Main disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>▪ Reduces macro-vascular risk&lt;br&gt;▪ Weight loss&lt;br&gt;▪ Low risk of hypoglycaemia&lt;br&gt;</td>
<td>▪ Gastrointestinal side effects&lt;br&gt;▪ Lactic acidosis (rare in patients without contraindications)</td>
</tr>
<tr>
<td></td>
<td>▪ Improve multiple cardiovascular risk factors/markers (lipids, CRP, PAI-1,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>thrombocyte-hyperactivity)&lt;br&gt;▪ Cost effective&lt;br&gt;▪ Fixed dose combinations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>are available (with Sulfonylureas, DPP-4 inhibitors)</td>
<td></td>
</tr>
<tr>
<td>Sulfonylurea</td>
<td>▪ Reduces microvascular risk (Glibenclamide)&lt;br&gt;▪ Reduces nephropathy (Gliclazide)</td>
<td>▪ Rapid secondary failure (vs Metformin)&lt;br&gt;▪ Moderate risk of hypoglycaemia (varies between different agents)</td>
</tr>
<tr>
<td></td>
<td>▪ Cost effective&lt;br&gt;▪ Fixed Dose Combinations are available (with Metformin)</td>
<td>▪ Potential cardiovascular safety issues, especially in combination with Metformin</td>
</tr>
<tr>
<td>Glinide</td>
<td>▪ Reduces postprandial blood glucose</td>
<td>▪ No outcome data&lt;br&gt;▪ Hypoglycaemia (possibly similar risk to Sulfonylureas)&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Weight gain&lt;br&gt;▪ Long-term efficacy/safety data lacking&lt;br&gt;▪ (especially in combination with other oral agents)&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Drug costs</td>
</tr>
<tr>
<td>a-Glucosidase inhibitors</td>
<td>▪ Weight neutral&lt;br&gt;▪ Low risk of hypoglycaemia&lt;br&gt;▪ Serious side effects extremely rare&lt;br&gt;▪ Glucose-lowering efficacy only modest</td>
<td>▪ No robust cardiovascular outcomes data&lt;br&gt;▪ Gastrointestinal side effects (leading to poor adherence)</td>
</tr>
<tr>
<td>DPP-4 inhibitor</td>
<td>▪ Low risk of hypoglycaemia (except in combination with a sulfonylurea)&lt;br&gt;▪ Weight-neutral&lt;br&gt;▪ Fixed dose combinations are available (with metformin)</td>
<td>▪ No outcome data&lt;br&gt;▪ Limited long-term clinical experience at present&lt;br&gt;▪ Possible link to pancreatitis&lt;br&gt;▪ Drug costs</td>
</tr>
</tbody>
</table>
### Section 3: Treatment plan for all types of diabetes

Continued Table 3: Advantages and disadvantages of current glucose-lowering therapies in type-2 diabetes

<table>
<thead>
<tr>
<th></th>
<th>Main advantages</th>
<th>Main disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulin</strong></td>
<td>▪ Glucose-lowering efficacy&lt;br&gt;▪ (potentially limitless with up-titration)&lt;br&gt;▪ Reduces microvascular risk</td>
<td>▪ Most effective insulin strategy remains undetermined&lt;br&gt;▪ Moderate to high risk of hypoglycaemia&lt;br&gt;▪ Weight gain&lt;br&gt;▪ Frequent blood glucose monitoring&lt;br&gt;▪ May involve frequent injections&lt;br&gt;▪ Drug costs (esp. analogues)</td>
</tr>
<tr>
<td><strong>GLP-1 receptor agonist</strong></td>
<td>▪ Low risk of hypoglycaemia (except in combination with a sulfonylurea)&lt;br&gt;▪ Weight loss&lt;br&gt;▪ Lowers blood pressure&lt;br&gt;▪ Potential beta cell protective effect</td>
<td>▪ No outcome data&lt;br&gt;▪ Gastrointestinal side effects&lt;br&gt;▪ Limited long-term clinical experience at present&lt;br&gt;▪ Antibody formation (Exenatide only)&lt;br&gt;▪ Possible interaction with other drugs due to delayed gastric emptying&lt;br&gt;▪ Possible link to pancreatitis&lt;br&gt;▪ Drug costs</td>
</tr>
</tbody>
</table>
### Section 3: Treatment plan for all types of diabetes

#### Table 4: Types of insulin

<table>
<thead>
<tr>
<th>Type</th>
<th>Rapid-acting/Prandial/Meal-time/Bolus/Correction Insulins</th>
<th>Short-acting:</th>
<th>Basal/Background Insulins</th>
<th>Intermediate:</th>
<th>Long-acting:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lispro (Humalog)</td>
<td>Regular</td>
<td>NPH</td>
<td>Glargine (Lantus)</td>
<td>Detemir (Levemir)</td>
</tr>
<tr>
<td></td>
<td>Aspart (NovoLog)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glulisine (Apidra)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 5: Summary of Insulin preparations pharmacodynamics: (Onset, peak and duration of action)

<table>
<thead>
<tr>
<th>Insulin Preparation</th>
<th>Onset of Action</th>
<th>Peak</th>
<th>Effective duration</th>
<th>Maximum duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lispro (Humalog)</td>
<td>0.2-0.5 min</td>
<td>0.5-1.5 hr</td>
<td>3-4 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td>Aspart (NovoLog)</td>
<td>0.2-0.5 min</td>
<td>0.5-1.5 hr</td>
<td>3-4 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td>Glulisine (Apidra)</td>
<td>0.2-0.5 min</td>
<td>0.5-1.5 hr</td>
<td>3-4 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td><strong>Short-acting insulin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>0.5-1 hr</td>
<td>2-3 hr</td>
<td>3-6 hr</td>
<td>6-8 hr</td>
</tr>
<tr>
<td><strong>Intermediate-acting insulin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH</td>
<td>2-4 hr</td>
<td>6-10 hr</td>
<td>10-16 hr</td>
<td>14-18 hr</td>
</tr>
<tr>
<td><strong>Long-acting insulin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glargine (Lantus)</td>
<td>1.1 hr</td>
<td>none</td>
<td>24 hr</td>
<td>24 hr</td>
</tr>
<tr>
<td>Detemir (Levemir)</td>
<td>1.1 hr</td>
<td>none</td>
<td>24 hr</td>
<td>24 hr</td>
</tr>
<tr>
<td><strong>Premixed fixed combinations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humulin 70/30</td>
<td>30 min</td>
<td>Dual peak</td>
<td>3-12 hr</td>
<td>16-24 hr</td>
</tr>
<tr>
<td>Novolin 70/30</td>
<td>30 min</td>
<td>Dual peak</td>
<td>3-12 hr</td>
<td>16-24 hr</td>
</tr>
<tr>
<td>Humulin 50/50</td>
<td>30 min</td>
<td>Dual peak</td>
<td>3-12 hr</td>
<td>16-24 hr</td>
</tr>
<tr>
<td>Humalog Mix 75/25</td>
<td>0.2-0.5 min</td>
<td>Dual peak</td>
<td>10-16 hr</td>
<td>14-18 hr</td>
</tr>
<tr>
<td>NovoLog Mix 70/30</td>
<td>0.2-0.5 min</td>
<td>Dual peak</td>
<td>10-16 hr</td>
<td>14-18 hr</td>
</tr>
<tr>
<td>Humalog Mix 50/50</td>
<td>0.2-0.5 min</td>
<td>Dual peak</td>
<td>10-16 hr</td>
<td>14-18 hr</td>
</tr>
<tr>
<td><strong>Animal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>0.5-2 hr</td>
<td>3-4 hr</td>
<td>4-6 hr</td>
<td>6-10 hr</td>
</tr>
<tr>
<td>NPH</td>
<td>4-6 hr</td>
<td>8-14 hr</td>
<td>16-20 hr</td>
<td>20-24 hr</td>
</tr>
</tbody>
</table>
Section 3: Treatment plan for all types of diabetes

NOTE: There are many variables that can affect the absorption rates of subcutaneous insulin injections. This timetable is a guideline to aid in predicting an individual’s response to insulin.

The recommendations for glycaemic control and initiation of therapy

Assessment of glycaemic control
Two primary techniques are available for health providers and patients to assess the effectiveness of the management plan on glycaemic control: patient self-monitoring of blood glucose (SMBG) and the HbA1c.

Self-Monitoring of Blood Glucose (SMBG)
The self-monitoring of blood glucose (SMBG) is an essential tool in the management of diabetes because it:

- Helps to monitor immediate and daily levels of control
- Detects hypoglycaemia
- Assists in the safe management of hyperglycaemia
- Has educational value in assessing blood glucose responses to insulin, food and exercise

Timing of the SMBG
Blood glucose levels are best measured:

- At different times in the day to show levels of the blood glucose in response to the action profiles of insulin, food intake and exercise. In this way, changes may be made in the management plan to improve blood glucose profiles
- To confirm hypoglycaemia and to monitor recovery
- During inter-current illness to prevent hyperglycaemic crises
- In association with vigorous sport or exercise

Table 6: Recommended target capillary blood glucose in SMBG for most non-pregnant adults with diabetes

<table>
<thead>
<tr>
<th>Capillary plasma glucose</th>
<th>Pre-prandial capillary plasma glucose (Before meals)</th>
<th>Peak postprandial capillary plasma glucose (2 hours after meals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEAL</td>
<td>4 – 7 mmol/l</td>
<td>up to 10 mmol/l</td>
</tr>
<tr>
<td>POOR</td>
<td>&gt;7</td>
<td>&gt; 10</td>
</tr>
</tbody>
</table>

NOTE: Frequent, accurate SMBG is the only method by which optimal glycaemic control can be achieved by the intensified management regimens.
**Glycated haemoglobin (HbA1c)**

- Glucose attaches itself to the haemoglobin (Hb) molecule during the life-cycle of the circulating red cell, forming glycated haemoglobin (HbA1c).
- HbA1c level reflects levels of glycaemia over the preceding 6–12 weeks.
- HbA1c is not a good indicator in persons with haemolytic blood disorders such as sickle cell disease, haemolytic anaemia or in patients who have received recent blood transfusion.

**Recommendations:**

- Perform the HbA1c test at least two times a year in patients who are meeting treatment goals (and who have stable glycaemic control).
- Perform the HbA1c test quarterly in patients whose therapy has changed or who are not meeting glycaemic goals.

**Goals should be individualised based on:**

- Duration of diabetes
- Age/life expectancy
- Co-morbid conditions
- Known CVD or advanced microvascular complications
- Hypoglycaemia unawareness
- Individual patient considerations

**More stringent glycaemic goals (HbA1c < 7%) are recommended for:**

1. Patients with new diabetes or short duration of diabetes (less than 8-10 years)
2. Young patients without CVD
3. Type-1 diabetes patients, provided they are not prone to frequent hypoglycaemia.

**Less stringent glycaemic goals (HbA1c up to 8%) may be appropriate for:**

1. Elderly patient with frequent hypoglycaemia
2. Patients with advanced CVD or other co-morbid conditions

**Glycaemic Management**

The following patients require hospitalisation in order to be treated initially with insulin:

- Patients who presented with diabetic ketoacidosis.
- Patients who are extremely catabolic (significant weight loss) or in hyperosmolar state.
Section 3: Treatment plan for all types of diabetes

All other patients can be started on treatment as outpatient based on following initial assessment of the case:

- If the patient presented at diagnosis with HbA1c >9%
  - A. Without symptoms ➔ Start dual or triple therapy
  - B. With symptoms ➔ Start Insulin ± oral therapy
- If the patient presented at diagnosis with HbA1c ≤9% - follow the sequence:

**Step 1: Mono-therapy**

- To be started if HbA1c <7.5%

### Medication Table

<table>
<thead>
<tr>
<th>First line mono-therapy</th>
<th>Metformin + lifestyle modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication:</td>
<td>All if no contraindication or side effects</td>
</tr>
<tr>
<td>Absolute Contraindications:</td>
<td>Renal impairment, creatinine &gt;133 mmol/l in men and &gt;124 mmol/l in women or eGFR &lt;30ml/min/1.73m²</td>
</tr>
<tr>
<td>Relative contraindications:</td>
<td>Congestive cardiac failure, hepatic impairment and respiratory compromise</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second line mono-therapy</th>
<th>Sulfonylurea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precautions:</td>
<td>Elderly, hepatic or renal impairment due to increased risk of hypoglycaemia.</td>
</tr>
<tr>
<td></td>
<td>Better to avoid in patient with G6PD deficiency because of increased risk of haemolytic anaemia.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third line mono-therapy</th>
<th>DPP-4 inhibitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indications:</td>
<td>Metformin side effects</td>
</tr>
<tr>
<td></td>
<td>Sulfonylurea side effects</td>
</tr>
<tr>
<td>Precaution:</td>
<td>In moderate to severe renal impairment, use renal dose</td>
</tr>
</tbody>
</table>

**Titration of Metformin:**

1. Begin with low-dose Metformin (500 mg) taken (once or twice) per day with/after meals (breakfast and/or dinner).
2. After 5–7 days, if gastrointestinal side effects have not occurred, advance dose to 500 mg twice per day (medication to be taken with/after breakfast and dinner).
3. If gastrointestinal side effects appear as doses advanced, decrease to previous lower dose and try to advance the dose at a later time.
4. The maximum effective dose can be up to 2,500 mg/day. Gastrointestinal side effects may limit the dose that can be used.
5. Metformin treatment should be titrated to its maximally effective dose over one month or as tolerated.
Step 2: Dual Therapy:

- Should be considered immediately, if the HbA1c is ≥7.5% or if monotherapy failed after 3 months.

Four options are available

<table>
<thead>
<tr>
<th>First line dual therapy</th>
<th>Medication</th>
<th>Indication:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metformin with Sulfonylurea</td>
<td>If no contraindication for any (see above table)</td>
</tr>
</tbody>
</table>

Or

<table>
<thead>
<tr>
<th>Second line dual therapy</th>
<th>Medication</th>
<th>Indication:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metformin with DPP-4 inhibitor</td>
<td>If there are contraindications to the first line</td>
</tr>
</tbody>
</table>

Or

<table>
<thead>
<tr>
<th>Third line dual therapy</th>
<th>Medication</th>
<th>Indication:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DPP-4 inhibitor with Sulfonylurea</td>
<td>If Metformin cannot be used</td>
</tr>
</tbody>
</table>

The fourth option is for tertiary setup:

<table>
<thead>
<tr>
<th>Fourth line dual therapy</th>
<th>Medication</th>
<th>Indication:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GLP-1 receptor agonist and Metformin</td>
<td>To be initiated at tertiary care centers by endocrinologist/diabetologist GLP-1 receptor agonist can be initiated early as second line of therapy in morbidly obese diabetic patient</td>
</tr>
</tbody>
</table>

- BMI > 35
- Duration of diabetes < 10 years
- eGFR >30, No nephropathy

Consider the following remarks:

- If HbA1c is < 8%, triple oral therapy is optional.
- If HbA1c ≥ 8%, initiate basal insulin plus dual therapy.

Step 3: Triple therapy

- Should be considered if the dual therapy has failed after 3 months.
  1. Metformin, Sulfonylurea, and DPP-4 inhibitors.
  2. Metformin, Sulfonylurea, and GLP-1 receptor agonist by tertiary care physicians endocrinologist/ diabetologist
Step 4: Insulin plus the Dual Therapy

For patients who failed the triple therapy or those with high HbA1c (≥8.0%) while on dual therapy, insulin must be started. The best way for insulin initiation is to start with basal insulin (intermediate or long-acting) in order to control fasting blood glucose and then prandial insulin (short-acting) is added, if pre-meal blood glucose readings are out of range.

Starting Insulin and Dose adjustment

When preparing the Patient for Insulin Therapy:

- Discuss treatment goals with the patient
  - Explain the rationale for adding insulin to the treatment regimen and the health benefits associated with improved glycaemic control
  - Allay patient fears about possible negative health consequences associated with insulin therapy
  - Assure the patient that the need for insulin does not mean his/her diabetes has worsened to a point where it cannot be managed successfully

Figure 2: How the dose of basal and prandial insulin is initiated and adjusted

- Start with bedtime basal insulin (long acting insulin e.g. Lantus (insulin glargine)/ Levemir (insulin detemir)/ NPH with 10 units or 0.2 units per kg)
- Check fasting glucose daily and increase dose by 2 units every 3 days until fasting levels are in target (4-7mmol/l). You can increase dose in larger increments, e.g., by 4 units every 3 days, if fasting glucose is >10mmol/l (180 mg/dl)
- If hypoglycaemia occurs, or fasting glucose level <3.9 mmol/l (70 mg/dl), reduce basal insulin by 4 units
- If fasting glucose in target, check pre-meals & bedtime blood glucose. Add prandial insulin as below. Start with (0.1 units per kg) & adjust by 2units every 3 days until blood glucose is in range.

Encourage the patient to have home self-monitoring of blood glucose (SMBG) and titrate insulin accordingly (refer to the following text)

Continue monitoring for hypoglycaemia especially fasting hypoglycemia and if any is recorded reduce basal insulin and/or prandial insulin as indicated (2-4 units or by 10-20% of the current dose)

NOTE: Target pre-meals blood glucose 4.0 – 7.0 mmol/l for most patients
Consider the following remarks for hyperglycemia: (Fig. 2)

- For elevated fasting blood glucose levels, adjust only the basal insulin dose.
  If both the pre-meal and the 2 hour post-meal blood glucose are out of range; consider the following actions:
  - For elevated pre-prandial blood glucose at lunchtime, adjust breakfast rapid-acting insulin dose.
  - For elevated pre-prandial blood glucose at dinnertime, adjust lunchtime rapid-acting insulin dose.
  - For elevated bedtime blood glucose, adjust dinnertime rapid-acting insulin dose.

Practical Recommendations for Optimising Insulin Use:

- Avoid delays in the initiation of insulin therapy
- Continue oral therapy when initiating basal insulin
- Look for patterns of hyperglycaemia/hypoglycemia when monitoring
- Titrate basal and prandial doses appropriately
- Ensure correct insulin injection technique/timing

Management of Dyslipidaemia

Screening
In most adult patients, measure fasting (12 hours) lipid profile at least annually. In adults with low-risk lipid values (LDL cholesterol < 2.6 mmol/l, HDL cholesterol > 1.3 mmol/l, and triglycerides < 1.7 mmol/l), lipid assessments may be repeated every two years.

Treatment goals and recommendations:

- Lifestyle modification focusing on the reduction of saturated fat, and cholesterol intake; weight loss (if indicated); and increased physical activity should be recommended to improve the lipid profile in patients with diabetes.
- Statin therapy should be added to lifestyle therapy, regardless of baseline lipid levels, for diabetic patients:
  o With overt cardiovascular disease.
  o Without cardiovascular disease over the age of 40 and who have one or more other CVD risk factors:
    - Cigarette smoking,
    - Hypertension (BP ≥140/90 or antihypertensive medication),
    - Low HDL-cholesterol (HDL-C) <40 mg/dL [1.03 mmol/L],
    - Family history of premature CHD (male first degree relatives <55 years, female first degree relatives <65 years).
- For lower-risk patients without overt CVD under the age of 40; statin therapy should be considered in addition to lifestyle therapy if LDL cholesterol remains above 2.6 mmol/l or if there are multiple CVD risk factors.
Section 3: Treatment plan for all types of diabetes

- In individuals without overt CVD, the primary goal is LDL cholesterol < 2.6 mmol/l.
- In individuals with overt CVD, the primary goal is LDL cholesterol < 1.8 mmol/l, using a higher dose of statin.
- If drug-treated patients do not reach the above targets on maximal-tolerated statin therapy; a reduction in LDL cholesterol of ~ 30–40% from baseline is an alternative therapeutic goal.
- If targets are not reached on maximally-tolerated doses of statins, combination therapy using statins and other lipid-lowering agents may be considered to achieve lipid targets.

Management of hyper-triglyceridemia

There is limited data available on the management of hyper-triglyceridemia. However, the following approach is reasonable:

- For patients with fasting triglyceride level {below 5.7 mmol/l}, treat with a statin and consider fibrates, nicotinic acid or fish oil as alternative.
- For patients with fasting triglyceride level {above 5.7 mmol/l}, treat with a fibrate followed by the addition of a statins once the triglyceride levels are brought down.

Monitoring therapy:
1. Repeat lipid profile 6-8 weeks after starting therapy and adjust the dose or add another drug if targets are not achieved.
2. Liver function tests:
   - Before initiating the therapy
   - At 6-8 weeks after initiation or change of drugs or dose.
3. Creatinine kinase:
   - Before initiating treatment
   - Repeat only if there is muscle pain (discontinue if myositis is present or suspected)

NOTE:
- If the creatinine clearance is < 30 ml/min, use statin with caution.
- In preconception period/pregnancy; STOP statin.
- If unexplained peripheral neuropathy develops, stop statin and seek specialist advice.

Management of diabetes in special situation (Ramadan)

Management of diabetic patients during Ramadan:
The management of diabetic patients in Ramadan is quiet challenging. The aim of drug treatment in patients with diabetes is to decrease the frequency of hypoglycaemia and to balance glycaemia. There are no good controlled trials looking at the best way to manage diabetic patients during Ramadan. So, the following recommendations are based on expert opinion:
Section 3: Treatment plan for all types of diabetes

1. Patients treated with oral hypoglycaemic drugs: Make no change. However, physicians are advised to reduce the Sahoor dose to 75% of the usual evening dose in people with high risk of hypoglycaemia like the elderly.

2. Patients treated with insulin:
   - Basal insulin alone: Make no change in the dose. The dose should be taken at Fatoor time.
   - Basal/bolus insulin (two injections): to reverse the usual schedule i.e. the usual morning dose is taken at Fatoor and half the evening dose are taken at Sahoor.
   - Basal/bolus insulin (three injections): reduce to two injections regimen as above.

**NOTE:** Patient should be advised to check blood glucose at least four times in the first few days (Fatoor, 12:00 am, Sahoor and 12:00 pm) and the dose is adjusted accordingly.

Therapy to be tailored according to the dietary and religious habits of the patient, i.e., timing of the main diet and long prayers should be coordinated with the timing of insulin utilization.

Fasting is not recommended for the following patients:
1. Pregnant patients.
2. Unstable diabetes.
3. Elderly patients with chronic complications and/or other co-morbid conditions where the risk for hypoglycaemia is high.
A. Hypoglycaemia

- The issue of hypoglycaemia should be addressed in each clinic visit particularly with those patients treated with an insulin secretogogues or insulin.

- Hypoglycaemia in DM is defined as low glucose levels, accompanied by the typical symptoms of hypoglycaemia, which are relieved by the ingestion of glucose (Whipple's triad).

- Hypoglycaemia in diabetes is the result of treatment that raises insulin levels and lowers plasma glucose concentration. These treatment modalities include insulin or insulin secretogogues such as a sulfonylurea or a non-sulfonylurea insulin secretogogues (e.g. Nateglinide or Repaglinide).

- Hypoglycaemia can be fatal. It is estimated that 2–4% of people with Type-1 DM die from hypoglycaemia.

Symptoms and Signs of Hypoglycaemia

Symptoms and signs of hypoglycaemia are summarized in table (7).

Table 7: Symptoms and Signs of Hypoglycaemia

<table>
<thead>
<tr>
<th>Autonomic</th>
<th>Neuroglycopenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremor</td>
<td>Difficulty in concentration</td>
</tr>
<tr>
<td>Perspiration</td>
<td>Quietness</td>
</tr>
<tr>
<td>Tingling</td>
<td>Becoming aloof</td>
</tr>
<tr>
<td>Palpitation</td>
<td>Change in behaviour and confusion</td>
</tr>
<tr>
<td>Hunger</td>
<td>Becoming aggressive</td>
</tr>
<tr>
<td>Headache</td>
<td>Temper tantrums in children</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Unconsciousness (coma), seizures</td>
</tr>
<tr>
<td>Visual disturbances and double vision</td>
<td></td>
</tr>
</tbody>
</table>

Hypoglycaemic unawareness/ Asymptomatic hypoglycaemia

- When hypoglycaemia occurs in the absence of hypoglycaemic symptoms, the event is called ‘hypoglycaemic unawareness’.

- Attenuated sympathetic neural response causing the clinical syndrome of hypoglycaemic unawareness results in impairment or even loss of the warning symptoms that previously prompted the behavioural defence, i.e. the ingestion of carbohydrates.

- Hypoglycaemic unawareness is the result of untreated recurrent hypoglycaemia.

- Hypoglycaemic unawareness is associated with a six-fold increased risk for severe hypoglycaemia.
**Section 4: Acute complications of Diabetes Mellitus**

Table 8: Hypoglycaemia classification in persons with diabetes (ADA Workgroup)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe hypoglycaemia</td>
<td>An event requiring assistance of another person to actively administer carbohydrate, glucagon, or other resuscitative actions. Plasma glucose measurements may not be available during such an event, but neurological recovery attributable to the restoration of plasma glucose to normal is considered sufficient evidence that the event was induced by low plasma glucose concentration.</td>
</tr>
<tr>
<td>Documented symptomatic hypoglycaemia</td>
<td>An event during which typical symptoms of hypoglycaemia are accompanied by measured plasma glucose concentration &lt;3.9 mmol/l (&lt;70 mg/dl)</td>
</tr>
<tr>
<td>Asymptomatic hypoglycaemia</td>
<td>An event not accompanied by typical symptoms of hypoglycaemia but with measured plasma glucose concentration &lt;3.9 mmol/l (&lt;70 mg/dl)</td>
</tr>
</tbody>
</table>

**The risk factors for hypoglycaemia in diabetes:**

Conventional risk factors: relative or absolute insulin excess

1. Insulin or insulin secretagogues
2. Exogenous glucose delivery is decreased (e.g. after missed meals and during the overnight fast).
3. Glucose utilisation is increased (e.g. during exercise).
4. Endogenous glucose production is decreased (e.g. after alcohol ingestion).
5. Sensitivity to insulin is increased (e.g. after weight loss and in an increase in regular exercise)
6. Insulin clearance is decreased (e.g. with renal failure).

**Treatment recommendations: (figure 3)**

For treatment recommendations, refer to the next following chart.

- The commonly recommended dose of glucose for adults is 20-25 gm. Clinical improvement should occur within 5 to 10 minutes, although full recovery may take 10–20 minutes. It should be noted that over-treatment does not speed recovery, and will simply produce hyperglycaemia afterwards. Therefore over-treatment should be avoided.

- The glycaemic response to oral glucose is often transient, and usually lasts less than two hours in insulin-induced hypoglycaemia. Therefore, the ingestion of a more substantial snack or a meal shortly after the plasma glucose is raised is advisable.
The initial I.V glucose dose is 25 gm (100ml of 25% glucose solution). The glycaemic response to I.V glucose bolus is transient. A subsequent glucose infusion is often needed, and food should be provided orally as soon as the patient is able to ingest food safely.

**Fig. 3: Treatment of hypoglycemia**

**Symptoms and signs suggestive of hypoglycaemia**
- Tremor, palpitation, hunger, headache, sweating, anxiety, visual disturbances, hallucinations
- Change in behaviour and confusion, difficulty in concentration, becoming aggressive, becoming aloof, unconsciousness (coma), seizures

**Check Glucose level (by glucometer)**

- Hypoglycaemia (glucose <3.5 mmol/l) in conscious person
  - Treat hypoglycaemia with oral carbohydrates, (1/2 cup of juice, one slice of bread, biscuits, 4 crackers, 1 teaspoon of honey)
  - Re-check glucose level after 10-15 min
  - Repeat the above if glucose still low
  - Repeat testing and treating until blood glucose returns to normal range
  - If the blood glucose does not normalise after two attempts at treatment, then establish an intravenous access, start with 5% or 10% dextrose infusion 80-100 ml/hr and refer to the regional hospital

- Low blood glucose (3.5-3.9 mmol/l); Ask the diabetic person to eat sandwich or biscuit

- Hypoglycaemia in unconscious person or in person unable to take orally
  - 1. Do the A.B.C.
  - 2. Insert an I.V line

- I.V access cannot be established
  - Start Glucagon 1 mg, i.m
  - If I.V access can be established, start 10% dextrose infusion 80-100 ml/hr

- When I.V access is established:
  - 100ml of 25% glucose intravenously and start 10% dextrose infusion 80-100 ml/hr
  - Or
  - 50 ml of 50% glucose intravenously and start 10% dextrose infusion 80-100 ml/hr
  - Or
  - 100 ml of 10% glucose intravenously and start 10% dextrose infusion 80-100 ml/hr

Transfer to the nearest regional hospital for further management
Section 4: Acute complications of Diabetes Mellitus

Prevention of further attacks of hypoglycaemia:

- The most important step in the management of hypoglycaemia is to identify the cause in order to prevent future episodes.
- The physician/nurse should discuss precipitating factors, signs, symptoms and the management of hypoglycaemia with the subject and his/her relatives.
- If there are no dietary factors and no change in lifestyle, then anti-diabetic medications/insulin doses need to be modified.
- While driving, an emergency supply of glucose or sweets should be kept in the car, taking into consideration unexpected delays, breakdowns etc.
- On a long journey the blood glucose should be monitored periodically and snacks should be taken at regular intervals.


B. Diabetic ketoacidosis in adults (DKA)

- Diabetic ketoacidosis (DKA) is characterised by the triad of hyperglycaemia, high anion gap metabolic acidosis and the presence of ketone bodies. It is common in type-1 DM, although it may also occur in type-2 DM during stressful situations.
- Ketoacidosis is a potentially lethal condition and should be suspected and treated promptly.
- Check for ketone bodies if glucose ≥14 mmol/l in type-1 DM or when you suspect DKA.
- Send all diabetic patients with positive ketones to the emergency department for further management.

Precipitating factors:

- Poor compliance/Insulin withdrawal/inadequate treatment.
- Infection, especially urinary, respiratory tract, and soft tissue infections.
- Myocardial infarction and cerebrovascular accident.
- Trauma and surgery.
- Unrecognised type-1 DM.

Signs and symptoms of DKA:

- Polydipsia
- Polyuria
- Nausea and vomiting
- Dehydration (most obvious sign)
- Abdominal pain and muscle cramps
- Drowsiness (and, rarely, coma)
- Acidotic breathing
Section 4: Acute complications of Diabetes Mellitus

Diagnostic criteria for DKA:

- Plasma glucose ≥14mmol/l
- Test for ketone bodies (Positive)
- Serum bicarbonate <15 mmol/l
- PH <7.3

Management of DKA in adults: (Figure 4)

(For the management of DKA, please refer to the following chart)

- Arrange for urgent referral for admission to the nearest regional hospital.
- Until referral is being arranged, commence the patient on normal saline and insulin as given below:

1. **Rehydration/ I.V fluid:**
   - 1000 ml of 0.9% normal saline given over one hour, then 1000ml over two hours, then 500 ml over four hours (80-100ml/hour)
   - **Insulin:** Give 0.1units/kg of regular short acting insulin subcutaneously
   - 3. A nurse should accompany the patient during transfer to the hospital

**NOTE:** Use caution in elderly patients with DM and those with heart failure.

C. Hyperglycaemic Hyperosmolar State (HHS) /Hyperglycaemic hyperosmolar non ketotic state/coma (HONK)

- Suspect this condition if the patient has signs and symptoms of severe hyperglycaemia (blood glucose 33 mmol/l or more), drowsiness, severe dehydration and with negative or mild positive test for ketones

Management

Arrange for urgent referral for admission to the nearest regional hospital. Until referral is being arranged, commence I.V. fluids and insulin as given below:

1. **Rehydration/ I.V fluid:**
   - Saline infusion using 1000 ml of 0.45% or 0.9% normal saline given over one hour, then 1000ml over two hours, then 500 ml over four hours (80-100 ml/hour)
   - **Insulin:** Give 0.1units/kg of regular short acting insulin subcutaneously
   - 3. A nurse should accompany the patient during transfer to the hospital

**NOTE:** Use caution in elderly patients with DM and those with heart failure, and renal failure.
Section 4: Acute complications of Diabetes Mellitus

Figure 4: Management of DKA in adults

Symptoms and signs suggestive of DKA or hyperglycaemia, glucose ≥14 mmol/l

Check for ketone bodies in the urine or blood

1. I.V Fluid:
   Normal saline Hydration
   Start 1000 ml of 0.9% normal saline given over one hour, then 1000 ml over two hours followed by 500 ml over four hours

2. Insulin:
   Give 0.1 units/kg of regular insulin subcutaneously

Ketone bodies positive

Treat for DKA with insulin and hydration

Ketone bodies negative

Treat as simple hyperglycaemia

Give 0.1 units/kg of regular insulin s.c

Modify underlying diabetic treatment

• Transfer the patient to the nearest hospital
• A nurse should accompany the patient during transfer
Section 5: Chronic complications of Diabetes Mellitus

1. Diabetic eye diseases

- Diabetic retinopathy is the most common cause of blindness in people with diabetes.
- The prevalence of diabetic retinopathy increases with the duration of diabetes.
- In type 1 diabetes, subjects should have eye examination within 3-5 years.
- In type 2 diabetes, retinopathy can be present at the time of diagnosis. Therefore, all new patients with type 2 diabetes should be referred to the ophthalmologist at diagnosis and at least once a year thereafter.
- People with hypertension are at greater risk of developing diabetic retinopathy.
- Pregnancy also causes deterioration of diabetic retinopathy (please refer to section on diabetes and pregnancy.)

**NOTE:** All new patients with type 2 diabetes should be referred to the ophthalmologist at diagnosis and at least once a year thereafter.

During each visit, the primary physician should enquire about the following:

- Change in eyesight
- Blurred vision
- Pain in the eye
- Redness
- Enquire about the patient’s last eye check up by an ophthalmologist
- History of other micro-vascular complications such diabetic nephropathy or neuropathy

If any of these symptoms are present and/or the last eye assessment was more than one year ago. The patient should be referred to an ophthalmologist.

2. Diabetic nephropathy

**Definition of nephropathy:**
(For definition, please refer to following tables 9&10)

Abnormalities of urinary albumin excretion are the earliest evidence of nephropathy, and this is not detectable by traditional urine dipstic test; these patients should be screened for increased urinary albumin by measurement of the albumin to creatinine ratio.

**The early morning spot urine test is indicated in the following:**

- At diagnosis in all type-2 diabetes
- After 3-5 years of diagnosis in type-1 diabetes
- In subjects with established retinopathy
Section 5: Chronic complications of Diabetes Mellitus

How to perform the test

- Ask the patient to collect early morning mid-stream urine sample at home and bring it to the clinic or this sample could be collected in your clinic.
- Send the sample to the laboratory requesting “Albumin-to-Creatinine ratio”
- Avoid doing this test in patients with UTI or in female patients during menstruation.

Use the following table for interpretation of the results.

Table 9: Urine Albumin to Creatinine ratio

<table>
<thead>
<tr>
<th>Category</th>
<th>Random spot collection (mg/mmol of creatinine)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 2.5</td>
</tr>
<tr>
<td>Micro-albuminuria</td>
<td>≥ 2.5 and &lt;30</td>
</tr>
<tr>
<td>Clinical albuminuria (nephropathy)</td>
<td>≥ 30</td>
</tr>
</tbody>
</table>

*Microalbuminuria is also defined as the excretion of between 30-300 mg of albumin in urine over 24 hours. Albumin excreted >300mg per day is called macroalbuminuria or (Clinical albuminuria)
Management of nephropathy:

1. **Diabetic nephropathy can be prevented by**
   - strict glycemic control,
   - treatment of hypertension to target (BP <140/80mmHg),
   - avoidance of nephrotoxic drugs (like aminoglycosides, NSAID and contrast media),
   - smoking cessation, and early and effective treatment of infection
Section 5: Chronic complications of Diabetes Mellitus

Therapeutic goals:
- Optimise glucose control → Treat to target
- Optimise blood pressure control → Treat to target
- Continue monitoring urine albumin excretion twice per year using eGFR to assess both response to therapy and disease progression
- Reduction of protein intake may improve measures of renal function (urine albumin excretion rate, eGFR) → Refer the patient to the dietician for proper counselling
- People with diabetes and albuminuria should be treated with ACE inhibitors or ARBs.
- When ACE inhibitors, ARBs, or diuretics are used, monitor serum creatinine, and electrolytes within 2-4 weeks for electrolyte disturbance or worsening in the renal functions

Table 10: Stages of Chronic Kidney disease (CKD) based on eGFR

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>eGFR (ml/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kidney damage* with normal or increased GFR</td>
<td>≥90</td>
</tr>
<tr>
<td>2</td>
<td>Kidney damage* with mildly decreased GFR</td>
<td>60–89</td>
</tr>
<tr>
<td>3</td>
<td>Moderately decreased GFR</td>
<td>30–59</td>
</tr>
<tr>
<td>4</td>
<td>Severely decreased GFR</td>
<td>15–29</td>
</tr>
<tr>
<td>5</td>
<td>Kidney failure</td>
<td>&lt;15 or dialysis</td>
</tr>
</tbody>
</table>

2. Indications for the referral to the nephrologists;
- Uncertainty about aetiology of the kidney disease
- Patients with pre-existing renal disease and hypertension
- Patients with worsening proteinuria/albuminuria in spite of medical therapy
- Worsening renal function
- Side effects of ACE inhibitors or ARBs such as persistent hyperkalaemia
- Patients with small kidney size on renal ultrasound
### Section 5: Chronic complications of Diabetes Mellitus

#### Table 11: Management of Chronic Kidney Diseases (CKD) in Diabetes Mellitus

<table>
<thead>
<tr>
<th>eGFR (ml/min/1.73m²)</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>▪ Yearly measurement of creatinine, urinary albumin excretion, potassium</td>
</tr>
<tr>
<td></td>
<td>▪ Referral to nephrology if there is a possibility for non-diabetic kidney disease (type 1 diabetes duration&lt;10 years, heavy proteinuria, abnormal findings on renal ultrasound, resistant hypertension, rapid fall in eGFR, active urinary sediments or abnormal urine microscopy)</td>
</tr>
<tr>
<td></td>
<td>▪ Consider the need for medication dose adjustment</td>
</tr>
<tr>
<td></td>
<td>▪ Monitor eGFR every 6 months</td>
</tr>
<tr>
<td></td>
<td>▪ Monitor electrolytes, bicarbonate, haemoglobin, calcium, phosphorus, parathyroid hormone at least yearly</td>
</tr>
<tr>
<td></td>
<td>▪ Exclude vitamin D insufficiency</td>
</tr>
<tr>
<td></td>
<td>▪ Consider bone density testing</td>
</tr>
<tr>
<td></td>
<td>▪ Referral for dietary counselling</td>
</tr>
<tr>
<td>eGFR=45–60</td>
<td>▪ Monitor eGFR every 3 months</td>
</tr>
<tr>
<td></td>
<td>▪ Monitor electrolytes, bicarbonate, calcium, phosphorus, parathyroid hormone, haemoglobin, albumin, weight every 3–6 months</td>
</tr>
<tr>
<td></td>
<td>▪ Consider need for medication dose adjustment</td>
</tr>
<tr>
<td>eGFR ≤30</td>
<td>▪ Referral to nephrologist</td>
</tr>
</tbody>
</table>


#### 3. Hypertension in diabetes

- Hypertension (defined as a blood pressure (BP) ≥140/90mmHg) is an extremely common co-morbid condition in diabetics. Blood pressure should be checked during each clinic visit.
- Hypertension substantially increases the risk of both macro- and micro-vascular complications, including stroke, coronary artery disease, peripheral vascular disease, retinopathy and nephropathy
Section 5: Chronic complications of Diabetes Mellitus

- Diagnosis of hypertension should be based on high blood pressure measurements (≥140mmHg systolic and/or ≥90mmHg diastolic) on at least two or three separate occasions one to two weeks apart.

- The target blood pressure in a patient with uncomplicated diabetes is ≤140/90 mmHg *

Table 12: Management of hypertension in diabetic patients

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural therapy (regular physical activity, diet modification and smoking cessation) + pharmacological treatment</td>
<td>≥140</td>
<td>≥90</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;140</td>
<td>&lt;90</td>
</tr>
</tbody>
</table>

* Recommendation is based on ADA 2015 guidelines

Summary:

1. The dietary therapy should focus on low sodium intake, and a low fat diet.
2. The drug of choice is an ACE inhibitor or an Angiotensin II receptor blocker (ARB).
3. Many people will require two or more drugs to achieve the recommended BP target, a combination of ACE inhibitors or ARBs with calcium channel blockers/diuretic
4. If there is inadequate control of hypertension with moderate doses of a single drug, it is often preferred to maximise the first drug before adding a second drug.
5. Although diuretics and Beta-blockers reportedly reduce insulin sensitivity and increase triglyceride levels while Beta-blockers also mask hypoglycaemic awareness, in practice this is not a major contraindication considering the benefits of Beta-blockers in diabetic people with ischemic heart disease.
6. In pregnant woman with diabetes and chronic hypertension.
   - A blood pressure target of 110–129/65–79 mmHg is suggested in the interest of long-term maternal health and minimising the risk of impaired foetal growth
   - ACE inhibitors and ARBs are contraindicated during pregnancy
Anti-hypertensive drugs that can be used to treat diabetic patients with hypertension

- ACE inhibitors or Angiotensin-II receptors blockers (ARBs) are the first drugs of choice
- Diuretics
- Calcium channel blockers
- Selective beta-blockers in patients with ischemic heart disease
- α-blockers
- Hydralazine

4. Diabetic neuropathy

- Neuropathy is common in patients with diabetes and may be detected soon after the onset of the disease. Neuropathy can affect the sensory, motor and autonomic nervous systems and can be disabling. It is a common cause for lower limb amputation.
- Pain due to peripheral neuropathy can be severe and distressing and often requires attention. Drug treatment includes anticonvulsants or tricyclic antidepressants such as amitriptyline
- Autonomic neuropathy can have a wide spectrum of symptoms by affecting many different systems, like the cardiovascular, gastrointestinal and genitourinary systems. This results in postural hypotension, erectile dysfunction, gastroparesis, (heartburn, nausea and vomiting) diarrhoea and neurogenic bladder.
- Referral to a specialist is indicated for patients with symptoms of peripheral or autonomic neuropathy.

5. Diabetic foot

Amputation and foot ulceration are common causes for morbidity and disability in people with diabetes. Early recognition and management of risk factors can prevent or delay adverse outcomes. The risk of ulcers or amputations is increased in people who have the following risk factors:

- Previous amputation
- Past foot ulcer history
- Peripheral neuropathy
- Foot deformity
- Callus formation over high pressure points
- Peripheral vascular disease
- Visual impairment
- Diabetic nephropathy (especially patients on dialysis)
- Poor glycaemic control
- Cigarette smoking
What leads to amputation in people with diabetes?
The initiating factors are loss of neural function and poor vascular supply

↓ Injury and/or Skin breakdown

↓ Infection

↓ Gangrene

↓ Amputation

Role of the physician / diabetic foot nurse in foot care:
1. Newly-diagnosed diabetic patients should have foot assessment
2. The physician should look for the following:
   ▪ Injury
   ▪ Swellings
   ▪ Red or black areas
   ▪ Calluses (thick and hard skin in places of constant pressure)
   ▪ Ulcers
   ▪ Pus discharge
   ▪ Deformities

Performing the monofilament test

1. Use a 10g monofilament for sensation testing.

2. Touch with gentle application of pressure through the tip until it gets bent. Touch certain parts of the feet which are at high risk as shown in the picture below

3. Record the finding on the chart
Indications for referral:

- If the patient does not have signs of neuropathy-refer the patient for annual foot assessment.
- If the patient has signs of neuropathy but has no ulcers or deformity-Refer the patient for podiatrist assessment and management.

Summary:

1. Patient who can sense the monofilament at all sites on the drawing has no neuropathy.
2. The subject who has even one abnormal test for sensation has neuropathy and is at risk of a diabetic foot complication.

Foot care advice for patients:

- **Inspect your feet daily.** Examine both feet check for cuts, blisters, redness, swelling, or nail problems.
- **Use a magnifying hand mirror to look at the bottom of your feet.**
- **It is important to keep feet clean. Wash with soap and water (never use hot water). Dry carefully especially in between the toes.**
- **Apply cream to your feet – but not between your toes.** Use a moisturiser daily to keep dry skin from itching or cracking. But DON’T moisturise between the toes – that could encourage a fungal infection.
- **Never walk barefoot, even at home!** Always wear shoes or slippers. You could step on something and get a scratch or cut.
- **Do not smoke, because it decreases the blood circulation in diabetes this may cause peripheral vascular disease, which may result in amputation of the feet.**
- **Avoid the wrong type of socks.** Avoid tight elastic bands (they reduce circulation). Don’t wear thick or bulky socks (they can fit poorly and irritate the skin). Change them daily.
Section 5: Chronic complications of Diabetes Mellitus

- **Wear comfortable shoes that fit well and have plenty of room in them.** New shoes should be broken in gradually. Avoid wearing slippers or sandals. If you do wear them, you have to be extra careful not to injure your feet.

- Examine your shoes every day for foreign objects (stones, pins) which may injure your feet.

- **Cut nails carefully.** Cut them straight across and file the edges. Don’t cut nails too short, as this could lead to ingrown toe nails.

- Do not cut or remove calluses by yourself, report to the clinic.

- If your feet feel cold, wear socks. Do not apply hot water bottles or heating pads.

- Report to the physician promptly for any injuries such as wounds or thorn entry, in your feet, fungal infection, ingrown nails or swelling.

- Do not apply medicine or solution to an open wound but cover with clean dressing cloth/pad.

- Take care of your diabetes. Keep your blood glucose levels under good control.

6. Cardiovascular diseases

Cardiovascular diseases (coronary heart disease, stroke and peripheral vascular disease) are the leading causes of death in the diabetics. Risk factors for the development of macrovascular disease are frequently found in people with diabetes.

**Assessment**

The initial assessment of the newly diagnosed type 2 individual should always include:

- Clinical screening for risk factors of CVD; for example, hypertension, smoking, obesity and hyperlipidaemia

- Screening for early signs of cardiovascular abnormalities

- A baseline ECG

- Serum fasting lipid profile

Steps taken to reduce CVD risk factors should be an integral part of the management plan.

**Prevention**

- Encourage smoking cessation

- Encourage abstinence from alcohol

- Restrict fatty and high carbohydrate diet

- Encourage regular exercise

- Control the patient’s diabetes to target

- Treat hypertension to target

- Treat dyslipidaemia to target

- Add low dose aspirin as primary prevention in those with type 1 or type 2 diabetes at increased cardiovascular risk (10-year risk >10% based on the Framingham risk score)

- If the patient has cardiac symptoms or new ECG changes, refer to a cardiologist for further assessment.
Introduction
The ongoing epidemic of obesity and diabetes has led to more type -2 diabetes in women of childbearing age, resulting in an increase in the number of pregnant women with undiagnosed type 2 diabetes. Also women with obesity when they become pregnant they have higher risk of developing gestational diabetes mellitus (GDM).

Types of diabetes in pregnancy
1. Pregestational Diabetes
   - Type 1 Diabetes
   - Type 2 Diabetes
2. Diabetes detected during pregnancy
   - Overt Diabetes
   - Gestational Diabetes

Significance of diabetes during pregnancy:
Uncontrolled Diabetes in pregnancy can increase the risk of the following adverse effects:
- Increased risk miscarriage
- Increased risk of congenital anomalies
- Pre-eclampsia
- Hydramnios
- Fetal organomegaly (hepatomegaly, cardiomegaly)
- Birth trauma
- Perinatal Mortality
- Neonatal respiratory problems
- Metabolic complications (hypoglycemia, hyperbilirubinemia, hypocalcaemia)

development of obesity and diabetes during childhood

NOTE:
- Pregestational/Overt diabetes - Leads to more congenital anomalies
- GDM - Leads to more macrosomia and premature delivery
- The risk of complication in Overt Diabetic women is twice as much as in GDM

Introduction
Pregestational diabetes includes women known to have diabetes before conception. Preconception counselling has to be provided to all women with diabetes who are considering pregnancy. Such women should have plans implemented 3 months before withdrawing contraceptive measures or trying to conceive, in order to achieve a safe and successful pregnancy outcome.

Glycemic Control:
Women with diabetes, planning pregnancy should strive to achieve blood glucose and haemoglobin A1c (HbA1C) levels as close to normal as possible while avoiding hypoglycemia. Overweight and obese women, need to lose weight prior to conception.
Section 6: Diabetes And Pregnancy

Adjustment of Medical Therapy:

- In women on insulin therapy, the multi dose regimen (MDI) is the most appropriate option to facilitate target achievement and to allow flexible dosing adjustment during pregnancy. The insulin dose may need to be increased as pregnancy advances.
- All oral hypoglycemic medications except Metformin should be stopped and replaced with insulin.
- Folic acid supplementation:
  Folic acid 5 mg OD needs to be supplemented 3 months before withdrawing contraception and continued until breast feeding.

Retinal assessment:
A baseline assessment of diabetic retinopathy is recommended to assess for any treatable condition which can be stabilized preconception. Women with established retinopathy should have retinal assessment done once in each trimester because of the risk of progression during pregnancy.

Renal assessment:
Renal functions should be assessed by measuring urine albumin to creatinine ratio, serum creatinine, and estimated Glomerular Filtration Rate (eGFR) before conception. Any significant changes can be assessed by a nephrologist and stabilized prior to conception. Monitor serum creatinine and eGFR throughout pregnancy. Refer to a nephrologist if the serum Creatinine ≥120 umol/l, or eGFR < 90ml/min/1.73m2.

Control of Hypertension:
It is important to control blood pressure prior to conception to avoid deterioration post conception. ACE inhibitors and Angiotensin Receptor Blockers (ARBs) should be replaced with safer medication like Labetolol and Methyl dopa.

Statin therapy:
Statins have to be stopped well before conception as they are potentialy teratogenic.

Thyroid function:
Thyroid function should be assessed before pregnancy.

Checklist for Women with Pre-existing Diabetes

- Attain preconception HbA1c <7.0%
- Assess and manage any diabetic complication
- Shift to multiple daily insulin (MDI) in patients on premixed insulin.
- Achieve good blood pressure control on safe anti-hypertensive medication.
- Supplement Folic Acid 5 mg OD: 3 months pre-conception
- Discontinue potential teratogenic medications e.g: ACE-inhibitors/ARB’s, Statins, etc
Gestational Diabetes Mellitus:

Introduction
GDM is defined as a condition associated with maternal hyperglycemia less severe than that found in patients with overt diabetes, but associated with an increased risk of adverse pregnancy outcome.

Any lean pregnant women, with positive circulating Anti-islet cell or Anti GAD antibody, or low C peptide level, should be diagnosed as type-1 diabetes.

Risk factors for developing GDM:

- First-degree relative with diabetes
- Women who delivered a baby weighing $\geq 4$ kg
- Previous history of GDM
- History of previous unexplained still birth or neonatal death.
- Women with polycystic ovary syndrome
- HbA1c $\geq 5.7\%$, Impaired Glucose Tolerance (IGT), or Impaired Fasting Glucose (IFG) in the past.
- Other clinical conditions associated with insulin resistance (e.g., Obesity BMI $\geq 30$Kg/m$^2$, acanthosis nigricans)

Screening and diagnostic testing:

When to screen:
Universal screening is recommended at first prenatal visit, irrespective of the trimester.

Screening methods:
The methods of screening has been mentioned in the following flow chart.
Section 7: Gestational Diabetes Mellitus (GDM)

Screening for Diabetes in Pregnancy

All Pregnant women at Registration → Do FBS/RBS

If FBS < 5.1 mmol/l OR RBS < 7.0 mmol/l
  - If Low Risk for GDM: Do 75gm OGTT at 22-24 weeks of Gestation
  - If High Risk for GDM: Do 75gm OGTT

If RBS 7.0 - 11.0 mmol/l
  - Do 75gm OGTT

If FBS 5.1 - 6.9 mmol/l
  - If FBS ≥ 5.1 - 6.9 mmol/l or 2-hrs PG ≥ 8.5 mmol/l: GDM
  - If FBS < 5.1 mmol/l or 2-hrs PG < 8.5 mmol/l: Repeat 75gm OGTT at 22-24 weeks of Gestation

If FBS ≥ 7.0 mmol/l OR RBS ≥ 11.1 mmol/l
  - If > 12 week of gestation: GDM
  - If ≤ 12 week of gestation: Overt Diabetes

¹ Confirm the diagnosis by doing Glycosylated hemoglobin (HbA₁c).
² If >7-11.1 in the 1st trimester, diagnose and treat as diabetes.
³ If FBS ≥ 5.1-6.9 mmol/l or 2-hrs PG ≥ 8.5 mmol/l, Diagnose as GDM.
Antenatal assessment and care:
Ultrasound examination should be performed in early pregnancy to confirm gestational age and fetal viability.
- Anomaly ultrasound scans to be arranged at 20-22 weeks of gestation.
- Growth scan at 28, 32 and 36 weeks.
- Monthly visits till 28 weeks and once in 2 weeks till 36 weeks

Table 13: Total Weight gain and rate of weight gain during pregnancy

<table>
<thead>
<tr>
<th>Prepregnancy BMI (Kg/m²)</th>
<th>Total Weight gain (in Kg)</th>
<th>Rate of weight gain in 2nd and 3rd Trimester (in Kg/Week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt; 18.5)</td>
<td>12.5-18</td>
<td>0.51 (0.44-0.58)</td>
</tr>
<tr>
<td>Normal weight (18.5-24.9)</td>
<td>11.5-16</td>
<td>0.42 (0.35-0.50)</td>
</tr>
<tr>
<td>Overweight (25-29.9)</td>
<td>7-11.5</td>
<td>0.28 (0.23-0.33)</td>
</tr>
<tr>
<td>Obese (≥30)</td>
<td>5-9</td>
<td>1.22 (0.17-0.27)</td>
</tr>
</tbody>
</table>

N.B: Calculations assume a 0.5 to 2 Kg weight gain in the first trimester.

Management of GDM and Overt Diabetes:
Rationale for treatment: Identifying women with GDM is important because appropriate therapy can decrease foetal and maternal morbidity

1. Management of lifestyle:

A. Nutritional therapy:
All patients with GDM should receive nutritional counselling from a dietician upon diagnosis and should be placed on an appropriate diet.

Nutrition therapy has been shown to improve glycemic control for people living with overt-diabetes and for women with gestational diabetes.

Calorie allotment: Calorie allotment is based on ideal body weight and is calculated based on the current weight of the pregnant woman. The suggested caloric intake is approximately:
- 30 kcal per kg (current weight) per day in pregnant women with BMI 22 to 25.
- 24 kcal per kg (current weight) per day in overweight pregnant women with BMI 26 to 29.
- 12 to 15 kcal per kg (current weight) per day for obese pregnant women with BMI >30.
- 40 kcal per kg (current weight) per day in pregnant women with BMI <22.

B. Exercise:
Encourage mild to moderate exercise (eg: walking) as part of the treatment plan for women with GDM when there are no medical or obstetrical contraindications to this level of physical activity.
Section 7: Gestational Diabetes Mellitus (GDM)

2. Glucose monitoring:
Multiple daily self-measurement of blood glucose is important, and more so for the recognition of women who should begin an anti-hyperglycemic agent and for dose adjustment in patient receiving medical therapy. The below table is suggested as minimum for pregnant women on oral therapy. More Frequent monitoring is advised for patients on insulin therapy or when monitoring patients on lifestyle intervention.

<table>
<thead>
<tr>
<th></th>
<th>FBG</th>
<th>Post BF</th>
<th>Pre Lunch</th>
<th>Post Lunch</th>
<th>Pre dinner</th>
<th>Post Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Glycemic targets:
- Premeal - ≤5.3 mmol/L (95 mg/dL)
- 2 h Post meal- ≤ 6.7 mmol/L (120 mg/dL)

3. Medical therapy:

A. Oral hypoglycemic agents:
Women with diabetes maybe advised to use Metformin as an adjunct or alternative before starting insulin. Metformin can be initiated at a dose of 500mg twice daily and increased up to 2.5 g/day. Dose increments should be done over 3-5 days both to reduce gastrointestinal side effects and to permit identification of the minimum dose required for adequate glycemic control.

B. Injectable:
- Insulin (NPH, Regular Insulin, Aspart, Lispro- all fall in Category B of US-FDA)
  - Approximately 15% of women with GDM require insulin because target glucose levels are exceeded despite they being on dietary therapy.
  - If fasting blood glucose concentration is high, intermediate-acting insulin, such as NPH insulin, can be given before bedtime.
  - If postprandial blood glucose concentrations are high, insulin Aspart or insulin Lispro can be given before meals at a dose calculated at (1.5 units per 10 grams carbohydrate in the breakfast meal and 1 unit per 10 grams carbohydrate in the meals taken at lunch and dinner).
  - If both preprandial and postprandial blood glucose concentrations are high, then a four injection per day regimen should be initiated.
**Section 7: Gestational Diabetes Mellitus (GDM)**

The total dose:
- (0.7 unit/kg up to week 12),
- (0.8 unit/kg for weeks 13 to 26),
- (0.9 unit/kg for weeks 26 to 36), and
- (1.0 unit/kg for weeks 36 to term).

- In severely obese woman, the initial doses of insulin may need to be increased to 1.5 to 2.0 units/kg in order to overcome the combined insulin resistance of pregnancy and obesity.

**C. Others**

**Asprin:**
- Add low dose of Aspirin 75mg OD from the 12th week of gestation.

**Peri-partum management:**

Glucose control: Maternal hyperglycemia should be avoided during labour to reduce the risk of foetal acidosis and neonatal hypoglycemia.

Maternal blood glucose levels should be kept between 4.0 -7.0 mmol/L.

Women should receive adequate glucose during labour in order to meet the high energy requirements. Routine IV Dextrose and IV insulin protocols may be helpful.

**Post-partum follow-up:**

Encourage women to breastfeed post delivery.
- Metformin may be used during breast-feeding.
- A fasting blood glucose done 24 hours(ideally 72 hours) post delivery and post withdrawal of all anti hyperglycemic agents can diagnose persistent dysglycemia. An OGTT done 4-6 weeks postpartum can diagnose persistent dysglycemia.
- Screen for postpartum thyroiditis in patients with Type-1 diabetes. Check TSH 6-8 weeks postpartum.

**Contraception:**
- Any type of contraception is acceptable.
- Low-dose oestrogen-progestin oral contraceptives may be used in women with a history of GDM as long as there are no medical contraindication.
- Progestin-only (but not combined oestrogen-progestin) oral contraceptives (OCs) have been associated with an increased risk of developing type-2 diabetes in women with recent GDM.

**Future risks:**
- These patients are at high risk for recurrent GDM, impaired glucose tolerance, and overt diabetes over the subsequent five years.
- Recurrence: One-third to two-thirds of women with GDM will have GDM in their subsequent pregnancy.
4. Follow-up and prevention of type-2 Diabetes Mellitus

All women with previous GDM should undergo an oral glucose tolerance test 6 to 12 weeks after delivery, using a two-hour 75 gram oral glucose tolerance test. An abnormal fasting blood glucose level is diagnostic;

A. Diagnose diabetes, if fasting glucose level is ≥7 mmol/L (126 mg/dl) and/or 2 hour post glucose level is ≥11.1 mmol/L (200 mg/dl),

B. Diagnose impaired fasting glucose, if fasting blood glucose level is 5.5-6.9 mmol/L (100-125 mg/dl) and

C. Diagnose impaired glucose, tolerance if the 2 hour post glucose load ranges from 7.8-11 mmol/L (140-200 mg/dl)

Follow-ups:

- Those with impaired glucose tolerance should be counselled about their risk for developing overt diabetes and referred for proper management. Drugs that may adversely affect glucose tolerance (e.g. Glucocorticoids) should be avoided. They should have annual assessment of their glycemic status. These patients should also be given advice regarding contraception and the planning of future pregnancy.

- Women with normal glucose tolerance should be counselled regarding their risk of developing GDM in subsequent pregnancies and type-2 diabetes in the future.

- Long-term follow-up is essential. Reassessment of glycemic status should be undertaken every two years

- In women who did not undergo screening for GDM, but diabetes is suspected postpartum because of infant outcome, postpartum screening for diabetes should be considered.
Introduction to Diabetes in Children

- Type-1 diabetes mellitus is not uncommon in the paediatric age group. Its proper recognition and early management can avoid acute and long-term chronic complications.
- All newly diagnosed children with type-1 diabetes should be referred to tertiary care for proper counselling and education.
- Diagnostic criteria for type-1 diabetes in children and adolescent is based on:
  1. Blood glucose measurement
  2. The presence or absence of symptoms.

According to these criteria, a diagnosis of diabetes can be made if:-
- Characteristic symptoms and signs are present
- Fasting blood glucose ≥7.0 mmol/l and or random blood glucose ≥11.1 mmol/l confirmed by the laboratory

Symptoms and signs:

Insidious:-
- Polyuria and polydipsia
- Weight loss
- Lethargy
- Nocturnal enuresis

Acute:-
- Vomiting
- Abdominal pain
- Dehydration
- Deep rapid breathing

Management of diabetes in children

- All children who present with symptoms of diabetes and are found to have fasting blood glucose ≥7 mmol/l or random blood glucose ≥11.1 mmol/l should be referred to a regional hospital for further diagnosis and management.
- After stabilisation of the patient in the regional hospital, these patients should be referred to a tertiary care center where a paediatric endocrinologist is available.
- In Muscat governorate, any newly diagnosed type-1 diabetes should be referred back to the Royal Hospital or the SQUH.
Acute complications in paediatric care

A. Hypoglycaemia:
All physicians should recognise the symptoms of hypoglycaemia and its treatment.

Symptoms of hypoglycaemia:
- Sweating
- Palpitation
- Headache
- Confusion
- Dizziness
- Convulsion

Table 14: Management of hypoglycaemia in symptomatic and asymptomatic children

<table>
<thead>
<tr>
<th>Asymptomatic with blood glucose &lt; 4 mmol/l</th>
<th>Symptomatic (drowsy or unconscious) and unable to take orally</th>
</tr>
</thead>
<tbody>
<tr>
<td>mild symptoms and the child is able to take orally</td>
<td>Give glucagon intramuscular injection</td>
</tr>
<tr>
<td>Give the child:</td>
<td>&gt;6 years → 1 mg</td>
</tr>
<tr>
<td>250 ml of water with two teaspoons of sugar</td>
<td>&lt;6 years → 0.5 mg</td>
</tr>
<tr>
<td>OR</td>
<td>▪ Establish i.v line and initiate intravenous 10% Dextrose as slow push 2 ml/kg.</td>
</tr>
<tr>
<td>250 ml of juice containing sugar</td>
<td>▪ Check blood glucose after 10 minutes, if the blood glucose (BG) is not raised:</td>
</tr>
<tr>
<td>o Repeat the above step after 15 minutes if the blood glucose remains &lt; 4mmol/l</td>
<td>1- Repeat 10% Dextrose 2 ml/kg as slow push</td>
</tr>
<tr>
<td>o Once the blood glucose is corrected to &gt; 4mmol/l, allow the child to have a snack</td>
<td>2- Followed by an infusion 5ml/kg/hr of 10% Dextrose.</td>
</tr>
<tr>
<td>▪ Refer patients to regional hospital</td>
<td>▪ NOTE: Recheck blood glucose every 15 minutes to ensure that it has increased to ≥ 4 mmol/l.</td>
</tr>
</tbody>
</table>
Section 8: Diabetes in children

B. Diabetic Ketoacidosis:

- A life-threatening condition due to the lack of insulin
- It is a medical emergency and should be managed with I.V fluids and insulin by a trained specialist Paediatrician.

Definition:

- Hyperglycaemia: (blood glucose ≥15 mmol/l) very rarely normo-glycemic DKA may occur.
- Metabolic acidosis: (venous blood gas PH ≤ 7.3 & HCO₃ ≤ 15 mmol/l)
- Ketonaemia or ketonuria

The role of the attending physicians in the management of DKA:

1. Stabilise the patient by checking ABC (Airway, Breathing and Circulation)

   **The Air way**
   
   A. If the patient is conscious and has acidotic breathing give the patient oxygen using a face mask or nasal cannula.
   B. If the patient is unconscious and unable to breath, put an oropharyngeal tube and ventilate using an ambu-bag.

2. Make a clinical assessment including:-
   
   A. Assessment of the degree of dehydration
   B. Blood pressure
   C. Pulse rate

3. Insert a cannula and collect blood for:
   
   A. Blood glucose (bedside finger prick for glucose)
   B. Urea and electrolyte (if available)
   C. Blood gas (if available)
   D. Urine for ketone (strips) if patient passed urine
   E. Start i.v fluid immediately, according to the patient status as given below:

If B.P is low and the patient is having tachycardia with poor peripheral circulation:

- Give the patient 20 ml/kg of normal saline over 10 minutes. This can be repeated three times or until you can record blood pressure
- If the patient is not in shock, give 10ml/kg bolus of Normal saline and assume that the patient has 10% dehydration
- Then calculate (Deficit + Maintenance ; the boluses given) as:
  
  - Deficit of 10% dehydration: (100 ml/kg/48 hours)
  - Daily maintenance over 24 hours (see the table)
Section 8: Diabetes in children

<table>
<thead>
<tr>
<th>First 10 kg body with</th>
<th>100 ml/kg/ 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next 10 kg body with</td>
<td>50 ml/kg/ 24 hours</td>
</tr>
<tr>
<td>After 20 kg body with</td>
<td>20 ml/kg/ 24 hours</td>
</tr>
</tbody>
</table>

(Practical example):
A five-year old child with type-1 diabetes on insulin treatment is found to have high BG and ketones in the urine (+++), the child’s weight is 10 kg and his B.P is not recorded, pulse 200/min, poor circulation. How would this patient be managed?

Clinical assessment for ABC (connect to oxygen by face mask)
1. Establish i.v line
2. Give 20 ml/ kg fluid slow bolus: (20mlX10kg) = 200 mL Normal saline over 10 minutes
3. Measure B.P/ Pulse
4. Still B.P low < 80/40 mmHg & pulse rate is high > 200
5. Give 20 ml/ kg fluid second bolus: (20ml X 10kg) = 200 mL Normal saline over 10 minutes
6. Measure B.P and pulse
7. If B.P 90/60 and pulse 120/min
8. Start i.v fluid with normal saline (0.9% Nacl) only, without potassium or dextrose
9. Calculate the deficit (100ml X 10kg)= 1000/48 hr = 21 ml/1 HR
10. Calculate maintenance (100ml X 10kg)=1000/24 hr = 41 ml/1 HR
11. Adding the two (deficit + maintenance), the patient will need 62 ml/hr (as normal saline)
12. Transfer the patient by ambulance to a regional hospital immediately

If there is delay in transferring the patient (> one hour) please start DKA management protocol

Sick-day rules
Illnesses like fever, common cold and tonsillitis can be associated with either increased blood glucose or lower blood glucose. The B.G can also drop if the patient is unable to eat normally.

What is your advice as a physician?
- Monitor blood glucose closely (every four hours)
- Encourage patient to take insulin (please do not stop insulin treatment)
- If blood glucose is low <5 mmol
  - Advise the patient to eat first then to re-check blood glucose, if blood glucose is >5 mmol/l, then give him/her the usual dose of insulin.
  - If the patient is unable to eat, encourage him/her to have fluids and soups and when BG is < 10 mmol/l reduce the dose of insulin by 20% of the total dose.
**Section 8: Diabetes in children**

- If blood glucose is 10-15 mmol – use the same treatment doses
- If B.G >17 – check ketones in urine; if (+) start 0.45% NACL as intravenous fluid maintenance and send the patient to a regional hospital.

**If the patient is on Lispro or aspart and glargine or levimir:**

- Continue with glargine or levimir
- Give lispro only if B.G >5mmol/l and when the child can eat
- If child unable to eat, hold on to the short-acting lispro or aspart
- If blood glucose 5-10 mmol/l; use the same treatment doses
- If B.G > 17mmol/l; check urine for ketones
- If urine ketones (+) and blood glucose > 15 mmol/l; start 0.45% Normal saline as maintenance

**Calculation of rescue doses of insulin:**

- Extra 10% of the total dose of insulin: if blood glucose >17 and ketones were negative
- Extra 20% of total dose of insulin: if blood glucose >17 and ketones are positive

**Advise the patient to take more clear fluid, such as water, laban and soup.**

**When to refer to the hospital (emergency room):**

- If the child has gastroenteritis (vomiting, loose motion) please refer to A/E (regional hospital) for proper monitoring and hydration
- Persistent hyperglycaemia B. G>17 mmol and ketone (+) in urine
- If symptomatic hypoglycaemia (not responding to treatment)

**When should you routinely refer the diabetic patient from the local health center to the tertiary care?**

1. Persistent poor glycaemic control
2. HbA1c >8% on two consecutive occasions
3. Recurrent episodes of DKA
4. Recurrent attack of hypoglycaemia
5. Failure to thrive

**NOTE:** HbA1c should be done over once in three months
Section 9: The role of primary care physician in diabetes

Introduction:
It is expected that all PHC physicians manage patients with diabetes mellitus in the PHC, without the need to refer simple cases to the regional hospital or regional diabetologist. The role of the primary health care physician is to elucidate symptoms of diabetes mellitus, screen high-risk groups, diagnose the condition, order appropriate investigations at his disposal, initiate treatment, follow-up patients and refer them as needed.

Who should be screened?
1. Any individual 40 years old or above
2. Any individual with symptoms that could be attributed to diabetes mellitus
   - Polyuria (especially at night), polydipsia and /or polyphagia
   - Unexplained weight loss
   - Tiredness, undue fatigue and general weakness, both physical and mental
   - Blurred vision or visual deterioration.
   - Pains and aches in the body and limbs.
   - Recurrent skin infections and slow healing of wounds.
   - Fungal infections especially of mouth and feet.
   - Numbness or tingling in fingers or toes.
   - Itching of genitals-balanitis and pruritus vulvae.
   - Loss or weakness of sexual drive and impotence
   - Foot ulceration or infection (cellulitis and abscesses).
3. Any individual with risk factors for diabetes mellitus.

The Initial Assessment
The PHC physician should use the “Diabetes Mellitus Initial & Annual Assessment form” to record the following:

A. Perform the initial or annual assessment registration according to the defined assessment form.

B. Assessment
   - Finger prick for glucose
   - Weight and height (to calculate BMI=Weight in Kg/Height2 in meters)
   - Blood pressure, pulse
   - Perform full physical examination
   - Look in the mouth for poor oral hygiene or hygiene or fungal infections and refer to dentist if needed.
Section 9: The role of primary care physician in diabetes

- Examine the lower limbs
  - Ankle jerk,
  - Feel peripheral pulses, dorsalis pedis and posterior tibial artery and look for calluses, cracks, wounds, fungal infections, ulcers and dry skin and see if patient has appropriate footwear
  - Use 10-gram monofilament to examine for pressure sensation in the feet.
  - Use a tuning fork (frequency 128) for checking loss of vibration sense

Diagnose diabetic neuropathy if any one of the following are present:

- Loss of sensation to the 10 gram monofilament
- Loss of vibration sensation to F128 tuning fork.

C. Laboratory investigations:

- If patient has not fasted, ask patient to come fasting next time for baseline serum lipids (total cholesterol, LDL, HDL, and TG).
- Complete the baseline laboratory investigations (Urea, Creatinine, eGFR, HbA1c etc)
- Send urine for micro-albuminuria.
- Baseline ECG.

D. Initiate treatment

- Discuss the treatment plan with the patient

E. Referrals

- Refer to the dietician, diabetes nurse and wound nurse or podiatrist
- Refer patient to the nearest ophthalmology clinic for baseline eye check-up
- If the patient is a complicated case or has other co-morbidities, refer to the regional diabetes specialty clinic and other speciality clinics

F. Diabetes register (to be filled by the nurse).

Allocate a registration number for each person. The number is coded as follows: the first three digits should represent the health facility code, the next four digits the month and year, and the last three digits the serial number of the person.
Section 9: The role of primary care physician in diabetes

G. Give the patient a diabetes/hypertension care booklet to be filled by nurse or doctor. The register number allotted on the diabetes register has to be entered into this booklet.

Sample of the diabetes and hypertension booklet (H/P7)

Follow-up plan

- This depends on the type of diabetes, glycemic control, and change in treatment as well as the presence of complications.

- Patients started on insulin or having a major change in insulin regime may need to be seen more frequently until reasonable control is achieved.
The Follow-up visits

A. History
- Inquire if patient still has symptoms of uncontrolled diabetes or infections
- Inquire about diet compliance
- Inquire about medication compliance and its acute complications (hypo or hyperglycaemia).
- Inquire if he/she has symptoms of any chronic complication (chest pain, eye sight, foot problems)
- Check if he/she has been to see the ophthalmologist and see if you have got a feedback
- Review previously ordered investigation (HbA1c, U&E, etc)
- Ask about tobacco and alcohol use
- Inquire about physical activity

B. Physical examinations & laboratory investigations
- Perform finger prick for glucose
- Measure Weight, height and waist circumference
- Measure blood pressure & pulse
- Examine the feet (Feel peripheral pulses, dorsalis pedis and posterior tibial artery. Inspect for wounds and ulcers, dry skin and assess if the patient is using appropriate footwear)
- HbA1c
  - 3-monthly in patients whose therapy has changed or those who are not meeting glycaemic control targets.
  - 6-monthly in patients who are meeting treatment goals and who have stable glycaemic control.

C. Clinical decisions
- Assess if the patient has adequate glycemic control
- Assess if the patient’s lipids and blood pressure are on target
- Modify his medications accordingly
- Ensure that the patient has received appropriate education
- Assess if the patient needs further referrals to other specialties

D. Documentation
- Ensure the proper documentation of your findings for all follow-up visits

The annual visits
- The main aim in these visits is to review your treatment strategies, to see if they have worked and assess for complications
## Section 9: The role of primary care physician in diabetes

### a. History
- Follow the same pattern as for regular follow-up visits.

### b. Physical examination
- Same as in the follow-up and initial assessment.

### c. Laboratory investigations
- Blood glucose (fasting or random), Urea and Electrolytes (U&E1)
- HbA1c
- Screen all diabetics for microalbuminuria on a yearly basis. Testing for microalbuminuria is done and early morning sample.
- Fasting lipids (total cholesterol, LDL, HDL, and TG). It should be done 3 month after any adjustment of lipid treatment. This could be done yearly if the patient does not have borderline or abnormal lipid profile.
- ECG and other tests as clinically indicated.

### d. Clinical decisions & documentation
Follow the same pattern as for follow-up visits, except that you need to also document your findings in the diabetes register until an electronic register is developed.

### e. Dealing with defaulters
Defaulter s are those who do not come for their annual assessment. The nurse should highlight the defaulter names in the list and hand it over to the medical record officer. The MR Officer should contact the patient and give him/her a new appointment.

1. Defaulters who passed away: Nurse should strike their names out of the diabetes register and keep a record (A4 page) list of the dead in the register. This will enable you to find the actual number of people with DM in your area.

2. Those who moved to live in another area in the same governorate or to a different governorate should be contacted by the medical record officer to receive a detailed medical report.
Section 10: Prevention of Diabetes Mellitus

Introduction:
Randomised controlled trials have shown that in subjects at high risk for developing type 2-diabetes (e.g. those with IGT, IFG and obesity), the adoption of a healthy lifestyle brings about significant reduction in the incidence of type-2 diabetes mellitus. These trials include the Finnish Diabetes Prevention Study, the Diabetes Prevention Program, Indian Prevention Study, Stop NIDDM, and the DREAM study.

The role of the Physician
- Increase awareness about diabetes and its complications.
- Involve community leaders in diabetes control activities like inviting them to inaugurate meetings.
- Highlight the importance of the deadly triangle – smoking, lack of physical exercise and an unhealthy diet as a strong risk factor for developing diabetes.
- Screen people who are at high risk for diabetes and its complications every year.

The people at high-risk for DM
Include those with:
- BMI >30kg/m²
- First degree relative (father, mother or affected siblings) with diabetes mellitus
- History of gestational diabetes mellitus or delivering a baby weighing >4kg
- Hypertensives (B.P >140/90mm Hg)
- Dyslipidaemia (abnormal total cholesterol and/or HDL and/or LDL cholesterol and/or triglycerides)
- History of IFG or IGT on prior testing.

Management recommendations
Emphasize the importance of lifestyle changes and weight loss for prevention of Type-2DM.

Recommendations include the following:
- Patients with IGT, IFG, or an HbA1c of 5.7–6.4% should be encouraged to loose 5–10% of their body weight and increase their physical activity to at least 150 min/week of moderate activity such as walking.
- Follow-up counselling and reinforcement appears to be important for success.
- Screening for the development of diabetes in those with pre-diabetes should be performed every year.

The indications of Metformin in pre-diabetes:
- Very high risk for developing diabetes with combined IFG and IGT plus other risk factors such as HbA1c >6%, low HDL cholesterol, elevated triglycerides, hypertension or family history of diabetes in a first-degree relative.
- Obese with pre-diabetes.
Section 11: Patient-provider interaction and communication skills

Introduction

Patient-physician communication is an integral part of clinical practice. When done well, such communication produces a therapeutic effect for the patient, especially with chronic and highly complex illnesses like diabetes, as has been concluded and validated in several studies. Formal training programs have been created to enhance and measure specific communication skills. Many of these efforts, however, focus on medical schools and early postgraduate years and, therefore, remain isolated in academic settings. Thus, the communication skills of the busy physician often remain poorly developed, and the need for established physicians to become better communicators continues. This chapter briefly reflects the effective communication skills that had been reviewed and studied by several researchers from different countries and hence considered as evidence base for clinical practice.

Communication skills

It is important to understand that the medical consultation is a core clinical skill for all health-care providers particularly at the primary care level. Physicians and other health care providers need to have quality communication skills and to have a good relationship with their patients to support their learning and effectively manage their illness. Focusing particularly on patient-doctor interaction is not enough with regard to management of diabetes, but it could be better to emphasize also on the other providers’ skills who constitute the health care team.

There are different definitions of good communication and several verbal and non-verbal types of behaviour that have been found to be important for creating a good patient-provider communication during consultations at the primary care level.

These types of behaviour are objectively measurable and have been linked in empirical studies with favourable patient outcomes such as satisfaction and recall, intermediate outcomes such as adherence/compliance, and long-term outcomes such as symptom resolution and better quality of life.
Table 15 summarises the common verbal and non-verbal behaviour for good communication skills:

### Table 15: Verbal and non-verbal behaviour for good communication

<table>
<thead>
<tr>
<th>Positive Non-Verbal Communication Skills</th>
<th>Positive Verbal Communication Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body position</td>
<td>Friendly welcoming</td>
</tr>
<tr>
<td>Head nodding or gestures- to encourage patients to talk/continue</td>
<td>Empathy and courtesy</td>
</tr>
<tr>
<td>Attentive listening to patients’ symptoms and concerns</td>
<td>Reassurance and support</td>
</tr>
<tr>
<td>Eye contact to patients with less mutual gaze</td>
<td>Good history taking</td>
</tr>
<tr>
<td>Positive facial expression</td>
<td>Various patient-centred techniques</td>
</tr>
<tr>
<td>Use the computer less, or pay less attention to the computer during medical encounters or while the patient is talking</td>
<td>Explanations</td>
</tr>
<tr>
<td></td>
<td>Positive reinforcement</td>
</tr>
<tr>
<td></td>
<td>Orienting the patient during physical examination</td>
</tr>
<tr>
<td></td>
<td>Appropriate consultation length</td>
</tr>
<tr>
<td></td>
<td>Summarisation and clarification</td>
</tr>
</tbody>
</table>

Section 11: Patient-provider interaction and communication skills

Barriers to good physician-patient communication and communication traps to avoid are also summarised in Table 16:

Table 16: Barriers and communication traps to avoid\textsuperscript{13,18}

<table>
<thead>
<tr>
<th>Barriers to good physician-patient communication</th>
<th>Communication traps to avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech ability or language articulation</td>
<td>Using highly technical language or jargon when communicating with the patient</td>
</tr>
<tr>
<td>Foreign language spoken</td>
<td>Not showing appropriate concern for problems voiced by the patient</td>
</tr>
<tr>
<td>Dysphonia</td>
<td>Not pausing to listen to the patient</td>
</tr>
<tr>
<td>Time constraints on physician or patient</td>
<td>Not verifying that the patient has understood the information presented</td>
</tr>
<tr>
<td>Speech ability or language articulation</td>
<td>Using an impersonal approach or displaying any degree of apathy in communications</td>
</tr>
<tr>
<td>Unavailability of physician or patient to meet face-to-face</td>
<td>Not becoming sufficiently available to the patient</td>
</tr>
<tr>
<td>Cerebral-vascular event or altered mental state</td>
<td>Interrupted patient’s and consultation privacy e.g.: by telephone calls; knocking in the door; entry of uninvited patient to consultation room etc.</td>
</tr>
<tr>
<td>Medication effect</td>
<td></td>
</tr>
<tr>
<td>Psychological or emotional distress</td>
<td></td>
</tr>
<tr>
<td>Gender differences</td>
<td></td>
</tr>
<tr>
<td>Racial or cultural differences</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

Source:


Section 11: Patient-provider interaction and communication skills

Factors affecting provider-patient interaction (from providers’ and patients’ sides)
Some problems in communications can arise during history taking or during discussion of how the patient’s complaints should be managed. These problems may be related to a lack of communication skills on the part of either the physician or the patient. Furthermore, the influence of culture should be considered.19-22

Physicians’ barriers:
Physicians’ barriers to good interaction could be related to:
1. Lack of knowledge
2. Lack of interest
3. Lack of adherence to guidelines
4. Lack of support from other trained providers (e.g. nurses; dieticians or health educators)
5. Poor patient adherence or poor response to treatment
6. Unsuccessful efforts to encourage the patients to achieve lifestyle changes can create frustration

Patients’ barriers
1. Non-acceptance of diabetes
2. Absence of symptoms
3. Divergent cultural concepts
4. Chronicity of the disease
5. Specific expectations and beliefs
6. Co-morbid conditions
7. Low education level

Culture and communication
Patient-provider interaction is also affected by the social and cultural background of the provider and the patient. Culture has an important influence on many aspects of a person’s life such as behaviour, beliefs and attitudes to illness and health and on dietary beliefs and practices that sometimes are difficult to change. Culture must always be seen in its particular context which is made up of historical, religious, ritual, family structure, diet, social and geographical elements that mutually influence culture and are also influenced by culture.22 In addition, linguistic barriers and different ways of interpreting experience with illness and treatment can cause problems in the communication and understanding when the patient and health-care provider come from different cultures.23 In this respect, to help diabetic patients to gain real and better control over their diabetes, health-care professionals need to understand patients’ health beliefs, how they perceive the disease, and other social norms.24 To gain patients’ cooperation, the health care providers should support patients and facilitate their empowerment by encouraging them to make informed personal decisions in their everyday life with diabetes and to enhance their participation in the consultations. This requires major changes in provider-patient interaction from authoritarian to a more sharing and supportive approach.24,25 Several researches concluded that diabetes patients who had medical encounters characterised by patient-centred care were found to be more satisfied and had better health outcomes.26,27 In this context, this chapter will also highlight the concept of patient-centred care as an important part of good communication and interaction with patients.
Summary and key messages
To improve adherence of patients to medication, oral hypoglycaemic agents or insulin, it has been suggested that instead of increasing the dose, changing the medication, adding a second drug or blaming the patients, clinicians and diabetes team members should consider support to the patients through education on self-management behaviour and patient-centred care using good communication skills. 19,28-30 Moreover, to gain patient compliance to all aspects of care, and for good metabolic control and health outcomes, it has been emphasised that all diabetes patients need to be provided with knowledge about the management of diabetes, and it is important to organise care that satisfies individual needs and favours patient education, aiming at empowering patient participation in self-care as an integral part of the patient-centred approach. 31-34
Section 12: WHO/ISH Cardiovascular risk scoring

Annexure: WHO/ISH Cardiovascular risk scoring
Adapted for guideline use from its publication source


1. Introduction
The WHO/ISH prediction charts for 14 WHO epidemiological sub-regions indicate 10-year risk of a fatal or non-fatal major cardiovascular event (myocardial infarction or stroke), according to age, sex, blood pressure, smoking status, total blood cholesterol and presence or absence of diabetes mellitus. There are two sets of charts. One set can be used in the setting where blood cholesterol can be measured. The other set is for a setting in which blood cholesterol cannot be measured. Each chart can only be used in the specific WHO epidemiological sub-region. The list of WHO/ISH risk prediction charts for EMR B, in which they can be used for its Member States are shown in table below.

List of WHO/ISH risk prediction charts by epidemiological sub-regions and WHO Member States for the Eastern Mediterranean

<table>
<thead>
<tr>
<th>WHO/ISH risk prediction charts by epidemiological sub-regions</th>
<th>WHO Member States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Mediterranean</td>
<td>EMR B</td>
</tr>
<tr>
<td>Bahrain, Iran (Islamic Republic of), Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates</td>
<td></td>
</tr>
</tbody>
</table>

Mortality strata: A: very low child mortality and very low adult mortality; B: low child mortality and low adult mortality; C: low child mortality and high adult mortality; D: high child mortality and high adult mortality; E: high child mortality and very high adult mortality.

2. Instructions on how to use WHO/ISH (World Health Organization/ International Society of Hypertension) risk prediction charts
The charts provide approximate estimates of cardiovascular disease (CVD) risk in people who do not have established coronary heart disease, stroke or other atherosclerotic disease. They are useful as tools to help identify those at high cardiovascular risk, and to motivate patients, particularly to change behaviour and, when appropriate, to take antihypertensive, lipid-lowering drugs and aspirin.

How do you use the charts to assess cardiovascular risk?

- First make sure that you select the appropriate charts using information in the table above.
- If blood cholesterol cannot be measured due to resource limitations, use the charts that do not have total cholesterol.
- Before applying the chart to estimate the 10-year cardiovascular risk of an individual, the following information is necessary.
Section 12: WHO/ISH Cardiovascular risk scoring

1. Presence or absence of diabetes\(^1\)
2. Gender
3. Smoker or non-smoker
4. Age
5. Systolic blood pressure\(^2\)
6. Total blood cholesterol (if in mg/dl divide by 38 to convert to mmol/l)

Once the information is available proceed to estimate the 10-years cardiovascular risk as follows:

**Step 1** Select the appropriate chart depending on the presence or absence of diabetes\(^1\)

**Step 2** Select male or female tables

**Step 3** Select smoker or non-smoker boxes\(^3\)

**Step 4** Select age group box (if age is 50-59 years select 50, if 60-69 years select 60 etc)

**Step 5** Within this box find the nearest cell where the individuals’ systolic blood pressure (mm Hg) and total blood cholesterol level (mmol/l)\(^4\) cross. The colour of this cell determines the 10-year cardiovascular risk.

\(^1\) A person who has diabetes is defined as someone taking insulin or oral hypoglycaemic drugs, or with a fasting plasma glucose concentration above 7.0 mmol/l (126 mg/dl) or a post-prandial (approximately 2 hours after a main meal) plasma glucose concentration above 11.0 mmol/l (200 mg/l) on two separate occasions). For very low resource settings urine sugar test may be used to screen for diabetes if blood glucose assay is not feasible. If urine sugar test is positive a confirmatory blood glucose test need to be arranged to diagnose diabetes mellitus.

\(^2\) Systolic blood pressure, taken as the mean of two readings on each of two occasions, is sufficient for assessing risk but not for establishing pretreatment baseline.

\(^3\) All current smokers and those who quit smoking less than 1 year before the assessment are considered smokers for assessing cardiovascular risk.

\(^4\) The mean of two non-fasting measurements of serum cholesterol by dry chemistry, or one non-fasting laboratory measurement, is sufficient for assessing risk.

**Practice points**

Please note that CVD risk may be higher than indicated by the charts in the presence of the following:

1. Already on antihypertensive therapy
2. Premature menopause
3. Approaching the next age category or systolic blood pressure category
4. Obesity (including central obesity);
5. Sedentary lifestyle;
6. Family history of premature coronary heart disease (CHD) or stroke in first degree relative (male < 55 years, female < 65 years);
7. Raised triglyceride level (> 2.0 mmol/l or 180 mg/dl);
8. Low HDL (high density lipoprotein) cholesterol level (< 1 mmol/l or 40mg/dl in males, <1.3 mmol/l or 50 mg/dl in females);
9. Raised levels of C-reactive protein, fibrinogen, homocysteine, apolipoprotein B or Lp(a), or fasting glycaemia, or impaired glucose tolerance;
10. Microalbuminuria (increases the 5-year risk of diabetics by about 5%)
11. Raised pulse rate.
12. Socioeconomic deprivation

**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%
Section 12: WHO/ISH Cardiovascular risk scoring

WHO sub-regions EMR B

WHO/ISH risk prediction chart for EMR B. 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.

Risk Level

- <10%
- 10% to <20%
- 20% to <30%
- 30% to <40%
- ≥40%

### EMR B People with Diabetes Mellitus

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
<th>SBP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-smoker</td>
<td>Smoker</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>60</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>50</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>40</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
</tbody>
</table>

### EMR B People without Diabetes Mellitus

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
<th>SBP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-smoker</td>
<td>Smoker</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>60</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>50</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
<tr>
<td>40</td>
<td>[Chart]</td>
<td>[Chart]</td>
<td>[Values]</td>
</tr>
</tbody>
</table>


References


