Introduction

In 2008, the HKSAR Working Group on Primary Care of the Food and Health Bureau set up three Task Forces, one of which was charged with producing Conceptual Model and Preventive Protocols. One of the reference frameworks was on diabetes care in primary care settings. The advisory group members contributing to the framework included experts in the academia, endocrinologists, primary care physicians, representatives from various medical organisations and patient groups. As part of their remit, the Task Force was responsible for “promulgating, maintaining and revising the models and frameworks”. The guideline thus produced draws on best evidence from international literature and offers recommendations based on different levels of hierarchical evidence. It adopts a life-course approach, encouraging continuous, patient-centred, coordinated and comprehensive approach based on the major principles of primary care. It was designed for use by primary care physicians and allied health professionals in the clinic and in community settings.

This article summarises the main contents of the reference framework on diabetes, and recommends future directions of diabetes care in Hong Kong’s primary care settings. The reference framework consists of a core document and a series of different modules. The core document includes information on the epidemiology of diabetes, population-based interventions, the role of primary care in its management, patient education, prevention, early identification, complication monitoring, drug treatment, patient empowerment, and rehabilitation. It is anticipated that the adoption of this framework will contribute to better control of this chronic condition in the primary care setting.

Epidemiology of diabetes: an increasingly serious health issue

Diabetes has been evolving as a worldwide epidemic and constitutes one of the important global burdens of diseases. The reference framework for diabetes care has been produced by the Task Force on Conceptual Model and Preventive Protocols of the Working Group on Primary Care, so as to enhance the clinical care for diabetes patients. The guideline emphasises a comprehensive, coordinated approach with interdisciplinary collaboration between major primary care stakeholders throughout the life of the patient. It was developed by drawing on evidence from international literature with input from primary care physicians, as well as specialists including endocrinologists, doctors from public and private sectors, as well as representatives from patient groups. This article presents the latest updates on the management of diabetes, ranging from its epidemiology, patient education, prevention, early identification, complication monitoring, drug treatment, patient empowerment, and rehabilitation. It is anticipated that the adoption of this framework will contribute to better control of this chronic condition in the primary care setting.
Hong Kong population will have diabetes, involving more than one million inhabitants.9 Diabetes induces a substantial public health burden as it is the leading cause of cardiovascular diseases, stroke, renal failure, visual loss, and leg amputation.10,11

Population approach in the prevention and control of diabetes across the life course

The control and management of diabetes using a population approach could address the whole spectrum of problems including health promotion, disease prevention, treatment, and rehabilitation.12-14 Different stages of patients’ life course will have their specific needs, which should be met by tailor-made strategies of healthy behaviour promotion, risk assessment, early disease detection, complication monitoring, and timely management. Table 1 shows the recommended approach applicable for use by primary care physicians in Hong Kong.

Prevention and early identification of diabetes

Primary care physicians could effectively reduce the incidence of diabetes by interventions targeting weight reduction and healthy dietary habits.15-21 In addition, patients with risk factors for diabetes should be screened using fasting plasma glucose, haemoglobin A1c or the oral glucose tolerance test (OGTT) as appropriate. The screening interval is recommended to be 3-yearly if results are normal, but more frequently in particularly high-risk groups (Box).22,23 According to the diagnostic criteria of the American Diabetes Association, diabetes is defined as a fasting plasma glucose of $\geq 7.0$ mmol/L, 2-hour plasma glucose of $\geq 11.1$ mmol/L during an OGTT, a random plasma glucose of $\geq 11.1$ mmol/L among those with classic symptoms of hyperglycaemia or hyperglycaemic crisis, or a glycated haemoglobin (HbA1c) of $\geq 6.5\%$. Repeated evaluations are recommended for confirmation of the diagnosis in the absence of unequivocal hyperglycaemia.

Assessment and treatment of patients diagnosed with diabetes

On initial diagnosis of diabetes, a comprehensive assessment of risk factors and diabetes complications should be undertaken. It is recommended that patients’ psychosocial aspects, need for carer support, and lifestyle behaviour including diet, physical activity, smoking, and alcohol consumption be assessed. These annual evaluations include body mass index, waist circumference, physical activity levels, dietary assessment, review of smoking status, measurement of blood pressure, lipid profile
TABLE 1. Framework for population approach in the prevention and control of diabetes across the life course

<table>
<thead>
<tr>
<th>Age-group</th>
<th>Lifestyle advice</th>
<th>Risk assessment</th>
<th>Early identification</th>
<th>Disease management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenatal</td>
<td>• Balanced diet</td>
<td>Risk factors for GDM</td>
<td>• Offer 75 g OGTT to those with risk factors of GDM</td>
<td>In women with GDM</td>
</tr>
<tr>
<td></td>
<td>• Regular intake of carbohydrates</td>
<td>• BMI ≥30 kg/m²</td>
<td></td>
<td>• Joint experts management</td>
</tr>
<tr>
<td></td>
<td>• Lower in fat</td>
<td>• Previous macromomic baby weighing ≥4.5 kg†</td>
<td></td>
<td>• Self-care advice</td>
</tr>
<tr>
<td></td>
<td>• Plenty of fruits, vegetables</td>
<td>• Previous GDM</td>
<td></td>
<td>• Early antenatal care</td>
</tr>
<tr>
<td></td>
<td>• Regular exercise</td>
<td>• Family history (first-degree relatives of DM)</td>
<td></td>
<td>• Perform OGTT and risk factor assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 weeks after delivery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Regular disease surveillance</td>
</tr>
<tr>
<td>Infancy</td>
<td>• Breast feeding and avoid obesity</td>
<td>• Monitor weight gain</td>
<td>-</td>
<td>• Monitor fetal growth</td>
</tr>
<tr>
<td></td>
<td>• Adequate sleep</td>
<td>-</td>
<td>-</td>
<td>Obstetric complications in women with GDM</td>
</tr>
<tr>
<td>Childhood</td>
<td>• Abstain from smoking</td>
<td>• Monitor weight for height</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• Regular exercise, adequate sleep, healthy eating</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• avoid excessive intake of sugar beverages</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• Increase physical activities in leisure time, avoid</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• excessive time on TV or computer games</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adulthood and</td>
<td>• Abstain from smoking</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>elderly</td>
<td>• Smoking cessation for smokers</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• Healthy eating</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• Weight management</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>• Regular exercise</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* BMI denotes body mass index, DM diabetes mellitus, GDM gestational diabetes mellitus, and OGTT oral glucose tolerance test

† The cut-offs of macrosomic baby was adapted from the Scottish Intercollegiate Guidelines Network guideline No. 116 ‘Management of Diabetes’

**BOX. High-risk groups of diabetes**

BMI denotes body mass index, LDL-C low-density lipoprotein–cholesterol, HDL high-density lipoprotein, and TG triglyceride

High-risk groups include:
- Age ≥45 years
- Family history (first-degree relatives) of diabetes
- Overweight (BMI ≥23 kg/m²) or obese (BMI ≥27.5 kg/m²)
- Abdominal circumference ≥80 cm for females and ≥90 cm for males
- Previous impaired glucose tolerance or impaired fasting glucose
- Hypertension
- Metabolic syndrome
- Clinical cardiovascular disease
- Presence of other cardiovascular risk factors (eg high LDL-C, low HDL, or high TG)
- Smoking
- Physical inactivity
- Women with a history of gestational diabetes mellitus/big baby, polycystic ovarian syndrome, long-term systemic steroid therapy

Monitoring, as well as HbA1c 6-monthly or even more frequently especially among younger individuals,21-25 Seasonal influenza vaccination is recommended for diabetes patients.26

The most important aim for treatment is to control hyperglycaemia, as well as concomitant cardiovascular risk factors like hypertension, lipid disorders, obesity, and albuminuria.

Major clinical trials demonstrated that early aggressive glycaemic control is associated with lower rates of microvascular complications and long-term cardiovascular risks,22,26 yet the risks of hypoglycaemia should be balanced especially among elderly patients. The targets of treatment could act as a reference for modifying treatment strategies (Table 2).
TABLE 2. Adult treatment target values

<table>
<thead>
<tr>
<th>Item*</th>
<th>Ideal control</th>
<th>Unsatisfactory control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting plasma glucose (mmol/L)</td>
<td>4-7</td>
<td>≥8</td>
</tr>
<tr>
<td>Glycated haemoglobin (upper limit of normal, %)</td>
<td>&lt;7 (&lt;110)</td>
<td>≥8 (≥130)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>&lt;23</td>
<td>≥27.5</td>
</tr>
<tr>
<td>Waist circumference¹ for male¹</td>
<td>&lt;90 cm (&lt;36 inches) and BMI &lt;23</td>
<td>≥90 cm (≥36 inches)</td>
</tr>
<tr>
<td>Waist circumference for female¹</td>
<td>&lt;80 cm (&lt;32 inches) and BMI &lt;23</td>
<td>≥80 cm (≥32 inches)</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>&lt;130</td>
<td>≥140</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>&lt;80</td>
<td>≥90</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>&lt;4.5</td>
<td>≥6.2</td>
</tr>
<tr>
<td>HDL-cholesterol for male (mmol/L)</td>
<td>&gt;1.0⁶</td>
<td>&lt;0.9</td>
</tr>
<tr>
<td>HDL-cholesterol for female (mmol/L)</td>
<td>&gt;1.3⁶</td>
<td>&lt;0.9</td>
</tr>
<tr>
<td>LDL-cholesterol (mmol/L)</td>
<td>&lt;2.6 (&lt;1.8 in patients with coronary heart disease)</td>
<td>≥3.4</td>
</tr>
<tr>
<td>Triglyceride (mmol/L)</td>
<td>&lt;1.7⁷</td>
<td>≥2.8</td>
</tr>
</tbody>
</table>

* BMI denotes body mass index, HDL high-density lipoprotein, and LDL low-density lipoprotein

† “Guide to physical measurement” issued by World Health Organization in 2008 provides reference method for measuring waist circumference:
   - Place a tape measure around the bare abdomen, just above the hip bone
   - Be sure the tape is snug, but does not compress the skin
   - The tape should be parallel to the floor, midway between the top of the iliac crest and the lower rib margin on each side
   - The patient should relax and exhale while the measurement is made

‡ May not be applicable to elderly age-groups

§ Source: Reference 23

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**FIG 2. Treatment options for type 2 diabetes**

HbA₁c denotes glycated haemoglobin

- Oral combination = metformin + one or more of sulphonylurea, DPP-4 inhibitor, thiazolidinedione, α-glucosidase inhibitors (modified from IDF-WPR guideline 2005,⁷ ADA/EASD 2009,⁸ AACE 2009⁹)
The choice of drug treatment depends on the level of glycaemic control. Unless contra-indicated, metformin is now used as a first-line agent (Fig 2). Among patients with HbA1c <7.5%, metformin monotherapy could be initiated, whilst early combination therapy should be considered if HbA1c is between 7.5% and 9%. For poorly controlled diabetes patients (HbA1c >9% despite 3-6 months of optimised drug therapy), basal insulin or addition of insulin to oral hypoglycaemic agents could be instituted. It is important to avoid medications which may aggravate weight gain in obese patients, like high doses of sulphonylureas, insulin, or a glitazone.

The choice of medications should be based on knowledge of the underlying pathophysiology, their side-effect profiles, the degree of hyperglycaemia, and risks of hypoglycaemia especially among the higher-risk individuals (e.g., elderly, the alcoholics, patients with renal or liver impairment). Most of these drug classes are similarly efficacious and combination therapy within the same class is generally not preferred (Table 3).

Management of diabetes complications

The macrovascular complications, namely coronary heart disease, stroke, and peripheral artery disease, should be cautiously screened during clinic visits. These include history taking to explore the respective symptoms, palpation of peripheral pulses, and electrocardiography for patients with cardiovascular risk factors (even if they are asymptomatic).

The major microvascular complications include diabetic nephropathy, neuropathy, and retinopathy. Early signs of diabetic nephropathy include microalbuminuria, followed by macroalbuminuria. Regular screening of renal function is important as its progressive deterioration signifies the need for renal dialysis and transplantation. Assessment of plasma creatinine and random albumin:creatinine ratio is needed. Other causes of microalbuminuria like urinary tract infection, severe hyperglycaemia, cardiac failure, and vigorous physical activity require exclusion (Fig 3a). If not contra-indicated, patients presenting with microalbuminuria should be prescribed angiotensin-converting enzyme inhibitors or angiotensin receptor blockers to reduce progression to diabetic nephropathy. If they are not tolerated, patients should be maintained normotensive by resorting to other antihypertensive drug classes. In case of overt diabetic nephropathy or proteinuria, renal ultrasonography and urine microscopy can be used to exclude non-diabetic causes.

For assessment of diabetic eye diseases, patients should initially undergo a proper dilated eye examination, which includes checking for visual acuity, lens opacity, and retinopathy. Retinal photography instead of direct ophthalmoscopy is

| TABLE 3. Mode of actions, benefits, and side-effects of blood glucose–lowering drugs |
|---|---|---|---|
| Drugs | Reduction in glycated haemoglobin (HbA1c in %) | Main mode of action | Benefits | Side-effects and limitations |
| Metformin | 1.5 | Lower production of hepatic glucose | No weight gain; cheap | Gastro-intestinal complaints; lactic acidosis (very rare) |
| Sulphonylureas | 1.5 | Stimulate insulin secretion | Cheap | Hypoglycaemia, sometimes severe and of long duration; weight gain |
| Thiazolidinediones | 0.5-1.5 | Improve insulin sensitivity | Improve lipid profile and pioglitazone may reduce risk of cardiovascular disease | Fluid retention, which can cause heart failure (rare), weight gain, bone fracture, pioglitazone should not be used in patients with a history of carcinoma of bladder or in patients with uninvestigated visible blood in urine; expensive |
| α-Glucosidase inhibitors | 0.5-0.8 | Retard intestinal absorption of glucose | No weight gain; low risk of hypoglycaemia | Gastro-intestinal side-effects; multiple daily dosing required; expensive |
| Meglitinides | 1-1.5 | Stimulate insulin secretion | Short-acting, less risk of hypoglycaemia | Need to be taken at meal time; expensive |
| Dipeptidylpeptidase 4 inhibitors | 0.5-1.0 | Stimulate insulin secretion, suppress glucagon production | Low risk of hypoglycaemia; no weight gain | Experience limited; expensive |
| GLP-1 analogues | 0.5-1.0 | Stimulate insulin secretion, suppress glucagon production | Low risk of hypoglycaemia; promote weight loss | Experience limited; needs to be injected |
| Subcutaneous insulin | >2 | Stimulate peripheral glucose uptake and inhibit hepatic glucose output | Reduce severe hyperglycaemia; cheap; much experience | Weight gain; hypoglycaemia; needs to be injected; blood glucose must be monitored |
FIG 3. (a) Screening and management of diabetic renal disease

All people with type 2 diabetes from diagnosis

Assessment of:
- Random spot urine ACR
- Serum creatinine

For ACR
- <2.5 mg/mmol in men or
- <3.5 mg/mmol in women

Routine care
- Target blood pressure control <130/80 mm Hg
- Target HbA\textsubscript{1c} level <7%
- Lifestyle intervention
- Reduce body weight if obese/overweight
- Management of modifiable cardiovascular risk factors

For ACR
- ≥2.5-25 mg/mmol in men or
- ≥3.5-25 mg/mmol in women

Exclude other causes, for examples:
- Urinary tract infection
- Severe hyperglycaemia
- Cardiac failure
- Vigorous physical activity
- Contamination with blood
- Other renal disease
- An abnormal initial test requires confirmation by 2 out of 3

For ACR
- >25 mg/mmol

Overt diabetic nephropathy or proteinuria
- Perform renal ultrasound scan to exclude non-diabetes causes
- Test urine microscopy

Management of confirmed microalbuminuria
- ACE inhibitors or angiotensin receptor blockers irrespective of BP level unless there is significant hypotension, eg BP <100/60 mm Hg
- Target BP control <130/80 mm Hg
- Target HbA\textsubscript{1c} <7%
- Lifestyle intervention
- Reduce body weight if obese/overweight
- Management of modifiable cardiovascular risk factors

Management of overt diabetic nephropathy or proteinuria
- ACE inhibitors or angiotensin receptor blockers irrespective of BP level unless there is significant hypotension, eg BP <100/60 mm Hg
- Target BP control <130/80 mm Hg
- Target HbA\textsubscript{1c} <7%
- Lifestyle intervention
- Reduce body weight if obese/overweight
- Management of modifiable cardiovascular risk factors

For ACR
- ≥2.5-25 mg/mmol in men or
- ≥3.5-25 mg/mmol in women

Exclude other causes, for examples:
- Urinary tract infection
- Severe hyperglycaemia
- Cardiac failure
- Vigorous physical activity
- Contamination with blood
- Other renal disease
- An abnormal initial test requires confirmation by 2 out of 3

Follow-up:
- Annual assessment

Refer to specialists

now the best evidence-based practice.\textsuperscript{36-38} It should be performed annually but less frequent examination every 2 to 3 years is acceptable following one or more normal eye examinations. Patients with a background of retinal abnormality should have more frequent evaluations as they are at higher risk of developing diabetic retinopathy, whilst patients with any level of macular oedema, severe non-proliferative diabetic retinopathy, or any proliferative diabetic retinopathy should be promptly referred to an ophthalmologist (Fig 3b).\textsuperscript{39,40}

Annual foot examinations can reveal diabetes neuropathy. Any trivial lesions should be treated aggressively. The examinations include foot inspection, foot pulses, and detection of loss of protective sensation using 10-g monofilament, 128-Hz tuning fork, pinprick sensation, ankle reflexes, or vibration perception threshold.\textsuperscript{41,42} Certain abnormal findings warrant referral, for instance, active ulceration, callosities or corns, toe and nail deformities, absent peripheral pulses, and abnormal peripheral sensation. Simple management strategies for diabetic foot in the primary care sector include advice on footwear, additional support like custom-built footwear or orthotic insoles, and treatment of skin infections (Fig 3c).
Conclusion

Diabetes is becoming a worldwide epidemic. Its increasing incidence in Hong Kong will inevitably increase the burden on the health care system. However, primary care physicians are in a privileged position to provide comprehensive, and first-contact care entailing collaboration with specialists in other disciplines. A life-course approach with emphasis on early preventive care and regular screening is a crucial step towards its control as it is obviously the most cost-effective strategy to manage chronic disease. Efforts from physicians and other allied health care professionals alone are not adequate if patient education and self-care are not appropriately emphasised. This highlights a need to implement community-based educational programmes to enhance patient empowerment in conjunction with extensive adoption of this reference framework in primary care settings.

Acknowledgements

We would like to acknowledge the Members of the Task Force on Conceptual Model and Preventive Protocols of the Working Group on Primary Care and the two Clinical Advisory Groups for their invaluable contributions in the development of the reference frameworks.
All people with type 2 diabetes from diagnosis

Proper foot assessment
- Assessment of foot pulses
- Assessment for loss of protective sensation
- Inspection for:
  - skin cracks
  - callus
  - infection
  - deformities
  - state of nails

Presence of the following conditions?
- Active ulcer
- Callusities or corns
- Foot or toe or nail deformities
- In-growing toe nail
- Absent peripheral pulse
- Abnormal peripheral sensation

Yes → Early referral to specialists

No → Management
- Advise on proper footwear
- Discuss the need for additional support (eg prescription of custom-built footwear or orthotic insoles)
- Treat all skin infections
  - frequent wound dressing
  - debridement
  - administration of broad-spectrum antibiotics
- Annual assessment

Figure 3. (c) Assessment and management of diabetic foot problems

References


