MEDICAL PRACTICE

# The reference framework for diabetes care in primary care settings

CME

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**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.**

## 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.[1] One of the reference frameworks was on diabetes care in primary care settings.[2] 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".[2] 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, drug treatment, and patient empowerment. It is supplemented by 11 modules, where more detailed recommendations are presented on strategies of preventive care, dietary and exercise interventions, glucose control and monitoring, drug treatment, as well as management of diabetic complications. A summary of the diabetes reference framework is shown in Figure 1.

**Key words**
Diabetes mellitus; Hong Kong; Prevalence; Risk factors

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## Epidemiology of diabetes: an increasingly serious health issue

According to estimates of the International Diabetes Federation, there were 285 million people suffering from diabetes worldwide, and this figure was projected to reach 438 million in 2030.[3] In the next few decades, diabetes will be among the most common chronic diseases, which will pose a serious global public health threat.[4,5] In Hong Kong, the prevalence of diabetes is also rising; currently it affects one in 10 individuals or a total of about 700 000 subjects.[6] Among persons aged younger than 35 years, 2% suffered from diabetes while among subjects aged older than 65 years, the proportion was 20%.[6,7] Half of the patients with diabetes remain undiagnosed.[7,8] The prevalence of diabetes and impaired glucose tolerance rises in older age-groups, which adds a further burden to the health care system for the ageing population.[8] By the year 2025, it was estimated that 12.8% of the

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 $A_{1c}$ 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 ≥7.0 mmol/L, 2-hour plasma glucose of ≥11.1 mmol/L during an OGTT, a random plasma glucose of ≥11.1 mmol/L among those with classic symptoms of hyperglycaemia or hyperglycaemic crisis, or a glycated haemoglobin ($HbA_{1c}$) of ≥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

## 糖尿病參考概覽：糖尿病患者在基層醫療的護理

糖尿病已成為全球性疾病，亦是帶來沉重經濟負擔的重要病患之一。香港基層醫療工作小組轄下的基層醫療概念模式及預防工作常規專責小組為加強對糖尿病人的臨床護理，編制了糖尿病參考概覽。此概覽是為糖尿病患者人生中主要的持分者提供參考，為他們提供全面及協調的跨學科治理模式。此概覽根據國際文獻為實證基礎、並由基層醫療護理的醫生，以及包括內分泌科的專科醫生、公立及私家醫院醫生和病人組織的代表組成。本文載有治理糖尿病的最新資料，探討其流行病學、病人教育、預防、早期識別、併發症監察、藥物治療、病人權益及復康。希望藉著此概覽，在基層醫療層面上能更有效地控制這種慢性疾病。

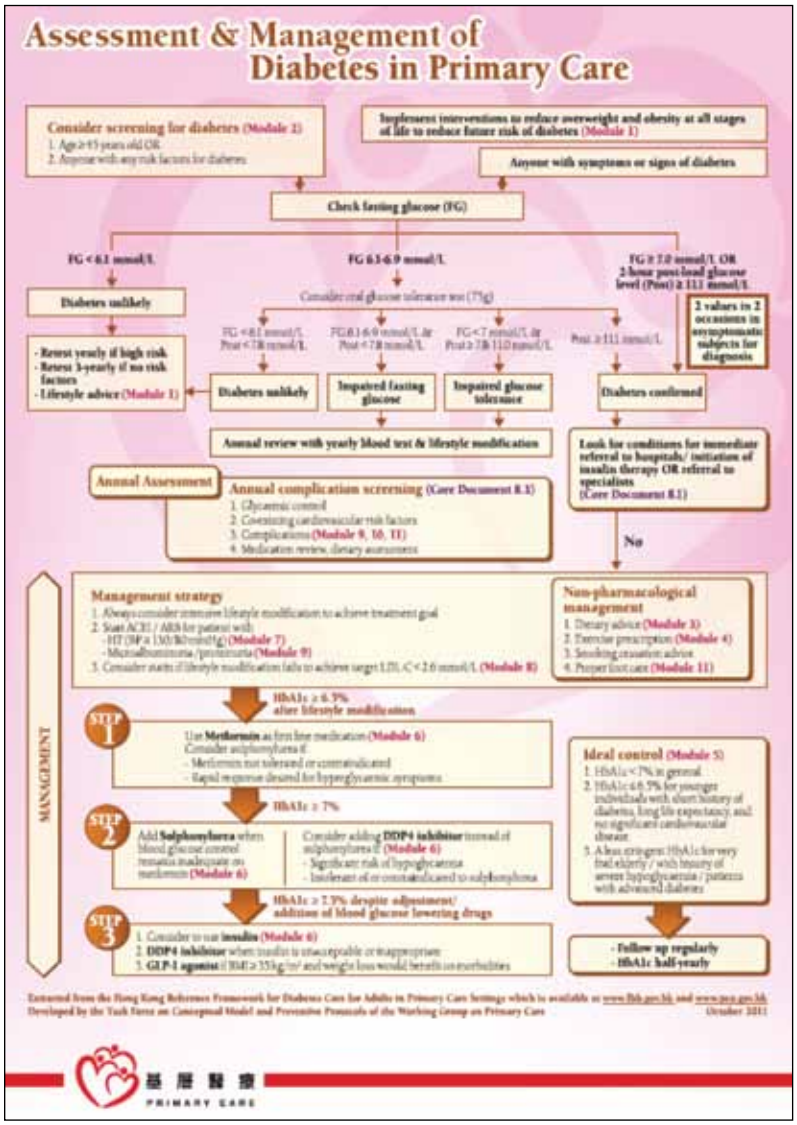


**FIG 1. One-page summary of the Hong Kong reference framework for diabetes care for adults in primary care settings**

Adapted from the Hong Kong reference frameworks for diabetes care for adults in primary care settings, 2010. The cut-off value of 6.1 mmol/L of normal and impaired fasting glucose is adopted from 2006 WHO Recommendations for the Diagnostic Criteria for Diabetes and Intermediate Hyperglycaemia. Reprinted with permission from the Primary Care Office, Department of Health, HKSAR

TABLE 1. Framework for population approach in the prevention and control of diabetes across the life course*

| Age-group | Lifestyle advice | Risk assessment | Early identification | Disease management | Complication monitoring | Rehabilitation care |
|---|---|---|---|---|---|---|
| Antenatal | • Balanced diet<br>• Regular intake of carbohydrates<br>• Lower in fat<br>• Plenty of fruits, vegetables<br>• Regular exercise | Risk factors for GDM<br>• BMI ≥30 kg/m$^2$<br>• Previous macrosomic baby weighing ≥4.5 kg†<br>• Previous GDM<br>• Family history (first-degree relatives) of DM | • Offer 75 g OGTT to those with risk factors of GDM | In women with GDM<br>• Joint experts management<br>• Self-care advice<br>• Early antenatal care<br>• Perform OGTT and risk factor assessment 6 weeks after delivery<br>• Regular disease surveillance | • Monitor fetal growth<br>• Obstetric complications in women with GDM | - |
| Infancy | • Breast feeding and avoid obesity<br>• Adequate sleep | • Monitor weight gain | - | - | - | - |
| Childhood | • Abstain from smoking<br>• Regular exercise, adequate sleep, healthy eating and avoid excessive intake of sugar beverages<br>• Increase physical activities in leisure time, avoid excessive time on TV or computer games | • Monitor weight for height | - | Work closely with experts to:<br>• improve glycaemic and risk factor control<br>• advise on daily living and psychological support to child and parents<br>• advise on prevention and detection of ketoacidosis<br>• monitor growth and development | • Growth and development<br>• Diabetic emergencies | - |
| Adulthood and elderly | • Abstain from smoking<br>• Smoking cessation for smokers<br>• Healthy eating<br>• Weight management<br>• Regular exercise | • Monitor BMI and abdominal circumference<br>• Family history of DM<br>• History of GDM<br>• Presence of other risk factors | • Early identification using fasting glucose | • Self-care advice and risk factor control<br>• Complications assessment and referral to specialist care as appropriate<br>• Educate carer and provide support<br>• Beware of reduced renal and liver function and increased risk of drug toxicity and hypoglycaemia in elderly | • Avoid hypoglycaemia<br>• Manage diabetic complications in collaboration with specialists | • Optimise coping skills<br>• Provide support to carer<br>• Multidisciplinary approach |

* 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/m$^2$) or obese (BMI ≥27.5 kg/m$^2$)
- 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 $HbA_{1c}$ 6-monthly or even more frequently especially among younger individuals.[23-25] 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,[27,28] 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

| Item* | Ideal control | Unsatisfactory control |
|---|---|---|
| Fasting plasma glucose (mmol/L) | 4-7 | ≥8 |
| Glycated haemoglobin (upper limit of normal, %) | <7 (<110) | ≥8 (≥130) |
| BMI (kg/m$^2$) | <23 | ≥27.5 |
| Waist circumference† for male‡ | <90 cm (<36 inches) and BMI <23 | ≥90 cm (≥36 inches) |
| Waist circumference for female‡ | <80 cm (<32 inches) and BMI <23 | ≥80 cm (≥32 inches) |
| Systolic blood pressure (mm Hg) | <130 | ≥140 |
| Diastolic blood pressure (mm Hg) | <80 | ≥90 |
| Total cholesterol (mmol/L) | <4.5 | ≥6.2 |
| HDL-cholesterol for male (mmol/L) | >1.0§ | <0.9 |
| HDL-cholesterol for female (mmol/L) | >1.3§ | <0.9 |
| LDL-cholesterol (mmol/L) | <2.6 (<1.8 in patients with coronary heart disease) | ≥3.4 |
| Triglyceride (mmol/L) | <1.7§ | ≥2.8 |

* 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

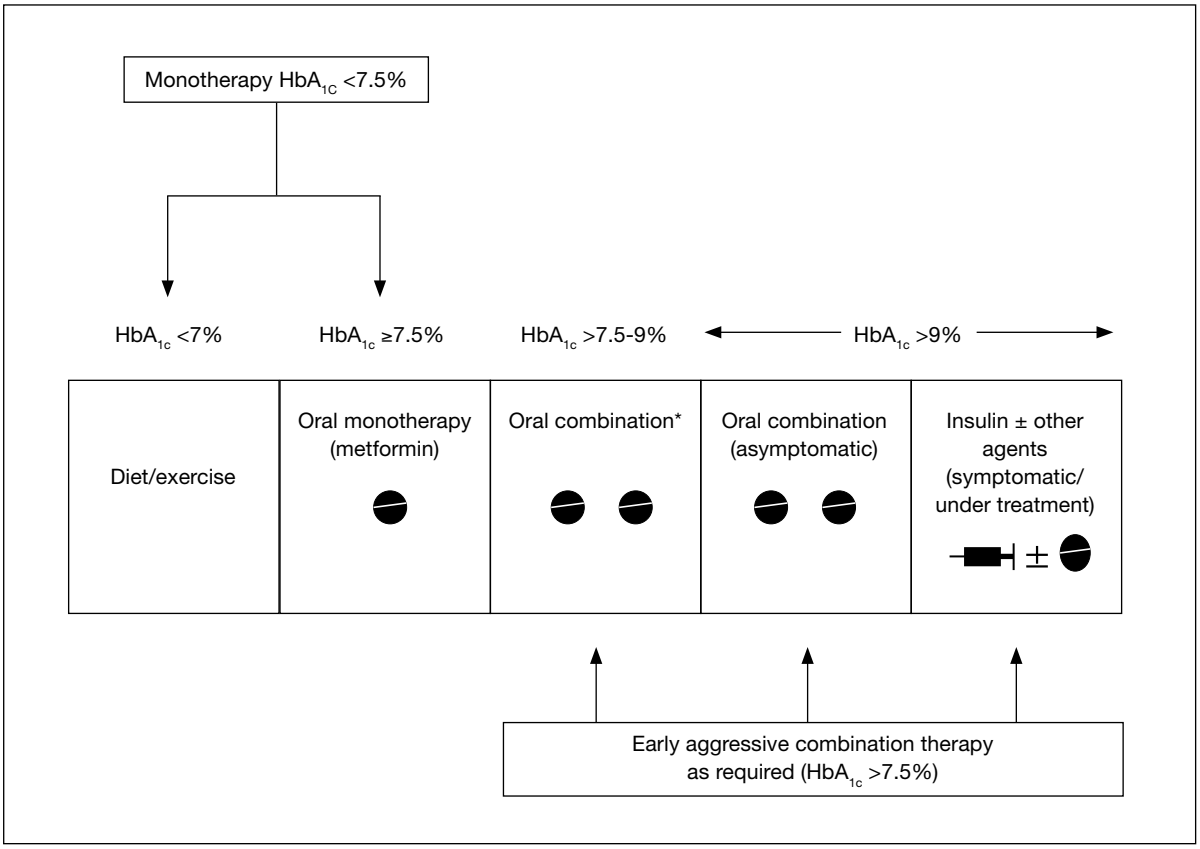


FIG 2. Treatment options for type 2 diabetes
$HbA_{1c}$ denotes glycated haemoglobin

* Oral combination = metformin + one or more of sulphonylurea, DPP-4 inhibitor, thiazolidinedione, α glucosidase inhibitors (modified from IDF-WPR guideline 2005,[29] ADA/EASD 2009,[30] AACE 2009[31])

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[29-31]). Among patients with $HbA_{1c}$ <7.5%, metformin monotherapy could be initiated, whilst early combination therapy should be considered if $HbA_{1c}$ is between 7.5% and 9%. For poorly controlled diabetes patients ($HbA_{1c}$ >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 (eg 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.[32-34] 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.[35] 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 ($HbA_{1c}$ 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 |

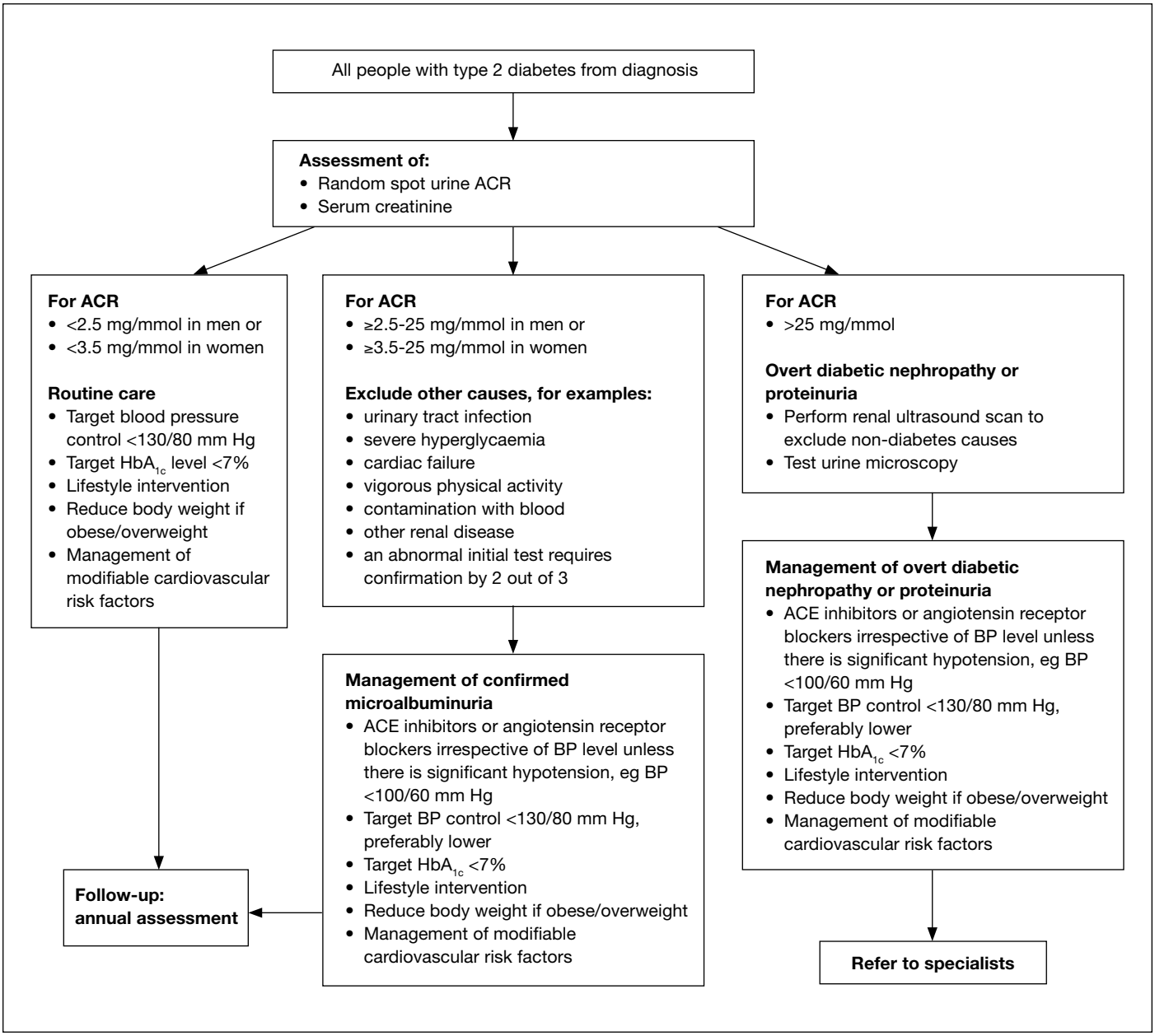


FIG 3. (a) Screening and management of diabetic renal disease[2]
ACR denotes albumin-creatinine ratio, $HbA_{1c}$ glycated haemoglobin, ACE angiotensin-converting enzyme, and BP blood pressure

now the best evidence-based practice.[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).[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.[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).

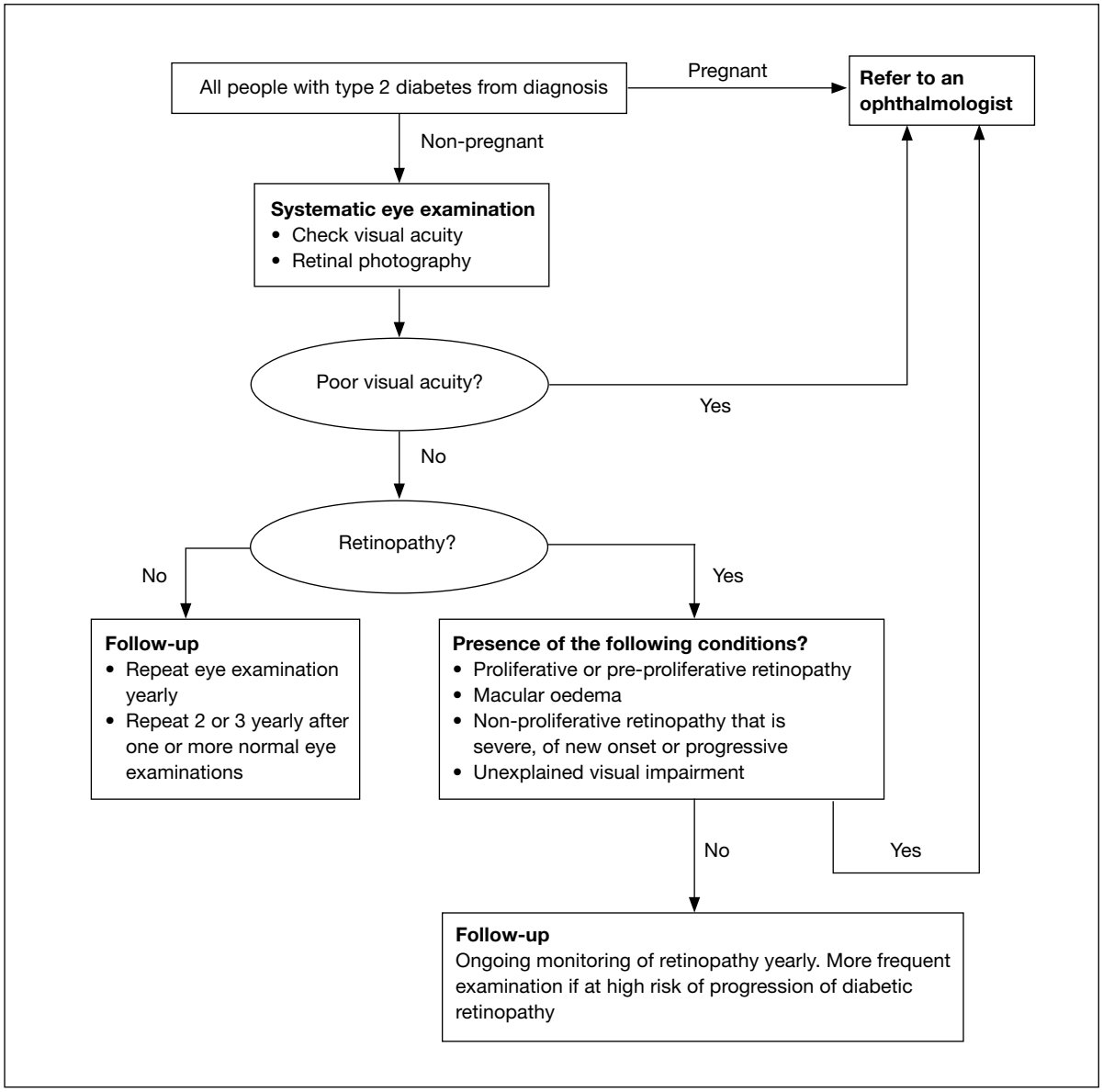


FIG 3. (b) Screening and management of diabetic eye disease[2]
Dilated direct ophthalmoscope by an experienced doctor should only be used opportunistically and is not a substitute for systematic screening programme. Such opportunistic screening is an option only if systematic screening by retinal photography is not possible/ available

## 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.

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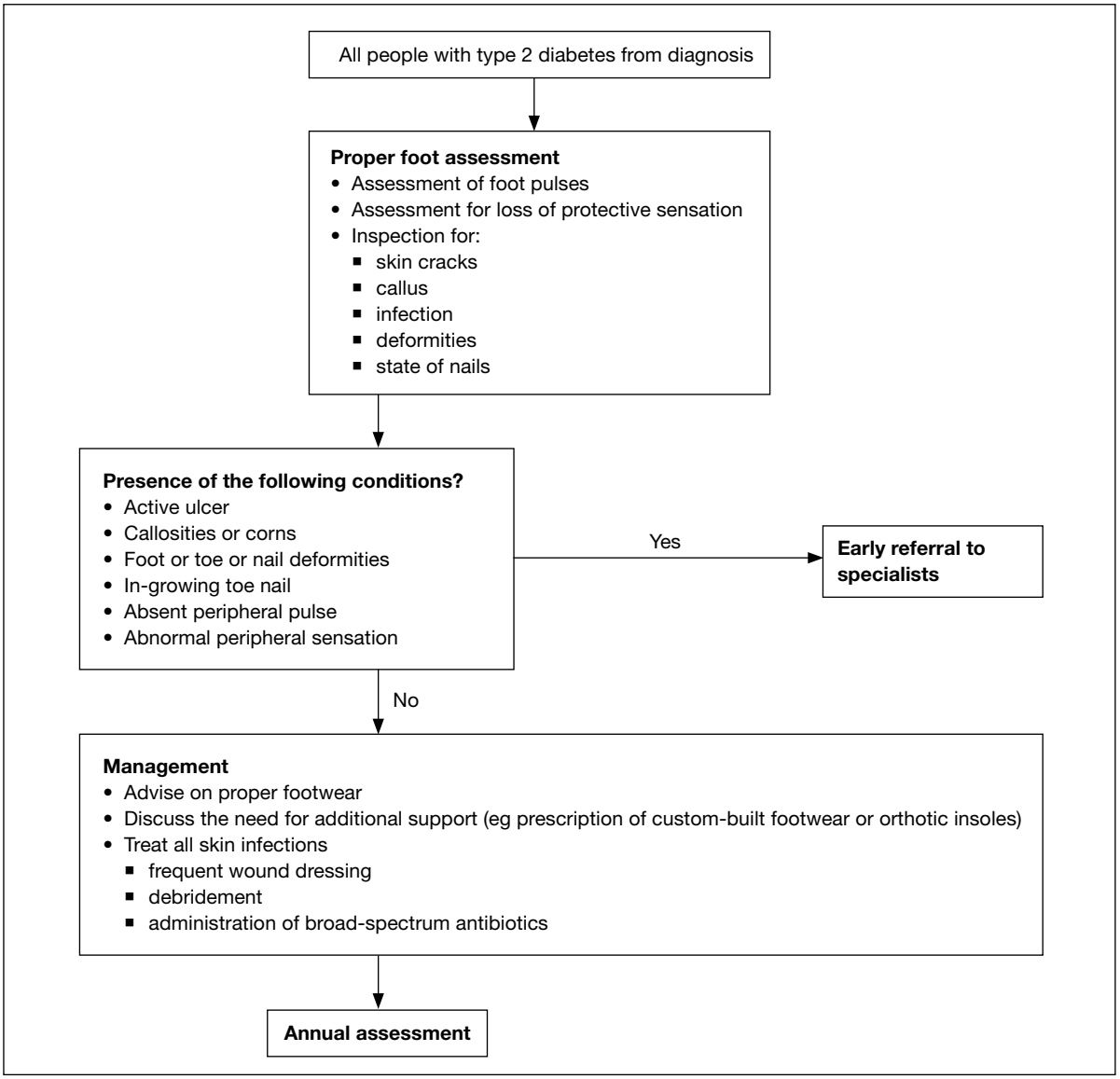


FIG 3. (c) Assessment and management of diabetic foot problems[2]

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