

# *General practice management of type 2 diabetes*

2014–15



## General practice management of type 2 diabetes – 2014–15

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Supporting the education programs of Diabetes Australia



# *Type 2 diabetes: goals for optimum management*

The table on the flip side lists goals for optimum diabetes management that all people with diabetes should be encouraged to reach.

This table has been specifically designed as a card for you to pull out and place on your desk or nearby for easy reference.



RACGP



Diabetes  
Australia

## Type 2 diabetes: goals for optimum management

Encourage all people with type 2 diabetes to approach/reach these goals	
Diet	Normal healthy eating. If concerns regarding cardiovascular risk, advise Mediterranean diet.
Body mass index (kg/m <sup>2</sup> )	Therapeutic goal is 5–10% loss for people overweight or obese with type 2 diabetes. With BMI >35 and comorbidities or BMI >40, greater weight loss measures should be considered. Note that BMI is a difficult parameter to standardise between different population groups.
Physical activity	At least 30 minutes of moderate physical activity on most if not all days of the week (total ≥150 minutes/week).
Cigarette consumption	0 (per day)
Alcohol consumption	≤2 standard drinks (20 g) per day for men and women.
BGL	6–8 mmol/L fasting and 8–10 mmol/L postprandial. Ongoing self-monitoring of blood glucose is recommended for people with diabetes using insulin, with hyperglycaemia arising from illness, with haemoglobinopathies, pregnancy or other conditions where data on glycaemic patterns is required. Routine self-monitoring of blood glucose in low-risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended.
HbA1c (mmol/mol; %)	Needs individualisation according to patient circumstances. Generally: <ul style="list-style-type: none"> <li>• ≤53 mmol/mol (range 48–58)</li> <li>• ≤7% (range 6.5–7.5).</li> </ul> Allowing for normal variation in test accuracy, HbA1c results which range between 6.5 and 7.5% would reflect this goal.
Total cholesterol (mmol/L) <4.0	Initiation of pharmacotherapy is dependent on the assessment of absolute cardiovascular risk (Refer to the Australian absolute CVD risk calculator). This requires using multiple risk factors, which is considered more accurate than the use of individual parameters. Once therapy is initiated the specified targets apply; however, these targets should be used as a guide to treatment and not as a mandatory target.
HDL-C (mmol/L) ≥1.0	
LDL-C (mmol/L) <2.0	
Non-HDL-C (mmol/L) <2.5	
Triglycerides (mmol/L) <2.0	
Blood pressure (mmHg) 130/80	
Urinary albumin excretion	Timed overnight collection (mcg/min): <20 Spot collection (mg/L): <20 Urinary albumin-to-creatinine ratio <ul style="list-style-type: none"> <li>• Women (mg/mmol): &lt;3.5</li> <li>• Men (mg/mmol): &lt;2.5</li> </ul>
Vaccination	Consider immunisation against influenza and pneumococcal disease, and the dTPa vaccine.



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## *About the RACGP*

The RACGP is Australia's largest professional general practice organisation and represents urban and rural GPs. We represent more than 26,500 members working in or towards a career in general practice and are proud that more than 22,500 GPs in Australia have chosen to be a member of the RACGP.

The RACGP is responsible for defining the nature of the discipline, setting the standards and curriculum for education and training, maintaining the standards for quality clinical practice, and supporting GPs in their pursuit of excellence in patient care and community service. We offer our members access to a vast suit of clinical resources, business support tools, education programs and are proud to advocate for the general practice profession on behalf of all GPs.

The RACGP advocates and promotes high-quality diabetes management and care through:

regular articles in *Australian Family Physician*, the most widely read peer-reviewed general practice journal in Australia, available at [www.racgp.org.au/afp/](http://www.racgp.org.au/afp/)

- advocacy on key issues related to diabetes management
  - partnership with Diabetes Australia in the production of this handbook
  - access to an extensive library collection, with many items available electronically
- the flagship products *Guidelines for preventive activities in general practice* (the Red Book), *Putting prevention into practice* (the Green Book) and *SNAP: a population health guide to behavioural risk factors in general practice*, available at [www.racgp.org.au/your-practice/guidelines/](http://www.racgp.org.au/your-practice/guidelines/)

# *About Diabetes Australia*

Diabetes Australia is the national body for people affected by all types of diabetes and those at risk. We are committed to reducing the impact.

Diabetes Australia combines the voice of consumers, health professionals and researchers committed to reducing the impact of diabetes.

Diabetes Australia has four key activities:

- **Leadership** – national advocacy and raising of national awareness to support policies and programs to benefit all people affected by diabetes
- **Management** – national self-management programs and promoting the best possible management of diabetes to help prevent complications
- **Prevention** – national prevention programs for the 2–3 million Australians at high risk of developing type 2 diabetes and whole of population, primary prevention
- **Research** – supporting, funding and promoting the best diabetes research.

Diabetes Australia is the Australian member of the International Diabetes Federation (IDF), through which we work to reduce the impact of diabetes in the Western Pacific region and throughout the world.

## Working with general practice

- Diabetes Australia publishes the *Diabetes Management Journal* quarterly, to inform GPs and health professionals in the field of diabetes management. This ensures that the latest information on the optimum care for people with diabetes, and the latest developments in diabetes management are delivered to frontline healthcare providers. The *Diabetes Management Journal* is available through Diabetes Australia, and professional membership of state and territory diabetes organisations ([www.diabetesaustralia.com.au](http://www.diabetesaustralia.com.au)).

## National Diabetes Services Scheme – how your patients will benefit from membership

Diabetes Australia administers the National Diabetes Services Scheme in conjunction with state and territory diabetes organisations as Agents. The NDSS is an Australian Government initiative and has operated successfully for 27 years to provide subsidies on diabetes self-management products and support services. As at December 2013 there were over 1,100,000 Australians registered with the NDSS.

Through the NDSS, people with diabetes can receive telephone support through the National Infoline **1300 136 588**, along with a range of diabetes information and education resources targeted for type 1 diabetes, type 2 diabetes and gestational diabetes.

## Educational resources from Diabetes Australia

Membership of state and territory diabetes organisations provides access to a wide range of educational resources and support for people with diabetes, their families and carers, including information sheets in different languages available for free download from [www.diabetesaustralia.com.au](http://www.diabetesaustralia.com.au) with links to state and territory diabetes organisations.

# *Acronyms*

ABI	Ankle brachial index
ACE	Angiotensin converting enzyme
ACEI	Angiotensin converting enzyme inhibitor
ADA	American Diabetes Association
ADIPS	Australian Diabetes in Pregnancy Society
AN	Acanthosis nigricans
ARA	Angiotensin-receptor antagonist
ARB	Angiotensin receptor blocker
AUSDRISK	Australian Type 2 Diabetes Risk Assessment Tool
BGL	Blood glucose level
BMI	Body mass index
BP	Blood pressure
CAD	Coronary artery disease
CCM	Chronic Care Model
CKD	Chronic kidney disease
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DBP	Diastolic BP
DKA	Diabetic ketoacidosis
DR	Diabetic retinopathy
DPP4	Dipeptidyl peptidase-4
dTPa	Diphtheria-tetanus-acellular pertussis
ECG	Electrocardiogram
eGFR	Estimated glomerular filtration rate
FBG	Fasting blood glucose
GAD	Glutamic acid decarboxylase
GDM	Gestational diabetes mellitus
GFR	Glomerular filtration rate
GLP-1	Glucagon-like peptide-1
GP	General practitioner
GPMP	General Practice Management Plan

HbA1c	Glycated haemoglobin
HDL-C	High density lipoprotein cholesterol
HONC	Hyperosmolar nonketotic coma
IA -2	Insulinoma antigen 2
IFG	Impaired fasting glucose
IGT	Impaired glucose tolerance
LADA	Latent autoimmune diabetes of adults
LDL-C	Low density lipoprotein cholesterol
MBS	Medicare Benefits Scheme
MODY	Maturity onset diabetes of the young
NDSS	National Diabetes Services Scheme
NHMRC	National Health and Medical Research Council
NPS	National Prescribing Service
NSAID	Non-steroidal anti-inflammatory drug
NVDPAA	National Vascular Disease Prevention Alliance
OCP	Oral contraceptive pill
OGTT	Oral glucose tolerance test
OHA	Oral hypoglycaemic agent
PAD	Peripheral arterial disease
PAID	Problem Areas in Diabetes
PBS	Pharmaceutical Benefits Scheme
PCOS	Polycystic ovary syndrome
PHQ-2	Patient Health Questionnaire-2
RACGP	The Royal Australian College of General Practitioners
RBG	Random blood glucose
RCT	Randomised controlled trial
SBP	Systolic blood pressure
SGLT2	Sodium glucose co-transporter 2
SIGN	Scottish Intercollegiate Guidelines Network
SMBG	Self-monitoring of blood glucose
SNAP	Smoking, nutrition, alcohol, physical activity
TCA	Team Care Arrangements
TGA	Therapeutic Goods Administration
UACR	Urinary albumin-to-creatinine ratio

## Type 2 diabetes: goals for optimum management

Encourage all people with type 2 diabetes to approach/reach these goals	
<b>Diet</b>	<p>Normal healthy eating.</p> <p>If concerns regarding cardiovascular risk, advise Mediterranean diet.</p>
<b>Body mass index (kg/m<sup>2</sup>)</b>	<p>Therapeutic goal is 5–10% loss for people overweight or obese with type 2 diabetes.</p> <p>With BMI &gt;35 and comorbidities or BMI &gt;40, greater weight loss measures should be considered.</p> <p>Note that BMI is a difficult parameter to standardise between different population groups.</p>
<b>Physical activity</b>	<p>At least 30 minutes of moderate physical activity on most if not all days of the week (total ≥150 minutes/week).</p>
<b>Cigarette consumption</b>	<p>0 (per day)</p>
<b>Alcohol consumption</b>	<p>≤2 standard drinks (20 g) per day for men and women.</p>
<b>BGL</b>	<p>6–8 mmol/L fasting and 8–10 mmol/L postprandial.</p> <p>Ongoing self-monitoring of blood glucose is recommended for people with diabetes using insulin, with hyperglycaemia arising from illness, with haemoglobinopathies, pregnancy or other conditions where data on glycaemic patterns is required.</p> <p>Routine self-monitoring of blood glucose in low-risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended.</p>
<b>HbA1c (mmol/mol; %)</b>	<p>Needs individualisation according to patient circumstances. Generally:</p> <ul style="list-style-type: none"> <li>• ≤53 mmol/mol (range 48–58)</li> <li>• ≤7% (range 6.5–7.5).</li> </ul> <p>Allowing for normal variation in test accuracy, HbA1c results which range between 6.5 and 7.5% would reflect this goal.</p>

## Encourage all people with type 2 diabetes to approach/reach these goals

<b>Total cholesterol (mmol/L) &lt;4.0</b>	<p>Initiation of pharmacotherapy is dependent on the assessment of absolute cardiovascular risk (Australian absolute CVD risk calculator). This requires using multiple risk factors, which is considered more accurate than the use of individual parameters.</p> <p>Once therapy is initiated the specified targets apply; however, these targets should be used as a guide to treatment and not as a mandatory target.</p>
<b>HDL-C (mmol/L) ≥1.0</b>	
<b>LDL-C (mmol/L) &lt;2.0</b>	
<b>Non-HDL-C (mmol/L) &lt;2.5</b>	
<b>Triglycerides (mmol/L) &lt;2.0</b>	
<b>BP (mmHg) 130/80</b>	<p>Timed overnight collection (mcg/min): &lt;20</p> <p>Spot collection (mg/L): &lt;20</p> <p>Urinary albumin-to-creatinine ratio</p> <ul style="list-style-type: none"> <li>• Women (mg/mmol): &lt;3.5</li> <li>• Men (mg/mmol): &lt;2.5</li> </ul>
<b>Urinary albumin excretion</b>	
<b>Vaccination</b>	<p>Consider immunisation against influenza and pneumococcal disease, and the dTPa vaccine.</p>





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# 1. Introduction

Diabetes is a national health priority. The number of people with type 2 diabetes is growing, most likely the result of rising overweight and obesity rates, lifestyle and dietary changes, and an ageing population. Within 20 years, the number of people in Australia with type 2 diabetes may increase from an estimated 870,000 in 2014, to over 2.5 million.<sup>1</sup> The most socially disadvantaged Australians are twice as likely to develop diabetes.

If left undiagnosed or poorly managed, type 2 diabetes can lead to coronary artery disease (CAD), stroke, kidney failure, limb amputations and blindness. The early identification and optimal management of people with type 2 diabetes is therefore critical. General practice has the central role in type 2 diabetes management across the spectrum, from identifying those at risk right through to caring for patients at the end of life. These guidelines support general practitioners (GPs) and their teams to provide high-quality management by providing up-to-date, evidence-based information tailored for general practice.

In the development of the 2014–15 edition of *General practice management of type 2 diabetes*, the RACGP has focused on factors relevant to current Australian clinical practice. The RACGP has used the skills and knowledge of your general practice peers who have an interest in diabetes management and are members of the RACGP's National Faculty of Specific Interests Diabetes Network.

This edition represents 18 years of a successful relationship between the RACGP and Diabetes Australia. We acknowledge the support of the RACGP National Standing Committee – Quality Care, the Medical Education and Scientific Committee of Diabetes Australia, and RACGP staff in the development of these guidelines. We would also like to acknowledge the contribution of the previous editorial panel (Dr Pat Phillips, Dr Peter Harris, Dr Linda Mann and Ms Carole Webster), whose dedication and commitment to previous editions has been instrumental to the success of these guidelines.

## 1.1 Defining type 2 diabetes

Diabetes is a group of disorders and the tenth leading cause of deaths in Australia. There are four clinical classes of diabetes:

1. **Type 1 diabetes** – results from  $\beta$  cell destruction due to an autoimmune process usually leading to insulin deficiency.
2. **Type 2 diabetes** – results from a progressive insulin secretory defect on the background of insulin resistance.
3. **Gestational diabetes mellitus (GDM)** – any degree of glucose intolerance with onset or first recognition during pregnancy.
4. **Other specific types of diabetes** – due to other causes such as genetic defects in  $\beta$  cell function, genetic defects in insulin action, diseases of the exocrine pancreas (e.g. cystic fibrosis), and drug- or chemical-induced causes (e.g. in the treatment of HIV/AIDS or after organ transplantation).

Type 2 diabetes is a largely preventable, chronic and progressive medical condition that results from two major metabolic dysfunctions: **insulin resistance** and then pancreatic islet cell dysfunction causing a relative **insulin deficiency**. In the individual, these occur due to modifiable lifestyle-related risk factors interacting with genetic risk factors.

The relative insulin deficiency leads to chronic hyperglycaemia and multiple disturbances in carbohydrate, protein and fat metabolism including:

- $\beta$  islet cell dysfunction, failure of response to insulin signalling and increased islet cell apoptosis
- $\alpha$  cell dysfunction with elevated glucagon levels
- resultant disorders of hepatic gluconeogenesis and insulin resistance with elevated glucose production
- muscle cell insulin resistance with decreased glucose uptake
- kidney adaptation with altered gluconeogenesis and increased glucose reabsorption via increased sodium glucose transporter protein activity
- diminished incretin hormonal production or incretin resistance
- maladaptive cerebral hormonal responses to insulin and appetite
- increased lipolysis with elevated free fatty acids.

## 1.2 A patient-centred approach

Throughout these guidelines we refer to patient-centred care.

The concept of patient-centred care incorporates the patient experience of care and patients as partners in their healthcare.<sup>2</sup> In practice, this means providing care that is ‘respectful of and responsive to individual patient preferences, needs and values, and ensures that patient values guide all clinical decisions’<sup>3</sup> and supports self-management.

Understanding a patient’s diabetes-related (and comorbidity) experiences can improve patient–practitioner communication and help the GP understand their patient’s priorities for education, resources and management. This is essential for building and adapting diabetes management plans to be consistent with an individual patient’s needs.

## 1.3 How to use these guidelines

These guidelines have been designed to provide pragmatic, evidence-based recommendations for use in general practice and adopt the most recent recommendations from organisations including the National Health and Medical Research Council (NHMRC), the Scottish Intercollegiate Guidelines Network (SIGN), the American Diabetes Association (ADA) and other relevant sources. The recommendations tables include the reference or source of each recommendation, and the grade of recommendation. In cases where these are not available or current, results of systematic reviews and primary research studies have been considered to formulate the overall recommendation. References to support these recommendations are included.

In each section, where possible, information is presented as:

- recommendations
- clinical context (or what you need to know)
- in practice (or what you can do).

Information specific to the Aboriginal and Torres Strait Islander population is highlighted in boxed text. Recommendations in some areas are different for Aboriginal and Torres Strait Islander patients. It is therefore important to identify, record and report the Aboriginal and Torres Strait Islander status of patients. The RACGP has a position paper outlining the processes of identification, available at [www.racgp.org.au/yourracgp/faculties/aboriginal](http://www.racgp.org.au/yourracgp/faculties/aboriginal).

See *Appendix A: Summary, explanation and source of recommendations*.

## *2. Clinical governance – sustaining and improving high standards of care*

The RACGP defines clinical governance as a framework through which clinicians and health service managers are jointly responsible and accountable for patient safety and quality care.<sup>4</sup>

Within this framework are embedded the principles of recognisably high standards of care, transparent responsibility and accountability for maintaining those standards, and a constant dynamic of quality improvement.<sup>5</sup>

### 2.1 Applying a clinical governance framework to diabetes care

Achieving equitable, safe, effective and high-quality care for patients across the spectrum of type 2 diabetes is no small task. It requires a coordinated interaction between patients, healthcare providers and the healthcare system with a focus on improving the patient experience and outcomes throughout the continuum of care.

Each of these elements requires systems and support. For example, comprehensive care for diabetes starts with prevention: through timely identification of at-risk individuals, education and support, it is possible to prevent or delay the onset of type 2 diabetes. The key is implementing risk assessment strategies and subsequently having the resources and communication strategies to effect change in patients' lifestyles. These need to operate and be supported at both local and national levels.

Effective leadership is essential. Owners of a general practice (and others involved in its corporate governance) play an active role in developing these systems by cultivating a culture focused on clinical quality and patient-centred care.

### In practice

Applying a clinical governance approach to your general practice means focusing on:

- **patients** – providing high-quality, effective and ongoing care, and ensuring good communication and support to enable patients to be informed and involved
- **healthcare teams** – ensuring adequate training and resources for the practice team and developing working relationships with all potential members of a diabetes team



- **quality improvement** – managing risk, ensuring high standards of care, using clinical audits, and creating and maintaining an environment that supports clinical excellence
- **information** – ensuring high-quality information systems, management and sharing, which are the backbone to integrated care.

## 2.2 Models of high-quality healthcare

### The medical home

Quality and safety in diabetes care starts with coordinated, ongoing and comprehensive primary healthcare. Primary care is the central component of care across the spectrum of patients with diabetes: those dealing with a new diagnosis, those managing (often multiple) medications, those with complications of diabetes and multimorbidity, through to patients at the end of life.

A general practice chosen by a patient to provide ongoing, comprehensive, patient-centred care is known as a 'medical home'. The medical home is responsible for the patient's healthcare across their entire health journey and this approach results in better health outcomes for patients and their families.<sup>6</sup> Australian general practice encapsulates the medical home model.<sup>7</sup>

This model has measurable benefits, including improved continuity of patient care<sup>8</sup> and improved quality and cost effectiveness of care for patients with a chronic disease.<sup>9</sup>

Medical homes reduce disparities in access to quality care among traditionally difficult to reach groups,<sup>10,11</sup> which leads to improved overall population health<sup>12</sup> and lower overall healthcare spending.<sup>13</sup>

### A model for chronic disease management

For patients with type 2 diabetes across the spectrum, structured care programs that are easy to implement, are well supported and meet the needs of the individual are required. These programs bring together healthcare teams, evidence-based guidelines, useful support tools and good systems to support patients throughout their journey.

See *Section 5* for information on structured care and patient education.

The Chronic Care Model (CCM), developed by the MacColl Institute, [www.improvingchroniccare.org/index.php?p=The\\_Chronic\\_Care\\_Model&s=2](http://www.improvingchroniccare.org/index.php?p=The_Chronic_Care_Model&s=2), identifies the fundamental elements of a healthcare system that support high-quality chronic disease care:

- health system (organisation and mechanisms)
- delivery system design
- decision support
- clinical information systems
- self-management support
- the community.

The CCM has been shown to be an effective framework for improving the quality of diabetes care.<sup>14</sup>

## In practice

### Health system

Create a culture, use systems and access mechanisms that promote safe, high-quality care.

General practices can access the Australian Government system level incentives to support diabetes care. This support is provided through Medicare payments to GPs, nurses, allied health professionals and general practices. These include the Chronic Disease Management (CDM) items (formerly known as Enhanced Primary Care), which provide support for developing management plans and organising team care.

Patients have experienced improvements in process and clinical outcomes with these management plans and team care arrangements.<sup>15</sup>

#### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

It is recommended that all practices identify patients of Aboriginal or Torres Strait Islander descent. Registering patients also allows access to the Closing the Gap Pharmaceutical Benefits Scheme (PBS) co-payment, earlier interventions (as determined by PBS criteria) and access to specific MBS item numbers.

*See Appendix B: Accessing government support for diabetes care in general practice.*

## Delivery system design

Good delivery of diabetes care requires a proactive approach (keeping patients as healthy as possible rather than reacting when they are sick). An effective system to achieve this needs to combine educated and engaged patients with a range of healthcare providers using good communication and information technology.<sup>15</sup>

Collaborative multidisciplinary teams are best suited to provide diabetes care and facilitate patient self-management.<sup>16,17</sup> Using multidisciplinary care and engaging the wider team has been shown to improve outcomes for people with diabetes.<sup>18</sup>

A team approach provides flexible, collaborative and comprehensive care to meet individual patient needs. Roles within a general practice team are not mutually exclusive, and clear guidance is required to identify the team member primarily responsible for key activities. Teamwork success may be supported by workflow charts for coordination and management of structured care programs (care planning).

## Decision support

Accessible guidelines for diabetes management and associated issues (e.g. Driver's Licence Standards, antibiotic guidelines) are required for GPs to make decisions about diabetes care that is consistent with evidence and meets regulations.

Having contemporary electronic records also facilitates this goal by ensuring prescription error checking against medication allergy, and drug–drug and drug–disease interactions.

## Clinical information systems

Structured diabetes care programs require good information management systems (registers, recalls and reminders) combined with risk factor, complication assessment management and comorbidity strategies. Management plans are most effective when they involve a team care arrangement and are reviewed regularly.<sup>15</sup>

Structured recall systems ensure a patient receives formal reviews at regular intervals. Several studies have shown that computerised recall systems, monitoring and reminding patients and practice team members about appointments, investigations and referrals improves diabetes care.<sup>19–22</sup> Computerised systems can also provide automated reminders, generate mailing lists of those overdue for preventive activities and help minimise repeat data entries.

Combining a reminder system with a practice register ensures that the reminder system is both systematic and targeted. This can prevent patients with diabetes

missing out on basic care such as screening for retinopathy (30% not screened) and foot care (50% not checked every 6 months). Depending on the complexity of individual patient needs, structured recall may occur on a 3- to 12-month basis.

For example, during a consult the GP and patient make key management decisions or team care changes dependent on care plan progress. A recall is added in a timeframe suited to patient needs. This cycle then repeats. Another example is where a structured recall may ensure that all necessary pathology tests are completed before the next practice visit by the patient.

## Self-management support

The aim is to facilitate skills-based learning and patient empowerment. Diabetes self-management education can target medication education and compliance, goal setting, foot care and interpretation of laboratory results.

The DESMOND Program<sup>23,24</sup> is a specialised education program that appears effective for patients newly diagnosed with type 2 diabetes in providing weight loss and smoking cessation and with positive improvements in beliefs about illness. It also appears to be cost effective. This program is currently only available in Western Australia.

## The community

Community resources and policies can be harnessed to improve the quality of the practice service including:

- National Diabetes Services Scheme (NDSS)
- Diabetes Australia resources
- Medicare Local collaborations
- partnerships with universities or hospitals in providing diabetes care
- pharmacy resources
- support groups
- community health centres.

### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

Some Medicare Locals run Chronic Care Coordination Programs for Aboriginal and Torres Strait Islander patients, which can help access practical help in attending a range of specialist and allied health appointments.

## 2.3 A quality improvement program relevant to diabetes care

Accreditation against the RACGP *Standards for general practices*, 4th edition, requires a commitment to quality improvement from a general practice. This can involve examining practice structures, systems and clinical care. Using practice data to identify areas in need of improvement is one way to achieve this.

Clinical audit software tools are widely available to assist practices to evaluate clinical outcomes for patients with diabetes. Audit information can be used to improve management of patients with diabetes on many levels. For example, patients can be identified on the basis of:

- incomplete information such as no smoking status, no recent blood pressure (BP) or glycated haemoglobin (HbA1c) reading
- Aboriginal and Torres Strait Islander background
- the presence of other risk factors such as HbA1c >9% or microalbuminuria
- outstanding diabetes cycle of care items.

To help practices start quality improvement activities, the RACGP is developing a core set of clinical indicators to support care evaluation. This is supported with the RACGP's Practice guides and tools for clinical indicators, available at [www.racgp.org.au/your-practice/business/tools/support](http://www.racgp.org.au/your-practice/business/tools/support). Four of these indicators are relevant to diabetes care:

Indicator number	Description
1	Practice infrastructure to support safety and quality of patient care
5	Assessment of absolute cardiovascular risk
12	Screening for retinopathy in patients with diabetes
13	Screening for nephropathy in high-risk patients (including diabetes)

Use of clinical indicators to assess care is advised but entirely voluntary.

# 3. Screening, risk assessment, case finding and diagnosis

## 3.1 Identifying risk of diabetes in asymptomatic patients

Recommendations	Reference	Grade*
Individuals should be screened for risk of diabetes every 3 years from age 40 years using AUSDRISK	(25) NHMRC, 2009	B
Individuals at high risk and those with impaired glucose tolerance or impaired fasting glucose (not limited by age) should be tested:		
• with fasting blood glucose	(25) NHMRC, 2009	B
• every 3 years	(25) NHMRC, 2009	C
Aboriginal and Torres Strait Islander peoples should be screened from age 18 years	(25) NHMRC, 2009	

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

Type 2 diabetes is the most common form of diabetes in Australia, although many cases remain undiagnosed. Additionally, almost 1 in 6 adults are affected by impaired glucose tolerance (IGT) or impaired fasting glucose (IFG).<sup>1</sup> Earlier detection increases opportunities to reduce morbidity and mortality.

The Australian Type 2 Diabetes Risk Assessment Tool (AUSDRISK, [www.ausdrisk.com.au](http://www.ausdrisk.com.au)) (*Appendix C*) was developed in 2007 and agreed on as a national type 2 diabetes risk assessment tool by the Federal and all state and territory governments.

AUSDRISK calculates the risk of developing diabetes over a 5-year period. Patients with scores of 12 or more are considered at high risk.

According to AUSDRISK research:

- For scores of 12–15, approximately one person in every 14 will develop diabetes.
- For scores of 16–19, approximately one person in every seven will develop diabetes.
- For scores of 20 and above, approximately one person in every three will develop diabetes.

Note that the score may overestimate the risk of diabetes in those younger than 25 years and underestimate the risk in Aboriginal and Torres Strait Islander peoples.

## In practice

Screen for undiagnosed diabetes in individuals at high risk<sup>25,26</sup> (see *Box 1*).

In patients with IGT or IFG, yearly fasting blood glucose (FBG) tests are recommended.

### **Box 1. People considered to be at high risk of type 2 diabetes**

- People with IGT or IFG
- All patients with a history of a cardiovascular event (acute myocardial infarction, angina, peripheral vascular disease or stroke)
- People aged 35 and over originating from the Pacific Islands, Indian subcontinent or China
- People aged 40 years and over with body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup> or hypertension
- Women with a history of GDM
- Women with polycystic ovary syndrome (PCOS) who are obese
- Patients on antipsychotic medication
- People of any age with IGT or IFG

## Screening for risk of diabetes in specific populations

For Aboriginal and Torres Strait Islander peoples, the AUSDRISK Tool can be used from 18 years of age. Those considered at high risk should have an FBG test every 3 years (see *Box 1* for people considered to be at high risk of type 2 diabetes).<sup>27</sup> FBG should be tested in people with high individual risk or who are from a community with high prevalence of diabetes. People with low individual risk or who are from a community with low prevalence (<5%) may be screened for risk with AUSDRISK.<sup>28</sup>

Note that people with Pacific Islander, Southern European or Asian backgrounds are twice as likely as other Australians to have developed diabetes within 5 years.<sup>29</sup>

See *Section 13: Diabetes and reproductive health* for recommendations on screening in pregnancy.

## 3.2 Case finding in patients with symptoms suggestive of diabetes

### Clinical context

Clinical suspicion for type 2 diabetes needs to remain high, as early type 2 diabetes is often asymptomatic.

### Clinical symptoms of diabetes

Symptoms of diabetes include:

- lethargy, polyuria, polydipsia
- frequent fungal or bacterial infections
- blurred vision
- loss of sensation (i.e. touch, vibration, cold)
- poor wound healing.



## Clinical signs of insulin resistance

Signs of insulin resistance may include:

- **acanthosis nigricans (AN)** – typically characterised by hyperpigmentation (darkening of skin pigment) and usually accompanied by a velvety change in texture of the affected skin. Common sites are the neck and axillae
- **skin tags** – benign (non-cancerous) skin growths on the body or face. They can be smooth or wrinkled, skin-coloured or just slightly darker than skin colour and can vary in size
- **central obesity** – defined by a high waist-to-hip ratio, waist-to-thigh ratio and waist circumference
- **menstrual irregularities** – PCOS is the most common cause of infertility in women who have gone through puberty and is often associated with insulin resistance
- **hirsutism** – excess facial and body hair, especially on women, which can indicate insulin resistance.

### Box 2. Are insulin levels helpful?

- There is no role for testing insulin levels to assess insulin resistance in IFG, IGT or diabetes evaluation
- Patients with signs of insulin resistance should have FBG testing

## In practice

Patients should be tested for diabetes if they:

- have symptoms or complications of diabetes
- are at high risk of developing diabetes or
- have clinical signs of insulin resistance.

## Tests to detect diabetes

Testing high-risk patients or those with a clinical suspicion for diabetes involves three types of biochemical analyses.

The diagnosis of diabetes may require one or more evaluations of:

- blood glucose levels
  - FBG
  - random blood glucose (RBG) which is anything other than fasting (i.e. <8 h)
- OGTT
- HbA1c.

### 3.3 Impaired fasting glucose or impaired glucose tolerance

The definition of diabetes is based on a collection of symptoms based on an arbitrary glycaemic measure, and is not entirely defined by subsequent risk of health outcomes. On glucose challenge testing, patients with elevated glucose values but without levels high enough to be diagnosed with type 2 diabetes, are considered to have either IFG or IGT (see *Figure 1*).

These states are not considered to be benign and reflect a risk of developing diabetes in the future. In addition, as cardiovascular disease (CVD) risk is distributed across a continuum of post-challenge glucose levels, any degree of post-challenge hyperglycaemia may be associated with the development of premature CVD.

Microvascular complications are commonly present at the time of diagnosis of type 2 diabetes in both symptomatic and asymptomatic individuals.<sup>30</sup>

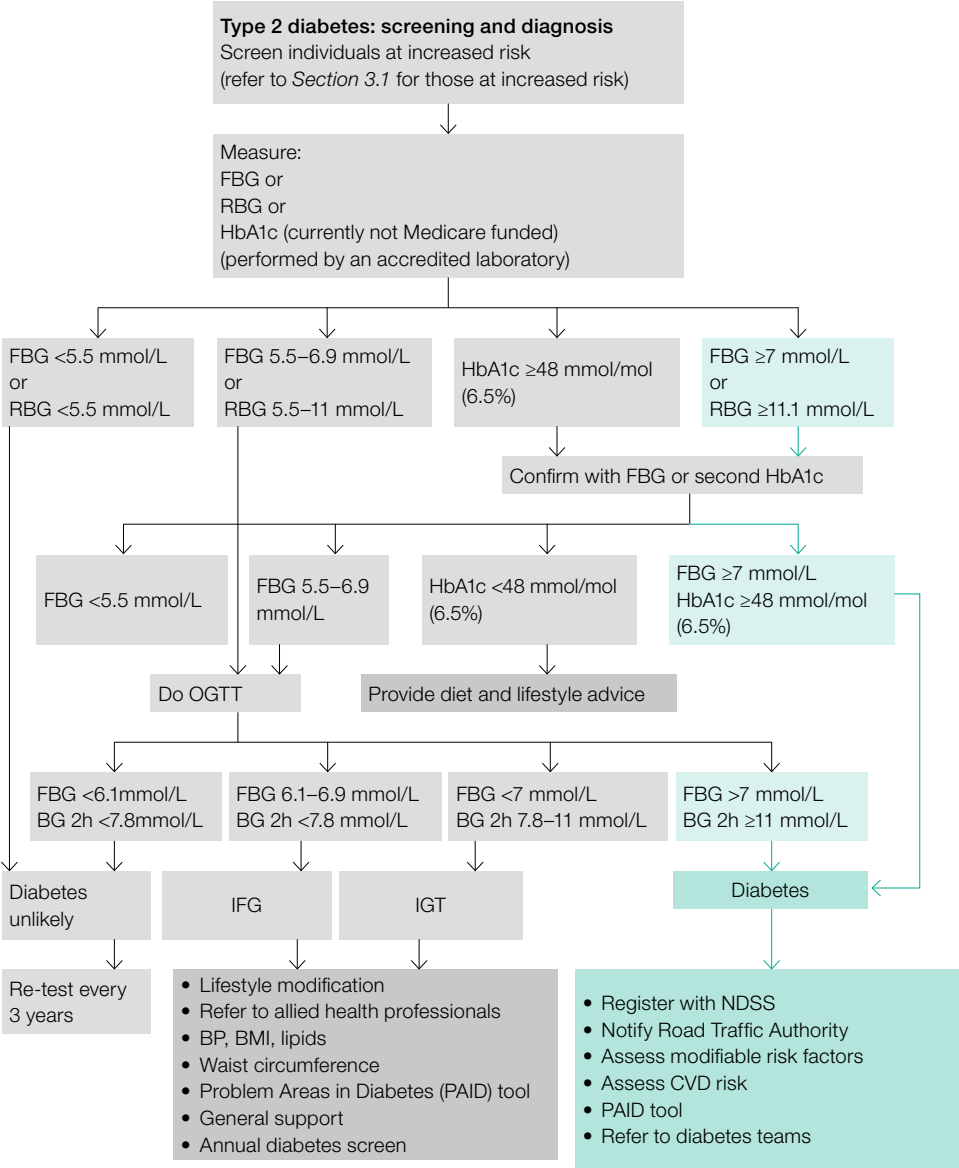
### 3.4 Diagnosis of diabetes

Once the diagnostic criteria (see *Box 3*) are reached, type 2 diabetes is the most likely diagnosis (see *Figure 1*).

#### Box 3. Diagnostic criteria for type 2 diabetes

- FBG  $\geq 7.0$  mmol/L (on two separate occasions)
- 2 hour postprandial  $\geq 11.0$  mmol/L on OGTT (on two separate occasions)
- HbA1c  $\geq 6.5\%$  (48 mmol/mol) (on two separate occasions)

Figure 1. Screening and diagnosis algorithm



HbA1c has recently been endorsed as a diagnostic test for diabetes by the World Health Organization. The Australian Diabetes Society, the Royal College of Pathologists of Australasia, and the Australasian Association of Clinical Biochemists have reviewed the available evidence and confirmed that HbA1c can be used to establish the diagnosis of diabetes.<sup>31</sup>

At the time of publication, the HbA1c assay was not funded by Medicare as a diagnostic or screening test for diabetes, although approval for this purpose is being sought. Note that HbA1c may be artificially normal in people with haemoglobinopathy or haemolysis, and that it may be artificially high in people with iron deficiency.

Other diagnostic possibilities include unusual presentations of:

- type 1 diabetes
- latent autoimmune diabetes of adults (LADA)<sup>32</sup>
- maturity onset diabetes of the young (MODY)<sup>33</sup>
- GDM (in pregnancy).

Consider type 1 diabetes if there are no other features of the metabolic syndrome and there is the presence of:

- ketonuria (which may be absent)
- polyuria, polydipsia
- weight loss or BMI <25 kg/m<sup>2</sup>
- young age
- family history of autoimmune disease
- rapid onset of symptoms.

If suspicious, test for glutamic acid decarboxylase (GAD) and/or insulinoma antigen 2 (IA-2) antibodies. These will be present in 90% of patients with type 1 diabetes. Alternatively C-peptide levels will determine those patients with absence of or minimal insulin production.

Note that GAD antibodies are common in LADA. GAD and IA-2 antibodies are absent in MODY, where there is often an autosomal dominant inheritance within the immediate family.

Common forms are MODY 3 (incidence of 69% of MODY types), which has a hepatocyte nuclear factor 1 alpha gene mutation, and MODY 2 (14%) which has a glucokinase mutation.

# 4. Preventing type 2 diabetes

Recommendations	Reference	Grade*
Lifestyle modifications that focus on increased physical activity, dietary change and weight loss should be offered to all individuals at high risk of developing type 2 diabetes (Structured diabetes prevention programs are available)	(34) NHMRC, 2009	A
Bariatric surgery can be considered in selected morbidly obese individuals (based on weight alone or the presence of comorbidities) at high risk of type 2 diabetes	(34) NHMRC, 2009	C
Individuals at high risk of diabetes should be identified through the use of risk assessment tools	(34) NHMRC, 2009	C

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

The dysglycaemic states (IFG, IGT) affect more than 2 million Australians over 25 years of age.<sup>1</sup> These occur when blood glucose levels are elevated above normal but not high enough to be diagnosed as diabetes.

Intervention is warranted only to prevent or delay progression to type 2 diabetes, and to reduce mortality associated with the metabolic condition itself.

Clinical trial evidence demonstrates that metabolic disruption leading to diabetes can be stopped and regressed with effective diet and lifestyle modification as well as with some drug therapies. The foundation studies demonstrating prevention of type 2 diabetes development by structured lifestyle behaviour change programs were conducted in Finland and the United States of America.<sup>35,36</sup> Both studies had intensive programs supporting the intervention group.

In patients with dysglycaemic states, structured lifestyle interventions can achieve a relative risk reduction RRR of 58% for the development of type 2 diabetes. Of the therapies, pharmacotherapy with metformin has been shown to achieve a relative risk reduction of 31%, particularly in overweight individuals with BMI >35 kg/m<sup>2</sup>. This is, however, still less effective than successful lifestyle change.<sup>37</sup>

*Note:* At the time of publication, metformin did not have Therapeutic Goods Administration (TGA)/PBS approval for this indication within Australia.

## In practice

GPs should consider implementing systems for identification and management of diabetes as well as programs and strategies for educating patients about diabetes and encouraging lifestyle modification.

### Lifestyle modification

Lifestyle modification programs (see *Section 6*) should be developed using a patient-centred approach. These should be individualised with realistic goals based on what the patient can and wants to achieve. Each plan should focus on physical activity, dietary modification and weight control.

Plans could involve other practice team members and may include referral to allied health professionals such as dietitians, diabetes educators and exercise physiologists or physiotherapists and may include a structured goal-oriented program.

### Bariatric surgery

Bariatric surgery may be considered for adults with BMI  $>40$  kg/m<sup>2</sup>, or adults with BMI  $>35$  kg/m<sup>2</sup> with comorbidities such as type 2 diabetes, taking into account each individual situation.<sup>38</sup>

Consider referral for bariatric surgery for the management of people with obesity with type 2 diabetes when other interventions have failed. GPs should inform their patients to be aware of the possible side effects of bariatric surgery, which can be life-threatening, and to liaise with a specialised surgical team if there are concerns.<sup>38</sup>

# 5. Structured care and patient education

## 5.1 Patient-centred diabetes care

Recommendations	Reference	Grade*
A patient-centred approach should be employed that incorporates patient preferences and assesses literacy and numeracy	(16) American Diabetes Association, 2013	B
Routine care of people with type 2 diabetes should address disparities associated with socioeconomic status and ethnicity	(16) American Diabetes Association, 2013	C

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

How well a patient can read and use numbers has a significant impact on their ability to self-manage. Patients with diabetes and lower literacy or numeracy skills are at greater risk for poor diabetes outcomes.<sup>39</sup>

Many factors influence a person's literacy and numeracy (e.g. socioeconomic status, cognitive function, culture). Health literacy is defined as an individual's ability to read, perform basic numeracy skills, and understand and use healthcare information to make decisions and follow instructions for treatment.<sup>40</sup> In 2006, the Australian Bureau of Statistics identified that half of healthcare clients lacked sufficient health literacy to navigate the system.<sup>41</sup> Importantly this means that simply providing brochures and written information is not health education and is unlikely to change health behaviour.

A patient's health literacy typically improves through self-education and contact with health providers.<sup>42</sup>

## In practice

A patient-centred consultation involves assessing a patient's clinical signs and symptoms as well as their thoughts, fears, preferences and expectations and their social context. This ensures a complete understanding of the individual who is living with type 2 diabetes.

From a position of mutual understanding, management plans can then be developed with the patient, and tailored to specifically meet their needs, values and choices. Studies show that patient-centred management plans are more likely to be adhered to and result in better health outcomes.<sup>43</sup>

Many of the assessments discussed in these guidelines are performed informally during a routine consultation. However, systems should be developed within the practice to allow appropriate assessment, review and management of individual patients.

### Assess (health) literacy status

A patient's literacy and numeracy skills affect their capacity for self-management and what resources they will need. Literacy and numeracy skills are not always obvious and GPs may worry that attempting to evaluate them will be uncomfortable for patients. The evidence in the literature does not support this concern.<sup>44</sup>

Organisations such as Diabetes Australia, [www.diabetesaustralia.com.au](http://www.diabetesaustralia.com.au), provide culturally and linguistically appropriate information in several languages; they also have low literacy resources.

### Determine priorities for management

Discover what areas are affecting the patient's quality of life in the context of comorbidities and life expectancy. Determine the management priorities, focusing on specific interventions (including those chosen by the patient) that have the most impact on the individual and will form the basis of their continuing care.

### Consider enrolment in structured programs

Both structured diabetes care programs and structured self-management education programs have been developed.

See *Appendix D* for a template of a General Practice Management Plan (structured patient-centred care plan).



# 5.2 A structured diabetes care program consistent with the chronic care model

Recommendations	Reference	Grade*
Care should be aligned with components of the CCM to ensure productive interactions between a prepared proactive practice team and an informed activated patient	(16) American Diabetes Association, 2013	A
When feasible, care systems should support team-based care, community involvement, patient registries and embedded decision support tools to meet patient needs	(16) American Diabetes Association, 2013	B
Treatment decisions should be timely and based on evidence-based guidelines that are tailored to individual patient preferences, prognoses and comorbidities	(16) American Diabetes Association, 2013	B

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

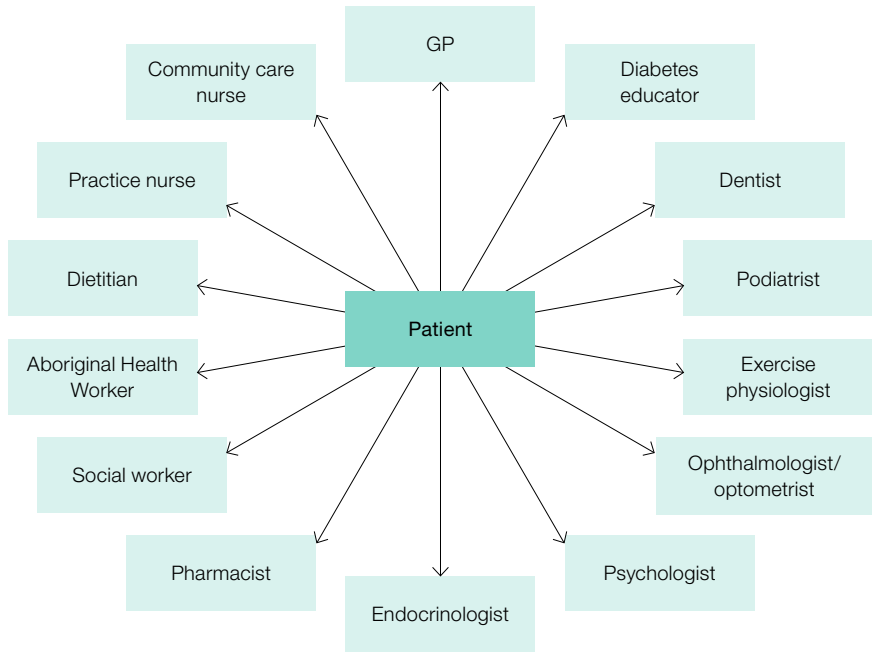
The goal of a structured care program is to increase the quality of life for people with diabetes. Structured care means having all the necessary aspects of the required care in place.

The structure of each diabetes care program will vary based on the local circumstances and the needs of the patient. There is good evidence to support patient access to a variety of healthcare providers.<sup>15</sup>

Access to, and care delivery by, different healthcare providers allows the patient to benefit from a broad perspective on their health and wellbeing. There are some team roles that fit into most patients' programs but whatever the composition of the team, care needs to be organised and delivered systematically.

Multidisciplinary care (see *Figure 2*) also covers gaps in care that may be apparent to one healthcare provider, but go unnoticed by another. For example, recognising a patient's social difficulties may be detected during an educator evaluation or by a practice nurse rather than during a routine medical consult.

Figure 2. Potential members of the multidisciplinary diabetes care team



Registered nurses and practice nurses within a general practice can provide both an administrative and a clinical role. Practice nurses often manage the diabetes register, structured care and recall system, as well as provide a clinical assessment before the GP sees the patient. Practice nurses have an important role in team-based care processes, including motivational interviewing, education activities and support for lifestyle modification. These can be facilitated and enabled upon GP assessment and recommendation. This enables healthcare efficiency and allows the GP to focus on any identified problems. Practice nurses can also act as practice liaison, and facilitate rapid access to GP care in the event of a clinical problem.

### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

Involvement of an Aboriginal Health Worker, or an Aboriginal Liaison Officer, or Indigenous Outreach worker or Care Coordinator is essential in the care of Aboriginal and Torres Strait Islander peoples.

## 5.3 Patient education and self-management

Recommendations	Reference	Grade*
All people with type 2 diabetes should be referred for structured diabetes patient education	(34) NHMRC, 2009	A
Diabetes education should be delivered in groups or individually	(34) NHMRC, 2009	A
Diabetes education should be culturally sensitive and tailored to the needs of socioeconomically disadvantaged populations	(34) NHMRC, 2009	B

\*Refer to *Appendix A* for an explanation of the Grade.

Education to support self-management is an integral part of diabetes care. Patients and their carers should be offered a structured, evidence-based education program at the time of diagnosis, with annual update and review.<sup>45</sup>

Educating people with diabetes about their condition and its treatment will assist in self-management and reduce the risks of complications related to diabetes.<sup>46</sup>

In addition to the team members mentioned (*Figure 2*), patients can obtain further education and support through the NDSS, <http://osd.ndss.com.au/search>, and their state or territory diabetes organisation.

Multiple online support and education programs are available for patients who are unable to access face-to-face group meetings. However, there are few studies on the individual effectiveness of these programs.

### Self-management

Self-management involves the person with diabetes working in partnership with their carers and health professionals so they can:

- understand their condition and various treatment options
- contribute to, review and monitor a plan of care (e.g. care plan)
- engage in activities that protect and promote health
- monitor and manage the symptoms and signs of the condition
- manage the impact of the condition on physical functioning, emotions and interpersonal relationships.

Identifying barriers to self-management is important when developing a management plan with the patient. Issues around cognition, physical disability, mental health, health literacy, socioeconomic constraints, location and access to services can have an impact on the ability of the person to self-manage their diabetes.

# 6. Lifestyle modification

Recommendations	Reference	Grade*
Lifestyle modifications that focus on increased physical activity, dietary change and weight loss should be offered to all individuals at high risk of developing type 2 diabetes	(34) NHMRC, 2009	A

\*Refer to *Appendix A* for an explanation of the Grade.

Early type 2 diabetes can usually be managed through diet and exercise alone.<sup>46,47</sup> Lifestyle continues to play an important role in glycaemic control and managing cardiovascular risk in more advanced stages of type 2 diabetes.

## 6.1 Physical activity

Recommendations	Reference	Grade*
People with type 2 diabetes of all ages benefit from accumulating 30 minutes or more of moderate physical activity on most if not all days of the week	(48) Briffa T, 2006	B

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

Regular physical activity improves metabolic control, reduces cardiovascular risks and can reduce the risk of developing type 2 diabetes.<sup>49</sup> Low-level aerobic exercise (e.g. brisk walking for half an hour per day) and physical resistance training improves glucose tolerance, energy expenditure, feeling of wellbeing and work capacity, and improves BP, lipid profiles and mood.

## In practice

The goal is for patients to undertake aerobic training which 'makes you puff' and brings the heart rate up to 60–70% of maximum ( $220 - \text{age [years]} = \text{maximum beats per minute}$ ) for a minimum of 30 minutes three or four times per week. This establishes and maintains fitness and aerobic capacity.

Evidence indicates that people with diabetes, IFG and/or IGT should aim for a minimum of 210 minutes per week of moderate intensity exercise or 125 minutes per week of vigorous intensity exercise and no more than 2 consecutive days without training. Two or more resistance training sessions per week (2–4 sets of 8–10 repetitions) are included in the total 210 or 125 minutes of moderate or vigorous exercise respectively.<sup>50</sup>

Note that setting short-term, gradually increasing goals may engage the patient in healthier steps to achieving goals.

People requiring insulin or those treated with sulphonylureas need to be aware of potential delayed effects of physical activity on glucose levels – in particular delayed hypoglycaemia 6–12 hours after cessation of the activity.

People with diabetes need to be advised to moderate or cease their activity if they develop cardiovascular symptoms or feel unwell. Patients with claudication need to be encouraged to continue physical activity.

When advising on physical activity, the GP should explain:

- the risks and benefits of physical activity for the individual
- the importance of varying intensity of exercise levels
- the importance of following the chest pain/discomfort and/or diabetes symptom management plan.<sup>48</sup>

Clinical advice should be given to stop physical activity if the patient experiences symptoms of hypoglycaemia and to discontinue further physical activity until reviewed by their GP.

General physical activity safety advice for people with diabetes:

- Instruct patients to check their blood glucose level (BGL) before, during and after prolonged physical activity if using insulin or sulphonylureas, for extra carbohydrate needs and/or delayed hypoglycaemia.
- Advise patients on how to recognise, prevent or manage hypoglycaemic events, including potential post-exercise hypoglycaemia (i.e. need for carbohydrates).
- Advise patients to carry a rapid-acting glucose source at all times (e.g. jelly beans).
- Advise patients that if their pre-exercise BGL is <5 mmol/L, they should eat (e.g. sandwich, fruit) before engaging in physical activity.

- Advise patients to wear correct supportive footwear – especially if there is neuropathy, vascular disease, abnormal foot structure or previous foot ulcer(s), in which case the advice of a podiatrist with an interest in high-risk feet should be sought.
- Advise patients to check their feet after physical activity for blisters, warm areas or redness.<sup>48</sup>

When prescribing a physical activity program, the GP should be aware of the following:

- A careful history should be taken.
- Special attention needs to be paid to exertion-induced symptoms, chest or abdominal discomfort, claudication or syncope.
- People with type 2 diabetes frequently have silent macrovascular disease.
- Recommendation for referral to an exercise specialist such as an exercise physiologist should be considered.

Screening with a stress electrocardiogram (ECG) is not indicated in asymptomatic individuals, but specific symptoms need to be actively investigated.

### **ABORIGINAL AND TORRES STRAIT ISLANDER POINT**

Many Aboriginal and Torres Strait Islander people are involved in physically demanding sporting and cultural activities.

GPs should be aware of activities that might be affordable, appropriate and accessible for their Aboriginal and Torres Strait Islander patients, which may be run by local community groups.

Some activities such as hunting or other cultural activities may not be considered as 'exercise' or 'physical activity' by some Aboriginal and Torres Strait Islander people. A careful history in the context of a trusting doctor–patient relationship may bring about better understanding.

## 6.2 Dietary assessment

Recommendations	Reference	Grade*
Consumption of cereal foods (especially three serves a day of wholegrains) is associated with reduced risk of type 2 diabetes	(51) NHMRC, 2013	B
Consumption of at least one and a half serves of dairy foods (milk, yoghurt, cheese) per day is associated with reduced risk of type 2 diabetes	(51) NHMRC, 2013	C

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

Most of the burden of disease due to poor nutrition in Australia is associated with eating too much energy-dense and relatively nutrient-poor foods, and eating too few nutrient-dense foods, including vegetables, fruit and wholegrain cereals.

Recommendations from the Australian Dietary Guidelines:<sup>51</sup>

- Enjoy a wide variety of nutritious foods from these five groups every day:
  - plenty of vegetables, including different types and colours, and legumes/beans
  - fruit (consumption of fruit is not associated with risks of type 2 diabetes)
  - grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties, such as breads, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley
  - lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans
  - milk, yoghurt, cheese and/or their alternatives, mostly reduced fat (reduced fat milks are not suitable for children under the age of 2 years).
- Drink plenty of water.
- Limit intake of foods containing saturated fat, added salt, added sugars and alcohol:
  - Restrict foods high in saturated fat such as many biscuits, cakes, pastries, pies, processed meats, commercial burgers, pizza, fried foods, potato chips, crisps and other savoury snacks.
  - Limit foods and drinks containing added salt.
  - Avoid foods and drinks containing added sugars such as confectionary, sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters, energy and sports drinks.
  - If you choose to drink alcohol, limit intake. For women who are pregnant, planning a pregnancy or breastfeeding, not drinking alcohol is the safest option.

Dietary evaluation and optimisation is a critical component in the management of type 2 diabetes. The core themes around nutrition in type 2 diabetes are eating healthily and, where appropriate, body weight (loss) and caloric management (portion control and type of food).

Two other key themes are eating for cardiovascular protection and meal planning and glycaemic control.

## Eating for cardiovascular protection

The Mediterranean diet appears to be one of the healthiest dietary patterns in the world as it is associated with a low morbidity and mortality for some chronic diseases, including CVD.<sup>52</sup> In persons with high cardiovascular risk, Mediterranean diets reduced cardiovascular events when compared with advice to follow a low-fat diet.<sup>53</sup>

The Mediterranean diet traditionally includes fruits, vegetables, nuts, fish and small amounts of meat. Grains in the Mediterranean region are typically wholegrain, and bread is eaten plain or dipped in olive oil.

The diet recommended for a person with diabetes in the Australian Dietary Guidelines<sup>51</sup> is qualitatively little different from the Mediterranean diet, or that recommended for all people (irrespective of whether they have diabetes, hypertension or dyslipidaemia).

## Meal planning and glycaemic control

Some people with diabetes may require more intensive meal planning to ensure glycaemic control. They should have one high-fibre, low-GI carbohydrate food at each meal.<sup>54,55</sup> This type of food includes wholegrain breads, rolled oats, low-fat, low-added sugar breakfast cereals, pasta, legumes and temperate fruits. Other carbohydrate foods can be included but in lesser amounts. These include rice, potato and tropical fruit. Also consider referring the person for medical nutrition therapy from an accredited practising dietitian.

## In practice

Dietary habit changes are often slow and incremental. There is no need for a 'special' diet for diabetes but the requirement to follow a sensible, balanced eating plan. Constant reinforcement of dietary advice usually results in enhanced cooperation and better glycaemic control.



Keep advice simple and inform patients of what they can eat rather than what they cannot. Sugar does not need to be eliminated. A small amount of sugar as part of a mixed meal or food (e.g. breakfast cereal) does not adversely affect the blood glucose level. Allowing small amounts of sugar as part of a high-fibre, low-fat meal plan increases the choice of foods available and may aid adherence.

Consider recommending the National Health and Medical Research Council (NHMRC) ‘Healthy Eating for Adults’<sup>51</sup> or the Mediterranean diet, which are easy to access and implement. Advice from an accredited practicing dietitian is recommended.

**ABORIGINAL AND TORRES STRAIT ISLANDER POINT**

There is evidence that Aboriginal and Torres Strait Islander communities in urban and remote regions face significant access barriers to nutritious and affordable food. Nutritious food tends to cost more. Food choices can be significantly altered when people have access to appropriate foods and education about nutrition.

GPs should make themselves aware of local community initiatives for the supply of fresh fruit and vegetables at affordable prices. In some areas, these include arrangements with farmers’ markets or local community gardens.

6.3 Weight

Recommendations	Reference	Grade*
Adults with IFG, IGT or diabetes can be strongly advised that the health benefits of 5–10% weight loss include prevention, delayed progression or improved control of type 2 diabetes	(38) NHMRC, 2013	A
For adults with BMI >40 kg/m <sup>2</sup> , or adults with BMI >35 kg/m <sup>2</sup> and comorbidities that may improve with weight loss, bariatric surgery may be considered, taking into account the individual situation	(38) NHMRC, 2013	A
Use BMI to classify overweight or obesity in adults	(38) NHMRC, 2013	B
For adults, use waist circumference, in addition to BMI, to refine assessment of risk of obesity-related comorbidities	(38) NHMRC, 2013	C

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

Excess weight in individuals usually results from a prolonged period of energy imbalance. However, the causes of overweight and obesity are complex. Diet and physical activity are central to the energy balance equation, but are directly and indirectly influenced by a wide range of social, environmental, behavioural, genetic and physiological factors, the relationships between which are not yet fully understood.

The relationship between weight and health outcomes is complex. In a recent systematic review and meta-analysis, compared with normal weight, overweight was associated with significantly lower all-cause mortality. Grade 1 obesity overall was not associated with higher mortality, whereas grades 2 and 3 obesity were associated with significantly higher all-cause mortality.<sup>56</sup>

Loss of body weight often results in improved glycaemic control, BP and lipid profiles. Sustained weight reduction of approximately 5 kg is associated with a reduction in HbA1c of approximately 0.5–1%. In adults with BMI <35 kg/m<sup>2</sup>, with dysglycaemic states or hypertension, weight loss of at least 2–3 kg achieved with lifestyle interventions may result in a clinically meaningful reduction in systolic blood pressure (SBP) (an average of 4.5 mmHg systolic and 3–3.5 mmHg diastolic).<sup>38</sup>

It is important to encourage any degree of weight loss. An ideal body weight is often not achievable and setting this as a goal discourages patients to attempt any dietary change. Many studies suggest that a weight loss of 5–10% will improve glycaemic control.<sup>57,58</sup>

Recent trial evidence did not confirm that intensive lifestyle intervention focusing on weight loss results in any reduction in cardiovascular events in overweight or obese adults with type 2 diabetes.<sup>59</sup> This was despite greater reductions in HbA1c and greater initial improvement in fitness and all cardiovascular risk factors, except for low density lipoprotein cholesterol levels.

## In practice

### Weight assessment

Assessing weight is typically done using BMI. Note that BMI is a difficult parameter to standardise between different population groups.

For those of European descent, healthy BMI is 18.5–24.9, overweight is 25–29.9 and obese is  $\geq 30$ .<sup>38</sup> Different classification criteria may apply to other population groups. Some groups may have equivalent levels of risk at a lower BMI (e.g. people of Asian origin) or higher BMI (e.g. Torres Strait Islander and Maori peoples).<sup>60</sup>

It is advisable to also assess waist circumference (cm) as this is a good indicator of total body fat and is a useful predictor of visceral fat. Waist circumference of  $\geq 94$  cm in men and  $\geq 80$  cm in women conveys increased risk. As with BMI, these values may differ for other population groups.<sup>38</sup>

### Weight management

The key issue for weight management is learning to eat a range of foods in amounts appropriate for energy requirements. Sources of hidden energy need to be identified and minimised (e.g. alcohol, cakes and sweet beverages), especially those with added fat.

A reduction in total energy intake of 2000 kilojoules (475 calories) to 2500 kilojoules (600 calories) per day should result in a weight loss of 0.5 kg a week.

Very low energy diets are a useful intensive medical therapy that is effective in supporting weight loss when used under medical supervision. These may be considered in adults with BMI  $>30$  kg/m<sup>2</sup>, or with BMI  $>27$  kg/m<sup>2</sup> and obesity-related comorbidities, taking into account each individual situation.

Bariatric surgery may be a consideration for people with BMI  $>35$  kg/m<sup>2</sup> who have suboptimal blood glucose levels and are at increased cardiovascular risk, taking into account each individual situation. GPs should inform their patients to be aware of the possible side effects of bariatric surgery, which can be life-threatening, and to liaise with a specialised surgical team if there are concerns.<sup>38</sup>

## 6.4 Smoking cessation

Recommendations	Reference	Grade*
Smoking cessation should be a major focus of the management of people with smoking-related diseases	(61) RACGP, 2011	A
All smokers should be offered brief advice to quit smoking	(61) RACGP, 2011	A

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

Smoking is associated with an increased risk of the development of type 2 diabetes in both men and women,<sup>62</sup> and smoking negatively affects glycaemic control (e.g. smokers with type 2 diabetes need larger doses of insulin to achieve control similar to those who do not smoke).<sup>63</sup>

Patients with diabetes who smoke further increase their risk of CVD, peripheral vascular disease and neuropathy (and progression of neuropathy). Smoking also increases the risk associated with hospitalisation for surgery.<sup>61</sup>

## In practice

The importance of smoking cessation in those with or at risk of type 2 diabetes cannot be overstated.

Guidelines for smoking cessation and a pharmacotherapy treatment algorithm are available as downloads from the RACGP website ([www.racgp.org.au](http://www.racgp.org.au)) and in the RACGP *Supporting smoking cessation: a guide for health professionals*.<sup>61</sup>

### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

Smoking cessation services for Aboriginal and Torres Strait Islander peoples are available at the Centre for Excellence in Indigenous Tobacco Control (CEITC) (CEITC Quitting resources, [www.ceitc.org.au/quitting-resources](http://www.ceitc.org.au/quitting-resources)).

In the absence of contraindications, smokers who have evidence of nicotine dependence should be offered pharmacotherapy if they are motivated to stop smoking. Choice of pharmacotherapy is based on clinical suitability and patient choice.

There is a lack of safety data on the use of varenicline or bupropion in diabetes. However, if diabetes is well controlled with insulin or oral hypoglycaemic medication, 150 mg once daily of bupropion can be prescribed. If the diabetes is poorly controlled, nicotine replacement therapy should be considered.<sup>61</sup>

# 6.5 Alcohol consumption

Recommendations	Reference	Grade*
People with diabetes can take alcohol in moderation as part of a healthy lifestyle but should aim to keep within the target consumption recommended for people without diabetes	(64) SIGN, 2010	B

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

Alcohol can lower blood glucose levels and reduce awareness of hypoglycaemia. Alcohol and hypoglycaemia have independent but additive effects on cognitive function.<sup>64</sup> It is recommended that people with diabetes abstain from alcohol if they plan to drive.<sup>65</sup>

Calorie restriction, which may involve reducing alcohol intake, can be important in reducing overweight as part of diabetes management.<sup>66</sup>

## In practice

Patients should be educated on how to avoid hypoglycaemia when drinking alcohol. Australian guidelines at the time of publication recommend  $\leq 2$  standard drinks (20 g) per day for both men and women. Low alcohol beers are a better choice than ordinary or diet beers.<sup>66</sup>

For healthy men and women, drinking no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury.<sup>66</sup>

## 7. *Evaluating the patient with diabetes*

### 7.1 Initial evaluation

The aim of initial evaluation of a patient with diabetes is to develop a whole-person assessment and discover which factors are affecting the patient's health and quality of life. Many people with diabetes are dealing with or have other medical conditions (not necessarily related to diabetes) and family, work or financial stresses. Some are also dealing with lifestyle factors including poor sleep, smoking, lack of exercise and pain that will affect their priorities for management.

People with type 2 diabetes are at risk of impaired emotional wellbeing, including diabetes-related distress, depression and anxiety.<sup>67</sup> This can have an impact on diabetes management and outcomes.

A detailed assessment including appraisal of cardiovascular risk and end-organ damage should be made at first diagnosis.

#### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

In Aboriginal and Torres Strait Islander patients the development of rapport may take precedence over a detailed assessment in a single consultation.

An assessment could be done over several visits.<sup>68</sup>

Developing a patient–doctor (or patient–healthcare worker) relationship based on trust and respect is the best way of overcoming cultural barriers and ensuring effective care in the long term.

### History

Specific symptoms, including:

- glycosuria: polyuria, polydipsia, polyphagia, unexplained weight loss, nocturia
- hyperglycaemia: malaise/fatigue, altered vision, delayed wound healing.

Risk factors for complications, including personal or family history of CVD, smoking, hypertension, dyslipidaemia and a history of past or current mental health problems.

Lifestyle issues, including smoking, nutrition, alcohol, physical activity (SNAP) and occupation.

Predisposition to diabetes, including:

- age, family history, cultural group, overweight, physical inactivity, hypertension
- obstetric history of large babies or GDM
- medication causing hyperglycaemia
- personal or family history of haemochromatosis
- personal or family history of other autoimmune diseases (e.g. hypothyroidism or hyperthyroidism).

General symptom review, including cardiovascular symptoms, neurological symptoms, bladder and sexual function, foot and toe problems and any recurrent infections (especially urinary and skin).

## Full physical assessment

- **Weight/waist:** BMI = weight (kg) divided by height<sup>2</sup> (m<sup>2</sup>). Waist circumference (cm).
- **Cardiovascular system:** including postural BP, central and peripheral vascular systems. Calculate absolute cardiovascular risk.
- **Eyes:** visual acuity (with correction); screen for retinopathy (retinal photography or examine with pupil dilation and ophthalmoscope).
- **Feet:** stratify the risk of developing foot complications – sensation and circulation, skin condition, pressure areas, interdigital problems, abnormal bone architecture.
- **Peripheral nerves:** tendon reflexes, sensation – touch (e.g. with 10-g monofilament) and vibration (e.g. with 128 Hz tuning fork).
- **Urinalysis:** testing for albumin, ketones, nitrites and/or leucocytes.

## Investigations

Where clinically indicated, obtain baseline levels of:

- urine microalbumin, plasma creatinine (calculated estimated glomerular filtration rate [eGFR])
- lipids: low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), total cholesterol, triglyceride
- HbA1c (mmol/mol or %).

## Immunisations

The following vaccinations are recommended for patients with type 2 diabetes:

- Influenza – once per year
- Pneumococcal
  - Non-Indigenous: <65 years – single dose and revaccinate at age 65 or after 10 years whichever later; >65 years – single dose and revaccinate after 5 years
  - Aboriginal and Torres Strait Islander peoples: <50 years – single dose and revaccinate age 50 or after 10 years whichever later; >50 years – single dose and revaccinate after 5 years
- Tetanus – booster at age 50 (unless booster has been given within 10 years). Tetanus vaccination in adults is best given with a multivalent vaccine such as dTPa (Boostrix or Adacel, or Boostrix-IPV or Adacel-Polio).

## 7.2 What needs evaluation every 3–6 months?

### History

Review SNAP profiles, patient's record of home testing (if utilised), and foot symptoms.

Any problems with medication, including persistence and adherence issues. An inquiry regarding the burden of self-management should be sought. GPs should have a low threshold for suspecting patient distress.

### Examination

Check weight and waist, height (children and adolescents), BP, feet examination if new symptoms or at risk (e.g. neuropathy ± peripheral vascular disease).

### Investigation

Measure HbA1c as needed on an individual basis according to diabetes control. Do not measure more frequently than three monthly.

Watch for intercurrent illnesses (e.g. urinary tract infections, thyrotoxicosis), which may alter the degree of control. Asymptomatic urinary infections are common in patients with diabetes, especially older women.

### Review

Review goals with patient to identify specific areas of focus for doctor consultation.



## 7.3 What should be evaluated yearly?

The yearly review is a time for more detailed assessment, updating the problem priority list, re-establishing goals and checking agreed arrangements for management. Eating plan, lifestyle, self-monitoring and treatment should be reviewed.

Daily diabetes self-care and management can place a considerable burden upon people with diabetes. It is common for people with diabetes, at times, to feel overwhelmed, frustrated, guilty, or to worry about their current and/or future diabetes management and health outcomes.

Patients with diabetes can be assessed for mental health issues, social isolation/networks and family or work stress. Consider assessing diabetes distress through the use of the PAID<sup>69</sup> questionnaire and depression with the Patient Health Questionnaire-2 (PHQ-2)<sup>70</sup> (see *Appendix E* for the PAID tool and *Appendix F* for the PHQ-2).

A full system review checking for vascular, renal, eye, nerve and podiatric problems is required.

As there is an increasing trend towards involving specialist allied health professionals, the yearly visit is a good opportunity to coordinate follow-up.

### Annual review

An annual review may address the following items.

#### History

- Issues specific to diabetes (e.g. patient perspective on adequacy of treatment, quality of life, medication burden and concerns regarding diabetes).
- Preventive health issues
  - smoking
  - nutrition (last contact with dietitian or diabetes educator)
  - alcohol intake
  - physical activity.
- Adequacy or problems with team care arrangements.

## Clinical examination

- Visual acuity.
- Cardiovascular system, including postural BP, central and peripheral vascular systems. Calculate absolute cardiovascular risk.
- Weight, waist, height (children and adolescents).
- Feet examination without shoes – pulses, monofilament check, any foot discomfort.

## Immunisations

- As in *Section 7.1*.

## Evaluation

- Identify specific clinical areas for focus within the consultation.
- Implement a systematic approach to identify mental health issues or distress related to the diabetes.
- Renew team care planning with identified interventions.
- Identify additional education goals with patient involvement.

## Referral when appropriate

- Diabetes educator, dietitian, podiatrist, exercise physiologist – if patient has developed a problem requiring review.
- Oral health professional – especially if periodontal disease is present.
- Psychologist – if issues identified, such as adjustment disorder, depression and/or anxiety.
- Retinal screening – second yearly with no retinopathy, more frequently if abnormal.
- Diabetes educator, dietitian, podiatrist and dental if periodontal disease is present.

Suggested actions	Team resource – Who?
<b>Ask</b>	
Symptoms	GP/practice nurse/diabetes educator
Goal setting supporting self-management	GP/practice nurse/diabetes educator
Cardiovascular issues	GP/practice nurse/diabetes educator
Glycaemic control	GP/practice nurse/diabetes educator
Other	GP/practice nurse/diabetes educator

Suggested actions	Team resource – Who?
<b>Assess (inclusive within an annual cycle of care)</b>	
Risk factors for modification	GP/practice nurse/diabetes educator
Weight, height	GP/practice nurse
Cardiovascular risk assessment	GP/practice nurse
Foot examination	Podiatrist/GP/practice nurse
Presence of other complications	GP/practice nurse/diabetes educator
Psychological status	GP/practice nurse/psychologist
Eye examination	GP/optometrist/ophthalmologist
Dental review	Dentist
Consider other assessments where appropriate, e.g. cognitive impairment, obstructive sleep apnoea	GP/practice nurse
<b>Advise</b>	
Review SNAP profiles, including specific issues	GP/registered nurse/diabetes educator
Nutrition	Dietitian
Physical activity levels	GP/exercise scientist/physiotherapy
Driving	GP/practice nurse/diabetes educator
Immunisation	GP/practice nurse
Sick day management	Diabetes educator, GP/practice nurse
Medication issues	GP/pharmacist
Self-monitoring blood glucose	Diabetes educator
<b>Assist</b>	
Register for NDSS	GP/diabetes educator
General Practice Management Plan and Chronic Disease Management Plan	GP/practice nurse
Cultural, psychosocial issues	GP/Aboriginal Health Worker/social worker/diabetes educator
<b>Arrange</b>	
Addition to Practice Diabetes Register and Recall	GP/practice nurse/practice staff
Organise reviews including pathology and annual cycle of care	GP/practice nurse
Driver's licence assessment	GP/practice nurse/endocrinologist (when indicated)

# 8. Managing glycaemia

The aim of glycaemic control is to avoid hyperglycaemia and hypoglycaemia, and prevent and manage glycaemic complications of diabetes. Overall, however, managing cardiovascular risk is a higher priority than strict glycaemic control.

See *Section 9* on macrovascular risk.

## 8.1 Glycaemic monitoring and control

Recommendations	Reference	Grade*
HbA1c measurement should be used to assess long-term blood glucose control	(71) NHMRC, 2009	A
SMBG is recommended for patients with type 2 diabetes who are using insulin where patients have been educated in appropriate alterations in insulin dose	(64) SIGN, 2010	B
Routine SMBG in low-risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended	(64) SIGN, 2010	B

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

### The accuracy and limitations of the HbA1c test

Koenig first proposed the measurement of HbA1c in diabetic patients as a marker for evaluating long-term control of diabetes in 1976.<sup>72</sup> Over time this has become a gold standard.

However, doctors should be aware of the potential pitfalls of HbA1c as a measure of long-term diabetes management.

## Test variation

HbA1c can be measured and reported using two different standards: the National Glycohaemoglobin Standardisation Program (NGSP) method reported as a per cent of units (e.g. 7%) and the newer International Federation of Clinical Chemistry (IFCC) standardisation reported as mmol/mol (e.g. 54 mmol/mol).

The variability of HbA1c values within Australia is now acceptably low. In a recent Australian study, more than 90% of HbA1c results fell within 6% of the median. A true level of 7.0% may be reported as anywhere between 6.6% and 7.4%.<sup>31</sup>

This variation needs to be considered when monitoring long-term glucose control.

## Conditions affecting the HbA1c result

Any condition that shortens erythrocyte survival or decreases mean erythrocyte age will falsely lower HbA1c test results regardless of the assay method used (see *Table 8.1*).

The presence of abnormal haemoglobin variants can cause unusually high HbA1c (e.g. HbF, HbE, HbD, HbJ Capetown, Hb Raleigh) or unusually low HbA1c readings (e.g. HbS, HbC, HbJ, HbG, Hb Ramadan).

**Table 8.1. Other causes of variances to HbA1c**

### **Abnormally low HbA1c**

- Haemolytic anaemia: congenital (e.g. spherocytosis, elliptocytosis), haemoglobinopathies, acquired haemolytic anaemias (e.g. drug-induced such as with dapsone, methyl dopa)
- Recovery from acute blood loss
- Chronic blood loss
- Chronic renal failure (variable)

### **Abnormally high HbA1c**

- Iron deficiency anaemia<sup>74</sup>
- Splenectomy
- Alcoholism
- Steroid therapy, stress, surgery or illness in the last 3 months

Several situations may indicate the presence of a haemoglobinopathy, including when:

- results of self-monitoring of blood glucose (SMBG) have a low correlation with HbA1c results
- an HbA1c result is different than expected
- an HbA1c result is more than 15%
- a patient's HbA1c test result is radically different from a previous test result following a change in laboratory HbA1c measurement methods.

If a haemoglobinopathy is suspected, then a haemoglobin electrophoresis is suggested. Schnedl et al. reported a prevalence of abnormal haemoglobin variants of 0.6% among 15 000 HbA1c estimations in a period of over 6 years.<sup>73</sup>

Reliable HbA1c tests, in which haemoglobin variants do not cause interference, are available. Otherwise, alternative forms of diabetes monitoring such as continual blood glucose estimations, SMBG and fructosamine should be considered for these patients.

## SMBG

A 2012 Cochrane review<sup>75</sup> on the effect of SMBG in patients with type 2 diabetes not using insulin found limited clinical benefit as measured by HbA1c from SMBG and no evidence that SMBG affects patient satisfaction, general wellbeing or general health-related quality of life.

Self-monitoring is usually recommended:

- for patients on insulin and oral hypoglycaemic agents (OHAs) that can cause hypoglycaemia
- when monitoring hyperglycaemia arising from illness (see *Section 11* and *Appendix J*)
- with pregnancy, as well as pre-pregnancy planning
- when changes in treatment, lifestyle or other conditions requires data on glycaemic patterns
- when HbA1c estimations are unreliable (e.g. haemoglobinopathies).

The method and frequency of monitoring need to reflect individual circumstances and therapeutic aims and where the person with diabetes and their healthcare providers have the knowledge, skills and willingness to incorporate SMBG and therapy adjustments into diabetes care plans.

# In practice

Recommendations	Reference	Grade*
Blood glucose control should be optimised because of its beneficial effects on the development and progression of microvascular complications	(71) NHMRC, 2009	A
The potential harmful effects of optimising blood glucose control in people with type 2 diabetes should be considered when setting individual glycaemic targets	(71) NHMRC, 2009	A
The general HbA1c target in people with type 2 diabetes is $\leq 7\%$ ( $\leq 53$ mmol/mol). Adjustments to diabetes treatment should be considered when HbA1c is above this level	(71) NHMRC, 2009	A
Targets for SMBG levels are 6–8 mmol/L fasting and pre-prandial, and 6–10 mmol/L 2 h postprandial	(71) NHMRC, 2009	C

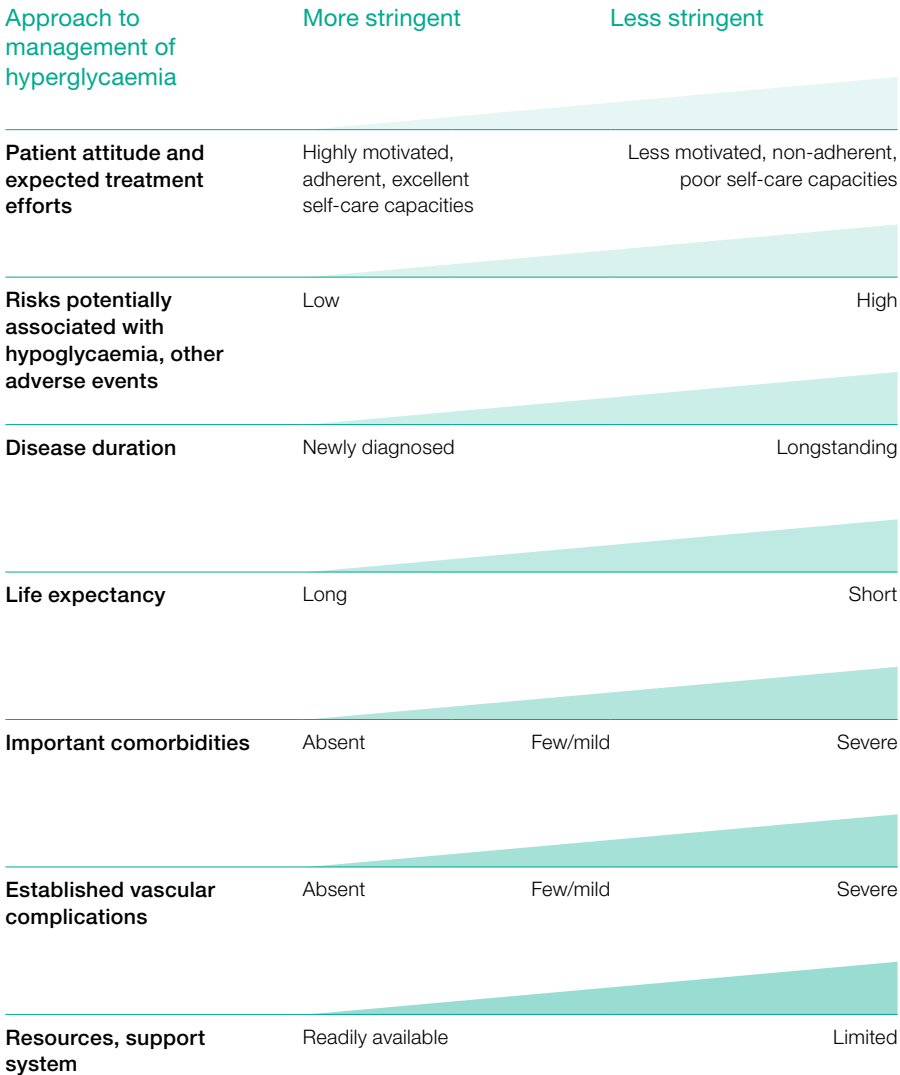
\*Refer to *Appendix A* for an explanation of the Grade.

## HbA1c targets and individualisation

The general HbA1c target in people with type 2 diabetes is HbA1c  $\leq 7\%$  (53 mmol/mol). Due to the natural variation of HbA1c test results, a target HbA1c of 7.0% would be achieved by laboratory results being in a range of 6.5–7.5% (48–58 mmol/mol).

All patients with diabetes need to optimise their blood glucose control to achieve short- and long-term health outcomes. However, what is ‘optimal’ will vary depending on the balance between benefits and risks and the patient’s priorities (see *Figure 3*).

Figure 3. A guide to individualised management of hyperglycaemia



Copyright 2012 American Diabetes Association. Reproduced with permission from the American Diabetes Association from Inzucchi SE, Bergenstal RM, Buse JB, et al. Management of hyperglycemia in type 2 diabetes: a patient-centered approach: position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). Diabetes Care 2012;35(6):1364–79.



Given the range of diabetic presentations to general practice, there can be no one glycaemic target that suits all patients. Targets need be individualised and balanced against patient capabilities and the risk of severe hypoglycaemia, especially among older people.

Control of diabetes symptoms (e.g. polydipsia, polyuria) can usually be achieved around the HbA1c level of 8.0%. This does not necessarily achieve optimum metabolic control.

More stringent HbA1c targets might be considered in selected patients (e.g. those with short disease duration, long life expectancy, no significant CVD) if this can be easily and safely achieved without significant hypoglycaemia or other adverse effects of treatment.

Not everyone benefits from long-term aggressive glucose management.

Less stringent HbA1c goals (e.g. 7.5–8.0% or even slightly higher) are appropriate for patients with a history of severe hypoglycaemia, limited life expectancy, advanced complications, extensive comorbid conditions and those in whom the target is difficult to attain despite intensive self-management education, repeated counselling, and effective doses of multiple glucose-lowering agents, including insulin.<sup>76</sup>

Targets for self-monitored glycaemic control in type 2 diabetes are shown in *Table 8.2*.

**Table 8.2. Targets for self-monitored glycaemic control in type 2 diabetes**

FBG (mmol/L)	Pre-prandial blood glucose (mmol/L)	Postprandial blood glucose (mmol/L)	Comment
6.0–8.0	6.0–8.0	6.0–10.0	NHMRC values <sup>71</sup>

## 8.2 Medication – general

Recommendations	Reference	Grade*
Care should be taken to address potential harmful effects of optimising blood glucose control when setting individual glycaemic targets	(71) NHMRC, 2009	A
Interventions to achieve target HbA1c should begin with lifestyle modification followed by pharmacological options selected on the basis of individual clinical circumstances, side effects and contraindications	(71) NHMRC, 2009	A
Blood glucose control should be optimised because of its beneficial effects on the development and progression of microvascular complications	(71) NHMRC, 2009	A
Adults with a high absolute risk of CVD should be simultaneously treated with lipid and BP-lowering pharmacotherapy in addition to lifestyle advice unless contraindicated or clinically inappropriate	(78) NVDPA, 2012	B

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

In addition to lifestyle modification, most people with type 2 diabetes require pharmacotherapy to achieve long-term glycaemic control and to prevent complications of diabetes.

Benefits from management of hyperglycaemia in prevention of microvascular complications have been supported in prospective clinical trials. BP and lipid-lowering therapy have been demonstrated in clinical trials to show clear benefits in preventing cardiovascular events and reducing premature mortality.

The choice, order and combination of medications are based on evidence, risk of side effects and patient choice/capacity.

### In practice

Use of these therapies is associated with risks and other negative effects. These should be taken into consideration when deciding the appropriateness of implementing the treatment recommendations contained in these guidelines. These therapies may be contraindicated in some situations and their use may result in troublesome side effects.

## 8.3 Glucose-lowering agents

### Clinical context

Multiple hypoglycaemic pharmacotherapies are available (see *Appendix G*).

Algorithms have been designed to help navigate choice. However, applying the principles of patient-centred care may mean that choices made by algorithm are not always appropriate.

In Australia, the existing PBS hypoglycaemic pharmacotherapies algorithm was under review by the Pharmaceutical Benefits Advisory Committee at the time of publication. The review is considering how to incorporate the newer agents available on the market.<sup>55</sup> The Australian Diabetes Society is also currently developing an evidence-based algorithm which will be made available in the online version of this handbook.

Taking a more holistic approach (e.g. addressing major cardiovascular risks), other evidence-based guidelines such as SIGN suggest 'standard' and 'alternative' approaches to glycaemic management (see *Figure 4*).

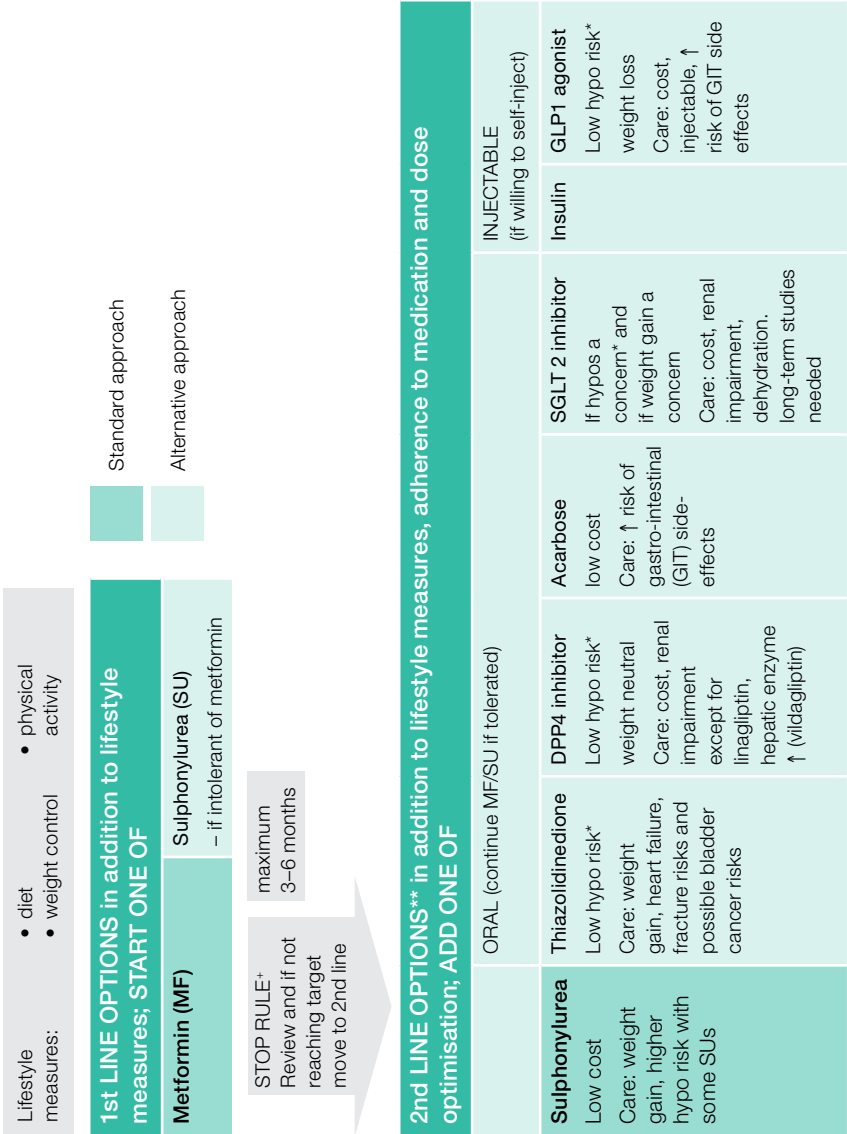
High-quality, prospective analyses of clinical outcomes with respect to microvascular and macrovascular complications reduction from the use of OHAs are still variable across the different classes.

Additionally, when analysing combination therapies used in current suggested algorithms for management of hyperglycaemia, high-quality trials in positive outcome benefit are lacking. The most studied agents include metformin and sulphonylureas. Newer classes of medications and individual agents such as the incretins and sodium glucose co-transporter 2 (SGLT2) inhibitors have no current randomised placebo controlled prospective trial data to demonstrate positive cardiovascular outcome benefit.

Many different algorithms suggest multiple ways of combining agents. It would be wise to consult the PBS for any combination therapy as the restrictions and reimbursement may change.

Figure 4. Algorithm for lowering glucose in type 2 diabetes

Review and set glycaemic target: HbA1c <7% (53 mmol/mol) or individualised as agreed



STOP RULE+ Review  
and if not reaching  
target move to 3rd line

### 3rd LINE OPTIONS in addition to lifestyle measures, adherence to medication and dose optimisation; ADD OR SUBSTITUTE WITH ONE OF

ORAL (continue MF/SU if tolerated)		INJECTABLE (if willing to self-inject)	
PBS	Non-PBS	Insulin (continue MF if tolerated)	GLP-1 agonists (continue MF/SU if tolerated)
Thiazolidinedione (only pioglitazone is PBS listed) If no congestive heart failure	DPP4 inhibitor If weight gain a concern	<ul style="list-style-type: none"> <li>If glycosuric symptoms or rising HbA1c (e.g. &gt;8.5%)</li> <li>Basal insulin or premixed insulin initially</li> <li>Add prandial insulin with time if required (see <i>Appendix I</i>)</li> </ul>	<ul style="list-style-type: none"> <li>If BMI &gt;30 kg/m<sup>2</sup></li> <li>If a desire to lose weight</li> <li>PBS listed (exenatide)</li> </ul>
Acarbose	SGLT 2 inhibitor If other drugs are contraindicated		

+THE STOP RULE – If despite adequate titration doses of medication, blood glucose targets are not being attained after 6 months at the most – STOP and:

- check the patient's understanding of medical and self-management (health literacy) – reinforcement of lifestyle factors influencing health and fitness targets is appropriate
- review: non-adherence will affect ability to achieve targets and may increase risks of short-term and long-term complications
- exclude occult infection (e.g. urinary) or medications which may interfere with control (e.g. steroids) and consider alternate diagnoses such as LADA.

Ask at each visit about hypoglycaemia or other side effects of medication. This is especially relevant for patients who achieve lifestyle changes and are on SUs or insulin. When choosing an agent or agents, consider whether there has been either a prospective cardiovascular outcome trial or at least cardiovascular risk assessment trials

Prescribers should refer to the PBS for updated guidance on licensed indications, full contraindications and monitoring requirements  
\* Hypoglycaemia may affect driving, create occupational hazards and increase risk of falls (particularly in the elderly)

\*\* Continue medication if EITHER individualised target achieved OR HbA1c falls more than 0.5% (5.5 mmol/mol) in 3–6 months

Adapted from the Scottish Intercollegiate Guidelines Network. Management of diabetes. A national clinical guideline: 2010.<sup>64</sup> Additional advice and agents added; some advice removed.

## In practice

### Beginning glucose-lowering therapy

Healthy eating, exercise and education remain the foundation of any type 2 diabetes treatment program.

If lifestyle modification is not effective in controlling hyperglycaemia, metformin is the first choice unless contraindicated or not tolerated.

Second-line agents (added to existing metformin) may be necessary and should be chosen using an individualised approach, noting that agents work in different ways and are chosen to work synergistically.

While these guidelines recommend a stepwise approach to the management of type 2 diabetes, glycaemic management has become more complex with an increasing range of medications now available. There are uncertainties about the effects of various therapies on macrovascular events, a lack of data regarding long-term outcomes with newer agents and potentially serious adverse outcomes associated with some medications. Unfortunately a simple stepwise algorithm does not neatly match individualised patient needs. The European/American position statement<sup>76</sup> gives patient options depending on choices such as efficacy, risk of hypoglycaemia, major side effects, weight gain and costs but unfortunately does not address the lack of outcome data on individual choices of glycaemic agents.

Start with the correct dose of each medication and review at least every 3 months with the patient's individual HbA1c target.<sup>79</sup>

### What if medication is not working?

This is where the '**stop rule**' applies (see *Figure 4*).

Ask at each visit about hypoglycaemia or other side effects of medication.

This is especially relevant for patients who achieve lifestyle changes and are on sulphonylureas or insulin.

### Safety

As monotherapy agents, metformin, acarbose, glitazones, glucagon-like peptide-1 (GLP-1) mimetics and dipeptidyl peptidase-4 (DPP4) inhibitors will not cause hypoglycaemia.

Some long-acting sulphonylureas are more likely to cause hypoglycaemia than shorter-acting sulphonylureas (e.g. gliclazide).<sup>80,81</sup> Special care needs to be taken with those at increased risk of hypoglycaemia, especially in the elderly. People taking sulphonylureas or insulin may need to notify motor vehicle licensing authorities and their insurance company as these medications can affect driving performance (see *Section 14*).

## 8.4 Insulin

### Clinical context

The impact of insulin, as well as the comparative effectiveness of different insulin strategies, on microvascular and cardiovascular outcomes has been partly evaluated in comparative prospective outcome trials (e.g. UKPDS, ACCORD, ADVANCE, VADT).

Rapid-acting insulin and other long-acting insulin analogues offer little benefit relative to conventional insulins in terms of glycaemic control in type 2 diabetes. A meta-analysis demonstrated reduced hypoglycaemia for glargine insulin when compared to isophane insulin.<sup>82</sup> Detemir insulin caused comparatively less weight gain than glargine insulin, but had no glycaemic advantage and often required twice daily injections for the same glycaemic control.<sup>83,84</sup> Detemir insulin is not PBS indicated for type 2 diabetes in Australia.

Of the long-acting analogues, glargine insulin has had cardiovascular risk assessment (ORIGIN trial), which showed no cardiovascular risk increase but also no cardiovascular benefit.

Further long-term, high-quality prospective studies on long-term macrovascular complication reduction are needed for insulin analogues. Surrogate markers such as HbA1c may not necessarily equate with longer term, clinically significant benefits. The use of insulins, although improving glycaemic control, is associated with increased risks of hypoglycaemia and weight gain.

### Rare side effects of insulin therapy

Observational studies have reported a number of rare adverse events associated with insulin use, including congestive heart failure, oedema, lipodystrophy, allergic reactions, reversible transaminitis, reversible nephrotic syndrome and  $\beta$  cell destruction.

## Early insulin intervention

Short-term studies on early intervention with insulin in newly diagnosed type 2 diabetes have shown remission rates of diabetes of 42% at 24 months after therapy initiation. Body weight was higher in the remission groups. However, the absence of long-term studies on patient satisfaction and complication prevention does not support this as standard therapy in general practice.<sup>85</sup>

## Insulin types

See *Appendix H* for types of insulin available.

## Insulin delivery options

A range of devices are available to deliver insulin, including insulin pens, insulin syringes and insulin pumps. Choice will depend on patient preference and capability.

Insulin injectors (pens) are the most common way of administering insulin as they make multiple daily injection schedules much easier and allow people to be more flexible in their self-management. Older people may find the 'InnoLet' injector easier to use because it is larger and has more visible markings.

Insulin pumps have traditionally only been used in the management of type 1 diabetes. There is sparse literature about the benefits of using pumps in people with type 2 diabetes, however, anecdotally, these appear to be advantageous to some people.

Single use of pen needles and syringes is recommended.

## In practice

Insulin therapy can be well managed in general practice. This has been aided by advances in both pharmacotherapy (e.g. the availability of once daily basal insulins, which are relatively simple to initiate and titrate, plus simplified algorithms of prescribing) and technology, which has resulted in essentially painless delivery devices.

GPs should anticipate and proactively address patient (and doctor) hesitation to starting insulin therapy. Many patient concerns can be easily alleviated.<sup>86</sup>

Insulin is still the most effective hypoglycaemic agent for type 2 diabetes. Insulin is not the end of the road for the person with diabetes, nor does it represent therapeutic or patient failure.



## When should patients start insulin?

It is important to discuss with all patients with diabetes that insulin may be required at some stage of their illness. Insulin should be initiated in patients with type 2 diabetes who are taking maximal doses of OHAs (typically metformin and sulphonylureas) **and** who have suboptimal glycaemic control (HbA1c or blood glucose above individualised target) even when asymptomatic<sup>71,76,86,87</sup> **or** have symptomatic hyperglycaemia.<sup>71</sup>

Insulin therapy may be an easier alternative for elderly or nursing home patients with HbA1c >9%, especially if oral therapy is difficult.

## Before starting insulin

Ensure that other possible causes of hyperglycaemia have been addressed (e.g. lifestyle, non-adherence to OHAs, taking other medication or medical conditions).<sup>87</sup>

Discuss with patients the benefits and costs of using insulin for better glycaemic control (see *Box 4*).

Patients (or their carers) will need education about insulin delivery techniques and SMBG. Consider referral to a diabetes educator.

### Box 4. Benefits and costs

**Benefits:** ↓ complications

↑ quality of life

**Costs:** ↑ weight

↑ hypoglycaemic risk

↑ GP visits

## Initiating insulin

All insulins work effectively<sup>88</sup> and there is no wrong choice when commencing insulin. At the same time as selecting which insulin to use, consider which injecting device is most suitable for the patient.

Select one of two insulin schedules:

1. Basal insulin (e.g. glargine, isophane) once daily (see *Appendix 1.1*), or
2. Premixed (biphasic) insulin (e.g. lispro/lispro protamine or aspart/protamine insulin) once daily before the largest meal of the day<sup>89</sup> (see *Appendix 1.2*)

One way to commence insulin therapy is with basal insulin, which has a slightly lower risk of nocturnal hypoglycaemia especially if the fasting glucose is consistently above target.<sup>76, 87, 89</sup> However, premixed insulin may be simpler for a patient where both fasting and postprandial glucose are consistently elevated.

Dosage adjustment can be more complex with premixed insulins as both insulin components are adjusted simultaneously increasing the risk of both hypoglycaemia and weight gain compared with basal insulin.<sup>89–91</sup>

OHAs (e.g. metformin, sulphonylureas) are continued as:

- early cessation before blood glucose targets are achieved can result in significant hyperglycaemia
- ongoing use can reduce weight gain
- ongoing use allows a smaller insulin dose and can reduce the risk of hypoglycaemia or hyperglycaemia.<sup>87</sup>

## Titrating insulin

Set an individualised target (see *Section 8.1*), then 'start low and go slow' to gain patient confidence and reduce the risk of hypoglycaemia.<sup>87</sup>

If insulin is commenced in a timely fashion, HbA1c targets can often be achieved with once daily insulin dose. Blood glucose control may be achieved before the HbA1c is at target because HbA1c measures the blood glucose level (BGL) over the preceding 3 months.

Check HbA1c (3 months):

- Generally, if HbA1c is within target then continue with the current schedule.<sup>79</sup>
- If HbA1c is outside the target further action may be required (see *Box 5*).

### **Box 5. If HbA1c is outside target<sup>86</sup>**

Look for hidden hyperglycaemias by checking BGL before lunch and before bedtime.

If postprandial hyperglycaemia is identified, consider:<sup>87</sup>

- changing preceding meal size or composition
- increasing activity after meals
- adding acarbose
- adding a prandial insulin dose (see insulin intensification)
- switching to a premixed insulin (if on basal insulin alone).

# Insulin intensification – choosing a second-line insulin schedule

If HbA1c is elevated despite achieving appropriate BGL, a second-line insulin schedule (insulin intensification) should be implemented based on the individual patient needs (see *Table 8.3*).

**Table 8.3. Patient considerations with insulin intensification**

Considerations when setting targets	Lower target	Higher target	
Willing to monitor BGL several times/day	+	–	
Support from family and GP	+	–	
Physically and cognitively capable	+	–	
Considerations when selecting a schedule	Basal Plus	Basal Bolus	Premixed
Patient preference for fewest injections	+		+
Variable meal pattern	+	+	
Variable daily routine	+	+	
Better postprandial control required	+	+	±
Limited capacity (e.g. dexterity)			+

The preferred schedule is not the one with the most ‘+’, but one which meets the specific needs best.<sup>92, 94</sup>

There are three insulin intensification strategies<sup>92</sup> that can be implemented:

1. Basal Plus – where additional pre-prandial injection of short-acting insulin is added to basal insulin (see *Appendix 1.3*).
2. Basal Bolus – where short-acting insulin injections are used before each meal in addition to basal insulin (see *Appendix 1.3*).
3. Premixed – where additional injections of premixed are added to meals – either twice daily or three times a day, or, alternatively, basal insulin is switched to premixed insulins (see *Appendix 1.2*).

As Basal Bolus involves the most number of injections and monitoring, it is typically the final strategy implemented.

When insulin intensification is initiated (such as a second dose of insulin), metformin should be continued, but any remaining insulin secretagogues should be ceased due to increased risk of hypoglycaemia.

An alternative strategy to insulin intensification for patients using basal insulin is the addition of a GLP-1 receptor agonist (e.g. exenatide). This strategy has the potential to improve HbA1c and postprandial BGL, while controlling weight gain and having no marked increase risk of hypoglycaemia.<sup>93</sup> The introduction of the GLP-1 agonist requires instruction on injection technique – but is usually slowly titrated from a starting dose over several weeks, to a stable twice daily or once daily routine depending on the choice of agents. Currently, only exenatide is TGA approved (but not PBS listed) for use in combination with basal insulin.

## Follow-up

The insulin schedule and dosing should be reviewed at each consultation. The insulin dosage may need to be reduced if the person adopts a healthier lifestyle and/or loses weight.

## 9. Managing cardiovascular risk

Recommendations	Reference	Grade*
Patients with pre-existing CVD are at high risk	(78) NVDPA, 2012	A
Adults with any of the following conditions do not require absolute cardiovascular risk assessment using the Framingham Risk Equation because they are already known to be at clinically determined high risk of CVD: <ul style="list-style-type: none"> <li>• Diabetes and age &gt;60 years</li> <li>• Diabetes with microalbuminuria (&gt;20 mcg/min or urinary albumin-to-creatinine ratio (UACR) &gt;2.5 mg/mmol for men, &gt;3.5 mg/mmol for women)</li> <li>• Moderate or severe CKD (CKD) (persistent proteinuria or eGFR &lt;45 mL/min/1.73 m<sup>2</sup>)</li> <li>• A previous diagnosis of familial hypercholesterolaemia</li> <li>• SBP ≥180 mmHg or DBP ≥110 mmHg</li> <li>• Serum total cholesterol &gt;7.5 mmol/L</li> </ul>	(78) NVDPA, 2012	D
Calculate risk level using an evidence-based tool: National Vascular Prevention Disease Alliance charts, <a href="http://www.cvdcheck.org.au">www.cvdcheck.org.au</a> New Zealand Cardiovascular Risk charts, <a href="http://www.health.govt.nz/about-ministry/ministry-health-websites/new-zealand-guidelines-group">www.health.govt.nz/about-ministry/ministry-health-websites/new-zealand-guidelines-group</a> Heart Foundation NZ, <a href="http://www.knowyournumbers.co.nz">www.knowyournumbers.co.nz</a>	(78) NVDPA, 2012	B
Aboriginal and Torres Strait Islander peoples are generally assumed to be at higher risk	(78) NVDPA, 2012	B

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

CVD is the leading cause of death in people with diabetes, making assessment of cardiovascular risk a vital part of diabetes care.

Assessment of combined multiple risk factors (absolute CVD risk) is more accurate than the use of individual risk factors.<sup>78</sup>

As with glycaemic targets, treatment targets in CVD need to be made on an individual basis, balancing the benefits and risks of interventions. For example, the cardiovascular risk associated with lipid and BP levels is continuous and hence specific targets are somewhat arbitrary and should be used as a guide to treatment, and not as a mandatory requirement. *Table 9.1* can be used when developing a management plan for patients.

The risks associated with the effort required to reach a particular target, as opposed to achieving a near-target value, may outweigh any small absolute benefit. Any reduction in risk factor values will be associated with some benefit.<sup>78</sup>

Recommendations are summarised from the *Guidelines for the management of absolute CVD risk*, 2012.<sup>78</sup>

**Table 9.1. Risk management summary**

CVD risk	Lifestyle	Pharmacotherapy	Targets	Monitoring
<p><b>HIGH RISK</b></p> <p>Clinically determined or calculated using FRE as &gt;15% absolute risk of CVD events over 5 years</p>	<p>Frequent and sustained specific advice and support regarding diet and physical activity.</p> <p>Appropriate advice, support and pharmacotherapy for smoking cessation.</p> <p>Advice given simultaneously with BP and lipid-lowering drug treatment.</p>	<p>Treat simultaneously with lipid-lowering and BP-lowering unless contraindicated or clinically inappropriate.</p> <p>Aspirin not routinely recommended.</p> <p>Consider withdrawal of therapy for people who make profound lifestyle changes.</p>	<p>BP:</p> <p>≤140/90 mmHg in general or people with CKD;</p> <p>≤130/80 mmHg in all people with diabetes;</p> <p>≤130/80 mmHg if microalbuminuria or macroalbuminuria (UACR &gt;2.5 mg/mmol in men and &gt;3.5 mg/mmol in women).</p>	<p>Review response 6–12 weekly until sufficient improvement or maximum tolerated dose achieved.</p> <p>Adjust medication as required.</p> <p>Review of absolute risk according to clinical context.</p>

CVD risk	Lifestyle	Pharmacotherapy	Targets	Monitoring
<b>MODERATE RISK</b> Calculated using FRE as 10–15% absolute risk of CVD events over 5 years	Appropriate, specific advice and support regarding diet and physical activity. Appropriate advice, support and pharmacotherapy for smoking cessation. Lifestyle advice given in preference to drug therapy.	Not routinely recommended. Consider BP-lowering and/or lipid-lowering in addition to lifestyle advice if 3–6 months of lifestyle intervention does not reduce risk or: <ul style="list-style-type: none"> <li>• BP persistently <math>\geq 160/100</math> mmHg</li> <li>• Family history of premature CVD</li> <li>• Specific population where the FRE underestimates risk e.g. Aboriginal and Torres Strait Islander, South Asian, Maori, Pacific Islander and Middle Eastern peoples.</li> </ul> Consider withdrawal of therapy for people who make profound lifestyle changes.	Lipids: TC $< 4.0$ mmol/L; HDL-C $\geq 1.0$ mmol/L; LDL-C $< 2.0$ mmol/L; Non-HDL-C $< 2.5$ mmol/L; TG $< 2.0$ mmol/L.  Lifestyle: Smoking cessation (if smoker); consume diet rich in vegetables and fruit, low in salt and saturated and trans fats; at least 30 min physical activity on most or preferably every day of the week; limit alcohol intake.	Review response 6–12 weekly until sufficient improvement or maximum tolerated dose achieved. Adjust medication as required. Review absolute risk every 6–12 months.
<b>LOW RISK</b> Calculated using FRE as $< 10\%$ absolute risk of CVD events over 5 years	Brief, general lifestyle advice regarding diet and physical activity. Appropriate advice, support and pharmacotherapy for smoking cessation.	Not routinely recommended. Consider BP-lowering therapy in addition to specific lifestyle advice if BP persistently $\geq 160/100$ mmHg. Consider withdrawal of therapy for people who make profound lifestyle changes.		Review response 6–12 weekly until sufficient improvement or maximum tolerated dose achieved. Adjust medication as required. Review absolute risk every 2 years. Blood test results within 5 years can be used.

BP: blood pressure; CKD: chronic kidney disease; CVD: cardiovascular disease; DBP: diastolic blood pressure; FRE: Framingham Risk Equation; HDL-C: high density lipoprotein cholesterol; LDL-C: low density lipoprotein cholesterol; SBP: systolic blood pressure; TC: total cholesterol; TG: Triglycerides; UACR: urinary albumin-to-creatinine ratio.

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# In practice

There are several interventions for managing cardiovascular risk.

## Lifestyle interventions to reduce cardiovascular risk

Lifestyle changes in nutrition, physical activity and smoking status fundamentally underpin a comprehensive approach to cardiovascular risk minimisation. One study, the Look AHEAD study, showed improved HbA1c and quality of life benefit but no reduction in risk of cardiovascular morbidity or mortality in people with type 2 diabetes.<sup>59</sup>

Lifestyle changes show excellent cost-effectiveness in lowering the burden of disease and remain, the basis for management of all cardiovascular risk levels.<sup>95,96</sup>

See *Section 6*, Lifestyle modification.

## Antihypertensive medication to manage cardiovascular risk

Recommendations	Reference	Grade*
BP-lowering therapy in people with diabetes should preferentially include an angiotensin converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB)	(78) NVDPA, 2012	A
If monotherapy does not sufficiently reduce BP add one of the following:		
• Calcium channel blocker	(78) NVDPA, 2012	B
• Low-dose thiazide or thiazide-like diuretic	(78) NVDPA, 2012	C

\*Refer to *Appendix A* for an explanation of the Grade.

Lowering BP reduces cardiovascular events and all-cause mortality in people with type 2 diabetes in the same manner as for the general population.

While no difference is noted between different classes of BP-lowering therapy for CVD outcomes, there is clear evidence that in people with type 2 diabetes, antihypertensive therapy with an ARB or ACEI decreases the rate of progression of albuminuria, promotes regression to normoalbuminuria and may reduce the risk of decline in renal function. Combination of an ARB and an ACEI are not recommended.



The target level for optimum BP is controversial.

The target levels for BP therapy have been based on little direct evidence. Meta-analyses demonstrate that more intensive BP control (SBP  $\leq 130$  mmHg) compared to usual ( $< 140/90$  mmHg) was associated with further reduction in stroke only, but there was a 40% increase in serious adverse events. This target is currently being reconsidered by a number of organisations worldwide and the SBP may be adjusted upwards. Until such deliberations are complete, the general international BP target for people with diabetes remains  $\leq 130/80$  mmHg.

### Lipid medication to manage cardiovascular risk

Recommendations	Reference	Grade*
Use statins as first-line therapy	(78) NVDPA, 2012	A

\*Refer to *Appendix A* for an explanation of the Grade.

GPs should consider treatable secondary causes of raised blood lipids before commencing drug therapy.

When commencing drug therapy, statins remain the clear first-line choice. The results from several systematic reviews are consistent, and suggest that people with diabetes gain at least similar benefits from statin therapy as people without diabetes. The data clearly demonstrate that statin therapy results in a significant decrease in CAD morbidity and mortality in type 2 diabetes for those at high cardiovascular risk. This benefit is in contrast to the contentious effects of improved glycaemic control in CVD.

Apart from statins, the evidence for other lipid-lowering therapy in decreasing the risk of CAD is weak or inconsistent. Nicotinic acid, bile-acid resins, ezetimibe and fibrates (fenofibrate, gemfibrozil) have been suggested as alternatives for people who cannot tolerate a statin.

Nicotinic acid has been shown to reduce CVD outcomes, although the study was done in a non-diabetic cohort<sup>97</sup> and more recent studies have not confirmed this initial result. The use of nicotinic acid, in particular, as well as gemfibrozil and cholestyramine is limited by a high rate of adverse effects.

The role of fibrates to decrease CVD is contentious. All large prospective randomised clinical trials of fibric acids have failed to decrease the primary cardiovascular end point. However, in all studies, predominantly post-hoc analyses have shown that sub-groups having a low HDL-C level < 0.9 mmol/L together with a raised triglyceride (generally > 2.3 mmol/L) derive a significant benefit from fibrate therapy. Given these results, it is reasonable to consider the introduction of fenofibrate in high-risk patients on statin therapy whose LDL-C is not at target and who have low HDL-C and raised TG levels.

Two studies have prospectively assessed the effect of fenofibrate on microvascular disease, principally retinopathy. In both the FIELD and ACCORD studies, patients randomised to fenofibrate therapy had a significant reduction in retinopathy and need for laser surgery. Additionally, in FIELD, there was a reduction in peripheral neuropathy complications and an improvement in proteinuria, suggesting a more generalised effect on microvascular disease. In Australia, the TGA has now approved the use of fenofibrate for the treatment of diabetic retinopathy. Its use in patients with diabetes with evidence of retinopathy should now be considered. The benefits on retinopathy were not dependent on the patient having dyslipidaemia.<sup>98</sup>

## Antithrombotic therapy

Prescription of antithrombotic therapy (e.g. aspirin, clopidogrel) is not usually recommended in primary prevention.

GPs may need to make individual judgements regarding this because of other guidelines recommendations (e.g. transient ischaemic attack [TIA]). Guidelines for secondary prevention routinely advocate intensive antithrombotic therapy.

# 10. Managing microvascular and other complications

## 10.1 Diabetic retinopathy

Recommendations	Reference	Grade*
Ensure that all people with diabetes have a dilated fundus examination and visual acuity assessment at the diagnosis of diabetes and at least every 2 years	(99) NHMRC, 2008	None provided (Level I evidence)
Examine higher risk patients (longer duration of diabetes, poor glycaemic control, BP or blood lipid control) without diabetic retinopathy at least annually	(99) NHMRC, 2008	None provided (Level I evidence)
Conduct annual screening for Aboriginal or Torres Strait Islander peoples with diabetes	(99) NHMRC, 2008	None provided (Level IV evidence)

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

Diabetic retinopathy (DR) occurs as a result of microvascular disease of the retina and causes visual impairment and blindness.

DR is categorised as:

- non-proliferative DR or
- proliferative DR.

Tight control of blood glucose and BP reduces the risk of onset and progression of diabetic eye disease in type 2 diabetes.

With good screening and care, visual impairment due to diabetes can be avoided for the vast majority of patients.

### Retinal photography

Retinal photography is technically simple and is now usually performed within the Australian community by ophthalmologists, optometrists and some GPs. Training is required to ensure quality of image interpretation. Some isolated general practices and Aboriginal Health services are providing their own retinal photography services.

People whose retinal images suggest they may be at increased risk of having, or at some point developing sight-threatening retinopathy should be referred for ophthalmology.

## In practice

Assess all patients with type 2 diabetes for risk factors (see *Box 6*).

### Box 6. Risk factors for development and progression of DR

- Existing DR
- Poor glycaemic control
- Raised BP
- Duration of diabetes >10 years
- Microalbuminuria
- Dyslipidaemia
- Anaemia
- Pregnancy

The aim is to prevent vision loss and this is best done with regular review of fundi, early detection and optimisation of therapy.

GPs can monitor patients for diabetic eye disease if they are confident of their technique and examine the eyes through dilated pupils or have their own retinal camera. Where practitioners are not comfortable with fundoscopy and assessment of retina, referral to an ophthalmologist or optometrist is recommended.

Monitoring involves:

- visual acuity (with correction)
- cataracts (see *Section 10.2*)
- retinopathy (examine with pupil dilation or retinal camera, or refer to an optometrist or ophthalmologist).

Initial and then intermittent referral to an ophthalmologist or optometrist is still recommended for DR or peripheral retinopathy, which can be treated with laser photocoagulation therapy to prevent visual loss secondary to retinal haemorrhage.

Patients should be reviewed at least second yearly and more frequently if problems exist.

## 10.2 Other ophthalmological effects

### Refractive errors

Refractive errors occur as the lens shape alters with changes in blood glucose concentrations and result in blurred vision. Detection is done with pinhole test – blurred vision due purely to refractive error corrects with the pinhole test.

Correction of refractive errors should be postponed until blood glucose levels are stabilised.

### Cataracts

Cataracts occur prematurely in people with diabetes. Patients present with blurred vision and glare intolerance and may find night vision a particular problem. Over time, interpretation of colours becomes more difficult.

Clinically the light reflex is reduced and the fundus may be difficult to see.

Surgical treatment is recommended when reduced acuity is affecting lifestyle and independence.

### Maculopathy

Maculopathy is difficult to see ophthalmoscopically but is the most common cause of visual loss in people with diabetes. Assessment is by direct ophthalmoscopy (with dilated pupils), retinal photography and fluorescein angiography depending on the state of the patient's fundi.

### Sudden blindness

Sudden loss of vision, beyond the annual or biannual review of fundi and visual acuity may be due to:

- central retinal artery occlusion
- retinal detachment
- vitreous haemorrhage.

These conditions can occur independently of diabetes. Urgent contact with an ophthalmologist or timely assessment by a specialist team is indicated.

## 10.3 Neuropathy

### Clinical context

Pain and paraesthesia are common peripheral neuropathic symptoms, and if the autonomic nervous system is involved, gastrointestinal, bladder and sexual problems arise.

Diabetic neuropathic complications increase the patient burden of self-care and overall management.

The clinical focus is on prevention via good glycaemic control, and early recognition facilitated by good history and routine sensory testing. New modalities are arriving to assist in the management of diabetic neuropathies.

Before any treatment is instigated, exclusion of non-diabetic causes of neuropathy is suggested. This includes assessment for vitamin B12 deficiency, hypothyroidism, renal disease and review of neurotoxic drugs including excessive alcohol consumption.

### Autonomic neuropathy

Autonomic neuropathy may result in:

- orthostatic hypotension with >20 mmHg drop
- impaired and unpredictable gastric emptying (gastroparesis), which can cause a person's blood glucose levels to be erratic and difficult to control. Pro-kinetic agents such as metoclopramide, domperidone or erythromycin may improve symptoms
- diarrhoea
- delayed/incomplete bladder emptying
- erectile dysfunction and retrograde ejaculation in males
- reduced vaginal lubrication with arousal in women
- loss of cardiac pain, 'silent' ischaemia or infarction
- sudden, unexpected cardiorespiratory arrest especially under anaesthetic or treatment with respiratory depressant medications
- difficulty recognising hypoglycaemia
- unexplained ankle oedema.

**Cardiovascular autonomic neuropathy** should be suspected by resting tachycardia (>100 bpm) or orthostatic reduction in BP (a fall in SBP >20 mmHg on standing without an appropriate heart rate response). This applies to patients not currently on antihypertensive agents that may cause variations in BP responsiveness such as beta blockers. It is associated with increased cardiac event rates.

## Diabetic peripheral neuropathy

Recommendations	Reference	Grade*
All patients should be screened for distal symmetric polyneuropathy starting at diagnosis of type 2 diabetes and at least annually thereafter, using simple clinical tests	(100) American Diabetes Association, 2012	B
Antidepressants, including tricyclics, duloxetine and venlafaxine should be considered for the treatment of patients with painful diabetic peripheral neuropathy	(64) SIGN, 2010	A
Anticonvulsants, including pregabalin and gabapentin should be considered for the treatment of patients with painful diabetic peripheral neuropathy	(64) SIGN, 2010	A

\*Refer to *Appendix A* for an explanation of the Grade.

Diabetic neuropathies increase with age, duration of diabetes and level of control of diabetes. They are heterogeneous with diverse clinical manifestations and may be focal or diffuse.

### In practice

Early recognition and appropriate management is important. Patients with diabetes should be checked annually for diabetic peripheral neuropathy.

The appearance of peripheral neuropathy should prompt review and consideration of improved glycaemic control.

Combinations of more than one test have >87% sensitivity in detecting diabetic peripheral neuropathy. (See *Box 7*) Loss of 10-g monofilament perception and reduced vibration perception predict foot ulcers.<sup>101</sup>

The pain of peripheral neuropathy can be difficult to manage, although there is evidence that several agents can improve symptom control and quality of life. Tricyclic medications should be used as a first-line treatment, although side effects are not uncommon.

Gabapentin provides pain relief of a high level in approximately one-third of people who take this medication for painful neuropathic pain. Side effects are common (66%).<sup>102</sup> Pregabalin at daily oral doses of 300–600 mg provides high levels of benefit for a minority of patients experiencing neuropathic pain including painful diabetic neuropathy.<sup>103</sup>

Motor neuropathy sometimes occurs with muscle wasting, weakness and abnormalities of gait. This can contribute to foot problems by altering the biomechanics of the ankle and foot.

### Box 7. Tests to assess for peripheral neuropathy

- Pinprick sensation
- Vibration perception (using a 128-hz tuning fork)
- 10-g monofilament pressure sensation at the distal plantar aspect of both great toes and metatarsal joints
- Assessment of ankle reflexes

## 10.4 Nephropathy

Recommendations	Reference	Grade*
<b>Assessment</b>		
Kidney status in people with type 2 diabetes should be assessed by:		
• annual screening for albuminuria (note that dipstick urine test is not adequate to identify albuminuria)	(25) NHMRC, 2009	B
• annual estimation of the glomerular filtration rate (eGFR in mL/min/1.73m <sup>2</sup> )	(25) NHMRC, 2009	B
<b>Management</b>		
Reducing the risk or slowing the progression of nephropathy can be achieved by:		
• optimising glucose control aiming for a general HbA1c target of 7%	(104) Kidney Health Australia, 2012	A
• optimising BP control	(104) Kidney Health Australia, 2012	A
In people with type 2 diabetes and microalbuminuria or macroalbuminuria, ARB or ACEI antihypertensive should be used to protect against progression of kidney disease	(104) Kidney Health Australia, 2012	A
People with type 2 diabetes should be informed that smoking increases the risk of CKD	(104) Kidney Health Australia, 2012	B
People with diabetes and microalbuminuria are considered at high cardiovascular risk, and should be treated with multifactorial interventions (see <i>Section 9</i> )	(78) NVDPA, 2012	D

\*Refer to *Appendix A* for an explanation of the Grade.



## Clinical context

Diabetic nephropathy occurs in one in four women and one in five men with type 2 diabetes<sup>105</sup> and is the single leading cause of end-stage renal disease.

Diabetic nephropathy is more common in Aboriginal and Torres Strait Islander peoples. Some non-European groups (South-East Asian, African American, Afro-Caribbean, Maori peoples) have high rates of end-stage diabetic nephropathy, possibly, but not entirely, due to later diagnosis and poorer care.

There is strong evidence that treatment in the early stages of CKD reduces progression of kidney damage, morbidity and mortality. Therefore people with type 2 diabetes should be screened and retested regularly to detect early indications of kidney damage and to monitor the effects of treatment.

Intensive diabetes management with the goal of achieving near normoglycaemia has been shown in large prospective randomised studies to delay the onset of microalbuminuria and the progression of microalbuminuria to macroalbuminuria in patients with type 2 diabetes.

SBP appears to be the best indicator of the risk of CKD in type 2 diabetes. However, the optimum and safest lower limit of SBP has not been clearly defined. General advice is approaching a target of 130/80 mmHg.<sup>104</sup>

## In practice

### Assessment

Screening for microalbuminuria can be performed by measurement of the urine albumin-to-creatinine ratio (UACR) in a random spot collection (preferred method). Any positive UACR needs to be confirmed with a repeated collection and also with a midstream urine to exclude urinary tract infection as a contributor to proteinuria.

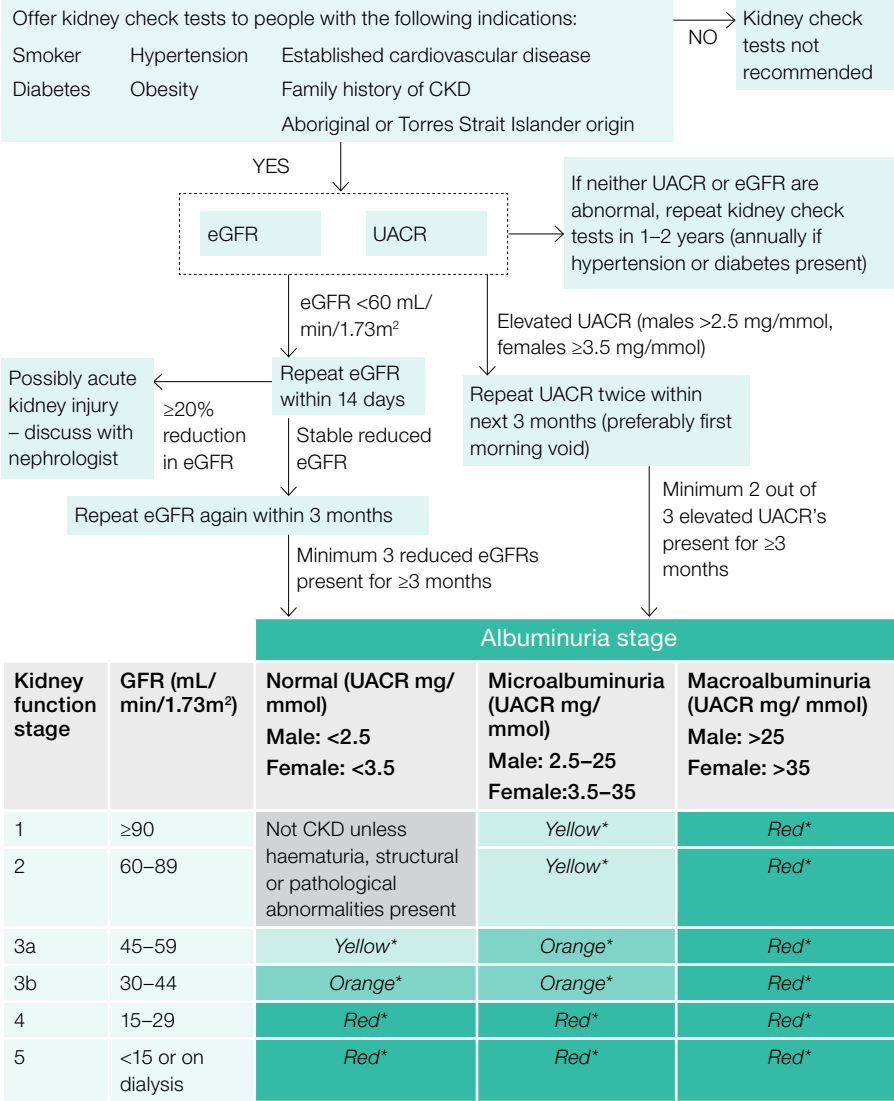
The automatic calculation of eGFR on measurement of serum creatinine is now implemented within Australia.

Review of possible nephrotoxic medication, investigations to exclude treatable causes of kidney disease, and the assessment of a patients cardiovascular risk form a baseline approach to patients with confirmed kidney disease.

See *Figure 5* for an algorithm for initial detection of CKD.

Figure 5. Algorithm for initial detection of CKD

Note: This algorithm does not allow for checks for people with glomerulonephritis, systemic lupus erythematosus or people on nephrotoxic drugs.



Combine eGFR stage (1-5), albuminuria stage and underlying diagnosis to fully specify CKD stage (e.g. stage 2 CKD with microalbuminuria secondary to diabetic kidney disease).  
\*Refer to colour-coded action plans (yellow, orange, red) in CKD Management in General Practice Management<sup>104</sup> for management strategies.  
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## Management

Due to potential reno-protective effects, the use of ACEI or an ARB should be considered for the small subgroup of people with normal BP who have type 2 diabetes and microalbuminuria.<sup>106</sup>

Medication considerations:

- **Metformin** – should be used with caution, and reduced when eGFR is 30–60 mL/min/1.73m<sup>2</sup>. It is not recommended and should be ceased when eGFR is <30 mL/min/1.73m<sup>2</sup>
- **DPP4 inhibitors** – reduction of dose of sitagliptin, vildagliptin, saxagliptin and alogliptin are required with eGFR <60 mL/min/1.73m<sup>2</sup>. Linagliptin has no dose adjustment requirement in renal impairment.
- **Sulphonylureas** – as renal function declines, the half-life of sulphonylureas increase, raising the risk of hypoglycaemia. Potentially nephrotoxic medications (e.g. non-steroidal anti-inflammatory drugs [NSAIDs]) should be avoided.

Box 8 shows the criteria for referral to a renal specialist.

### Box 8. Referral criteria for specialist renal care<sup>105</sup>

Referral criteria for specialist renal care may include:

- eGFR <30 mL/min/1.73m<sup>2</sup>
- persistent significant albuminuria (UACR ≥30 mg/mmol)
- consistent decline in eGFR from a baseline of <60 mL/min/1.73m<sup>2</sup> (a decline >5 mL/min/1.73m<sup>2</sup> over a 6-month period which is confirmed on at least three separate readings)
- glomerular haematuria with macroalbuminuria
- CKD and hypertension that is hard to get to target despite at least three antihypertensive agents.

## 10.5 Foot complications

Recommendations	Reference	Grade*
Assess all people with diabetes and stratify their risk of developing foot complications	(107) NHMRC, 2011	C
People assessed as having intermediate- or high-risk feet should be offered a foot protection program. A foot protection program includes foot care education, podiatry review and appropriate footwear	(107) NHMRC, 2011	C
Pressure reduction, otherwise referred to as redistribution of pressure or offloading, is required to optimise the healing of plantar foot ulcers	(107) NHMRC, 2011	B
Offloading of the wound can be achieved with the use of a total contact cast or other device rendered irremovable	(107) NHMRC, 2011	B
People with diabetes-related foot ulceration are best managed by a multidisciplinary foot care team	(107) NHMRC, 2011	C

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

Foot ulceration and limb amputation are among the major drivers of disability and healthcare costs in people with diabetes. Foot ulceration accounts for one in five of all diabetes-related admissions to hospital.

Podiatry problems may result from vascular or neuropathic complications of diabetes or both. Predisposing structural problems often exist, heightening complication risks. Improper footwear and tinea infection have been associated with increased podiatry problems.

A care plan and foot protection program that includes prevention, patient education, multidisciplinary care, and close monitoring and treatment of foot ulcers can substantially reduce amputation rates.

Patients should understand the importance of appropriate footwear and foot care, establish a regular self-monitoring schedule (including visual checks) and have an action plan to respond to early problems (e.g. skin breakdown). Regular podiatric review needs to be considered.

## In practice

Foot care education should be provided to all people with diabetes to assist with prevention of foot complications. For people with intermediate and high risk, a podiatry assessment is an important component of a foot protection program. However, where this is not possible, a suitably trained healthcare worker may perform the foot assessment.

A careful foot assessment should be performed to stratify the risk of developing foot complications. Assessment is dependent on three risk factors:

1. **Peripheral arterial disease (PAD)** – which can be assessed by dorsalis pedis and tibialis anterior pulses or hand held Doppler. If problems are suspected, consider ankle brachial index (ABI) testing.
2. **Neurological testing** – which can be undertaken using a neuropathy disability score or a 10-g monofilament assessment.
3. **Deformities and ulceration** – these can be assessed by visual inspection.

Practitioners are advised to stratify foot risk according to the presence of risk factors and history of ulceration. The intensity of monitoring and review increases according to level of risk.

*Table 10.1* shows risk categorisation for complications and elements to consider during foot assessment.

### ABORIGINAL AND TORRES STRAIT ISLANDER POINT

Until adequately assessed, all Aboriginal and Torres Strait Islander peoples with diabetes are considered to be at high risk of developing foot complications and therefore will require foot checks at every clinical encounter and active follow-up.

**Table 10.1. Guidance on risk categorisation for complications and elements to consider during foot assessment<sup>107</sup>**

Stratification of foot ulceration and amputation risk in diabetes		NHMRC grade*	Foot care and education – tailored to foot risk status
Low risk	No risk factors for foot ulceration or ulceration/amputation	C	Offer basic foot care information and annual foot assessment
Intermediate risk	One risk factor only (i.e. neuropathy, PAD) and no previous history of foot ulceration or amputation	C	Offer program that includes foot care education, podiatry review every 6 months and footwear assessment
High risk	Two or more risk factors (i.e. neuropathy, PAD or foot deformity) and/or previous foot ulceration or amputation	C	Offer program that includes foot care education, podiatry review and footwear assessment
High risk	Aboriginal or Torres Strait Islander peoples with diabetes	Practice point	Offer program that includes foot care education, podiatry review and footwear assessment

\*Refer to *Appendix A* for an explanation of the Grade.

## Foot ulceration

A foot ulcer is a serious condition and needs to be managed immediately.

The University of Texas wound classification system is the most useful tool for grading foot ulcers<sup>108,109</sup> (see *Table 10.2*).

The first priority of management of foot ulceration is to prepare the surface and edges of a wound to facilitate healing. Local sharp debridement of non-ischaemic wounds should be performed because it improves ulcer healing.

If arterial insufficiency is suspected, assessment and management of the peripheral vasculature is mandatory before removal of non-viable or necrotic tissue is considered. Referral to a vascular surgeon, high-risk foot clinic and/or multidisciplinary team is suggested in this situation.

Wound dressings need to be tailored to the specific characteristics of the wound. In **non-ischaemic ulcers**, create a moist wound environment. Currently there is insufficient evidence to demonstrate the superiority of any one type of wound dressing over another in management of ulcers. In **ischaemic ulcers** maintain a dry wound environment using a dry, non-adherent dressing until someone with experience in PAD has reviewed the wound.

Table 10.2. University of Texas Wound Grading System<sup>108,109</sup>

Grade/depth: 'How deep is the wound?'					
Stage/ comorbidities: 'Is the wound infected, ischaemic or both?'	Depth	Grade			
		0	I	II	III
	A	Pre- or post-ulcerative lesion completely epithelialised	Superficial wound not involving tendon, capsule or bone	Wound penetrating to tendon or capsule	Wound penetrating to bone or joint
	B	Pre- or post-ulcerative lesion completely epithelialised with infection	Superficial wound not involving tendon, capsule or bone with infection	Wound penetrating to tendon or capsule with infection	Wound penetrating to bone or joint with infection
	C	Pre- or post-ulcerative lesion completely epithelialised with ischaemia	Superficial wound not involving tendon, capsule or bone with ischaemia	Wound penetrating to tendon or capsule with ischaemia	Wound penetrating to bone or joint with ischaemia
	D	Pre- or post-ulcerative lesion completely epithelialised with infection and ischaemia	Superficial wound not involving tendon, capsule or bone with infection and ischaemia	Wound penetrating to tendon or capsule with infection and ischaemia	Wound penetrating to bone or joint with infection and ischaemia



Factors that favour referral to a multidisciplinary foot care team include:

- deep ulcers (probe to tendon, joint or bone)
- high-risk foot with active ulcer
- ulcers not reducing in size after 4 weeks despite appropriate treatment. If in regional or remote areas, a telemedical review or telephone review would be recommended
- the absence of foot pulses
- ascending cellulitis
- suspected Charcot neuroarthropathy (e.g. unilateral, red, hot, swollen, possibly aching foot).

If access to a multidisciplinary foot care team is limited, foot ulceration or foot complications other than those above should be managed by a GP together with a podiatrist and/or wound care nurse.<sup>107</sup>

An important reason for failure of an ulcer to heal is continued trauma to the bed of the wound. This generally occurs because the foot is insensate and the patient continues to bear weight through the wound. A number of offloading devices are currently available. These include total contact casts and removable prefabricated devices (e.g. controlled ankle movement walkers, half-shoes and therapeutic shoes).

## Infection

The need for antibiotics should be determined on clinical grounds.

It is appropriate for cultures to be collected for identification of microbiological organisms and antibiotic sensitivities. The most appropriate tissue samples for microbiological evaluation are either deep tissue swabs after debridement or tissue/bone biopsies.

Infected ulcers should be treated with antimicrobial therapy according to published antibiotic guidelines such as *Therapeutic Guidelines Antibiotic* version 14.

The duration of therapy may need to be for extended periods.

There is no need to culture clinically uninfected ulcers as colonising organisms will always be detected.

# 11. Glycaemic emergencies

See *Appendix J* for more detailed information.

Recommendations	Reference	Grade*
The potential harmful effects of optimising blood glucose control in people with diabetes should be considered when setting individual glycaemic targets	(71) NHMRC, 2009	A
Improving blood glucose control increases the risk of hypoglycaemia	(71) NHMRC, 2009	None provided (Level I evidence)

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

In patients with type 2 diabetes high and low glucose states can occur – and both have significant impacts and implications.

Hypoglycaemia is more common in people taking insulin. However it can also occur with sulphonylurea therapy either alone or supplementing other oral therapies. Other causative factors are a deficient carbohydrate intake, renal impairment and excessive alcohol ingestion.

The frequency of hypoglycaemia must not be underestimated, particularly in patients where the morbidity of hypoglycaemia poses particular problems and the symptoms may be unrecognised.

Emergency hyperglycaemic states include diabetic ketoacidosis (DKA) and hyperosmolar nonketotic coma (HONC). These conditions occur due to poor glycaemic control, implying compliance issues or underlying (or precipitating) causes such as infection or myocardial infarction. DKA is rare, but can occur in type 2 diabetes. It is no longer a complication unique to type 1 diabetes.

## In practice

All patients with type 1 diabetes and patients with type 2 diabetes on insulin and/or sulphonylureas and their families need to be informed about the risks, signs and symptoms, and actions to be taken.

## Recognising signs and symptoms

Symptoms of **hypoglycaemia** vary between persons. Common symptoms are weakness, trembling or shaking, sweating, lightheadedness, headache, dizziness, lack of concentration, behaviour change, tearfulness/crying, irritability, hunger and numbness around the lips and fingers.

Signs of **hyperglycaemic** states include severe dehydration, altered consciousness, shock and ketotic breath in patients with DKA.

## Intervention

Mild and moderate hypoglycaemia can be treated by following the 'Rule of 15' (see *Appendix J*). For moderate hypoglycaemia, the patient usually requires some assistance by a carer or health professional.

Severe hypoglycaemia that results in a hypoglycaemic coma (a person with diabetes who presents unconscious, drowsy or unable to swallow) is a true emergency.

Management is as follows:

- Commence appropriate resuscitation protocols.
- Give an injection of glucagon if available.
- Phone for an ambulance (dial 000) stating a 'diabetic emergency'.
- Wait with the patient until the ambulance arrives.
- When the person regains consciousness and can swallow, they can then be orally given a source of carbohydrate.

A patient with a hyperglycaemic emergency requires the following:

- Look for an underlying cause – sepsis, myocardial infarct.
- Correct extracellular fluid deficit and then slowly correct water depletion and hyperglycaemia.
- Monitor plasma glucose, sodium and potassium closely.
- Transfer to a specialist unit if possible.

See *Appendix J* for more information.

# *12. Diabetes, multimorbidity and medication complications*

## 12.1 Multimorbidity

### Clinical context

Healthcare systems around the world face a growing challenge of managing populations with multiple co-existent chronic conditions, including diabetes. On an individual level, multimorbidity can have a profound effect on a patient's ability to self-care and balance different treatment needs across multiple conditions.

The challenge for general practice is to optimise the care for these patients. Guidelines are usually configured for individual diseases rather than multimorbidity. Guidelines can only provide structured information and evidence-based recommendations. They are a guide for decision making for individual patients and infrequently address the problems of implementation in different patients with varying personal and clinical priorities.

High-quality management of diabetes cannot occur in isolation from other co-existing physical or mental health disorders, nor can management ignore age and socioeconomic issues.<sup>110</sup>

Three out of four adults with diabetes have at least one comorbid chronic disease<sup>110</sup> and up to 40% have at least three<sup>111,112</sup> (see *Figure 6*). These comorbidities may or may not be diabetes related and awareness and treatment of comorbidities is related to better glycaemic control.<sup>113</sup>

While many conditions have a concordant treatment focus (e.g. use of an ACEI to reduce the risk of cardiovascular events), others, such as depression, chronic obstructive pulmonary disease (COPD) and painful conditions may be discordant.<sup>114, 115</sup> For example, they require medications such as NSAIDs that may adversely affect the management of diabetes and whose presence is a risk factor for poorer self-care, more frequent diabetes complications and death.<sup>116</sup>

### Age and multimorbidity

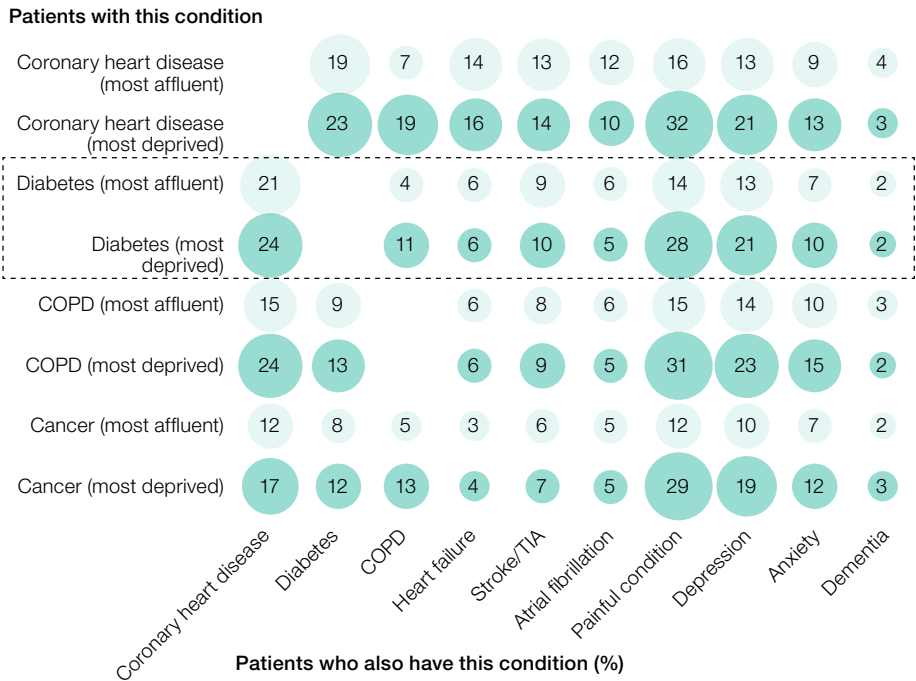
Symptomatic conditions may receive priority from patients. Studies of symptomatic burden have found that adults with type 2 diabetes aged ≥60 years report more physical symptoms such as acute pain and dyspnoea, and are more likely to have

cognitive impairment and physical disability than those without diabetes. Combined with obesity, these risks are approximately doubled. People <60 years report more psychosocial symptoms, such as depressed mood and insomnia. Acute pain was prevalent (41.8%) and 39.7% reported chronic pain, 24.6% fatigue, 23.7% neuropathy, 23.5% depression, 24.2% insomnia and 15.6% physical/emotional disability.<sup>117</sup>

### Socioeconomic status and multimorbidity

Being part of the most socially disadvantaged groups in Australia doubles the risk of developing diabetes. Within low socioeconomic groups, financial stressors may also play a role in treatment choices. Hence the management of diabetes should always be considered as part of a comprehensive management plan, which addresses whole-patient priorities.

Figure 6. Many patients with diabetes have other medical conditions



COPD: chronic obstructive pulmonary disease; TIA: transient ischaemic attack

Reproduced with permission from Elsevier from Barnett K, Mercer SW, Norbury M, et al.

Epidemiology of multimorbidity and implications for healthcare, research, and medical education: a cross-sectional study. *Lancet* 2012;380(9836):37–43.

## Approach to multimorbidity

A number of comorbidities are commonly associated with diabetes (see *Table 12.1*). The best approach for a patient with multimorbidity is the subject of international debate. Unfortunately multimorbidity increases clinical complexity, which is unlikely to be effectively addressed by more sophisticated guidelines<sup>114,119–121</sup> or the chronic care model.<sup>122–125</sup> Hence a set of principles to guide an approach seems to offer a clinical solution.

**Table 12.1. Comorbidities associated with diabetes or arising from complications of diabetes**

Classification	Common comorbidities
Psychological	Chronic pain disorders Depression and anxiety Dementia
Macrovascular disease	Hypertension Coronary disease Cerebrovascular disease Peripheral vascular disease High-risk foot issues
Microvascular disease	Renal impairment and CKD Neuropathy – peripheral, autonomic Retinopathy
Metabolic disorders	Dyslipidaemia Low testosterone in males Hepatic steatosis Joint issues (e.g. frozen shoulder) Pancreatitis
Overweight and obesity-related comorbidities	Obstructive sleep apnoea Osteoarthritis
Other	Bacterial, fungal and viral infections Periodontal disease

## In practice

Consider the following key principles in the approach to management of patients with type 2 diabetes and co-existing morbidities.

### Recognise clinical context and prognosis

Consider clinical management decisions within the context of risks, burdens, benefits, and prognosis of a patient's life (e.g. remaining life expectancy, functional status, and quality of life).<sup>114,120,121</sup> Treatment outcomes of glycaemia, hypertension, and hyperlipidaemia all have multi-year time horizons required to provide benefit and these may not be available in all clinical contexts.

### Set treatment priorities with the patient

Focus on outcomes that matter most to the individual. Shared decision making with patients is vital to ensure care is aligned with their values and preferences.<sup>120,126–129</sup>

Even though diabetes may be a clinically dominant condition, patients may prioritise therapeutic interventions differently. For example, pain relief from low back pain or respiratory relief from COPD may be considered above their diabetes needs, many of which may not cause daily symptoms.

### Recognise the limitations of the evidence base

Many of the patterns of multiple morbidity are concordant, having similar pathogenesis and therapeutic management strategies (e.g. diabetes, hypertension, CAD).

Clinical guidance regarding discordant conditions such as steroid dependent conditions (which potentiate poor glycaemic control), mental health conditions, chronic pain, cancer or conditions that alter medication pharmacokinetics (e.g. renal disease, cardiac failure, liver disease, malabsorptive states) is often lacking or sparse. The absolute harms and benefits of diabetic medications and burdens are not readily known in these populations. Other unknowns are the realistic estimate of benefit to the patient and the treatment horizon (i.e. the length of time taken for the patient to benefit).<sup>120</sup>

A degree of clinical judgement and a 'best care given the circumstances' is required in these situations.

## Optimise therapies

Polypharmacy (taking >5 medications) is one consequence of following single disease guidelines in people with multimorbidity.<sup>120,130–132</sup> Polypharmacy can be appropriate and has been said to be the price of success in creating effective treatments. It is also associated with higher rates of adverse drug events and hospitalisation, and is often particularly problematic in people who are physically frail<sup>121</sup> or have cognitive impairment.

Adherence to therapy can be much more difficult for patients taking numerous medications for multiple conditions.<sup>133</sup> Out-of-pocket costs for medication can be significantly higher for patients with diabetes than for most other chronic conditions<sup>134</sup> and the financial burden can lead to underuse of preventive services.<sup>135,136</sup>

Use strategies for choosing therapies that optimise benefit, minimise harm and enhance quality of life, particularly in older adults with multimorbidity.

## Be aware of common comorbidities with diabetes

**Macrovascular disease** includes CAD, hypertension, hyperlipidaemia and cerebrovascular disease. CVD is the primary cause of death for many persons with diabetes and is often found in patients with type 2 diabetes (see *Section 9*).

**Painful conditions** (both acute and chronic) are common in patients with type 2 diabetes. Peripheral neuropathies and arthritis account for most causes of pain. Arthritis is particularly problematic as it can reduce self-management capability (e.g. hand arthritis causing medication administration issues). Arthritis (and any other cause of pain) can also affect the patient's ability to engage in physical activity.

**Fractures** – research has shown that overall fracture risks are significantly higher for both men and women with type 2 diabetes. The increased risk of hip fracture has been observed despite patients having higher bone mineral density.

**Obstructive sleep apnoea** or sleep deprivation from any cause can aggravate insulin resistance, hypertension and hyperglycaemia. Sleep apnoea is especially common in adults with diabetes. The usual approach to obstructive sleep apnoea is diagnosis via a sleep study and management with individualised interventions including continuous positive airway pressure. Driving licence requirements, particularly in commercial drivers, are particularly relevant.

**Cancer** is the second largest cause of death in type 2 diabetes. A growing body of evidence suggests that diabetes and some anti-diabetic treatments may increase cancer risk. Patients with diabetes should undergo appropriate cancer screening



as recommended for all people in their age and sex. Patients should also try to reduce modifiable cancer risk factors, including quitting smoking, losing weight and increasing physical activity levels.<sup>137</sup>

**Renal impairment** – CKD affects approximately 40% of patients with diabetes. It is both a complication of diabetes, <http://outpatient.aace.com/type-2diabetes/management/#diabetic-kidney-disease>, and an independent comorbidity present before diabetes onset. The presence of kidney disease worsens cardiovascular risk and limits the number of hypoglycaemic medication options available. Further, the availability of over-the-counter nephrotoxic medications (e.g. NSAIDs) can easily exacerbate disease, and the ‘triple-whammy’ effect (ACEI/diuretic/NSAID) may go unrecognised without specific questioning. The onset of renal disease can be insidious.

**Mental health** issues such as diabetes-related distress, depression and anxiety are common. Rates of depression are increased by 15% in people with diabetes compared with people without diabetes. The odds ratio for depression in patients with type 2 diabetes compared with people without diabetes is higher in males (OR = 1.9, 95% CI 1.7–2.1) than females (OR = 1.3, 95% CI 1.2–1.4).<sup>138,139</sup>

Mental health issues can adversely affect patient–practitioner communication, adherence to diabetes management plans and glycaemic control, as well as adding to the burden of disease and reducing quality of life. Depression and diabetes are also associated with a significantly increased all-cause and CVD-related mortality.

Some antipsychotic medications can increase the risk of developing diabetes. Olanzapine and clozapine are associated with higher rates of diabetes compared with other antipsychotic agents.

**Dental problems** such as periodontitis (i.e. localised inflammation of the supporting structures of the teeth due to a chronic bacterial infection) are more common in patients with diabetes. Periodontitis can result in tooth loss and other dental complications that can interfere with the diet. Additionally there is a two-way relationship between diabetes and periodontitis – the management of periodontitis may lead to a modest reduction in HbA1c of approximately 0.4%.<sup>140–143</sup> Inversely, improving glycaemic control may also improve the severity and complications associated with periodontitis.

Oral and periodontal health reviews should be incorporated into the systematic individualised care of patients with diabetes. Early prevention and intervention may prevent permanent dental loss and help aid in glycaemic control.

## 12.2 Medication complications

### Clinical context

People with type 2 diabetes often take many medications – a significant proportion of patients take more than eight. There will always be a tension between multiple drug therapy to approach recommended goals and health issues from polypharmacy, drug interactions and confusion (especially in the elderly).

In 2007–08, 63% of people with diabetes reported using medications to help manage their condition; 13% of people with type 2 diabetes reported using insulin; and approximately 6% of people with diabetes reported using vitamin or mineral supplements or herbal remedies, although this is likely to be underestimated.<sup>144</sup>

Additionally, approximately 50% of patients do not take their medication doses exactly as prescribed by their healthcare professional.<sup>145</sup> This may be a barrier to achieving treatment targets and result in adverse outcomes.

It is important to understand the overall medication burden as it can lead to many issues including non-adherence, increased risk of falls and hypoglycaemia.

Contributing factors to non-adherence may include cost, complex treatment schedules and side effects.

### In practice

GPs should be aware and assess for non-adherence, possible drug interactions and side effects in every patient with type 2 diabetes. Patients on prescribed monotherapy may be using complementary therapy or misusing their prescribed medication.

Medication use, both conventional and complementary, should be reviewed at least once per year as part of the annual cycle of care.<sup>146,147</sup>

The RACGP guide *Putting prevention into practice*<sup>148</sup> provides some strategies to address patient adherence on pages 24–26. The full reference for the guide is available at [www.racgp.org.au/your-practice/guidelines/greenbook](http://www.racgp.org.au/your-practice/guidelines/greenbook)

For information regarding drug interactions, consult publications such as the *Australian Medicines Handbook*.

Pharmacists can be an invaluable resource as they have access to extensive medications databases, can detect potential drug interactions and provide useful advice to both the health professional and person with diabetes.<sup>149,150</sup>

## Important drug interactions and side effects

People with diabetes may be taking multiple hypoglycaemic medications in addition to other prescription and non-prescription agents. Some drug interactions are dangerous and special care is required in older patients and patients with comorbidities such as renal impairment and autonomic neuropathy.

A full list of potential drug interactions is beyond the scope of these guidelines. However, a summary of medications that can cause adverse events such as hyperglycaemia and those that can affect blood glucose levels are listed in *Appendix K*. Note that this is not an exhaustive list.

## Reporting of adverse events

Many medications are becoming available for the management of diabetes for which long-term safety data is not yet available. Primary healthcare professionals have an important role to play in identifying and reporting adverse events and possible drug interactions. These should be reported to the TGA, either online or by completing the Blue Card (for further information go to [www.tga.gov.au/hp/problem-medicine-reporting-reactions.htm](http://www.tga.gov.au/hp/problem-medicine-reporting-reactions.htm)).

## Home medicines review

Multiple systematic reviews have concluded that there is a lack of evidence for improved health outcomes for medication reviews. Benefit has been proposed where pharmacists work in close liaison with primary care doctors.<sup>151</sup>

The review should include consideration of:

- the need for each medication
- issues around patient compliance and understanding of the medication
- enquiry regarding medication side effects, particularly falls and cognitive impairment
- the use of aids such as dosette boxes and Webster packaging.<sup>27</sup>

## Complementary medicines

The use of complementary medicines is increasing in Australia. A survey of pharmacy customers found that 72% of respondents had used complementary medicines within the previous 12 months; 61% used prescription medicines daily and 43% had used these concurrently. Multivitamins, fish oils, vitamin C, glucosamine and probiotics were the five most popular complementary medicines.<sup>152</sup>

A substudy of the Fremantle Diabetes Study found that 23% of participants had consumed at least one complementary medication in the last year. Of the medications used, approximately 42% potentially necessitated additional patient monitoring or could be considered inappropriate for patients with diabetes.<sup>147</sup>

Predictable positive and negative interactions between complementary medicines and prescribed diabetes medications may be variable, as there is little formal assessment of many of these products.

The National Prescribing Service (NPS) has compiled a guide to medicines information resources relevant to Australian health professionals. This list is available at [www.nps.org.au/health-professionals/resources-and-tools/medicine-information-resources/guide-to-medicines-information-resources](http://www.nps.org.au/health-professionals/resources-and-tools/medicine-information-resources/guide-to-medicines-information-resources). Interactions can be checked by searching these resources, although the NPS does not guarantee their completeness or accuracy.

## 13. Diabetes and reproductive health

### 13.1 Polycystic ovary syndrome

#### Clinical context

PCOS is a metabolic and endocrine disorder affecting about one in 15 women worldwide.<sup>153</sup> The endocrine disruptions consist of excessive androgen secretion or activity and a large proportion of women also have insulin resistance and metabolic syndrome.

The cause of PCOS is unknown, but studies suggest a strong genetic component that is affected by gestational environment, lifestyle factors, or both.

Clinical manifestations include menstrual dysfunction, infertility, hirsutism, acne, obesity and glucose intolerance. Women with this disorder have an established increased risk of developing type 2 diabetes and a 2.4-fold increased odds of GDM, independent of age, race/ethnicity and multiple gestation.<sup>154</sup>

The diagnostic criteria of PCOS are hyperandrogenism, chronic anovulation and polycystic ovaries, after exclusion of other conditions that cause these same features (*Table 13.1*).<sup>155,156</sup> A consensus definition of the disorder based on the importance of the three diagnostic criteria relative to each other remain controversial.

**Table 13.1. Criteria for diagnosis of PCOS**

**The Rotterdam criteria are inclusive of National Institutes of Health (NIH) criteria however, the Rotterdam criteria may not meet NIH criteria**

The Rotterdam diagnostic criteria requires two of:

1. Oligo- or anovulation
2. Clinical and/or biochemical signs of hyperandrogenism
3. Polycystic ovaries

**and** exclusion of other aetiologies such as hyperthyroidism, hyperprolactinaemia, congenital adrenal hyperplasia, androgen-secreting tumours and Cushing's syndrome.

The NIH diagnostic criteria requires:

1. Oligo- or anovulation
2. Clinical and/or biochemical signs of hyperandrogenism

**and** exclusion of other aetiologies such as congenital adrenal hyperplasia, androgen-secreting tumours and Cushing's syndrome.

## In practice

There are several potential treatment options for PCOS with lifestyle modification being the basis for all.

### Oligomenorrhoea and amenorrhoea

Options include:

- an oral contraceptive pill (OCP) (low oestrogen doses [e.g. 20 µg] may have less impact on insulin resistance)
- cyclic progestins (e.g. 10 mg medroxyprogesterone acetate 10–14 days every 2–3 months)
- metformin (improves ovulation and menstrual cyclicity).

### Hirsutism

Choice of options depends on patient preferences, impact on wellbeing, and access to and affordability of professional cosmetic laser therapy. Eflornithine cream can be added and may induce a more rapid response.

Pharmacological therapy is as follows:

- **Primary therapy is the OCP** – but this needs monitoring for IGT in those at higher risk of developing diabetes.
- **Anti-androgen monotherapy** (e.g. spironolactone or cyproterone acetate) should not be used without adequate contraception. Therapies should be trialled for ≥6 months before changing dose or medication.
- **Combination therapy** – if ≥6 months of OCP is ineffective, add anti-androgen to OCP (twice daily spironolactone >50 mg or cyproterone acetate 25 mg/day, days 1–10 of OCP).

### Infertility

Patients and their partner may need advice and appropriate referral for fertility management.

### Cardiometabolic risk

Lifestyle modification to induce >5% weight loss in those who are overweight should be recommended. This reduces diabetes risk by approximately 50–60% in high-risk groups.

## 13.2 Pregnancy with pre-existing type 2 diabetes

Recommendations	Reference	Grade*
Pre-pregnancy glycaemic control should be maintained as close to the non-diabetic range as possible, taking into account risk of maternal hypoglycaemia	(64) SIGN, 2010	C
All women with diabetes should be prescribed high-dose pre-pregnancy folate supplementation, continuing up to 12 weeks gestation	(64) SIGN, 2010	B
Women with diabetes initially treated in early pregnancy with metformin or sulphonylureas should be advised that these medications do not appear to carry additional risk of teratogenesis or early pregnancy loss	(64) SIGN, 2010	B
All women with pre-gestational diabetes should be encouraged to achieve excellent glycaemic control	(64) SIGN, 2010	D
Postprandial glucose monitoring should be carried out in pregnant women with type 1 or 2 diabetes	(64) SIGN, 2010	C

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

Glycaemic control is important before and during pregnancy.<sup>157</sup> Women with all forms of diabetes (type 1 and type 2) are more prone to the complications of pregnancy. In addition, pregnancy may accelerate complications of diabetes.

Poor glycaemic control at conception and early pregnancy is associated with increased risk of congenital abnormalities and first trimester abortions. Both maternal and fetal complications are elevated when a pregnant woman has diabetes.

Good glycaemic control can mitigate the risk of maternal and fetal complications and the likelihood of birth trauma, and reduce the risk of early induction of labour and need for caesarean section.

With one exception, the advice in this section is also applicable to a patient with type 1 diabetes preparing for pregnancy with the management being restricted to insulin only.

For advice on pre-pregnancy blood glucose targets see SIGN – *Management of diabetes. A national clinical guideline* (2010).<sup>64</sup>

# In practice

## Pre-pregnancy

Where possible and practicable, formal pregnancy planning should occur prior to pregnancy and involve a multidisciplinary team working in conjunction with the GP.

It is important to:

- advise the importance of good control of clinical risk factors including but not limited to glycaemic control before becoming pregnant and throughout all stages of pregnancy
- aim for glycaemic control to be as close to the non-diabetic range as possible ensuring risks of maternal hypoglycaemia are managed. The risk of fetal abnormalities correlate with the level of HbA1c at the time of conception
- counsel the patient with respect to the risks of pregnancy with diabetes. It is important to explain that risks can be reduced but not eliminated
- recommend higher folate supplementation (5 mg) per day starting one month before pregnancy<sup>158</sup> and continued until 12 weeks of gestation to reduce the risk of having a baby with a neural tube defect
- address dietary advice as part of the multidisciplinary care approach to managing diabetes in pregnancy
- manage complications before pregnancy. For example proliferative retinopathy may be worsened in pregnancy and, if present, should be treated. Stable non-proliferative retinopathy is not a contraindication to pregnancy. Similarly, diabetic nephropathy can deteriorate in pregnancy. Women with moderate (eGFR 30–59) to severe renal impairment (eGFR <30) are at higher risk of complications. There is also a higher incidence of pregnancy-induced hypertension and pyelonephritis.<sup>159</sup>

Deferring pregnancy should be a recommendation until optimal glycaemia and improvement of BMI are established. Women should be reassured that any reduction in HbA1c towards the individualised target is likely to reduce the risk of congenital malformations.

Medications should be assessed on an individual basis, acknowledging the pregnancy risk classification and balanced against the benefit of continuing the medication during pregnancy and lactation.



## In pregnancy

Specialist endocrine and obstetric referral for multidisciplinary shared care is considered best practice.

## Safety of diabetes medications before and during pregnancy

Consideration of the safety of current oral and or injectable diabetes therapies should be undertaken ideally before pregnancy is planned or urgently once pregnancy is confirmed. Consultation with local specialist services on an individualised medication regimen is advised in most cases. Metformin and sulphonylureas are not associated with an increase in congenital malformation or early pregnancy loss.<sup>160,161</sup> Some diabetes centres deem metformin to be safe and may be used as an adjunct or alternative to insulin in the preconception period and during pregnancy. Some oral agents such as the glitazones and gliptins may need to be ceased and insulin therapy instituted.

### Insulin

Rapid-acting insulin analogues aspart and lispro may be safe to use during pregnancy. There is insufficient evidence about the use of long-acting insulin analogues except for detemir insulin (a long-acting insulin analogue) which is now classified as category A in pregnancy for patients with type 1 diabetes. However isophane insulin (also known as NPH insulin) remains the first most common choice for long-acting insulin during pregnancy for women with type 2 diabetes.

### Antihypertensives

ACEIs and angiotensin-II receptor antagonists should be discontinued as soon as pregnancy is planned or as soon as pregnancy is confirmed. Alternative antihypertensive agents suitable for use during pregnancy – such as methyl dopa, nifedipine or labetalol – should be substituted on specialist advice.<sup>162</sup>

### Statins

Statins should be used rarely in women of childbearing age, and should be discontinued as soon as pregnancy is planned, or as soon as pregnancy is confirmed.

## Antenatal care

SMBG is required in managing diabetes in pregnancy considering that insulin therapy may need regular adjustment and titration to achieve goals. The normal range for HbA1c changes throughout pregnancy, and it should be used as an adjunct to glycaemic care using other methods such as SMBG for assessing glycaemic control in pregnancy.

Close surveillance for new diabetes complications and monitoring of existing complications should occur routinely. Ultrasound screening at 10–13 weeks gestation (with biochemistry) for trisomies, and at 18–20 weeks for congenital cardiac and other malformations is advised. Fetal growth monitoring and wellbeing should occur with specialist support.

## Post partum

The GP should maintain or re-establish contact with mother and child as early as practicable to address any issues arising from the pregnancy, labour, surgery or other interventions that may have ensued.

This is an appropriate time to address breastfeeding as well as review medications. Metformin may be continued in breastfeeding with minimal effect on the baby.<sup>163</sup>

Re-establishing diabetes management goals, re-assessment of complications and timely contraceptive advice is also appropriate in the postnatal period.

## 13.3 Gestational diabetes mellitus

### Clinical context

Gestational diabetes, or gestational diabetes mellitus (GDM), is defined as carbohydrate intolerance that begins or is first diagnosed during pregnancy.

In normal pregnancy there is a natural increase in hyperglycaemic hormones including cortisol, growth hormone, human placental lactogen, progesterone and prolactin levels. The action of these hormones is usually compensated by increased insulin release. In pregnant women with abnormal glucose intolerance, however, the hyperglycaemic effects of pregnancy hormones is not adequately compensated.

GDM generally develops and is diagnosed in the late second or early third trimester of the pregnancy.

GDM is generally asymptomatic and affects about 5–8% of pregnancies in Australia,<sup>164</sup> depending on the population studied. Mothers born in high-diabetes-risk regions, such as Polynesia, Asia and the Middle East, are three times as likely to have GDM, as mothers born in Australia. Among Aboriginal and Torres Strait Islander mothers, GDM is twice as common, and pre-existing diabetes affecting pregnancy is 3–4 times as common as in non-Indigenous mothers.

The prevalence of GDM varies because of different screening and diagnostic criteria, as well as populations, race, ethnicity, age and body composition.

Potential maternal complications during pregnancy and delivery include preeclampsia and higher rates of caesarean delivery.

For the neonate, complications include birth injuries, respiratory difficulty at birth, hypoglycaemia and jaundice.

The precise level of glucose intolerance characterising GDM has been controversial.

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study was published in 2008. This study reported a correlation between increasing maternal glucose levels at 24–32 weeks gestation and a range of adverse maternal and fetal outcomes.

Subsequent consideration by the International Association of Diabetes in Pregnancy Group resulted in the formulation of new consensus guidelines for the testing and diagnosis of GDM. These have been adopted by the Australian Diabetes in Pregnancy Society (ADIPS). The ADIPS recommendations<sup>165</sup> are considered controversial both nationally and internationally<sup>166</sup> and have not been endorsed by the RACGP. There is a lack of clinical evidence that intervention is beneficial in the additional women identified by the new screening criteria

Until further evidence is forthcoming, existing recommendations remain the basis of RACGP support.

## In practice

### Screening and management of GDM

Recommendations	Reference	Grade*
Pregnant women with GDM should be offered dietary advice and blood glucose monitoring and be treated with glucose-lowering therapy depending on target values for fasting and postprandial targets	(64) SIGN, 2010	A

\*Refer to *Appendix A* for an explanation of the Grade.

GDM is diagnosed by screening during pregnancy (see *Box 9*).

### **Box 9. Screening and diagnosis of GDM**

- All pregnant women should be screened between 26 and 28 weeks gestation with a non-fasting glucose challenge.
- Women whose levels are  $\geq 7.8$  mmol/L should have a formal (fasting) 75 g OGTT.
- The diagnosis of GDM is made on the basis of a 75 g OGTT where the fasting level is  $> 5.5$  mmol/L or 2 hour result is  $\geq 8.0$  mmol/L.

Australian authorities continue to recommend routine screening at 26–28 weeks gestation.

The importance of management for women with GDM has been widely accepted and supported. This usually includes nutritional therapy, exercise, blood glucose monitoring and insulin therapy.

All women with GDM should be offered education, blood glucose monitoring and dietary advice. Most GDM responds positively to lifestyle management.

Limiting weight gain in pregnancy for obese or overweight women with GDM is desirable. Maternal weight loss during pregnancy is potentially dangerous for the developing fetus and is not advised.

Metformin and glibenclamide have been used internationally as initial glucose-lowering treatment in women with GDM. However these drugs have not been approved for this use in Australia. Lifestyle and insulin therapy remain the mainstay of therapy.

Close cooperation with the obstetric team is advised to monitor both maternal and fetal welfare.

In patients with GDM, as long as hypoglycaemia can be minimised, aim to achieve blood glucose:

- between 4 and 6 mmol/L pre-prandially, and
- $< 7$  mmol/L 2 hours postprandially.

## Follow-up of patients with a history of GDM

Recommendations	Reference	Grade*
Women with a history of GDM should receive:		
• a postpartum glucose tolerance test at 6–12 weeks	(16) American Diabetes Association, 2013	E
• a fasting blood glucose test	(167) RACGP, 2012	B
• every 3 years	(167) RACGP, 2012	C

\*Refer to *Appendix A* for an explanation of the Grade.

Although GDM usually resolves following birth, it is associated with increased risk for developing maternal type 2 diabetes in later life.

A population-based study reported the incidence of type 2 diabetes in women with previous GDM was 3.7% at 9 months postpartum, 13.1% at 5 years postpartum and 18.9% 9 years postpartum (versus 2% in controls without GDM).<sup>168</sup>

Development of type 2 diabetes after pregnancy appears to be related to known risk factors. Waist circumference and BMI are the strongest anthropometric measures associated with the development of type 2 diabetes in women with GDM.<sup>169</sup> A recent retrospective cohort study suggests those with a HbA1c greater than 6% at a 1 year postpartum check are the most likely to progress to type 2 diabetes and hence require yearly testing.<sup>170</sup>

After delivery, it is recommended that advice be given on healthy diet and exercise, which may include referral to a dietitian and a physical activity program. Encourage increasing physical activity (e.g. 30 minutes brisk walking five times a week) and/or weight loss, which reduces risk of developing diabetes by 40–60% in those at high risk.<sup>171</sup>

Breastfeeding is encouraged for its many health advantages.

Women with normal glucose tolerance should be counselled regarding their risk of developing GDM in subsequent pregnancies. Due to increased risk for developing maternal type 2 diabetes in later life, women with a history of GDM should:

- receive a fasting blood glucose every 3 years
- be offered preconception advice prior to future pregnancies.

## 13.4 Contraception

Contraception advice should follow guidelines that apply to women without diabetes. However the combined OCP may be contraindicated in the presence of diabetes complications or elevated cardiovascular risks that may accompany diabetes. Progesterone only oral contraceptives may then be used as an alternative. Other contraceptive implants and intrauterine devices may also be an option on an individual basis.

## 13.5 Sexual problems – men

### Clinical context

Erectile dysfunction is a common problem for men with diabetes.

Men with diabetes are four times more likely to develop erectile dysfunction than men without diabetes. The prevalence in men aged over 40 years with diabetes may be as high as 50% and incidence increases by approximately 10% per annum. Men with diabetes are also affected by erectile dysfunction at an earlier age than men who do not have diabetes, with occurrence approximately a decade earlier.<sup>172,173</sup>

Erectile dysfunction may occur acutely or chronically during periods of high blood glucose. Failure to achieve erection may be due to psychological causes, macrovascular disease or pelvic autonomic neuropathy.

An organic cause is more likely when there are other macro- or microvascular complications.

In addition, as a population/group/cohort, men with diabetes, (both type 1 and type 2), have been shown to have lower testosterone levels than men without diabetes. This may contribute to reduced libido and aggravate or exacerbate erectile dysfunction.

### In practice

It is important to enquire about erectile dysfunction in the annual review (cycle of care) and to differentiate psychogenic from organic causes.

Usually enquiring about spontaneous erections while asleep or in non-sexual situations will help.

Psychogenic erectile dysfunction requires counselling and behavioural therapy. Patients with organic erectile dysfunction should be counselled supportively.

Phosphodiesterase inhibitors (sildenafil, tadalafil, vardenafil) starting with a low dose are available for men with erectile dysfunction who wish to resume sexual activity.

Common side effects are generally mild and relate to vasodilation (flushing, nasal stuffiness).

If vasodilating nitrates are used, phosphodiesterase inhibitors can cause catastrophic and life-threatening hypotension, and are contraindicated.

Many of the men will have CVD (symptomatic or asymptomatic) and the potential cardiovascular risk of engaging in and resuming sexual activity needs to be discussed.

Other techniques such as intrapenile prostaglandin E1 (alprostadil) by injection, vacuum devices, or penile prostheses or implants may help.

The help of a sympathetic specialist urologist should be sought for those considering penile injection with vasoactive agents (preparations now commercially available) or surgical treatment.

## 13.6 Sexual problems – women

### Clinical context

Although women with diabetes do not seem to suffer from as much sexual dysfunction as men, some studies show that women may experience more psychological problems compared with men, who have more physical symptoms.

Women with diabetes may also experience higher rates of sexual dysfunction than their non-diabetic counterparts.

Symptoms of sexual dysfunction in women include:

- decreased or total lack of interest in intimacy or sexual relations
- decreased or no sensation in the genital area
- constant or occasional anorgasmia
- dryness in the vaginal area (presumably due to pelvic autonomic neuropathy), leading to dyspareunia.

Genital infections including moniliasis and vulvitis, which may contribute to sexual dysfunction, are not uncommon in diabetes.

Rates of depression, anxiety and psychological distress are higher in people with diabetes and may contribute to sexual dysfunction in men and women.

### In practice

It is important to enquire about sexual problems in the annual review and to manage physical and emotional aspects.

Explanation of lubricants may be useful.

# 14. Management of other impacts of diabetes

## 14.1 Sick day management

Recommendations	Reference	Grade*
Patients should be educated to develop a sick day management plan after initial diagnosis. This plan should be reviewed at regular intervals	(174) Australian Diabetes Educators Association, 2006	None provided
Assist in development of a sick day care plan and preparation of a home sick day management kit for patients to use during episodes of sickness	(174) Australian Diabetes Educators Association, 2006	None provided

\*Refer to *Appendix A* for an explanation of the Grade.

## Clinical context

Patients with diabetes require careful management (especially self-management) during times of illness due to other causes to prevent:

- hyperglycaemic and hypoglycaemic emergencies
- hyperglycaemic hyperosmolar states
- DKA (rare).

A clear and specific action plan ensures that patients can either self-manage or have access to their healthcare team for advice and early intervention, supervision and support.

The Australian Diabetes Educators Association (ADEA) has developed guidelines and patient information on sick day management.<sup>174</sup> Patient information is also available from state and territory diabetes organisations.



## In practice

Sick day management should be tailored to the individual patient and incorporate the following actions:

1. Look for the underlying cause and treat. Underlying causes include:
  - intercurrent illnesses, infections (urinary tract infections, boils), trauma, acute myocardial infarction and stroke
  - use of medications such as corticosteroids.
2. Increase self-monitoring to 3–4 times (or more often if required) per day.
3. Ensure continuity of advice and accessibility – telephone access or consultation with a health professional (including after-hours support).
4. Do not cease medications (metformin and GLP-1 mimetics may require further review).
5. A written action plan (*Table 14.1*) should be provided to both patient and carer.

**Table 14.1. Action plan**

<b>Commence action plan</b>	<ul style="list-style-type: none"><li>• When feeling unwell.</li><li>• Blood glucose &gt;15 mmol/L on two consecutive readings.</li></ul>
<b>Frequent monitoring of blood glucose</b>	2–4 hourly monitoring or more frequently if blood glucose is low.
<b>Medication</b>	Insulin or diabetes medications should be continued with the exception of metformin, dapagliflozin and canagliflozin.
<b>Food and water intake</b>	<ul style="list-style-type: none"><li>• Patients should try to maintain their normal meal plans if possible.</li><li>• Fluid intake (e.g. water) should be increased to prevent dehydration.</li><li>• Advise about alternative easy-to-digest foods like soups if the patient cannot tolerate a normal diet (some non-diet soft drinks may provide essential carbohydrate in this situation).</li><li>• If blood glucose &gt;15 use non-glucose containing fluids.</li><li>• If blood glucose &lt;15 use oral rehydration solutions if needed.</li><li>• If unable to tolerate oral fluids and blood glucose continues to drop – inform patient to attend medical care.</li></ul>
<b>Seek assistance</b>	<ul style="list-style-type: none"><li>• Individuals and support people need to assess whether they are well enough or able to follow the guidelines.</li><li>• If not they should call for help or attend hospital.</li></ul>

(Practice points from ADEA<sup>174</sup>)

## Special considerations

### Type 2 diabetes controlled with diet alone

- Worsening control may require the addition of sulphonylurea or insulin temporarily.
- While not prone to ketosis, patients with type 2 diabetes may have impaired body immune mechanisms that will make recovery slower.
- In addition they may become dehydrated because of the osmotic diuresis.

### Type 2 diabetes on OHAs

- Worsening control may require the use of insulin temporarily (this may require hospital admission).
- In patients with nausea, vomiting and/or diarrhoea, consider stopping metformin and GLP-1 mimetics temporarily as metformin may aggravate these symptoms and there may be a risk of acute renal impairment. Cessation of any SGLT2 inhibitor may be necessary with dehydration and hypovolaemia.

### Type 2 diabetes on insulin

- Patients may need to increase their morning intermediate or long-acting insulin dose by 10–20% and, depending on further blood glucose levels, modify subsequent doses of short-acting insulin during the day. This must be a documented strategy on their sick day management plan.
- Patients with gastrointestinal upset who are not eating, but who feel well and continue their usual activities, may need to reduce their insulin based upon their SMBG readings (especially rapid-acting insulin) to avoid hypoglycaemia.
- Underlying causes should be identified and treated and the doses of insulin and OHAs should be constantly reviewed.

## 14.2 Planned surgical procedures

People with diabetes should be seen several weeks before surgery for assessment of diabetic control and anaesthetic suitability. Attaining glycaemic control (i.e. an HbA1c approaching 7%) in the pre-operative period, has been shown to mean fewer complications and shorter hospital stays after surgery.

Pre-operative care is the same for both minor and major surgery, but blood glucose levels should be monitored intra-operatively (a prolonged procedure) and postoperatively for several days. Insulin may be required postoperatively for some people with diabetes.

## In practice

Patients prescribed OHAs (metformin, sulphonylureas, acarbose, glitazones and DPP4 inhibitors) as well as injectable GLP-1 agonists such as exenatide:

- can continue their diabetes medications on the day prior to surgery – be aware that gastric emptying is affected by GLP-1 agonists
- should omit their medications on the morning of surgery, irrespective of whether they are on the morning or afternoon list
- can generally recommence medications when they are able to eat meals.

Metformin can generally be recommenced 24 hours after major surgery provided that there has been no deterioration in serum creatinine.<sup>106</sup>

Patients with diabetes treated with insulin will usually require perioperative insulin and glucose infusions, and close blood glucose monitoring.

For colonoscopy preparation, Colonlytely rather than Fleet should be used in patients with renal impairment who may become severely hyperphosphataemic with Fleet.

Appropriate written instructions should be given to the patient beforehand.

## 14.3 Driving

Diabetes is identified as one of the medical conditions that may impair driving ability. Both diabetes and diabetes medications may alter the capacity to drive safely.

Impairment can occur due to unexpected hypoglycaemia (main hazard) for drivers with type 2 diabetes on glucose-lowering medications and/or sensory or end-organ complications, particularly reduced vision and reduced sensation in the feet. Other comorbidities such as sleep apnoea and cardiovascular problems have substantial implications.

Drivers with diabetes must meet specific national standards. Certain criteria must be met to ensure that their health status does not increase the risk of a crash. Medical assessment should include:

- therapeutic regimens (e.g. diabetes treated by glucose-lowering agents other than insulin or by insulin)
- commercial or private standards
- satisfactory control of diabetes
- lack of hypoglycaemia awareness
- recent severe hypoglycaemic event
- comorbidities and end-organ complications.

## In practice

Evaluate patients with diabetes capacity to drive against national standards.

Medical standards for drivers of private and commercial vehicles are contained in the Austroads document *Assessing Fitness to Drive* 2012, [www.austroads.com.au/assessing-fitness-to-drive](http://www.austroads.com.au/assessing-fitness-to-drive), (amended March 2013).

Specialist referral is usually required for commercial licences if on OHAs or insulin therapy. Licensing review periods are also determined by therapeutic regimes. Commercial licences are subject to yearly review if on any form of hypoglycaemic therapy.

An amendment to these standards in March 2013 states that persons holding a conditional driver's licence should be 'satisfactorily controlled' having a HbA1c level of less than 9.0% (75 mmol/mol) measured within the preceding 3 months. The intent of this recommendation was to alert GPs to the need for a further review of diabetes management.

An HbA1c level of 9.0% or higher should trigger a medical re-assessment of overall control and management. It does not necessarily mean that a person with an HbA1c of 9% or above cannot continue to hold a conditional driver's licence and it should not be used administratively by licensing authorities to deny eligibility for a licence in the absence of a medical review. There is no strong evidence of an association between high average blood glucose levels and driving risk.

As these are national standards, **it is important to contact the driving authority in individual states and territories as variations to the national standards do exist.**

The *Above 5 to Drive* ([www.ndss.com.au/Documents/NDSS/Resources/DrivingDiabetes/DrivingandDiabetesBooklet.pdf](http://www.ndss.com.au/Documents/NDSS/Resources/DrivingDiabetes/DrivingandDiabetesBooklet.pdf)) consumer booklet provides a checklist and offers advice for people with diabetes to ensure that they have safe blood glucose levels before they drive. The importance of taking extra precautions to maximise road safety and reduce risks of road accidents caused by hypoglycaemic incidents is highlighted.

## 14.4 Diving

People with type 2 diabetes, including those who use medication (OHAs or insulin), can participate in recreational scuba diving. They must be otherwise qualified to dive and meet several criteria as outlined in consensus guidelines for recreational diving with diabetes developed in 2005. (For more information, visit [www.diversalernetnetwork.org/files/UHMS\\_DAN\\_Diabetes\\_Diving\\_2005\\_Workshop\\_Proceedings.pdf](http://www.diversalernetnetwork.org/files/UHMS_DAN_Diabetes_Diving_2005_Workshop_Proceedings.pdf))

When evaluating persons with diabetes for medical fitness to dive, first ensure that no other exclusionary conditions (e.g. epilepsy, pulmonary disease) exist.

The physiological demands of diving must then be considered. People with diabetes are at higher risk than the general diving population of medical complications such as myocardial infarction, angina and hypoglycaemia.

## 14.5 Travel

People with diabetes can travel safely, provided a few extra precautions are taken and the travel is planned.

Those not using insulin generally have few problems during travel. The stress of travel may increase blood glucose levels slightly. The decreased activity experienced in a long plane trip, together with the amount of food given en route often results in increased blood glucose levels. These return to normal once a more usual lifestyle has been resumed at the destination.

Extra precautions before and during travel include:

- a medical consultation at least 6 weeks before the proposed travel to allow time to assess control and alter management as required
- checking of routine immunisation status and other medical conditions
- having a covering letter from their doctor and extra supplies of food, medication and monitoring equipment
- getting advice about special insurance
- finding out about Australian air security guidelines.

Australian air authorities stipulate the following security guidelines. If not using an Australian carrier, it is advisable for the patient to check with the chosen airline for applicable security guidelines.

- All diabetes supplies including testing equipment, insulin and glucagon delivery devices (syringes, pen needles and insulin pump consumables) carried on board must be in the hand luggage of the person who has diabetes and whose name appears on the airline ticket. It is not advisable to pack extra insulin in checked-in luggage as insulin exposed to extreme cold of the aircraft holds will lose efficacy.
- The traveller's name should appear on the insulin and/or glucagon prescription labels.
- It is advisable to carry legible prescriptions for all medications. The prescriptions must include the traveller's name, name and type of medication, and contact details of attending medical practitioner.
- The NDSS card is accepted as primary proof that a person with insulin-treated diabetes needs to carry with them their diabetes equipment such as insulin pen, pump, syringes, needles and glucagon kit. Supplementary photographic proof of identity such as a driver's licence may also be requested.
- It is advisable to carry a letter from the attending medical practitioner that outlines medical diagnoses, prescribed medications, if insulin is used and, if so, the delivery device(s). The letter must stress the importance of the patient having to carry medications with them and include the frequency of dosage. For those using an insulin pump, the letter must stress the need for the pump to be worn at all times.
- Some international regulations set limits of fluid containers that may be personally taken on board aircraft. People with diabetes who need to carry supplies of insulin are exempt. They will be required to present the insulin at the security point and carry proof of their condition and their need for insulin.
- People wearing electronic devices to monitor blood glucose levels or to infuse insulin should check with the airline as to whether these devices can be operated during the flight.

### **Rights of people with diabetes during security check**

People with diabetes who use an insulin pump are not required to remove their pump at the security point. If security staff requests this, the person with diabetes has the right to request access to a private consultation room which security staff are required to provide. People with diabetes are also entitled to make this request if discussion about their condition is required.

For more information about travel and diabetes, visit [www.diabetesaustralia.com.au/en/Living-with-Diabetes/Everyday-Life/Travel--Diabetes](http://www.diabetesaustralia.com.au/en/Living-with-Diabetes/Everyday-Life/Travel--Diabetes) or <http://travelsecure.infrastructure.gov.au> and scroll down to 'special needs'.

## 15. Diabetes and end-of-life care

Recommendations	Reference	Grade*
To minimise the risks of hypoglycaemia and metabolic compensation, a blood glucose range of 6–15 mmol/L is appropriate for most palliative care patients	(175) Diabetes UK, 2012	None provided
Maintain at HbA1c at no lower than 59 mmol/mol (7.5%) if on hypoglycaemic medication depending on the individual's life expectancy as HbA1c will be less relevant in patients with months or days left to live	(175) Diabetes UK, 2012	None provided

\*Refer to *Appendix A* for an explanation of the Grade.

### Clinical context

The aim of glycaemic control in patients at the end of life changes from preventing and managing long-term complications of diabetes to preserving quality of life.

Terminally ill patients often have multiple factors affecting their glycaemic control (see *Box 10*). Glucose-lowering therapy should be tailored to minimise the risks of hypoglycaemia and hyperglycaemic states and symptoms.

#### Box 10. Factors affecting glycaemic control in patients with type 2 diabetes at end of life

- Stress response to severe or sustained illness
- Organ failure
- Malignancy
- Chemotherapy
- Use of steroids
- Frequent infections
- Poor appetite/smaller meals
- Poor nutrition
- Cachexia
- Dehydration
- Difficulty taking medications (e.g. difficulty swallowing, nausea, stress)
- Weight loss

Hyperglycaemia can worsen pain, confusion, thirst, cognition, confusion and incontinence. Blood glucose levels beyond 15 mmol/L may cause polyuria and increase risks of infection.

Hypoglycaemia can also cause discomfort and confusion and impaired cognitive function.

DKA can mimic terminal illness. If not recognised and treated it can severely impair quality and even duration of life.

Although there is little evidence about optimal blood glucose range, it is generally agreed that a range of 6–15 mmol/L is appropriate for most palliative care patients to optimise patient wellbeing and cognitive function.<sup>176, 177</sup>

## In practice

Aim to provide an appropriate level of intervention according to stage of illness, symptom profile, and respect for dignity. In most cases, tight glycaemic control to meet general targets is no longer appropriate in patients nearing the end of life.

Ideally, discuss dying with patients and their families prior to the need for end-of-life care so that the important considerations can be addressed in advance care planning.<sup>178</sup> Liaison with palliative care team and with the community diabetes team is recommended as part of a multidisciplinary approach to end-of-life diabetes care.

## Diabetes medications at end of life

Insulin alone is a simpler option for patients and their carers than combinations of tablets and insulin. Consider switching patients from combinations to insulin alone, once or twice daily. Patients on insulin with poor intake will need lower doses.

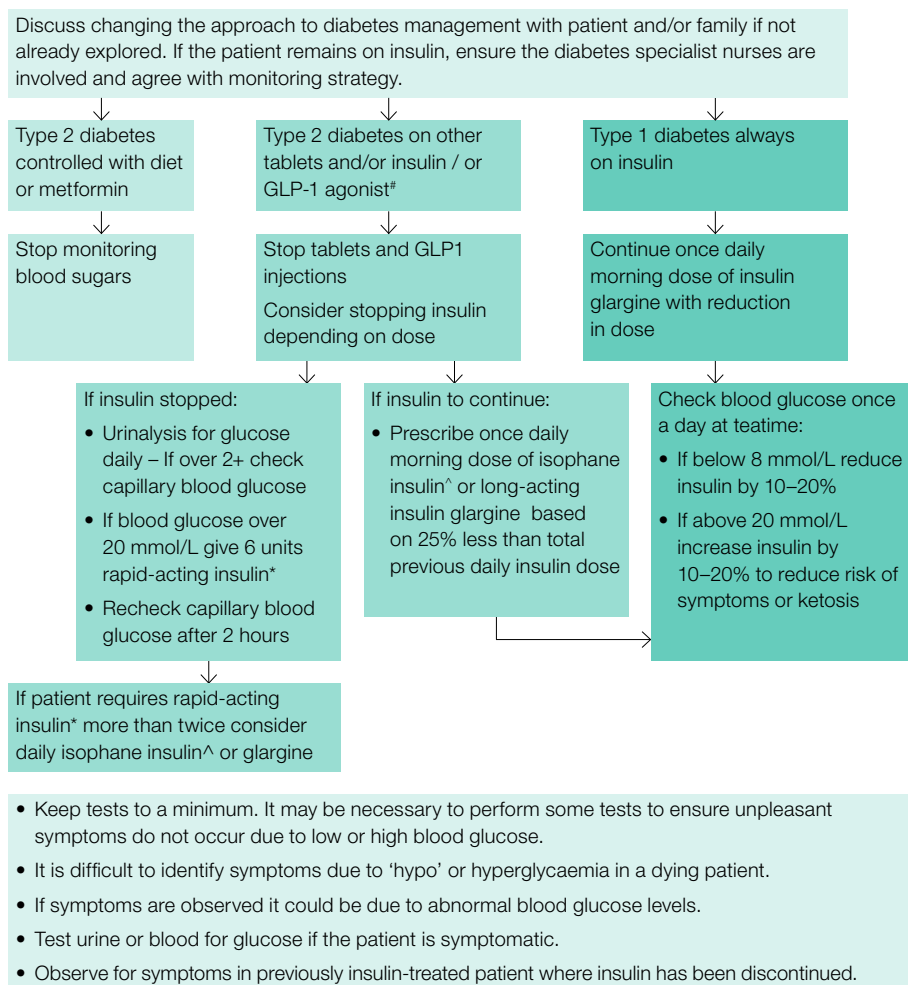
Avoid long-acting sulphonylurea preparations (glibenclamide, glimepiride) if small meals are being taken.

*Figure 7* shows an algorithm for an end-of-life diabetes care management strategy.<sup>179</sup>

Consider referral to specialist care for assistance with complex treatment decisions such as frequent hypoglycaemia, use of insulin or managing steroids.



Figure 7. Algorithm for an end of life diabetes care management strategy



## 16. Issues under debate

### Issue – Diagnostic criteria for GDM

New ADIPS guidelines significantly lower diagnostic threshold.

Guidelines not accepted by RACGP due to lack of evidence and implications for resource utilisation.

### Issue – Postnatal screening for type 2 diabetes mellitus

New ADIPS guidelines significantly increase screening frequency.

Guidelines not accepted by RACGP due to lack of evidence and implications for resource utilisation.

Screening remains as in the RACGP's *Guidelines for preventive activities in general practice*, 8th edition (Redbook) – 3 yearly FBGs.

Postpartum GTT should be performed 3 yearly.

### Issue – BP targets in diabetes management

Guidelines routinely advocate BP target of SBP  $\leq 130$  mmHg.

BP-lowering reduces cardiovascular events and mortality in people with type 2 diabetes. However, the target levels for BP therapy have been based on little direct evidence. Meta-analyses demonstrate that more intensive BP control (SBP  $\leq 130$  mmHg) was only associated with further reduction in stroke. A 40% increase in serious adverse events was observed.

This target is currently being reconsidered by a number of organisations worldwide and the SBP may be adjusted upwards. Until such deliberations are complete, the general international BP target for people with diabetes remains  $\leq 130/80$  mmHg (see page 52 of *NVDPA Guidelines for the management of absolute CVD risk*).<sup>78</sup>

### Target HbA1c levels

National Institute for Health and Clinical Excellence Quality and Outcomes Framework (NICE/QOF) in the UK change the target from 7.0% to 7.5% because of the several large trials showing harm with too low a target. Because of the measurement error you would need a range around that mean of, for example, 6.5–8%. That would allow for measurement variation as well as some individualisation and negotiation with the patient, in a more person-centred approach.

### Other

Is an eGFR 45–60 of any clinical consequence?

Use of the PAID/PHQ2 tools to detect depression and distress in diabetes and linkage to long-term improved outcomes and complication reduction.

# *Appendix A: Summary, explanation and source of recommendations*

## Coding scheme for levels of evidence and grades of recommendation in this publication

### A1. NHMRC scheme

Levels of evidence	
Level	Explanation
I	Evidence obtained from a systematic review of level II studies
II	Evidence obtained from a randomised controlled trial (RCT)
III-1	Evidence obtained from a pseudo-RCT (i.e. alternate allocation or some other method)
III-2	Evidence obtained from a comparative study with concurrent controls: <ul style="list-style-type: none"><li>• non-randomised, experimental trial</li><li>• cohort study</li><li>• case-control study</li><li>• interrupted time series with a control group</li></ul>
III-3	Evidence obtained from a comparative study without concurrent controls: <ul style="list-style-type: none"><li>• historical control study</li><li>• two or more single arm study</li><li>• interrupted time series without a parallel control group</li></ul>
IV	Case series with either post-test or pre-test/post-test outcomes
Practice point	Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees
Grade of recommendation	
Grade	Explanation
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution

## A2. SIGN levels of evidence and grading system (1999–2012)

Level of evidence	
Level	Explanation
1++	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
1–	Meta-analyses, systematic reviews of RCTs or RCTs with a high risk of bias
2++	High-quality systematic reviews of case control or cohort or studies High-quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with low risk of confounding bias or chance and a moderate probability that the relationship is causal Well-conducted basic science with low risk of bias
2–	Case-control or cohort studies with a high risk of confounding bias or chance and significant risk that the relationship is not causal
3	Non-analytic studies (e.g. case reports, case series)
4	Expert opinion
Grades of recommendations	
A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+

### A3. American Diabetes Association (ADA) evidence grading system for clinical practice recommendations

Level of evidence	Explanation
A	<p>Clear evidence from well-conducted, generalizable RCTs that are adequately powered, including:</p> <ul style="list-style-type: none"> <li>• evidence from a well-conducted multicenter trial</li> <li>• evidence from a meta-analysis that incorporated quality ratings in the analysis.</li> </ul> <p>Compelling non-experimental evidence (i.e. 'all or none' rule developed by the Centre for Evidence-Based Medicine at the University of Oxford).</p> <p>Supportive evidence from well-conducted RCTs that are adequately powered, including:</p> <ul style="list-style-type: none"> <li>• evidence from a well-conducted trial at one or more institutions</li> <li>• evidence from a meta-analysis that incorporated quality ratings in the analysis.</li> </ul>
B	<p>Supportive evidence from well-conducted cohort studies:</p> <ul style="list-style-type: none"> <li>• evidence from a well-conducted prospective cohort study or registry.</li> <li>• evidence from a well-conducted meta-analysis of cohort studies.</li> </ul>
C	<p>Supportive evidence from poorly controlled or uncontrolled studies:</p> <ul style="list-style-type: none"> <li>• Evidence from randomized clinical trials with one or more major or three or more minor methodological flaws that could invalidate the results.</li> <li>• Evidence from observational studies with high potential for bias (such as case series with comparison with historical controls).</li> <li>• Evidence from case series or case reports.</li> </ul> <p>Conflicting evidence with the weight of evidence supporting the recommendation</p>
E	Expert consensus or clinical experience.

# Summary of recommendations

## 3.1 Identifying risk of diabetes in asymptomatic patients

Recommendations	Reference	Grade*
Individuals should be screened for risk of diabetes every 3 years from age 40 years using AUSDRISK	(25) NHMRC, 2009	B
Individuals at high risk and those with IGT or IFG (not limited by age) should be tested with:		
• fasting blood glucose	(25) NHMRC, 2009	B
• every 3 years	(25) NHMRC, 2009	C
Aboriginal and Torres Strait Islander peoples should be screened from age 18 years	(25) NHMRC, 2009	

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 4 Preventing type 2 diabetes

Recommendations	Reference	Grade*
Lifestyle modifications that focus on increased physical activity, dietary change and weight loss should be offered to all individuals at high risk of developing type 2 diabetes (Structured diabetes prevention programs are available)	(34) NHMRC, 2009	A
Bariatric surgery can be considered in selected morbidly obese individuals (based on weight alone or the presence of comorbidities) at high risk of type 2 diabetes	(34) NHMRC, 2009	C
Individuals at high risk of diabetes should be identified through the use of risk assessment tools	(34) NHMRC, 2009	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 5.1 Patient-centred diabetes care

Recommendations	Reference	Grade*
A patient-centred approach should be employed that incorporates patient preferences and assesses literacy and numeracy	(16) American Diabetes Association, 2013	B
Routine care of people with type 2 diabetes should address disparities associated with socioeconomic status and ethnicity	(16) American Diabetes Association, 2013	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 5.2 A structured diabetes care program consistent with the chronic care model

Recommendations	Reference	Grade*
Care should be aligned with components of the CCM to ensure productive interactions between a prepared proactive practice team and an informed activated patient	(16) American Diabetes Association, 2013	A
When feasible, care systems should support team-based care, community involvement, patient registries and embedded decision support tools to meet patient needs	(16) American Diabetes Association, 2013	B
Treatment decisions should be timely and based on evidence-based guidelines that are tailored to individual patient preferences, prognoses and comorbidities	(16) American Diabetes Association, 2013	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 5.3 Patient education and self-management

Recommendations	Reference	Grade*
All people with type 2 diabetes should be referred for structured diabetes patient education	(34) NHMRC, 2009	A
Diabetes education should be delivered in groups or individually	(34) NHMRC, 2009	A
Diabetes education should be culturally sensitive and tailored to the needs of socioeconomically disadvantaged populations	(34) NHMRC, 2009	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 6 Lifestyle modification

Recommendations	Reference	Grade*
Lifestyle modifications that focus on increased physical activity, dietary change and weight loss should be offered to all individuals at high risk of developing type 2 diabetes	(34) NHMRC, 2009	A

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

### 6.1 Physical activity

Recommendations	Reference	Grade*
People with type 2 diabetes of all ages benefit from accumulating 30 minutes or more of moderate physical activity on most if not all days of the week	(48) Briffa T, 2006	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

### 6.2 Dietary assessment

Recommendations	Reference	Grade*
Consumption of cereal foods (especially three serves a day of wholegrains) is associated with reduced risk of type 2 diabetes	(51) NHMRC, 2013	B
Consumption of at least one and a half serves of dairy foods (milk, yoghurt, cheese) per day is associated with reduced risk of type 2 diabetes	(51) NHMRC, 2013	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.



## 6.3 Weight

Recommendations	Reference	Grade*
Adults with IFG, IGT or diabetes can be strongly advised that the health benefits of 5–10% weight loss include prevention, delayed progression or improved control of type 2 diabetes	(38) NHMRC, 2013	A
For adults with BMI >40 kg/m <sup>2</sup> , or adults with BMI >35 kg/m <sup>2</sup> and comorbidities that may improve with weight loss, bariatric surgery may be considered, taking into account the individual situation	(38) NHMRC, 2013	A
Use BMI to classify overweight or obesity in adults	(38) NHMRC, 2013	B
For adults, use waist circumference, in addition to BMI, to refine assessment of risk of obesity-related comorbidities	(38) NHMRC, 2013	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 6.4 Smoking cessation

Recommendations	Reference	Grade*
Smoking cessation should be a major focus of the management of people with smoking-related diseases	(61) RACGP, 2011	A
All smokers should be offered brief advice to quit smoking	(61) RACGP, 2011	A

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 6.5 Alcohol consumption

Recommendations	Reference	Grade*
People with diabetes can take alcohol in moderation as part of a healthy lifestyle but should aim to keep within the target consumption recommended for people without diabetes	(64) SIGN, 2010	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 8.1 Glycaemic monitoring and control

Recommendations	Reference	Grade*
HbA1c measurement should be used to assess long-term blood glucose control	(71) NHMRC, 2009	A
SMBG is recommended for patients with type 2 diabetes who are using insulin where patients have been educated in appropriate alterations in insulin dose	(64) SIGN, 2010	B
Routine SMBG in low risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended	(64) SIGN, 2010	B
Blood glucose control should be optimised because of its beneficial effects on the development and progression of microvascular complications	(71) NHMRC, 2009	A
The potential harmful effects of optimising blood glucose control in people with type 2 diabetes should be considered when setting individual glycaemic targets	(71) NHMRC, 2009	A
The general HbA1c target in people with type 2 diabetes is ( $\leq 7\%$ , 53 mmol/mol). Adjustments to diabetes treatment should be considered when HbA1c is above this level	(71) NHMRC, 2009	A
Targets for SMBG levels are 6–8 mmol/L fasting and pre-prandial, and 6–10 mmol/L 2 h postprandial	(71) NHMRC, 2009	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 8.2 Medication – general

Recommendations	Reference	Grade*
Care should be taken to address potential harmful effects of optimising blood glucose control when setting individual glycaemic targets	(71) NHMRC, 2009	A
Interventions to achieve target HbA1c should begin with lifestyle modification followed by pharmacological options selected on the basis of individual clinical circumstances, side effects and contraindications	(71) NHMRC, 2009	A
Blood glucose control should be optimised because of its beneficial effects on the development and progression of microvascular complications	(71) NHMRC, 2009	A
Adults with a high absolute risk of CVD should be simultaneously treated with lipid and BP-lowering pharmacotherapy in addition to lifestyle advice unless contraindicated or clinically inappropriate	(78) NVDPA, 2012	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 9 Cardiovascular risk

Recommendations	Reference	Grade*
Patients with pre-existing CVD are at high risk		A
Adults with any of the following conditions do not require absolute cardiovascular risk assessment using the Framingham Risk Equation because they are already known to be at clinically determined high risk of CVD: <ul style="list-style-type: none"> <li>• Diabetes and age &gt;60 years</li> <li>• Diabetes with microalbuminuria (&gt;20 mcg/min or UACR &gt;2.5 mg/mmol for men, &gt; 3.5 mg/mmol for women)</li> <li>• Moderate or severe CKD (persistent proteinuria or eGFR &lt;45 mL/min/1.73 m<sup>2</sup>)</li> <li>• A previous diagnosis of familial hypercholesterolaemia</li> <li>• SBP ≥180 mmHg or DBP ≥110 mmHg</li> <li>• Serum TC &gt;7.5 mmol/L</li> </ul>	(78) NVDPA, 2012	D
Calculate risk level using an evidence-based tool: National Vascular Prevention Disease Alliance charts, <a href="http://www.cvdcheck.org.au">www.cvdcheck.org.au</a> New Zealand Cardiovascular Risk charts, <a href="http://www.health.govt.nz/about-ministry/ministry-health-websites/new-zealand-guidelines-group">www.health.govt.nz/about-ministry/ministry-health-websites/new-zealand-guidelines-group</a> Heart Foundation NZ, <a href="http://www.knowyournumbers.co.nz">www.knowyournumbers.co.nz</a>	(78) NVDPA, 2012	B
Aboriginal and Torres Strait Islander peoples are generally assumed to be at higher risk	(78) NVDPA, 2012	B

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## Antihypertensive medication to manage cardiovascular risk

Recommendations	Reference	Grade*
BP-lowering therapy in people with diabetes should preferentially include an ACEI or ARB	(78) NVDPA, 2012	A
If monotherapy does not sufficiently reduce BP add one of the following:		
• Calcium channel blocker	(78) NVDPA, 2012	B
• Low-dose thiazide or thiazide-like diuretic	(78) NVDPA, 2012	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## Lipid medication to manage cardiovascular risk

Recommendations	Reference	Grade*
Use statins as first-line therapy	(78) NVDPA, 2012	A

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 10.1 Diabetic retinopathy

Recommendations	Reference	Grade*
Ensure that all people with diabetes have a dilated fundus examination and visual acuity assessment at the diagnosis of diabetes and at least every 2 years	(99) NHMRC, 2008	None provided (Level I evidence)
Examine higher risk patients (longer duration of diabetes, poor glycaemic control, BP or blood lipid control) without diabetic retinopathy at least annually	(99) NHMRC, 2008	None provided (Level I evidence)
Conduct annual screening for Aboriginal or Torres Strait Islander peoples with diabetes	(99) NHMRC, 2008	None provided (Level IV evidence)

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 10.3 Diabetic peripheral neuropathy

Recommendations	Reference	Grade*
All patients should be screened for distal symmetric polyneuropathy starting at diagnosis of type 2 diabetes and at least annually thereafter, using simple clinical tests	(100) American Diabetes Association, 2012	B
Antidepressants, including tricyclics, duloxetine and venlafaxine should be considered for the treatment of patients with painful diabetic peripheral neuropathy	(64) SIGN, 2010	A
Anticonvulsants, including pregabalin and gabapentin should be considered for the treatment of patients with painful diabetic peripheral neuropathy	(64) SIGN, 2010	A

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 10.4 Nephropathy

Recommendations	Reference	Grade*
<b>Assessment</b>		
Kidney status in people with type 2 diabetes should be assessed by:		
• annual screening for albuminuria (note that dipstick urine test is not adequate to identify albuminuria)	(25) NHMRC, 2009	B
• annual estimation of the glomerular filtration rate (eGFR in mL/min/1.73m <sup>2</sup> )	(25) NHMRC, 2009	B
<b>Management</b>		
Reducing the risk or slowing the progression of nephropathy can be achieved by:		
• optimising glucose control aiming for a general HbA1c target of 7%	(104) Kidney Health Australia, 2012	A
• optimising BP control	(104) Kidney Health Australia, 2012	A
In people with type 2 diabetes and microalbuminuria or macroalbuminuria, ARB or ACEI antihypertensive should be used to protect against progression of kidney disease	(104) Kidney Health Australia, 2012	A
People with type 2 diabetes should be informed that smoking increases the risk of CKD	(104) Kidney Health Australia, 2012	B
People with diabetes and microalbuminuria are considered at high cardiovascular risk, and should be treated with multifactorial interventions (see <i>Section 9</i> )	(78) NVDPA, 2012	D

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 10.5 Foot complications

Recommendations	Reference	Grade*
Assess all people with diabetes and stratify their risk of developing foot complications	(107) NHMRC, 2011	C
People assessed as having intermediate or high-risk feet should be offered a foot protection program. A foot protection program includes foot care education, podiatry review and appropriate footwear	(107) NHMRC, 2011	C
Pressure reduction, otherwise referred to as redistribution of pressure or offloading, is required to optimise the healing of plantar foot ulcers	(107) NHMRC, 2011	B
Offloading of the wound can be achieved with the use of a total contact cast or other device rendered irremovable	(107) NHMRC, 2011	B
People with diabetes-related foot ulceration are best managed by a multidisciplinary foot care team	(107) NHMRC, 2011	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 11 Glycaemic emergencies

Recommendations	Reference	Grade*
The potential harmful effects of optimising blood glucose control in people with type 2 diabetes should be considered when setting individual glycaemic targets	(71) NHMRC, 2009	A
Improving blood glucose control increases the risk of hypoglycaemia	(71) NHMRC, 2009	None provided (Level I evidence)

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 13.2 Pregnancy with pre-existing type 2 diabetes

Recommendations	Reference	Grade*
Pre-pregnancy glycaemic control should be maintained as close to the non-diabetic range as possible, taking into account risk of maternal hypoglycaemia	(64) SIGN, 2010	C
All women with diabetes should be prescribed high-dose pre-pregnancy folate supplementation, continuing up to 12 weeks gestation	(64) SIGN, 2010	B
Women with diabetes initially treated in early pregnancy with metformin or sulphonylureas should be advised that these medications do not appear to carry additional risk of teratogenesis or early pregnancy loss	(64) SIGN, 2010	B
All women with pre-gestational diabetes should be encouraged to achieve excellent glycaemic control	(64) SIGN, 2010	D
Postprandial glucose monitoring should be carried out in pregnant women with type 1 or 2 diabetes	(64) SIGN, 2010	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 13.3 Gestational diabetes

### Screening and management of GDM

Recommendations	Reference	Grade*
Pregnant women with GDM should be offered dietary advice and blood glucose monitoring and be treated with glucose-lowering therapy depending on target values for fasting and postprandial targets	(64) SIGN, 2010	A

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## Follow-up of patients with a history of GDM

Recommendations	Reference	Grade*
Women with a history of GDM should receive:		
• a postpartum glucose tolerance test at 6–12 weeks	(16) American Diabetes Association, 2013	E
• a fasting blood glucose test	(167) RACGP, 2012	B
• every 3 years	(167) RACGP, 2012	C

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 14.1 Sick day management

Recommendations	Reference	Grade*
Patients should be educated to develop a sick day management plan after initial diagnosis. This plan should be reviewed at regular intervals	(174) Australian Diabetes Educators Association, 2006	None provided
Assist in development of a sick day care plan and preparation of a home sick day management kit for patients to use during episodes of sickness	(174) Australian Diabetes Educators Association, 2006	None provided

\*Refer to earlier in *Appendix A* for an explanation of the Grade.

## 15 Diabetes and end-of-life care

Recommendations	Reference	Grade*
To minimise the risks of hypoglycaemia and metabolic compensation, a blood glucose range of 6–15 mmol/L is appropriate for most palliative care patients	(175) Diabetes UK, 2012	None provided
Maintain at HbA1c at no lower than 59 mmol/mol (7.5%) depending on the individual's life expectancy as HbA1c will be less relevant in patients with months or days left to live	(175) Diabetes UK, 2012	None provided



## *Appendix B: Accessing government support for diabetes care in general practice*

### **Support for developing management plans and organising team care**

The Australian Government supports general practices taking a high-quality and proactive approach to diabetes care through Medicare payments to GPs, nurses, allied health professionals and general practices. These include the Chronic Disease Management (CDM) items (formerly Enhanced Primary Care), Service Incentive Payments (SIP) and the Practice Incentives Program (PIP).

The CDM items provide support for developing management plans and organising team care.

**General Practice Management Plans** (GPMP – item 721) are documented plans developed together by the GP and the patient. They incorporate the patient's needs, goals, how these are to be achieved, and reference to any resources used. Templates are available via medical software and various general practice networks and Medicare Locals.

Payments are made for development and for structured reviews of GPMPs.

**Team Care Arrangements** (TCA – item 723) are expansions of the GPMP that detail allied healthcare worker and other members of the team who implement any part of the GPMP. This includes active participation by at least two other providers who contribute to the care plan/TCA and the goals of management for the patient.

Both GPMPs and TCAs can have practice nurses or similar practice team members involved in their development.

Payments are made for development and for structured reviews of both GPMP (item 732) and TCA (item 732).

There is evidence that GPMPs that are reviewed on a regular basis can result in improvement in both process and clinical outcomes.<sup>15</sup>

Medicare payments also support the involvement of suitable qualified allied health members in providing care as documented in the TCA. Up to five treatments per year are subsidised at the time of publication.

Medicare has strict eligibility criteria for claims for the above. Further information is available at [www.health.gov.au/internet/mbsonline/publishing.nsf/Content/Medicare-Benefits-Schedule-MBS-1](http://www.health.gov.au/internet/mbsonline/publishing.nsf/Content/Medicare-Benefits-Schedule-MBS-1).

## Support for the annual cycle of care

The annual cycle of care is a method of incentivising quality diabetes care. However, the scope of annual cycle of care recommendations is less than the guideline recommendations.

Completion of an annual cycle of care requires assessment of a number of parameters (see *Table B.1*) and the professional attendance and appropriate documentation by a GP including any clinically relevant issues including:

- taking a patient history
- performing a clinical exam
- arranging any necessary investigation
- implementing a management plan
- providing appropriate preventive healthcare.

Patients and practitioners need to discuss desired outcomes and agree on goals to achieve these. An example of a structured patient-centred care plan (GPMP) is provided in *Appendix D*.

For practitioners – Support payments are provided for completing the annual cycle of care. When a patient with diabetes completes their annual cycle of care, their GP notifies Medicare Australia and is paid a SIP.

For practices – When more than 50% of practice patients with diabetes have completed their annual cycle of care, practices are automatically paid a quality outcome payment. This is calculated by Medicare and is dependent on the number of SIP payments claimed by GPs.

**Table B.1. Minimum requirements of care to complete an annual diabetes cycle of care for patients with established diabetes mellitus**

Minimum requirements of care to complete an annual diabetes cycle of care for patients with established diabetes mellitus Medicare Benefits Schedule – Item 2517*	Frequency
Weight and height plus BMI	At least twice every cycle of care
BP	At least twice every cycle of care
Feet examination	At least twice every cycle of care
Measure total cholesterol, triglycerides and HDL-C	At least once every year
HbA1c	At least once every year
Microalbuminuria	At least once every year
eGFR	At least once every year
Self-care education, diet, physical activity, smoking evaluation	Yearly
Medication review	Yearly
Ensure that a comprehensive eye examination is carried out	At least once every two years
* Medicare Benefits Schedule – Item 2517, <a href="http://www9.health.gov.au/mbs/fullDisplay.cfm?type=item&amp;qt=ItemID&amp;q=2517">www9.health.gov.au/mbs/fullDisplay.cfm?type=item&amp;qt=ItemID&amp;q=2517</a>	

## *Appendix C: The Australian Type 2 Diabetes Risk Assessment Tool – AUSDRISK*

The Australian Type 2 Diabetes Risk Assessment Tool was originally developed by the International Diabetes Institute on behalf of the Commonwealth, state and territory governments as part of the Council of Australian Governments' reducing the risk of type 2 diabetes initiative.

Patients determined as high risk by the AUSDRISK are only eligible for a GP evaluation (MBS items 701, 703, 705) for diabetes once every 3 years. An Aboriginal health assessment (MBS item 715) allows access to five follow-up allied health services in that year (Allied health items 81300 to 81360, visit [www.health.gov.au/internet/ctg/publishing.nsf/Content/practice-detail-card-7-allied-health-follow-up-services-mbs-items-81300-81360](http://www.health.gov.au/internet/ctg/publishing.nsf/Content/practice-detail-card-7-allied-health-follow-up-services-mbs-items-81300-81360)) (in addition to any available under a GPMP and TCA).

# The Australian Type 2 Diabetes Risk Assessment Tool (AUSDRISK)

## 1. Your age group

- |                  |                          |          |
|------------------|--------------------------|----------|
| Under 35 years   | <input type="checkbox"/> | 0 points |
| 35 – 44 years    | <input type="checkbox"/> | 2 points |
| 45 – 54 years    | <input type="checkbox"/> | 4 points |
| 55 – 64 years    | <input type="checkbox"/> | 6 points |
| 65 years or over | <input type="checkbox"/> | 8 points |

## 2. Your gender

- |        |                          |          |
|--------|--------------------------|----------|
| Female | <input type="checkbox"/> | 0 points |
| Male   | <input type="checkbox"/> | 3 points |

## 3. Your ethnicity/country of birth:

### 3a. Are you of Aboriginal, Torres Strait Islander, Pacific Islander or Maori descent?

- |     |                          |          |
|-----|--------------------------|----------|
| No  | <input type="checkbox"/> | 0 points |
| Yes | <input type="checkbox"/> | 2 points |

### 3b. Where were you born?

- |   |                          |          |
|---|--------------------------|----------|
| Australia   | <input type="checkbox"/> | 0 points |
| Asia (including the Indian sub-continent), Middle East, North Africa, Southern Europe | <input type="checkbox"/> | 2 points |
| Other   | <input type="checkbox"/> | 0 points |

## 4. Have either of your parents, or any of your brothers or sisters been diagnosed with diabetes (type 1 or type 2)?

- |     |                          |          |
|-----|--------------------------|----------|
| No  | <input type="checkbox"/> | 0 points |
| Yes | <input type="checkbox"/> | 3 points |

## 5. Have you ever been found to have high blood glucose (sugar) (for example, in a health examination, during an illness, during pregnancy)?

- |     |                          |          |
|-----|--------------------------|----------|
| No  | <input type="checkbox"/> | 0 points |
| Yes | <input type="checkbox"/> | 6 points |

## 6. Are you currently taking medication for high blood pressure?

- |     |                          |          |
|-----|--------------------------|----------|
| No  | <input type="checkbox"/> | 0 points |
| Yes | <input type="checkbox"/> | 2 points |

## 7. Do you currently smoke cigarettes or any other tobacco products on a daily basis?

- |     |                          |          |
|-----|--------------------------|----------|
| No  | <input type="checkbox"/> | 0 points |
| Yes | <input type="checkbox"/> | 2 points |

## 8. How often do you eat vegetables or fruit?

- |               |                          |          |
|---------------|--------------------------|----------|
| Every day     | <input type="checkbox"/> | 0 points |
| Not every day | <input type="checkbox"/> | 1 point  |

## 9. On average, would you say you do at least 2.5 hours of physical activity per week (for example, 30 minutes a day on 5 or more days a week)?

- |     |                          |          |
|-----|--------------------------|----------|
| Yes | <input type="checkbox"/> | 0 points |
| No  | <input type="checkbox"/> | 2 points |

## 10. Your waist measurement taken below the ribs (usually at the level of the navel, and while standing)

Waist measurement (cm)

### For those of Asian or Aboriginal or Torres Strait Islander descent:

#### Men

- |                  |                          |          |
|------------------|--------------------------|----------|
| Less than 90 cm  | <input type="checkbox"/> | 0 points |
| 90 – 100 cm      | <input type="checkbox"/> | 4 points |
| More than 100 cm | <input type="checkbox"/> | 7 points |

#### Women

- |                 |                          |          |
|-----------------|--------------------------|----------|
| Less than 80 cm | <input type="checkbox"/> | 0 points |
| 80 – 90 cm      | <input type="checkbox"/> | 4 points |
| More than 90 cm | <input type="checkbox"/> | 7 points |

### For all others:

#### Men

- |                  |                          |          |
|------------------|--------------------------|----------|
| Less than 102 cm | <input type="checkbox"/> | 0 points |
| 102 – 110 cm     | <input type="checkbox"/> | 4 points |
| More than 110 cm | <input type="checkbox"/> | 7 points |

#### Women

- |                  |                          |          |
|------------------|--------------------------|----------|
| Less than 88 cm  | <input type="checkbox"/> | 0 points |
| 88 – 100 cm      | <input type="checkbox"/> | 4 points |
| More than 100 cm | <input type="checkbox"/> | 7 points |

Add up your points

Your risk of developing type 2 diabetes within 5 years\*:

- ☐ **5 or less: Low risk**  
Approximately one person in every 100 will develop diabetes.
- ☐ **6-11: Intermediate risk**  
For scores of 6-8, approximately one person in every 50 will develop diabetes. For scores of 9-11, approximately one person in every 30 will develop diabetes.
- ☐ **12 or more: High risk**  
For scores of 12-15, approximately one person in every 14 will develop diabetes. For scores of 16-19, approximately one person in every 7 will develop diabetes. For scores of 20 and above, approximately one person in every 3 will develop diabetes.

\*The overall score may overestimate the risk of diabetes in those aged less than 25 years.

**If you scored 6-11 points in the AUSDRISK you may be at increased risk of type 2 diabetes.** Discuss your score and your individual risk with your doctor. Improving your lifestyle may help reduce your risk of developing type 2 diabetes.

**If you scored 12 points or more in the AUSDRISK you may have undiagnosed type 2 diabetes or be at high risk of developing the disease.** See your doctor about having a fasting blood glucose test. Act now to prevent type 2 diabetes.

# *Appendix D: Structured patient-centred care plan/General Practice Management Plan and Patient Care Plan*

<Insert practice letterhead>

General Practice Management Plan (MBS Item 721, Diabetes)	
Patient name:	Date of birth:
<<Full name>>	<<DOB>>
Contact:	Medicare or private health insurance:
<<Address>>	<<Medicare number>>
<<Telephone>>	<<Health insurance>>
Date of last GPMP (if done): <<Date>>	
<p>This Diabetes Care Plan was developed by staff at the [insert name] Medical Centre. While it specifically relates to management of your diabetes, your other health problems will also be considered. This care plan utilises the skills of many health professionals to help you to have the best of healthcare and for you to manage your diabetes.</p> <p>This plan focuses on proven therapies that, with support and care, may help prevent complications. Diabetes is best treated early and may be difficult to treat when complications arise. The management goals in this plan are set by National Diabetes expert bodies. Your diabetes will be monitored against these goals.</p> <p>This plan encourages you to be actively involved in your care. It is important that you and your healthcare team monitor your diabetes and report anything that is untoward. We particularly urge you to report any chest pains, unexplained weakness, foot problems, visual changes, or any symptom that concerns you.</p> <p>Emergency contact at [insert name] Medical Centre for diabetes – [name] [contact number]</p> <p>This document should be brought along with you to each visit to the dietitian, diabetes educator, practice nurse, other health professional and to the doctor when your review is due.</p>	

## Management plan outcomes

<b>Patient needs</b>	<p>To become educated regarding diabetes and appropriate preventative activities.</p> <p>To appropriately manage medication for diabetes and other supportive therapies.</p> <p>[Insert individual patient needs]</p>
<b>Management goals</b>	<p>To lead a happy healthy lifestyle.</p> <p>To progress toward/achieve recognised goals for diabetes care.</p> <p>To prevent onset or progression of CVD or its complications.</p> <p>To remain free of serious side effects from medication.</p> <p>To minimise the burden of diabetes management and care.</p>
<b>Treatment services</b>	<p>To participate in structured care system at the [insert name] Medical Centre.</p> <p>To involve other health service providers</p> <p>[Insert individualised patient treatment services]</p> <p>to assist in provision of services.</p>
<b>Patient actions</b>	<p>To undertake appropriate lifestyle measures (e.g. quit smoking, regular exercise, dietary changes).</p> <p>To participate in this management plan and to self-monitor impact of illness.</p> <p>To become educated regarding diabetes.</p> <p>[Insert individualised patient actions]</p>
<b>Monitoring and review</b>	<p>The first review will usually be at 1 week to 1 month – to monitor impact of any initial or ongoing therapy medication and other strategies.</p> <p>Every 3–6 months a major review of the management plan goals will occur.</p> <p>Thereafter reviews will depend on response to therapy and complexity of all health issues.</p> <p>A recall will be instituted at least every 3 months to monitor progress.</p>
<b>Review date</b>	[Insert review date]

### Past medical history

Family history

<<Clinical details of family history>>

Medications

<<Clinical details – medication list>>

Allergies

<<Allergy details>>

Social history

Patient name: <Full name>

GPMP (MBS Item 721, Diabetes)			
Patient problems / needs/relevant conditions	Goals – changes to be achieved	Required treatments and services including patient actions	Arrangements for treatments/ services (when, who, contact details)
<b>1. General</b>			
Patient's understanding of diabetes and self-management	Patient to have a clear understanding of diabetes and patient's role in managing the condition	Patient education	GP/nurse/diabetes educator
	Patient to understand the role of self-monitoring of glucose if this is required	Patient education	GP/nurse/diabetes educator
<b>2. Lifestyle</b>			
Nutrition	Normal healthy eating If concerns regarding cardiovascular risk, advise Mediterranean diet	Patient education OR As per Lifescripts action plan	GP to monitor Dietitian
Weight/BMI	Your target:____ Therapeutic goal is 5–10% loss for people overweight and obese with type 2 diabetes With BMI >35 and comorbidities or BMI >40, greater weight loss measures should be considered	Monitor Review 6 monthly OR As per Lifescripts action plan	Patient to monitor GP/nurse to review Dietitian when appropriate
Physical activity	Your target:____ At least 30 minutes of moderate physical activity on most if not all days of the week (total ≥150 minutes/week)	Patient exercise routine OR As per Lifescripts action plan	GP/exercise physiologist Patient to implement



## GPMP (MBS Item 721, Diabetes)

Patient problems / needs/relevant conditions	Goals – changes to be achieved	Required treatments and services including patient actions	Arrangements for treatments/ services (when, who, contact details)
Smoking	Complete cessation	Smoking cessation strategy: Consider: – quit – medication OR As per Lifescripts action plan	Patient to manage GP to monitor
Alcohol intake	Your target: <___ standard drinks/day Healthy: ≤2 standard drinks/day (adults)	Reduce alcohol intake Patient education OR As per Lifescripts action plan	Patient to manage GP to monitor
<b>3. Biomedical</b>			
Cardiovascular risk calculation			
Cholesterol/lipids	Cholesterol level to accepted national target	Initiation of pharmacotherapy is dependent on the assessment of absolute cardiovascular risk (Australian absolute CVD risk calculator). This requires using multiple risk factors, which is considered more accurate than the use of individual parameters  Once therapy is initiated the specified targets apply; however, these targets are somewhat arbitrary and should be used as a guide to treatment, and not as a mandatory requirement  Check every 6 months	GP
BP	BP to accepted national target		GP/nurse

## GPMP (MBS Item 721, Diabetes)

Patient problems / needs/relevant conditions	Goals – changes to be achieved	Required treatments and services including patient actions	Arrangements for treatments/ services (when, who, contact details)
HbA1c	Your target: <____ Healthy: ≤53 mmol/mol (range 48–58 mmol/mol) ≤7% (range 6.5–7.5%)	Needs individualisation according to patient circumstances  Check every 3–6 months or as advised by your GP	GP/nurse
Blood glucose level	Healthy:<6–8 mmol/L fasting  SMBG on an ongoing basis should be available to those people with diabetes using insulin, with haemoglobinopathies, pregnancy or other conditions where data on glycaemic patterns is required  Routine SMBG in low-risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended	Monitoring dependent on individual circumstances	Patient GP/nurse Diabetes educator when required

### 4. Medication

Medication review	Targeted and careful use of medications to maximise benefit and minimise side effects	Patient education Review medications	GP to review and provide education Pharmacist when required
Vaccinations	Influenza  Pneumococcal and dTPa vaccine	Annually  At appropriate intervals	GP/nurse

### 5. Complications of diabetes

Eye complications	Early detection of any problems	Eye check every 2 years  Retinal photography or referral by GP	GP/optometrist/ ophthalmologist
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## GPMP (MBS Item 721, Diabetes)

Patient problems / needs/relevant conditions	Goals – changes to be achieved	Required treatments and services including patient actions	Arrangements for treatments/ services (when, who, contact details)
Foot complications	Optimal foot care and avoidance of ulceration and amputation by: <ul style="list-style-type: none"> <li>• patient education on foot care and self-check</li> <li>• professional check feet every 6 months</li> <li>• early detection and management of complications</li> </ul>	Stratify the risk of developing foot complications: <ul style="list-style-type: none"> <li>• low/intermediate/ high risk</li> <li>• the intensity of monitoring and review increases according to level of risk</li> </ul>	GP/podiatrist/nurse patient GP
Kidney damage	Avoid kidney complications UACR <3.5 mg/mmol women <2.5 mg/mmol men	Test for microalbuminuria annually	GP
Sexual dysfunction	Maintain sexual function	To be discussed with patient where applicable	GP
<b>6. Psychosocial</b>			
Mood and distress from diabetes	Manage distress and depression		GP/nurse Psychologist when required
Licence assessment	Maintain safe driving to Road Authority Standards		GP/nurse/specialist
<b>7. Register with NDSS</b>	Provide access to best practice consumer resources to support self-management	Provision of self-management information and consumer support and advocacy	GP/nurse Diabetes Australia

## Patient monitoring

Measurements	Target	Progress				
<b>HbA1c</b> (This is a measure of how well your blood glucose has been controlled over the last 3 months)	6.5–7.5% or 48–58 mmol/mol  Individualised, as low as reasonably possible without side effects					
<b>Cardiovascular risk assessment</b> This is your risk of having a heart attack or stroke in the next 5 years						
<b>SBP</b> The highest reading in BP, is more closely related to poor outcomes.	<130 Initiation of drug therapy depends on the assessment of absolute cardiovascular risk					
<b>LDL-C</b> This is the 'bad' cholesterol implicated in causing CVD	<2.0 Targets should be used as a guide to treatment, and not as a mandatory requirement					
<b>HDL-C</b> This is the 'good' cholesterol, associated with protection against CVD	≥1.0					
<b>Triglycerides</b>	<2.0					
<b>Renal function –</b> eGFR is an indicator of overall kidney function Microalbuminuria Microalbuminuria is a sign of kidney stress. Identification at an early stage can prevent kidney problems and/or progression to kidney failure	eGFR Reduce albuminuria by decreasing BP and blood glucose levels					
<b>Foot examination</b> To identify potential and active foot problems (e.g. presence of ulcers, infection, corns, calluses, fissures)	Foot risk = low/intermediate/high Today's examination					

Measurements	Target	Progress				
<p>Vision</p> <p>This is to aid detection of early cataract formation.</p> <p>Ophthalmology review – to detect small vessel changes in your eyes</p>	<p>Visual care</p> <p>Full eye review every 2 years</p>					

Copy of GPMP offered to patient?<< \_\_\_\_\_ >>

Copy/relevant parts of the GPMP supplied to other providers?<< \_\_\_\_\_ >>

GPMP added to the patient's records?<< \_\_\_\_\_ >>

Date service completed:<< \_\_\_\_\_ >>

Proposed review date:<< \_\_\_\_\_ >>

I have explained the steps and costs involved, and the patient has agreed to proceed with the service. <<Steps and costs explained, patient agreed>>

GP signature: \_\_\_\_\_ Date: \_\_\_\_\_

## *Appendix E: PAID tool*

The PAID questionnaire is a psychometrically sound tool for detecting diabetes-related distress. The PAID questionnaire includes 20 items, each of which focuses on a different commonly experienced problem with diabetes.

Patients indicate how much each issue affects them personally, on a scale of 0 (not a problem) to 4 (serious problem). Individual items scored  $\geq 3$  (indicating a somewhat serious or serious problem area) should be discussed with the patient.

Item scores can also be added and standardised to a score out of 100 (by multiplying the total by 1.25). Higher scores indicate higher levels of diabetes-related distress. Scores  $\geq 40$  indicate severe diabetes-related distress and warrant further exploration and discussion with the patient.

Please read each question carefully. Put an X in the box that best describes you for each question.

Which of the following diabetes issues are currently a problem for you?	Not a problem	Minor problem	Moderate problem	Somewhat serious problem	Serious problem
1. Not having clear and concrete goals for your diabetes care?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
2. Feeling discouraged with your diabetes treatment plan?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
3. Feeling scared when you think about living with diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
4. Uncomfortable social situations related to your diabetes care (e.g. people telling you what to eat)?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
5. Feelings of deprivation regarding food and meals?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
6. Feeling depressed when you think about living with diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
7. Not knowing if your mood or feelings are related to your diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
8. Feeling overwhelmed by your diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
9. Worrying about low blood sugar reactions?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
10. Feeling angry when you think about living with diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
11. Feeling constantly concerned about food and eating?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>

Please read each question carefully. Put an X in the box that best describes you for each question.

Which of the following diabetes issues are currently a problem for you?	Not a problem	Minor problem	Moderate problem	Somewhat serious problem	Serious problem
12. Worrying about the future and the possibility of serious diabetes complications?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
13. Feelings of guilt or anxiety when you get off track with your diabetes management?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
14. Not 'accepting' your diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
15. Feeling unsatisfied with your diabetes physician?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
16. Feeling that diabetes is taking up too much of your mental and physical energy every day?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
17. Feeling alone with your diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
18. Feeling that your friends and family are not supportive of your diabetes management efforts?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
19. Coping with complications of diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>
20. Feeling 'burned out' by the constant effort needed to manage diabetes?	00 <input type="checkbox"/>	01 <input type="checkbox"/>	02 <input type="checkbox"/>	03 <input type="checkbox"/>	04 <input type="checkbox"/>

Investigation of specific concerns highlighted by the PAID questionnaire is useful for formulating and adjusting treatment options for your patients. Severe and persistent diabetes-related distress may warrant referral to a mental health specialist.

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# Appendix F: PHQ-2 tool

The PHQ-2 is a psychometrically sound tool for detecting depression and anhedonia. The PHQ-2 is composed of the first two items from the PHQ-9 (each describing a different problem/symptom of depression), making it ideal for use in busy clinical settings.

Patients indicate how frequently they have been bothered by each problem (item) over the past 2 weeks. The items are scored on a four point Likert scale from 0 (not at all) to 3 (nearly every day). Individual item scores are added together, resulting in a total score from 0 to 6. Total scores  $\geq 3$  warrant further assessment for depression using a diagnostic instrument or interview. Patients who are subsequently diagnosed with depression should be provided with ongoing healthcare professional support for the management and treatment for their depression and their ongoing diabetes care.

Note that as this tool has only two items, it may seem unnecessary to administer this tool to patients using paper and pen. However, an advantage of doing so is that it allows the patients to 'grade' their symptoms and allows the healthcare professional to track their patient's scores over time.

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	00 <input type="text"/>	01 <input type="text"/>	02 <input type="text"/>	03 <input type="text"/>
2. Feeling down, depressed, or hopeless	00 <input type="text"/>	01 <input type="text"/>	02 <input type="text"/>	03 <input type="text"/>

Developed by Robert L Spitzer, Janet BW Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

## *Appendix G: Available glucose-lowering agents*

When evaluating the clinical evidence of the following interventions, high-quality long-term prospective trials on clinical outcomes specific to type 2 diabetes and its complications are useful benchmarks. Agents recently listed for glycaemic management may only have cardiovascular trial data for safety or the absence of increased risk of harm which does not equate with benefit or risk reduction.

### **Metformin**

Prospective trials have demonstrated reduced progression (31%) from IFG or IGT to diabetes when metformin is combined with intensive lifestyle management. However, it is not indicated for this use in Australia.

In patients with type 2 diabetes, prospective cardiovascular trials such as UKPDS have shown microvascular and macrovascular benefits.

Metformin:

- is the medication of first choice for people with type 2 diabetes
- reduces hepatic glucose output and improves muscle cell insulin receptor resistance
- does not stimulate insulin release
- significantly reduces the risk of diabetes-related morbidity and mortality in overweight patients
- should be used with caution in people with hepatic or cardiac disease and those with a heavy alcohol intake or dehydration (e.g. acute gastroenteritis) and renal impairment.

Contraindication:

- Renal impairment ( $\text{eGFR} < 30 \text{ mL/min/1.73 m}^2$ ) is the only absolute contraindication to metformin. It should be used with caution in people with an  $\text{eGFR}$  of  $30\text{--}45 \text{ mL/min/1.73 m}^2$  with dose reduction suggested.

Main side effects:

- anorexia, nausea, vomiting
- diarrhoea, abdominal cramps, flatulence
- lactic acidosis (uncommon, but may occur with dehydration and co-existing renal, liver or CVD).

## Sulphonylureas

Prospective cardiovascular trials such as UKPDS have shown microvascular benefits. Macrovascular benefits emerged in follow-up of newly diagnosed patients who were intensively treated with sulphonylureas and insulin in UKPDS some 10 years post-trial. This is called the 'legacy' effect. Clear microvascular benefits have been shown in ACCORD, ADVANCE, and VADT trials using more recently developed sulphonylurea agents such as gliclazide.

Macrovascular benefits did not emerge in patients with pre-existing CVD with HbA1c below 7% (ACCORD trial).

Sulphonylureas:

- act to increase insulin secretion in a non-glucose dependent fashion and rely on some residual  $\beta$  cell function
- can be considered after a trial of healthy lifestyle and used in combination with agents such metformin.

Main side effects:

- weight gain
- symptomatic hypoglycaemia
- anorexia, nausea, diarrhoea, skin rashes
- occasionally blood dyscrasias
- glibenclamide and glimepiride may cause high rates of hypoglycaemia (in older patients and in patients with autonomic neuropathy or nephropathy).

## Acarbose

Prospective cardiovascular trials (STOP-NIDDM) have shown improvement in diabetes prevention in patients with IGT, and macrovascular benefits.<sup>180</sup> No prospective cardiovascular trials with positive outcome benefit have been reported for type 2 diabetes.

Acarbose:

- is useful when blood glucose values remain high after meals despite dietary modification
- inhibits the digestion of carbohydrate and thus slows the rate of glucose delivery into the circulation
- needs to be taken at the time of starting the meal and introduced gradually to avoid flatulence and abdominal discomfort.

If hypoglycaemia occurs (because of concurrent sulphonylurea or insulin treatment) glucose rather than other carbohydrates is required. Care is necessary in those with renal impairment or gastrointestinal disease and liver enzymes need to be monitored.

Main side effects:

- flatulence and abdominal bloating
- nonresponse to carbohydrates other than glucose if hypoglycaemic
- (rare) liver abnormalities.

## Glitazones (pioglitazone and rosiglitazone)

Prospective cardiovascular trial data exists. Pioglitazones (PROactive trial) did not demonstrate primary outcome benefit in major adverse cardiovascular events (MACE) and significantly increased heart failure risks (11% versus 8% in placebo).<sup>181</sup>

Several meta-analyses have suggested that rosiglitazone increased hospitalisation with heart failure or heart failure death when used in combination with sulphonylureas or metformin (RECORD study).

Glitazones:

- sensitise the liver and peripheral tissues to insulin and are effective in lowering blood glucose by reducing insulin resistance
- can (both pioglitazone and rosiglitazone) be used as combination therapy with metformin or sulphonylureas or insulin.

Contraindications (for both pioglitazone and rosiglitazone):

- moderate to severe cardiac failure
- increased risk of bladder cancer.<sup>182,183</sup>

Rosiglitazone is not recommended in patients with known ischaemic heart disease, particularly in those taking nitrates.

Rosiglitazone is not indicated on the PBS for triple therapy with metformin and a sulphonylurea or in combination with insulin.

Main side effects:

- increased subcutaneous fat and/or fluid
- decreased haemoglobin levels
- increased risk of peripheral fractures in women
- possible increased risk of myocardial infarction (rosiglitazone)
- increased LDL-C (rosiglitazone).

## Incretins<sup>184</sup>

Saxagliptin (SAVOR-TIMI trial) showed secondary endpoint data: statistically significant increase in hospital admissions for congestive heart failure. No demonstrated macrovascular benefits.

Alogliptin (EXAMINE trial) showed no increased cardiovascular risks but also does not demonstrate macrovascular benefits.

Other DPP4 inhibitors have no reported prospective cardiovascular trials demonstrating benefits.

Two classes of incretin medications exist – DPP4 inhibitors and GLP-1 agonists.

### DPP4 inhibitors:

(includes sitagliptin, linagliptin, saxagliptin, vildagliptin and alogliptin)

- are oral agents and act by increasing levels of circulating incretins – GLP-1 and glucose-dependent insulinotropic polypeptide (GIP) which are released by intestinal cells in response to food
- block the enzyme DPP4 which is responsible for rapid breakdown of GLP-1 and GIP
- cause elevated and prolonged action of physiologically released incretin hormones
- GLP-1 and GIP act on pancreatic cells to increase insulin levels and also suppress  $\alpha$  cell secretion of glucagon (elevated in type 2 diabetes)
- are weight neutral and improve postprandial control
- rarely cause hypoglycaemia except in combination with agents such as sulphonylureas and insulin
- dose reduction in renal impairment  $\text{eGFR} < 60 \text{ mL/min/1.73m}^2$  for sitagliptin, vildagliptin, alogliptin and saxagliptin. No dose adjustment required for linagliptin.

Main side effects:

- nasopharyngitis
- headache
- upper respiratory tract symptoms.

### **GLP-1 agonists:**

(includes exenatide, liraglutide and lixisenitide)

(no prospective cardiovascular trial safety data available)

- are injectable medications that bind to the GLP-1 receptor (exenatide is currently PBS subsidised, once weekly exenatide, liraglutide and lixisenitide are TGA approved for use in Australia but are currently not PBS listed).
- cause weight loss through actions on cerebral hormonal responses to insulin and appetite
- may affect gastric emptying
- only cause hypoglycaemia in combination with other medications such as sulphonylureas and insulin.

Main side effects:

- nausea, vomiting
- pancreatitis (rarely)
- weight loss.

## **SGLT2 inhibitors**

(no prospective cardiovascular trial safety data is available)

SGLT2 inhibitors:

- are novel oral medications that selectively inhibit SGLT2, the main renal glucose reabsorptive mechanism
- result in glycosuria with resultant lowering of glucose in a non-insulin dependent manner
- rely on adequate renal function.

Main side effects:

- weight loss
- increased urogenital and urinary tract infections
- aggravate dehydration.

## Appendix H: Types of insulin available

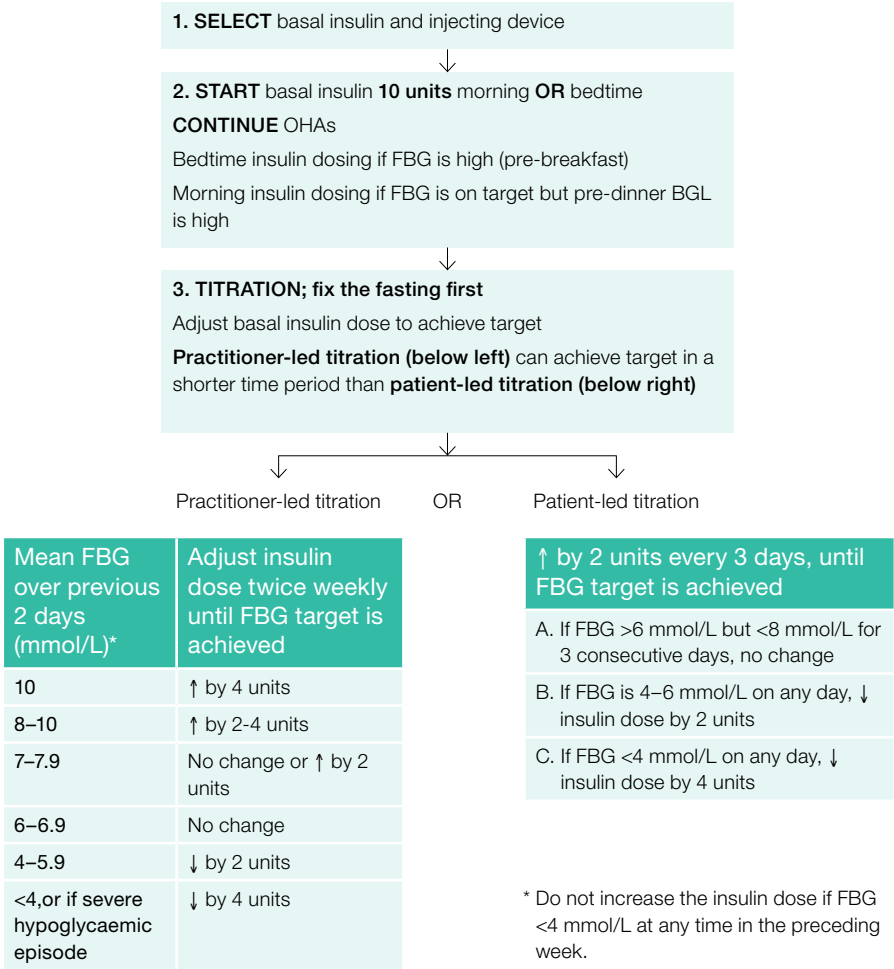
Type	Brand name	Manufacturer	Nature
<b>Rapid-acting (peak at 1 h, last 3.5–4.5 h)</b>			
Insulin lispro	Humalog+	Lilly	Analogue
Insulin aspart	NovoRapid+	Novo Nordisk	Analogue
Insulin glulisine	Apidra+	Sanofi	Analogue
<b>Short-acting (peak at 2–5 h, last 6–8 h)</b>			
Neutral	Actrapid	Novo Nordisk	Human
	Humulin R	Lilly	Human
	Hypurin Neutral	Aspen	Bovine
<b>Intermediate acting (12–24 h)</b>			
Isophane	Humulin NPH	Lilly	Human
	Protaphane	Novo Nordisk	Human
	Hypurin Isophane	Aspen	Bovine
<b>Long-acting (BASAL)</b>			
Insulin detemir (up to 24 h)	Levemir	Novo Nordisk	Analogue
Insulin glargine (24 h)	Lantus	Sanofi	Analogue
<b>Pre-mixed insulins</b>			
Lispro 25%/ lispro protamine 75%	Humalog Mix25+	Lilly	Analogue
Lispro 50%/ lispro protamine 50%	Humalog Mix 50+	Lilly	Analogue
Insulin aspart 30%/ insulin aspart protamine 70%	NovoMix 30+	Novo Nordisk	Analogue
Neutral 30%/ isophane 70%	Humulin 30/70	Lilly	Human
	Mixtard 30/70	Novo Nordisk	Human
Neutral 50%/ isophane 50%	Mixtard 50/50	Novo Nordisk	Human

+ Rapid-acting. Should be given immediately before eating.

The pharmacokinetics of the different insulins is patient-dependent. Review product information for each product before prescribing. An empirical approach to dosage together with a 'go slow' policy will result in the smoothest fine-tuning of management. Some of these insulins are available as injection devices, pen injectors, disposable insulin pens, cartridges and vials.

# Appendix I: Examples for insulin initiation and titration

## I.1: Guide to starting and adjusting basal insulin <sup>87,185</sup>





## I.2: Guide to starting and adjusting premixed insulin

### 1. SELECT premixed insulin and injecting device



#### INSULIN-NAÏVE patients

**2. START** premixed insulin **10 units** before the evening meal

**CONTINUE** metformin, consider tapering sulphonylureas as glycaemic control improves



### 3. TITRATION

Adjust the evening premixed insulin dose once or twice a week according to the schedule below to a FBG

BGL (lowest of 3 consecutive readings, mmol/L)	Insulin dosage adjustment
>7.9	↑ by 2–4 units
6.1–7.8	No change
4.5–6.0	↓ by 2 units
<4.5	↓ by 4 units

If a morning insulin dose is given, adjust the insulin dose according to evening pre-prandial BGL.



### 4. INTENSIFICATION: Once daily insulin to twice daily premixed insulin

#### When?

- Once FBG is at target, if evening pre-prandial BGL > FBG or if evening pre-prandial BGL is high
- After 3 months if HbA1c > target despite FBG and evening pre-prandial BGL at target

#### How?

1. Halve the current once daily insulin dose and give the reduced dose twice daily; pre-breakfast and pre-dinner
2. Monitor pre-dinner BGL and FBG versus targets
3. Once a week adjust both insulin doses independently (according to protocol above in step 3); **pre-breakfast insulin** is adjusted according to **pre-dinner BGL** and **pre-dinner insulin** is adjusted according to **FBG**

# 1.3: Guide to basal plus insulin intensification schedules

**1. SELECT** rapid-acting (prandial) insulin and injecting device

↓

**2. START** rapid-acting insulin **4 units** before the largest meal  
**CONTINUE** basal insulin at the current dose  
**CONTINUE** metformin, consider tapering sulphonylureas as glycaemic control improves  
**MONITOR** 2 hour postprandial BGL

↓

**3. TITRATION**  
Increase rapid acting (prandial) insulin dose by 2 units every 3 days to achieve target

2 hour postprandial BGL (mmol/L)	Rapid-acting (prandial) insulin dosage adjustment
> 7–8 (for 3 consecutive days)	No change
6.0–7.8	No change or ↓ by 2 units
<4.0 on any day	↓ by 2–4 units

↓

**Basal plus 2 to basal bolus insulin intensification schedules**

**When?**  
If HbA1c is not at target after 3 months add a further prandial insulin dose to another meal (e.g. basal plus 2 to basal bolus)

**How?**

1. Keep the current prandial and basal insulin doses unchanged
2. Add a new rapid-acting (prandial) insulin to the next largest meal of the day (starting at 10% of the basal insulin dose or 4 units)
3. ↑ new prandial insulin dose by 2 units every 3 days until postprandial target is achieved as per step 3 above

# *Appendix J: Glycaemic emergencies*

## **J.1 Hypoglycaemia**

Hypoglycaemia is a common complication of the management of type 1 diabetes. But the frequency of hypoglycaemia in type 2 diabetes is underestimated. Its clinical significance, especially in the elderly patient, is great. Hypoglycaemia can lead to falls, fractures, injuries, arrhythmias and, in severe cases, death. Symptoms may go unrecognised or may be mistaken for other conditions (e.g. TIA, vasovagal episodes).

Patients at risk of hypoglycaemia include:

- the elderly
- people with longstanding type 2 diabetes with CVD
- people with renal impairment and CKD
- people on monotherapy with insulin or long-acting sulphonylureas
- people on combination therapies with sulphonylureas and insulin
- patients using heavy machinery
- people with excessive alcohol intake
- people on beta blocker therapy (rare), in particular vasodilatory agents (e.g. propranolol, atenolol).

Hypoglycaemia occurs most frequently with:

- insulin therapy
- sulphonylurea therapy
- deficient carbohydrate intake
- unaccustomed exercise.

The risk of hypoglycaemia with each sulphonylurea relates to its pharmacokinetic properties. Long-acting preparations are associated with higher risks of hypoglycaemia (e.g. glibenclamide [Daonil, Glimel]). Studies have shown significantly lower rates of hypoglycaemia associated with the use of gliclazide (Diamicon) compared with other sulphonylureas.

Although many newer therapies for type 2 diabetes do not cause hypoglycaemia when used as monotherapy, their use in combination with insulin or sulphonylureas increases the risk of hypoglycaemia. The use of insulin analogs may limit, but not eradicate, the risk of hypoglycaemia.

**Symptoms of hypoglycaemia** vary between persons. Patients often learn to recognise their unique symptoms. The onset of symptoms usually occurs with a BGL  $<3.9$  mmol/L. Common symptoms fall into two categories: adrenergic symptoms of trembling or shaking, sweating, hunger, lightheadedness and numbness around the lips and fingers, and neuro-glycopenic symptoms of lack of concentration, weakness, behavioural change, tearfulness/crying, irritability, headache and dizziness.

**Severe hypoglycaemia** occurs clinically when a patient requires external assistance from another person to manage an episode of hypoglycaemia. A BGL  $<2.0$  mmol/L puts the person at risk of severe hypoglycaemia.

**Asymptomatic hypoglycaemia** (or biochemical hypoglycaemia) occurs when BGL is low ( $<3.9$  mmol/L) but above the normal threshold for detection of hypoglycaemia in most patients ( $\sim 3.5$  mmol/L).

**Hypoglycaemic unawareness** is of particular concern and refers to the clinical situation where a patient loses the ability to detect the early symptoms of hypoglycaemia. This results from repeated episodes of mild hypoglycaemia with eventual loss of adrenergic and neuro-glycopenic symptoms. It can lead to confusion and marked behavioural change which is not recognised by the patient and may progress to loss of consciousness.

The cause needs to be identified and the episode dealt with by reinforcing education, counselling the patient and perhaps changing treatment.

## Management of an episode of hypoglycaemia

If a patient with diabetes is showing signs of potential hypoglycaemia, first make sure the patient is safe (e.g. seated securely and not at risk of falling).

If possible, confirm that the symptoms are due to hypoglycaemia by performing a finger prick BGL.

If BGL is lower than 4.0 mmol/L and the patient is symptomatic, awake and can swallow, manage according to the **Rule of 15**:

- Provide **15 grams** of quick-acting carbohydrate that is easy to consume (e.g. half can of regular – non diet – soft drink, half glass fruit juice, 3 teaspoons of sugar or honey, 6–7 jellybeans, 3 glucose tablets).
- Wait **15 minutes** and repeat blood glucose check. If the level is not rising, suggest eating another quick-acting carbohydrate from the above list.
- If the patient's next meal is more than **15 minutes** away, provide some longer acting carbohydrate (e.g. a sandwich, 1 glass of milk or soy milk, 1 piece of fruit, 2–3 pieces of dried apricots, figs or other dried fruit, 1 tub of natural low-fat yoghurt, 6 small dry biscuits and cheese).
- Test glucose again during the next 2–4 hours.

Patients and carers should be made aware of the use of a similar Rule of 15.

If the patient is symptomatic but the blood glucose or capillary glucose cannot be performed to confirm the episode is due to hypoglycaemia, treat the patient as if they have hypoglycaemia by administering 15 g of quick-acting carbohydrate. If there is no improvement after 15 minutes, the patient could have another cause for the episode and further medical assistance may be necessary.

If the patient cannot safely swallow 15 g of carbohydrate due to their depressed mental state, consider the administration of 1 vial of glucagon intramuscularly, if available. If not, further emergency medical assistance will be required.

If glucagon is administered, always review the monitored capillary glucose after 15 minutes to ensure effective management of the hypoglycaemia has occurred and the blood glucose remains above 4 mmol/L. Test again 1 hour after severe hypoglycaemia to ensure stable glucose levels.

**Post-hypoglycaemia:** Re-assess the patient's circumstances, medication dosages, and dietary intake as well as overall need for glucose monitoring after any severe hypoglycaemic episode with both the patient and/or with their immediate family or support persons. Also ensure implications for driving competence, operation of machinery and other similar areas are discussed with the patient.

## J.2 Hyperglycaemic emergencies

Severe hyperglycaemia has significant morbidity and mortality.

Hyperglycaemic emergencies should be preventable in people known to have diabetes, and their occurrence in this group signifies a major breakdown in medical management. Adequate early management of sick patients with diabetes will prevent the development of hyperglycaemic emergencies.

### Diabetic ketoacidosis

DKA, once thought to typify type 1 diabetes mellitus, can occur in patients with type 2 diabetes mellitus under stress such as during surgery, trauma or infections. The very young, older people and pregnant patients are also at greater risk of DKA.

#### Signs of DKA:

- dehydration
- hyperventilation
- ketotic breath
- disturbed conscious state and shock

#### Common precipitating factors:

- urinary tract infection
- myocardial infarction
- pneumonia
- influenza

### Pathophysiology

DKA occurs when there is an absolute deficiency of insulin. For DKA to occur in type 2 diabetes, there needs to be significantly impaired insulin secretion as the result of 'glucotoxicity' together with severe insulin resistance, typically as the result of severe infection or other stresses.

This results in:

- increasing hepatic glucose production causing hyperglycaemia
- increasing peripheral lipolysis releasing free fatty acids. These are converted to ketoacids by the liver resulting in a metabolic acidosis
- hyperglycaemia-induced osmotic diuresis leading to sodium, potassium and phosphate depletion
- dehydration causing pre-renal failure.

# Assessment

The biochemical criteria for DKA are:

- venous pH <7.3 or bicarbonate <15 mmol/L
- presence of blood or urinary ketones.

Urinalysis can be used for initial assessment if blood ketone testing is not available.

The time-tested therapy for DKA is rehydration with saline-based intravenous fluid therapy, administration of intravenous insulin with subsequent administration of glucose as the BGL normalises, and adequate potassium replacement throughout to avoid hypokalaemia. Additionally associated problems arising from or precipitating the episode need to be addressed.<sup>186</sup>

Wherever possible the patient should be managed in a specialist medical unit.

In remote rural practice this may not be possible. In this situation it is advisable to contact the most appropriate diabetes resource person for advice while commencing treatment promptly.

Table J.1. General outline for the management of DKA

<b>Initial investigations</b>	<ul style="list-style-type: none"><li>• Blood glucose</li><li>• Arterial blood gases (venous in children)</li><li>• Electrolytes and renal function</li><li>• Urine glucose, ketones, microscopy and culture</li><li>• ECG</li><li>• Chest X-ray</li></ul>
<b>Frequent observation</b>	<p>Clinical and biochemical status. For example:</p> <ul style="list-style-type: none"><li>• ½ hourly: BP, pulse, urine output</li><li>• Hourly: capillary blood glucose</li><li>• 2 hourly: electrolytes especially potassium</li></ul>

<b>Fluids and electrolytes</b>	<p>Most patients have a deficit of several litres (40 to 80 mL/kg). Normal (0.9%) saline is suitable.</p> <p>If hypoperfusion is present, give 0.9% saline at 10 mL/kg and reassess. If central capillary refill remains &gt;2 seconds, a further bolus of 10 mL/kg of 0.9% saline may be given.</p> <p>Patients with DKA rarely require &gt;20 mL/kg in total as a bolus.</p> <p>Fluid replacement with normal saline and potassium should continue for at least the first 6 hours. If the blood glucose falls very quickly within the first few hours, or if the BGL reaches 12–15 mmol/L, change to normal saline with 5% dextrose and potassium.</p> <p><b>Do not administer potassium supplement</b> if the potassium level is greater than 5.5 mmol/L, or if the patient is anuric.</p> <p>If the potassium level is 4.5–6 mmol/L, start KCl at 40–60 mmol/L if person's weight is &gt;30 kg or 40mmol/L if person's weight is &lt;30 kg.</p> <p>Measure levels and adjust the dose at least 2 hourly.</p>
<b>Insulin</b>	<ul style="list-style-type: none"> <li>• An intravenous bolus of 0.15 units/kg neutral insulin.</li> <li>• An infusion of neutral insulin 100 units/L saline is commenced. Run 100 mL through the line before connecting to the patient to saturate insulin binding to the giving set. If a syringe pump is available add 50 units of neutral insulin to 50 mL of saline and flush the giving set. Commence the infusion at 0.05–0.15 units per kg per hour and adjust the dose depending on glycaemia (usual rates are 0.5–6 units per hour for a 70 kg adult).</li> <li>• When blood glucose levels fall below 15 mmol/L set up a 5% dextrose infusion (50–100 mL per hour) and make appropriate adjustments to other intravenous fluids.</li> <li>• DKA can be complicated by severe infection, arterial thrombosis, profound shock and lactic acidosis and cerebral oedema. Once treatment is initiated (unless the acidosis is mild and response rapid) transfer the patient to a specialist unit.</li> </ul>

## Hyperosmolar nonketotic coma

HONC occurs due to inadequate diabetes control in patients with type 2 diabetes. This is usually a result of illness or infection, however it can also be due to poor patient compliance. Older patients are at higher risk of HONC.

## Pathophysiology

HONC develops because of relative rather than absolute insulin deficiency. Significant insulin deficiency causes hyperglycaemia due to increased hepatic gluconeogenesis. However, as absolute insulin deficiency is not present, peripheral lipolysis remains suppressed and the release of free fatty acids is low. Little substrate is available for generation of ketoacids and a metabolic acidosis does not occur.



The hyperglycaemia results in an osmotic diuresis leading to pre-renal failure. Eventually, severe intravascular volume depletion occurs resulting in a further deterioration of renal function. Consequently glomerular filtration diminishes preventing the further excretion of glucose. With ongoing increased hepatic glucose production, decreased peripheral glucose utilisation and reduced urinary glucose losses, severe hyperglycaemia results.

#### Signs of HONC:

- severe dehydration
- altered consciousness
- coma
- shock

#### Common precipitating factors:

- urinary tract infection
- pneumonia
- myocardial infarction
- stroke

The depletion of the total body water leads to the hyperosmolality of body fluids reflected by the extreme hyperglycaemia and increased plasma sodium. This hyperosmolar state affects consciousness and may cause coma.

## General outline for the management of HONC

Wherever possible the patient with HONC should be managed in a specialist medical unit. In remote rural practice this may not be possible. In this situation it is advisable to contact the most appropriate diabetes resource person for advice while commencing treatment promptly.

Rapid correction of the hyperosmolar state is dangerous.

The priority is to correct the extracellular fluid deficit, then slowly correct the hyperglycaemia (with insulin) and water deficit (with low sodium fluids [e.g. 5% dextrose or 4% dextrose and normal saline]).

Monitor extracellular fluid status and plasma glucose, sodium and potassium.

It is important to note that blood glucose meters do not register very high glucose levels so access to a laboratory is necessary to monitor the correction of hyperglycaemia as well as to monitor sodium and potassium levels.

See *Table J.2* for an outline of management of HONC.

Table J.2. General outline of management of HONC

Recommendations and supporting evidence			
Observed derangement	Recommendations	SIGN Level of evidence	References
Dehydration	1. Initial treatment – 0.9% NaCl at the rate of 15–20 mL/kg/h or 1–1.5 L during the first hour.	1+	188
	2. Maintenance – guided by clinical state. 0.45% saline at 250–500 mL/h is appropriate in patients who are eunatraemic or hypernatraemic, while 0.9% NaCl at a similar rate is appropriate in hyponatraemic subjects.		
	3. When plasma glucose is 200 mg/dL in DKA or 300 mg/dL in HONC, 5% dextrose should be added to repletion continue insulin until ketonaemia resolves.	1+	188, 189, 190
Hyperglycaemia/ ketonaemia	1. IV regular insulin 0.14 units/kg/h as continuous infusion, or a bolus of 0.1 units/kg followed by 0.1 units/kg/h.	1++	188, 191, 192
	2. If blood glucose does not fall by 10% in the first hour, give 0.14 units/kg as a bolus, then continue infusion at the previous rate.		
	3. When the plasma glucose reaches 200 mg/dL in DKA or 300 mg/dL in HONC, insulin infusion rate should be reduced to 0.02–0.05 units/kg/h. Also, dextrose should be added to the intravenous fluids.	1+	188, 189
	4. Subcutaneously administered insulin analogs may be used in the medical ward or emergency room in mild–moderate DKA.	1+	193, 194
	5. Once DKA has resolved, patients can be started on a multiple dose insulin regimen. Patients who are unable to eat should continue to receive intravenous insulin infusion and fluid replacement.	1++	188, 189
	6. Some patients with type 2 diabetes may be treated with oral anti-diabetic agents and lifestyle modification after recovery.	1-	195

Recommendations and supporting evidence			
Observed derangement	Recommendations	SIGN Level of evidence	References
<b>Acidosis</b>	1. Adults with pH <6.9 may be given 100 mmol sodium bicarbonate in 400 mL sterile water with 20 mequiv KCl administered at a rate of 200 mL/h for 2 h until the venous pH is >7.0.	4	188, 189
	2. Patients with pH ≥ 6.9 do not require bicarbonate therapy.	1++	196, 197, 198
<b>Abnormal phosphate level</b>	1. There is no indication for phosphate therapy in most patients with DKA. In patients with potential complications of hypophosphatemia the use of phosphate may be justified. 20–30 mequiv/L potassium phosphate can be added to replacement fluids.	2++	188, 189, 199
	2. Potassium replacement may be given 1/3 as potassium phosphate and 2/3 as potassium chloride.	2++	189
	Serum calcium level should be monitored in patients receiving phosphate infusion.	2++	199
<b>Hypercoagulable state</b>	Prophylactic use of heparin may be beneficial in DKA and full anticoagulation may be indicated where there are no contraindications in HONC.	4	189, 200
<b>Prevention</b>	1. Education of the diabetic patient and care givers on the process of care and sick day management.	1–	201, 202
	2. Patients who use illicit drugs may benefit from drug rehabilitation.	2–	203, 204

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## Appendix K: Potential drug interactions

Medication	Effect	Mechanism of action	Comment
Alcohol, beta blockers, ACEI, high-dose salicylates, perhexiline	Hypoglycaemia or reducing response to glycaemic medications		
Sulphonamides, cimetidine, azole antifungal agents, NSAIDs, fluoxetine, fluvoxamine	Hypoglycaemia	Affects sulphonylurea pharmacokinetics	
Standard (non-low ionic) radiocontrast agents used in imaging procedures; NSAIDs, ACEIs, ARAs and diuretics	Renal impairment/dehydration (especially if patient is on metformin)		
Colonic preparation	Dehydration, Fleet (hyperphosphataemia)		
ACEI, ARB	Hyperkalaemia		The combination of an ACEI and ARB is no longer recommended due to high rates of hyperkalaemia and risk of profound hypotension
Beta blockers	Hyperglycaemia	Increased insulin resistance and decreased insulin excretion	Higher risk with vasodilating beta blockers (propranolol, atenolol, metoprolol); beta blockers with vasodilating activity (e.g. carvedilol) do not cause hyperglycaemia
Calcium channel blockers	Hyperglycaemia	Decrease insulin secretion	Uncommon
Diuretics	Hyperglycaemia	Postulated to cause changes in potassium availability	Thiazide diuretics have a higher risk

Medication	Effect	Mechanism of action	Comment
Antiretrovirals	Hyperglycaemia	Nucleoside reverse transcriptase inhibitors: increased insulin resistance, promote lipodystrophy and may cause pancreatitis  Protease inhibitors: as above plus reduced insulin secretion	
Glucocorticoids	Hyperglycaemia	Increased insulin resistance, reduced insulin secretion	Greatest risk with parenteral or oral preparations
Fish oils	Hyperglycaemia		Usually at high dose (>3 g/day)
HMG-Co-A reductase inhibitors	Hyperglycaemia	Increased insulin resistance, reduced insulin secretion	Small risks; higher with rosuvastatin and atorvastatin
Nicotinic acid	Hyperglycaemia	Increased insulin resistance, increased gluconeogenesis	Doses >2 g/day
Atypical antipsychotics: clozapine, olanzapine, haloperidol, quetiapine, risperidone	Hyperglycaemia	Increased insulin resistance, reduced insulin secretion, promote weight gain	Olanzapine and clozapine are associated with higher rates of diabetes compared with other antipsychotic agents
Adrenaline  Anticonvulsants: chlorpromazine, phenytoin  Antidepressants: tricyclic antidepressants  Antispasmodic: baclofen	Hyperglycaemia		See reference 205

Medication	Effect	Mechanism of action	Comment
High-dose beta agonists (e.g. IV salbutamol) Corticosteroids Immunomodulators: cyclosporin, interferon $\alpha$ , sirolimus, tacrolimus Somatostatin analogues: lanreotide, octreotide Lipid-lowering medication: nicotinic acid Retinoid: isotretinoin Antimicrobial: isoniazid			
Alcohol, aspirin, disopyramide Somatostatin analogues: lanreotide, octreotide Antimicrobial: trimethoprim with sulfamethazole	Decrease blood glucose levels		See reference 205

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## Notes

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## Notes

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# National Diabetes Services Scheme

The NDSS supports your patients  
with diabetes

If you have a patient with diabetes, make sure  
you register them with the NDSS to help them to  
manage their diabetes.

Registration is free and only done once.

The reverse side of this page has information on  
the NDSS and how to register your patients. You  
can pull this card out of the booklet and place it  
on your desk or nearby for easy reference.

# The National Diabetes Services Scheme

The National Diabetes Services Scheme (NDSS) commenced in 1987, as an initiative of the Australian Government administered by Diabetes Australia.

## Why register?

When you register your patients with diabetes on the NDSS, they will be able to access diabetes-related products at subsidised prices as well as information and support services to help them manage their diabetes.

They will be able to access:

- » subsidised blood glucose and urine testing strips for all people with diabetes
- » free needles and syringes for people with diabetes who require insulin or an approved non-insulin injectable medication
- » subsidised insulin pump consumables for people with type 1 diabetes and gestational diabetes.

For a full list of products and prices, download the order form at [www.ndss.com.au](http://www.ndss.com.au)

Your patients will also be able to access a range of free diabetes information and support services. Encourage your patients to contact their local NDSS Agent on **1300 136 588** to find out about the services they can take advantage of to improve their knowledge and management of diabetes.

## Who can register?

All Australians who hold a Medicare card and have been diagnosed with diabetes can receive the benefits of NDSS registration.

## How to register

Registering a person with diabetes with the NDSS is a positive step in helping them self-manage their diabetes.

Registration is free and is as simple as completing the NDSS registration form:

- » Fill in the NDSS registration form.
- » Ensure the form is signed by a medical practitioner or credentialled diabetes educator.
- » Submit the completed registration form to the NDSS via:
  - email to [ndss@diabetesaustralia.com.au](mailto:ndss@diabetesaustralia.com.au)
  - fax to **1300 536 953** or
  - an NDSS Access Point.

There is a national network of NDSS Access Points which are, in most cases, located in a local pharmacy. To find the nearest Access Point phone **1300 136 588** or visit [osd.ndss.com.au](http://osd.ndss.com.au)

You can order multiple copies of the registration form by phoning your local NDSS Agent on **1300 136 588** or you can download it from the NDSS website [www.ndss.com.au](http://www.ndss.com.au)

## National Gestational Diabetes Register

All women diagnosed with gestational diabetes and registered with the NDSS are also registered on the NDSS National Gestational Diabetes Register.

## How registration will help your patients with gestational diabetes

Your patients will receive:

- » regular reminders to have follow up diabetes screening after the birth
- » valuable information on how to maintain a healthy lifestyle and minimise the risk of developing type 2 diabetes in the future.

Your patients with gestational diabetes will receive these benefits when you register them with the NDSS.

## For more information

Refer your patients to their local NDSS Agent

Phone: **1300 136 588**

Website: [www.ndss.com.au](http://www.ndss.com.au)

**ndss**  
national diabetes services scheme

  
**Diabetes  
Australia**

**1300 136 588**  
**ndss.com.au**

## Type 2 diabetes: goals for optimum management

Encourage all people with type 2 diabetes to approach/reach these goals	
Diet	Normal healthy eating. If concerns regarding cardiovascular risk, advise Mediterranean diet.
Body mass index (kg/m <sup>2</sup> )	Therapeutic goal is 5–10% loss for people overweight or obese with type 2 diabetes. With BMI >35 and comorbidities or BMI >40, greater weight loss measures should be considered. Note that BMI is a difficult parameter to standardise between different population groups.
Physical activity	At least 30 minutes of moderate physical activity on most if not all days of the week (total ≥150 minutes/week).
Cigarette consumption	0 (per day)
Alcohol consumption	≤2 standard drinks (20 g) per day for men and women.
BGL	6–8 mmol/L fasting and 8–10 mmol/L postprandial. Ongoing self-monitoring of blood glucose is recommended for people with diabetes using insulin, with hyperglycaemia arising from illness, with haemoglobinopathies, pregnancy or other conditions where data on glycaemic patterns is required. Routine self-monitoring of blood glucose in low-risk patients who are using oral glucose-lowering drugs (with the exception of sulphonylureas) is not recommended.
HbA1c (mmol/mol; %)	Needs individualisation according to patient circumstances. Generally: <ul style="list-style-type: none"> <li>• ≤53 mmol/mol (range 48–58)</li> <li>• ≤7% (range 6.5–7.5).</li> </ul> Allowing for normal variation in test accuracy, HbA1c results which range between 6.5 and 7.5% would reflect this goal.
Total cholesterol (mmol/L) <4.0	Initiation of pharmacotherapy is dependent on the assessment of absolute cardiovascular risk (Refer to the Australian absolute CVD risk calculator). This requires using multiple risk factors, which is considered more accurate than the use of individual parameters. Once therapy is initiated the specified targets apply; however, these targets should be used as a guide to treatment and not as a mandatory target.
HDL-C (mmol/L) ≥1.0	
LDL-C (mmol/L) <2.0	
Non-HDL-C (mmol/L) <2.5	
Triglycerides (mmol/L) <2.0	
Blood pressure (mmHg) 130/80	Timed overnight collection (mcg/min): <20 Spot collection (mg/L): <20 Urinary albumin-to-creatinine ratio <ul style="list-style-type: none"> <li>• Women (mg/mmol): &lt;3.5</li> <li>• Men (mg/mmol): &lt;2.5</li> </ul>
Urinary albumin excretion	
Vaccination	Consider immunisation against influenza and pneumococcal disease, and the dTPa vaccine.



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