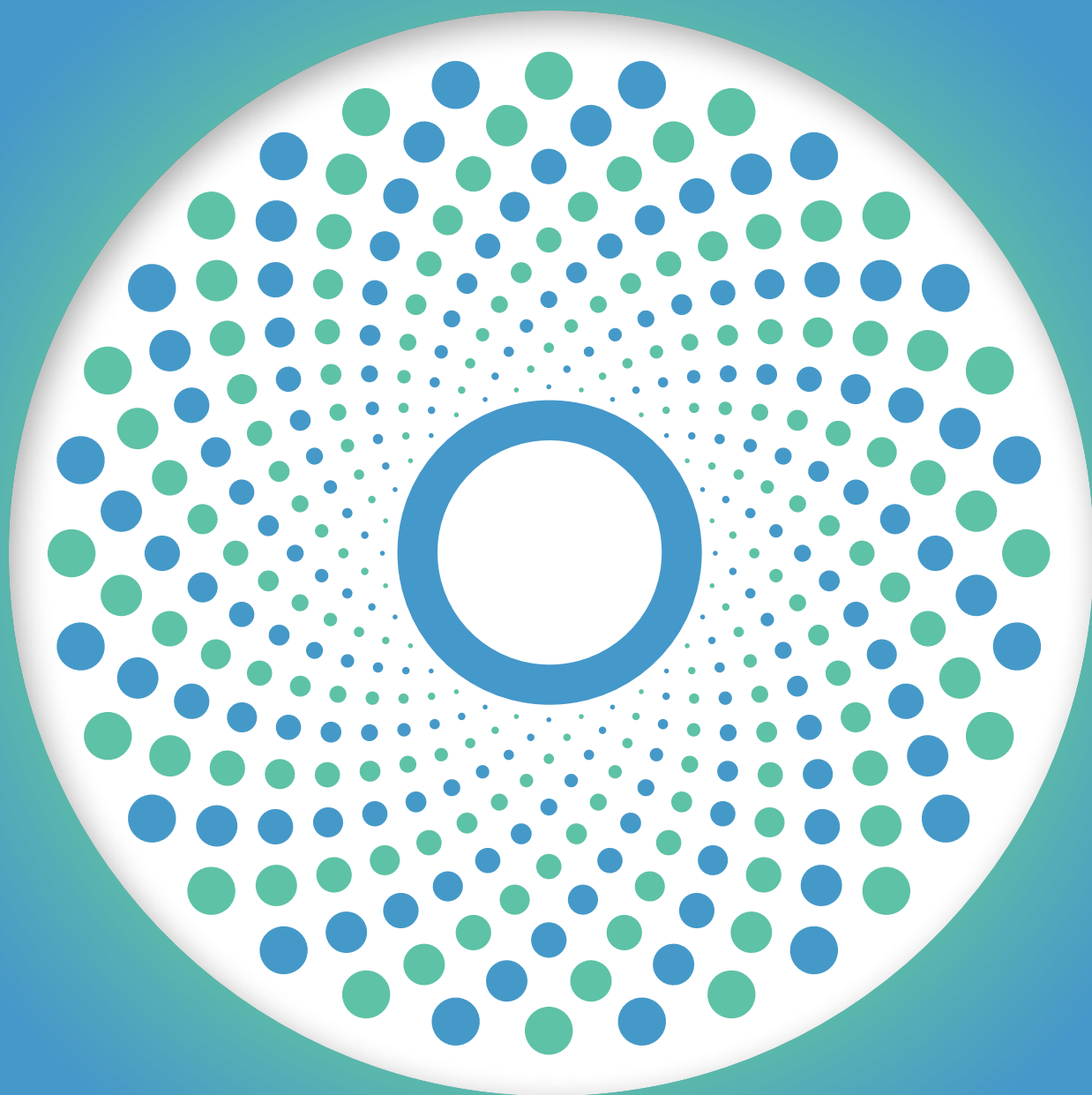


# Management of type 2 diabetes: A handbook for general practice



## **Management of type 2 diabetes: A handbook for general practice**

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*We acknowledge the Traditional Custodians of the lands and seas on which we work and live, and pay our respects to Elders, past, present and future.*

## Type 2 diabetes: Goals for optimum management

The following table lists goals for optimum management for all people with type 2 diabetes. For guidance on specific assessment intervals, advice and arrangements, refer to the relevant sections of this handbook.

Individual goals	
Encourage all people with type 2 diabetes to approach/reach these goals.	
<b>Diet</b>	Advise eating according to the <i>Australian dietary guidelines</i> , with attention to quantity and type of food Advise individual dietary review for people with difficulty managing weight, difficulty maintaining glucose levels in target range, CVD risk, or if otherwise concerned
<b>BMI</b>	Advise a goal of 5–10% weight loss for people who are overweight or obese with type 2 diabetes For people with BMI >35 kg/m <sup>2</sup> and comorbidities, or BMI >40 kg/m <sup>2</sup> , consider facilitating greater weight-loss measures
<b>Physical activity</b>	Children and adolescents: at least 60 min/day of moderate-to-vigorous physical activity, plus muscle- and bone-strengthening activities at least three days/week Adults: 150 minutes of aerobic activity, <b>plus</b> 2–3 sessions of resistance exercise (to a total ≥60 minutes) per week
<b>Cigarette consumption</b>	Zero per day
<b>Alcohol consumption</b>	Advise ≤2 standard drinks (20 g of alcohol) per day for men and women
<b>Blood glucose monitoring</b>	Advise 4–7 mmol/L fasting and 5–10 mmol/L postprandial SMBG is recommended for patients with type 2 diabetes who are using insulin. Education should be provided regarding frequency and timing of insulin dose For people not on insulin, the need for and frequency of SMBG should be individualised, depending on type of glucose-lowering medications, level of glycaemic control and risk of hypoglycaemia, as an aid to self-management SMBG is recommended in pregnancy complicated by diabetes or gestational diabetes SMBG is also recommended for people with hyperglycaemia arising from intercurrent illness. It may be helpful in haemoglobinopathies or other conditions where HbA1c measurements may be unreliable

Clinical management goals	
<b>Treatment targets for people with type 2 diabetes include the following. For a comprehensive list of assessments and screening intervals, refer to the section 'Assessment of the patient with type 2 diabetes'.</b>	
<b>HbA1c</b>	Target needs individualisation according to patient circumstances Generally $\leq 7\%$ (53 mmol/mol)
<b>Lipids</b>	Initiation of pharmacotherapy is dependent on the assessment of absolute CVD risk (refer to the <a href="#">Australian absolute cardiovascular disease risk calculator</a> ). This uses 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
Total cholesterol	<4.0 mmol/L
HDL-C	$\geq 1.0$ mmol/L
LDL-C	<2.0 mmol/L; <1.8 mmol/L if established CVD is present
Non-HDL-C	<2.5 mmol/L
Triglycerides	<2.0 mmol/L
<b>Blood pressure</b>	$\leq 140/90$ mmHg  Lower blood pressure targets may be considered for younger people and for secondary prevention in those at high risk of stroke  The target for people with diabetes and albuminuria/proteinuria remains <130/80 mmHg. As always, treatment targets should be individualised and monitored for side effects from medications used to lower blood pressure
<b>Urine albumin excretion</b>	UACR: <ul style="list-style-type: none"> <li>women: &lt;3.5 mg/mmol</li> <li>men: &lt;2.5 mg/mmol</li> </ul> Timed overnight collection: <20 $\mu\text{g}/\text{min}$ ; spot collection: <20 mg/L
<b>Vaccination</b>	Recommended immunisations: influenza, pneumococcus, diphtheria-tetanus-acellular pertussis (dTpa). Consider: hepatitis B (if travelling), herpes zoster
<i>BMI, body mass index; CVD, cardiovascular disease; GPs, general practitioners; HbA1c, glycated haemoglobin; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; SMBG, self-monitoring of blood glucose; UACR, urine albumin-to-creatinine ratio.</i>	

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## Acronyms and initialisms

<b>13vPCV</b>	13-valent pneumococcal conjugate vaccine	<b>DR</b>	diabetes-related retinopathy
<b>23vPPV</b>	23-valent pneumococcal polysaccharide vaccine	<b>dTpa</b>	diphtheria-tetanus-acellular pertussis
<b>ABI</b>	ankle-brachial pressure index	<b>eGFR</b>	estimated glomerular filtration rate
<b>ACE</b>	angiotensin converting enzyme	<b>FBG</b>	fasting blood glucose
<b>ACEI</b>	angiotensin converting enzyme inhibitor	<b>FGM</b>	flash glucose monitoring
<b>ACR</b>	albumin-to-creatinine ratio	<b>FITTER</b>	Forum for Injection Technique and Therapy Expert Recommendations
<b>ADA</b>	American Diabetes Association	<b>GAD</b>	glutamic acid decarboxylase
<b>ADEA</b>	Australian Diabetes Educators Association	<b>G-CSF</b>	granulocyte colony-stimulating factor
<b>ADIPS</b>	Australian Diabetes in Pregnancy Society	<b>GDM</b>	gestational diabetes mellitus
<b>ADS</b>	Australian Diabetes Society	<b>GI</b>	glycaemic index
<b>AGP</b>	ambulatory glucose profile	<b>GLP-1</b>	glucagon-like peptide-1
<b>AIHW</b>	Australian Institute of Health and Welfare	<b>GLP-1 RA</b>	glucagon-like peptide-1 receptor agonist
<b>APD</b>	accredited practising dietitian	<b>GP</b>	general practitioner
<b>ARB</b>	angiotensin receptor blocker	<b>GPMP</b>	GP management plan
<b>AUSDRISK</b>	Australian type 2 diabetes risk assessment tool	<b>HAPO</b>	Hyperglycemia and Adverse Pregnancy Outcome
<b>BGL</b>	blood glucose level	<b>HbA1c</b>	glycated haemoglobin
<b>BMI</b>	body mass index	<b>HDL-C</b>	high-density lipoprotein-cholesterol
<b>BP</b>	blood pressure	<b>HHS</b>	hyperosmolar hyperglycaemic state
<b>CCM</b>	Chronic Care Model	<b>HIV</b>	human immunodeficiency virus
<b>CGM</b>	continuous glucose monitoring	<b>IA-2</b>	insulinoma antigen-2
<b>CKD</b>	chronic kidney disease	<b>IDSA</b>	Infectious Diseases Society of America
<b>CrCl</b>	creatinine clearance rate	<b>IFCC</b>	International Federation of Clinical Chemistry
<b>CSII</b>	continuous subcutaneous insulin infusion	<b>IFG</b>	impaired fasting glucose
<b>CVD</b>	cardiovascular disease	<b>IGT</b>	impaired glucose tolerance
<b>DDS</b>	Diabetes Distress Scale	<b>IUCD</b>	intrauterine contraceptive device
<b>DiRECT</b>	Diabetes Remission Clinical Trial	<b>IWGDF</b>	International Working Group on Diabetic Foot
<b>DKA</b>	diabetic ketoacidosis	<b>LADA</b>	latent autoimmune diabetes of adults
<b>DMiP</b>	diabetes mellitus in pregnancy	<b>LAGB</b>	laparoscopic adjustable gastric banding
<b>DOAC</b>	direct oral anticoagulants	<b>LDL-C</b>	low-density lipoprotein cholesterol
<b>DPP-4i</b>	dipeptidyl peptidase-4 inhibitor	<b>MBS</b>	Medicare Benefits Schedule

<b>MI</b>	myocardial infarction	<b>TZD</b>	thiazolidinedione
<b>MODY</b>	maturity-onset diabetes of the young	<b>UACR</b>	urine albumin-to-creatinine ratio
<b>NDSS</b>	National Diabetes Services Scheme	<b>VEGF</b>	vascular endothelial growth factor
<b>NHMRC</b>	National Health and Medical Research Council	<b>VLED</b>	very low energy diet
<b>NICE</b>	National Institute for Health and Care Excellence		
<b>NSAID</b>	nonsteroidal anti-inflammatory drug		
<b>OGTT</b>	oral glucose tolerance test		
<b>OSA</b>	obstructive sleep apnoea		
<b>PAD</b>	peripheral arterial disease		
<b>PAID</b>	Problem Areas in Diabetes		
<b>PBS</b>	Pharmaceutical Benefits Scheme		
<b>PCOS</b>	polycystic ovary syndrome		
<b>PCSK9</b>	proprotein convertase subtilisin/kexin type 9 inhibitors		
<b>PHN</b>	Primary Health Network		
<b>PHQ-2</b>	Patient health questionnaire-2		
<b>PHQ-9</b>	Patient health questionnaire-9		
<b>QEBR</b>	qualified evidence-based recommendation		
<b>RACGP</b>	Royal Australian College of General Practitioners		
<b>RBG</b>	random blood glucose		
<b>RCT</b>	randomised controlled trial		
<b>RPE</b>	rate of perceived exertion		
<b>RR</b>	relative risk		
<b>SGLT2</b>	sodium glucose co-transporter 2		
<b>SGLT2i</b>	sodium glucose co-transporter 2 inhibitor		
<b>SIGN</b>	Scottish Intercollegiate Guidelines Network		
<b>SINBAD</b>	Site, Ischaemia, Neuropathy, Bacterial infection, Area, Depth		
<b>SMBG</b>	self-monitoring of blood glucose		
<b>SNAP</b>	smoking, nutrition, alcohol, physical activity		
<b>TBI</b>	toe brachial index		
<b>TGA</b>	Therapeutic Goods Administration		

## About the RACGP

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The RACGP is Australia's largest professional general practice organisation and represents urban and rural general practitioners (GPs), representing more than 41,000 members working in or towards a career in general practice.

The RACGP is responsible for defining the nature of the general practice discipline, setting the standards and curriculum for education and training, maintaining the standards for high-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 suite of clinical resources, business support tools and 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 Journal of General Practice (AJGP)*, the most widely read peer-reviewed general practice journal in Australia
- online general practice education provided by *gplearning* – the RACGP's online learning portal
- advocacy on key issues related to diabetes management
- partnership with Diabetes Australia in the production of this handbook
- giving members access to an extensive library collection, with many items available electronically
- the following flagship publications
  - *Guidelines for preventive activities in general practice (Red Book)*
  - *Putting prevention into practice: Guidelines for the implementation of prevention in the general practice setting (Green Book)*
  - *Smoking, nutrition, alcohol, physical activity (SNAP): A population health guide to behavioural risk factors in general practice*
  - *National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people.*

## About Diabetes Australia

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

Diabetes Australia combines the voices of consumers, health professionals and researchers dedicated to diabetes.

Diabetes Australia has four key activities:

- **Leadership for diabetes** – national advocacy, policy, campaigns and communication to raise awareness of diabetes and its impact.
- **Living with diabetes** – supporting self-care and choice, promoting the best possible management of diabetes to help prevent complications, and supporting all ages and stages of diabetes. These activities cover type 1 diabetes, type 2 diabetes, gestational diabetes and other diabetes.
- **Preventing diabetes** – promoting and developing prevention policies and programs for risk assessment, early detection and prevention, both in high-risk populations (two million Australians are at high risk of developing diabetes) and at a whole-of-population level.
- **Research for diabetes** – supporting, funding and promoting the best diabetes research.

### Working with general practice

To inform GPs and other health professionals in the field of diabetes management, Diabetes Australia publishes the *Diabetes Management Journal* quarterly. 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 through professional membership of state and territory diabetes organisations.

### The National Diabetes Services Scheme

Diabetes Australia administers the National Diabetes Services Scheme (NDSS) in conjunction with state and territory diabetes organisations, Australian Diabetes Society and the Australian Diabetes Educators Association. The NDSS is an Australian Government initiative and has operated successfully for more than 30 years. It provides universal access for all Australians with diabetes to subsidised diabetes products, and information, education and support services. As at September 2019, there were more than 1.34 million Australians registered with the NDSS.

Through the NDSS, people with diabetes can receive telephone support via the National Helpline on 1800 637 700, along with a range of diabetes information and educational resources and programs targeted for type 1, type 2 and gestational diabetes.

### Educational resources from Diabetes Australia

Membership of state and territory diabetes organisations provides additional benefits, including access to a wide range of educational resources and support for people with diabetes, their families and carers. To find out more, visit the [Diabetes Australia](#) website and click on your state or territory.

## Updates in this edition

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This updated edition of *Management of type 2 diabetes: A handbook for general practice* (Diabetes Handbook) contains new sections on the following topics:

- Early-onset type 2 diabetes
- Mental health and type 2 diabetes
- Management of type 2 diabetes in older people and residential aged care facilities
- The use of technology in managing type 2 diabetes

Significant updates to existing sections include:

- Managing risks and other impacts of diabetes – new recommendation regarding cessation of SGLT2 inhibitors in people with type 2 diabetes who are undergoing surgery and endoscopic procedures
- Reproductive health – removal of advice on management of polycystic ovary syndrome (PCOS). GPs can refer to [management guidelines for PCOS](#)
- Managing cardiovascular risk – new recommendation for the use of sodium glucose co-transporter 2 (SGLT2) inhibitors in people with type 2 diabetes associated with cardiovascular disease and suboptimal glucose control
- Managing risks and other impacts of diabetes – inclusion of a new section on diabetes management for people fasting during Ramadan

## Explanation and source of recommendations

The definitions of the levels of evidence and grades of recommendation in this handbook are provided here. Refer to '[How to use this handbook](#)' for further explanation of how to use these recommendations.

### National Health and Medical Research Council's levels of evidence and grades of recommendation (2009–16)

Levels of evidence	
Level	Definition
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 (ie 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 studies</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

Grades of recommendations	
Grade	Definition
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



## Diabetes Canada criteria for assigning levels of evidence and grades of recommendation

Criteria for assigning levels of evidence	
Level	Criteria
<b>Studies of diagnosis</b>	
Level 1	<ul style="list-style-type: none"> <li>a) Independent interpretation of test results (without knowledge of the result of the diagnostic or gold standard)</li> <li>b) Independent interpretation of the diagnostic standard (without knowledge of the test result)</li> <li>c) Selection of people suspected (but not known) to have the disorder</li> <li>d) Reproducible description of both the test and diagnostic standard</li> <li>e) At least 50 patients with and 50 patients without the disorder</li> </ul>
Level 2	Meets four of the level 1 criteria
Level 3	Meets three of the level 1 criteria
Level 4	Meets one or two of the level 1 criteria
<b>Studies of treatment and prevention</b>	
Level 1A	<ul style="list-style-type: none"> <li>a) Systematic overview or meta-analysis of high-quality RCTs</li> <li>b) Comprehensive search for evidence</li> <li>c) Authors avoided bias in selecting articles for inclusion</li> <li>d) Authors assessed each article for validity</li> <li>e) Reports clear conclusions that are supported by the data and appropriate analyses</li> </ul> <p>OR</p> <p>Appropriately designed RCT with adequate power to answer the question posed by the investigators</p> <ul style="list-style-type: none"> <li>a) Patients were randomly allocated to treatment groups</li> <li>b) Follow up at least 80% complete</li> <li>c) Patients and investigators were blinded to the treatment*</li> <li>d) Patients were analysed in the treatment groups to which they were assigned</li> <li>e) The sample size was large enough to detect the outcome of interest</li> </ul>
Level 1B	Non-randomised clinical trial or cohort study with indisputable results
Level 2	RCT or systematic overview that does not meet level 1 criteria
Level 3	Non-randomised clinical trial or cohort study; systematic overview or meta-analysis of level 3 studies
Level 4	Other
<b>Studies of prognosis</b>	
Level 1	<ul style="list-style-type: none"> <li>a) Inception cohort of patients with the condition of interest, but free of the outcome of interest</li> <li>b) Reproducible inclusion/exclusion criteria</li> <li>c) Follow up of at least 80% of subjects</li> <li>d) Statistical adjustment for extraneous prognostic factors (confounders)</li> <li>e) Reproducible description of outcome measures</li> </ul>
Level 2	Meets criterion a) above, plus three of the other four criteria
Level 3	Meets criterion a) above, plus two of the other criteria
Level 4	Meets criterion a) above, plus one of the other criteria
<p>*In cases where such blinding was not possible or was impractical (eg intensive vs conventional insulin therapy), the blinding of individuals who assessed and adjudicated study outcomes was felt to be sufficient.</p> <p>RCT, randomised controlled trial</p>	

Criteria for assigning grades of recommendations for clinical practice	
Grade	Criteria
Grade A	The best evidence was at level 1
Grade B	The best evidence was at level 2
Grade C	The best evidence was at level 3
Grade D	The best evidence was at level 4 or consensus

Source: Adapted from Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 clinical practice guidelines for the prevention and management of diabetes in Canada. Can J Diabetes 2018;42(Suppl 1):S1–S325.

American Diabetes Association levels of evidence	
Levels of evidence	Explanation
A	<p>Clear evidence from well-conducted, generalisable RCTs that are adequately powered, including:</p> <ul style="list-style-type: none"> <li>evidence from a well-conducted multicentre trial</li> <li>evidence from a meta-analysis that incorporated quality ratings in the analysis</li> </ul> <p>Compelling non-experimental evidence (ie '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> <p>Supportive evidence from a well-conducted case-control study</p>
C	<p>Supportive evidence from poorly controlled or uncontrolled studies:</p> <ul style="list-style-type: none"> <li>evidence from randomised 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

*RCT, randomised controlled trial*

# Summary of recommendations

## Defining and diagnosing type 2 diabetes

Recommendation	Reference	Grade*
Individuals who are not at high risk of type 2 diabetes should be screened for risk of diabetes every three years from 40 years of age using the Australian type 2 diabetes risk assessment tool (AUSDRISK)	1 NHMRC, 2009	C
Aboriginal and Torres Strait Islander people should be screened annually with blood testing (fasting plasma glucose, random venous glucose or glycated haemoglobin [HbA1c]) from 18 years of age	2 RACGP and NACCHO, 2018	Good Practice Point
Individuals with any one of the following risk factors: <ul style="list-style-type: none"> <li>• AUSDRISK score of <math>\geq 12</math></li> <li>• all people with a history of a previous cardiovascular event (acute myocardial infarction or stroke)</li> <li>• women with a history of gestational diabetes mellitus</li> <li>• women with polycystic ovary syndrome</li> <li>• patients on antipsychotic drugs</li> </ul> should be screened <ul style="list-style-type: none"> <li>• with fasting blood glucose (FBG) or HbA1c</li> </ul> <ul style="list-style-type: none"> <li>• every three years</li> </ul>	1 NHMRC, 2009 1 NHMRC, 2009	B C
Individuals with impaired glucose tolerance test or fasting glucose (not limited by age) should be screened: <ul style="list-style-type: none"> <li>• with FBG or HbA1c</li> </ul> <ul style="list-style-type: none"> <li>• every 12 months</li> </ul>	1 NHMRC, 2009 1 NHMRC, 2009	B C
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Person-centred care

Recommendation	Reference	Grade*
To optimise patient health outcomes and health-related quality of life, a person-centred communication style should be used that: <ul style="list-style-type: none"> <li>• uses person-centred and strength-based language</li> <li>• uses active listening</li> <li>• elicits patient preferences and beliefs</li> <li>• assesses literacy, numeracy and potential barriers to care</li> </ul>	1 American Diabetes Association, 2019	B
Care should be aligned with components of the Chronic Care Model (CCM) to ensure productive interactions between a prepared, proactive practice team and an informed, activated patient	1 American Diabetes Association, 2019	A
Care systems should support team-based care, community involvement, patient registries and embedded decision-support tools to meet patient needs	1 American Diabetes Association, 2019	B
Treatment decisions should be timely, based on evidence-based guidelines and tailored to individual patient preferences, prognoses and comorbidities	1 American Diabetes Association, 2019	B
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Preventing progression to type 2 diabetes

Recommendation	Reference	Grade*
People with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) should be referred to lifestyle intervention programs to: <ul style="list-style-type: none"> <li>• achieve and maintain a 7% reduction in weight</li> <li>• increase moderate-intensity physical activity to at least 150 minutes per week</li> </ul>	1 American Diabetes Association, 2019	A
People with glycated haemoglobin (HbA1c) 6.0–6.4% may also benefit from a structured weight loss and exercise program to reduce their risk of developing type 2 diabetes	2 Diabetes Canada, 2018	D, consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Early-onset type 2 diabetes

Recommendation	Reference	Grade*
All children, adolescents and young adults (aged <25 years) with type 2 diabetes should be referred to an endocrinologist or, if not accessible, a specialist physician with an interest in diabetes	RACGP Diabetes Handbook working groups, 2020	Consensus
For people aged ≥25 years with early-onset type 2 diabetes, due to the complexity of management and higher risk of complications, consider timely referral to an endocrinologist and/or management through a shared care arrangement	RACGP Diabetes Handbook working groups, 2020	Consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Lifestyle interventions for management of type 2 diabetes

Recommendation	Reference	Grade*
<b>Physical activity</b>		
<b>Children and adolescents</b> with type 1 or type 2 diabetes or at high risk of type 2 diabetes should engage in 60 min/day or more of moderate- or vigorous-intensity aerobic activity, with vigorous muscle-strengthening and bone-strengthening activities at least three days/week	3 American Diabetes Association, 2019	C
Most <b>adults</b> with type 2 diabetes should engage in 150 minutes or more of moderate-to-vigorous intensity aerobic activity per week, spread over at least three days/week, with no more than two consecutive days without activity	3 American Diabetes Association, 2019	B
Additionally, adults with type 2 diabetes should engage in resistance exercise: <ul style="list-style-type: none"> <li>• 2–3 sessions/week on non-consecutive days</li> <li>• for a total of at least 60 minutes per week</li> </ul>	3 American Diabetes Association, 2019 4 Exercise & Sports Science Australia, 2012	B  Consensus
All adults, particularly those with type 2 diabetes, should decrease the amount of time spent in daily sedentary behaviour	3 American Diabetes Association, 2019	B
Prolonged sitting should be interrupted every 30 minutes for blood glucose benefits, particularly in adults with type 2 diabetes	3 American Diabetes Association, 2019	C
Flexibility training and balance training are recommended 2–3 times/week for older adults with diabetes; yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength and balance	3 American Diabetes Association, 2019	C
<b>Diet</b>		
Consumption of cereal foods (especially three serves/day of wholegrains) is associated with reduced risk of type 2 diabetes	5 NHMRC, 2013	B
Consumption of at least 1.5 serves/day of dairy foods (eg milk, yoghurt, cheese) is associated with reduced risk of type 2 diabetes	5 NHMRC, 2013	C
<b>Weight</b>		
In people with overweight or obesity with diabetes, a nutritionally balanced, calorie-reduced diet should be followed to achieve and maintain a lower, healthier body weight	6 Diabetes Canada, 2018	A, level 1A
An intensive healthy behaviour intervention program, combining dietary modification and increased physical activity, may be used to achieve weight loss, improve glycaemic control and reduce CVD risk	6 Diabetes Canada, 2018	A, level 1A
Weight management medication may be considered in people with diabetes and overweight or obesity to promote weight loss and improved glycaemic control	6 Diabetes Canada, 2018	A, level 1A
Metabolic surgery should be recommended to manage type 2 diabetes: <ul style="list-style-type: none"> <li>• in people with a body mass index (BMI) <math>\geq 40</math> kg/m<sup>2</sup></li> <li>• in people with a BMI 35.0–39.9 kg/m<sup>2</sup> when hyperglycaemia is inadequately controlled by lifestyle and optimal medical therapy</li> </ul>	7 Diabetes Surgery Summit, 2016	Consensus

Recommendation	Reference	Grade*
Metabolic surgery should also be considered for patients with type 2 diabetes and BMI 30.0–34.9 kg/m <sup>2</sup> if hyperglycaemia is inadequately controlled despite optimal treatment with either oral or injectable medications	7 Diabetes Surgery Summit, 2016	Consensus
<b>Smoking cessation</b>		
All people who smoke should be offered brief advice to quit smoking	8 RACGP, 2020	Strong recommendation; high certainty
<b>Alcohol consumption</b>		
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	9 Scottish Intercollegiate Guidelines Network, 2017	B
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Glucose monitoring

Recommendation	Reference	Grade*
Glycated haemoglobin (HbA1c) measurement should be used to assess long-term blood glucose control	1 NHMRC, 2009	A
Self-monitoring of blood glucose (SMBG) is recommended for patients with type 2 diabetes who are using insulin and have been educated in appropriate alterations in insulin dose	2 Scottish Intercollegiate Guidelines Network, 2017	B
For people with type 2 diabetes not receiving insulin therapy: <ul style="list-style-type: none"> <li>frequency of SMBG should be individualised, depending on type of glucose-lowering medications, level of glycaemic control and risk of hypoglycaemia</li> <li>when glycaemic control is not being achieved, SMBG should be instituted and should include periodic pre- and post-prandial measurements and training of healthcare providers and people with diabetes in methods to modify health behaviours and glucose-lowering medications in response to SMBG values</li> </ul>	3 Diabetes Canada, 2018	D, consensus  B, level 2
A reasonable HbA1c goal for many non-pregnant adults is <7% (53 mmol/mol)	4 American Diabetes Association, 2019	A
Less stringent HbA1c goals (such as <8% [64 mmol/mol]) may be appropriate for patients with a history of severe hypoglycaemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, or long-standing diabetes in whom the goal is difficult to achieve despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin	4 American Diabetes Association, 2019	B
Targets for self-monitoring of blood glucose levels are 4.0–7.0 mmol/L for fasting and preprandial, and 5.0–10.0 mmol/L for two-hour postprandial	3 Diabetes Canada, 2018	B, level 2
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Medical management of glycaemia

Recommendation	Reference	Grade*
<b>Glucose-lowering medication in people newly diagnosed with type 2 diabetes</b>		
A person-centred approach should be used to guide the choice of glucose-lowering medication. Considerations include comorbidities (atherosclerotic cardiovascular disease, heart failure, chronic kidney disease), hypoglycaemia risk, impact on weight, cost, risk for side effects and patient preferences	1 American Diabetes Association, 2019	E†
Healthy behaviour interventions should be initiated at diagnosis	2 Diabetes Canada, 2018	B, level 2
If glycaemic targets are not achieved using healthy behaviour interventions alone within three months, glucose-lowering therapy should be added to reduce the risk of microvascular complications	2 Diabetes Canada, 2018	A, level 1A
Metformin should be chosen over other agents due to its low risk of hypoglycaemia and weight gain	2 Diabetes Canada, 2018	A, level 1A
Individuals with metabolic decompensation (eg marked hyperglycaemia, ketosis or unintentional weight loss) should receive insulin with or without metformin to correct the relative insulin deficiency	2 Diabetes Canada, 2018	D, consensus
All healthcare practitioners who initiate or educate patients on injectable glucose-lowering medications should be familiar with, and follow, the recommended guidelines	RACGP Diabetes Handbook working groups, 2020	Consensus
<b>Advancing treatment</b>		
Dose adjustments to, and/or addition of, glucose-lowering medications should be made in order to attain target glycated haemoglobin (HbA1c) within 3–6 months	2 Diabetes Canada, 2018	D, consensus
If glycaemic targets are not achieved, other classes of glucose-lowering agents should be added to improve glycaemic control	2 Diabetes Canada, 2018	B, level 2
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		
†E = expert opinion: recommendation in which there is no evidence from clinical trials, in which clinical trials may be impractical, or in which there is conflicting evidence.		

## Type 2 diabetes and cardiovascular risk

Recommendation	Reference	Grade*
<b>Assessing cardiovascular disease risk</b>		
Calculate cardiovascular disease (CVD) risk level using an evidence-based tool, for example: <ul style="list-style-type: none"> <li>• <a href="#">Australian absolute cardiovascular disease risk calculator</a></li> <li>• <a href="#">Australian cardiovascular risk charts</a></li> </ul>	RACGP Diabetes Handbook working groups, 2020	Consensus
Adults with any of the following conditions do not require absolute CVD 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 aged &gt;60 years</li> <li>• diabetes with microalbuminuria (&gt;20 mcg/min or urine albumin-to-creatinine ratio [UACR] &gt;2.5 mg/mmol for men and &gt;3.5 mg/mmol for women)</li> <li>• moderate or severe chronic kidney disease (persistent proteinuria or estimated glomerular filtration rate [eGFR] &lt;45 mL/min/1.73 m<sup>2</sup>)</li> <li>• a previous diagnosis of familial hypercholesterolaemia</li> <li>• systolic blood pressure ≥180 mmHg or diastolic blood pressure ≥110 mmHg</li> <li>• serum total cholesterol &gt;7.5 mmol/L</li> </ul>	1 NVDPA, 2012	D
Aboriginal and Torres Strait Islander peoples are generally assumed to be at higher risk	1 NVDPA, 2012	D
Patients with pre-existing CVD are at high risk	2 Baker IDI, 2015	None given
<b>Managing CVD risk</b>		
Adults at high absolute risk of CVD should be simultaneously treated with lipid and blood pressure-lowering pharmacotherapy in addition to lifestyle advice, unless contraindicated or clinically inappropriate	1 NVDPA, 2012	B
Sodium glucose co-transporter 2 (SGLT2) inhibitors are recommended in patients with type 2 diabetes in the setting of CVD and insufficient glycaemic control despite metformin, to decrease the risk of cardiovascular events and decrease the risk of hospitalisation for heart failure	3 Heart Foundation, 2018	Strong; high-quality evidence
<b>Antihypertensive medication</b>		
Antihypertensive therapy is strongly recommended in patients with diabetes and systolic blood pressure ≥140 mmHg	4 Heart Foundation, 2016	Strong; level I evidence
In patients with diabetes and hypertension, any of the first-line antihypertensive drugs that effectively lower blood pressure are recommended	4 Heart Foundation, 2016	Strong; level I evidence
In patients with diabetes and hypertension, a blood pressure target of <140/90 mmHg is recommended	4 Heart Foundation, 2016	Strong; level I evidence
A systolic blood pressure target of <120 mmHg may be considered for patients with diabetes in whom prevention of stroke is prioritised	4 Heart Foundation, 2016	Weak
In patients with diabetes where treatment is being targeted to <120 mmHg systolic, close follow-up is recommended to identify treatment-related adverse effects including hypotension, syncope, electrolyte abnormalities and acute kidney injury	4 Heart Foundation, 2016	Strong



Recommendation	Reference	Grade*
<b>Lipid-lowering medications</b>		
Use statins as first-line for lipid-lowering therapy	1 NVDPA, 2012	A
All adults with type 2 diabetes and known prior CVD (except haemorrhagic stroke) should receive the maximum tolerated dose of a statin, irrespective of their lipid levels  Note: The maximum tolerated dose should not exceed the maximum available dose (eg 80 mg atorvastatin, 40 mg rosuvastatin)	2 Baker IDI, 2015	A
In people with type 2 diabetes and known prior CVD, fibrates should be commenced in addition to a statin or on their own (for those intolerant to statin) when fasting triglycerides are greater than or equal to 2.3 mmol/L, or high-density lipoprotein cholesterol (HDL-C) is low <sup>†</sup>  Note: When used in combination with statins, fenofibrate presents a lower risk of adverse events than other fibrates combined with statins	2 Baker IDI, 2015	B
For adults with type 2 diabetes and known prior CVD already on maximally tolerated statin dose or intolerant of statin therapy, if fasting low-density lipoprotein cholesterol (LDL-C) levels remain $\geq 1.8$ mmol/L, consider commencing one of: <ul style="list-style-type: none"> <li>• ezetimibe</li> <li>• bile acid binding resins, or</li> <li>• nicotinic acid</li> </ul>	2 Baker IDI, 2015	Consensus
<b>Antithrombotic medication</b>		
All adults with type 2 diabetes and known prior CVD should receive long-term antiplatelet therapy unless there is a clear contraindication	2 Baker IDI, 2015	A
All adults with type 2 diabetes and a history of ischaemic stroke or transient ischaemic attack should receive: <ul style="list-style-type: none"> <li>• low-dose aspirin, or</li> <li>• clopidogrel, or</li> <li>• combination low-dose aspirin and extended-release dipyridamole</li> </ul>	2 Baker IDI, 2015	A A B
Patients with a history of stroke and non-valvular atrial fibrillation who have adequate renal function should be initiated on direct oral anticoagulants (DOACs) in preference to warfarin	5 Stroke Foundation, 2019	Strong recommendation
All adults with type 2 diabetes and recent acute coronary syndrome and/or coronary stent should receive, for 12 months after the event or procedure: <ul style="list-style-type: none"> <li>• combination low-dose aspirin and clopidogrel, or</li> <li>• combination low-dose aspirin and prasugrel, or</li> <li>• combination low-dose aspirin and ticagrelor</li> </ul>	2 Baker IDI, 2015	B B C
All adults with type 2 diabetes and a history of coronary artery disease, but no acute event in the past 12 months, should receive <ul style="list-style-type: none"> <li>• long-term low-dose aspirin, or</li> <li>• long-term clopidogrel if intolerant to aspirin</li> </ul>	2 Baker IDI, 2015	A B
In the presence of atrial fibrillation or other major risk factors for thromboembolism, there should be consideration of anticoagulant therapy according to other relevant guidelines	2 Baker IDI, 2015	Practice Point
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		
<sup>†</sup> HDL < 1.0 mmol/L (based on the cut-offs reported in the ACCORD and FIELD studies)		

## Microvascular complications: Diabetes-related eye disease

Recommendation	Reference	Grade*
Individuals with type 2 diabetes should be screened and evaluated for retinopathy by an optometrist or ophthalmologist at the time of diagnosis	1 Diabetes Canada, 2018	A, level 1
Follow-up screening interval for people with retinopathy should be tailored to the severity of retinopathy	1 Diabetes Canada, 2018	D, consensus
The recommended interval for those with no or minimal retinopathy is 1–2 years	1 Diabetes Canada, 2018	A, level 1
Examine higher risk patients (eg longer duration of diabetes; suboptimal glycaemic management, blood pressure or blood lipid control; people from a non-English-speaking background) who don't have diabetic retinopathy at least annually	2 NHMRC, 2008  3 RANZCO, 2019	None provided Level I evidence; level IV regarding people from non- English-speaking background  Consensus
Conduct annual diabetic retinopathy screening for Aboriginal or Torres Strait Islander people with diabetes	2 NHMRC, 2008	None provided Level IV evidence
Results of eye examinations and the follow-up interval plan should be communicated clearly to all members of the diabetes healthcare team	1 Diabetes Canada, 2018	D, consensus
To delay onset and progression of diabetic retinopathy, people with type 2 diabetes should be treated to achieve optimal control of: <ul style="list-style-type: none"> <li>• blood glucose</li> <li>• blood pressure</li> </ul>	1 Diabetes Canada, 2018	A, level 1A A, level 1A
Fenofibrate, in addition to statin therapy, may be used in people with type 2 diabetes to slow the progression of established retinopathy	1 Diabetes Canada, 2018	A, level 1A
Individuals with sight-threatening diabetic retinopathy should be assessed by an ophthalmologist	1 Diabetes Canada, 2018	D, consensus
Pharmacological intervention, laser therapy and/or vitrectomy may be used to manage diabetic retinopathy	1 Diabetes Canada, 2018	A, level 1A
Women with pre-existing type 2 diabetes who are planning for pregnancy or pregnant should be counselled on the risk of development and/or progression of diabetic retinopathy	4 American Diabetes Association, 2019	B
Eye examinations should occur before pregnancy or in the first trimester in patients with pre-existing type 2 diabetes; patients should then be monitored every trimester and for one year postpartum as indicated by the degree of retinopathy	4 American Diabetes Association, 2019	B
The presence of retinopathy is not a contraindication to aspirin therapy for cardioprotection, as aspirin does not increase the risk of retinal haemorrhage	4 American Diabetes Association, 2019	A
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Microvascular complications: Diabetes-related neuropathy

Recommendation	Reference	Grade*
All patients should be screened for diabetic peripheral neuropathy, starting at diagnosis of type 2 diabetes and at least annually thereafter	1 American Diabetes Association, 2019	B
Screening for peripheral neuropathy should be conducted by assessing loss of sensitivity to the 10 g monofilament, or loss of sensitivity to vibration at the dorsum of the great toe	2 Diabetes Canada, 2018	A, level 1
The following agents may be used alone or in combination to relieve painful peripheral neuropathy: <ul style="list-style-type: none"> <li>• anticonvulsants <ul style="list-style-type: none"> <li>– pregabalin</li> <li>– gabapentin</li> <li>– valproate</li> </ul> </li> <li>• antidepressants <ul style="list-style-type: none"> <li>– amitriptyline</li> <li>– duloxetine</li> <li>– venlafaxine</li> </ul> </li> <li>• topical nitrate spray</li> <li>• opioid analgesics</li> </ul>	2 Diabetes Canada, 2018	A, level 1 B, level 2 B, level 2 B, level 2  B, level 2 B, level 2
People with type 2 diabetes should be treated with intensified glycaemic control to prevent the onset and progression of neuropathy	2 Diabetes Canada, 2018	B, level 2
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Microvascular complications: Foot care

Recommendation	Reference	Grade*
Assess all people with diabetes and stratify their risk of developing foot complications	1 NHMRC, 2011	C
Assess risk stratification by enquiring about previous foot ulceration and amputation, visually inspecting the feet for structural abnormalities and ulceration, assessing for neuropathy using either the neuropathy disability score or a 10 g monofilament, and palpating foot	1 NHMRC, 2011	C
People assessed as having intermediate-risk or high-risk feet should be offered a foot protection program. This includes foot care education, podiatry review and appropriate footwear	1 NHMRC, 2011	C
Pressure reduction, otherwise referred to as 'redistribution of pressure' or 'off-loading', is required to optimise the healing of plantar foot ulcers	1 NHMRC, 2011	B
Off-loading of the wound can be achieved with the use of a total contact cast or other device rendered irremovable	1 NHMRC, 2011	B
People with diabetes-related foot ulceration are best managed by a multidisciplinary foot care team	1 NHMRC, 2011	C
There is insufficient evidence to recommend any specific dressing type for typical diabetic foot ulcers	2 Diabetes Canada, 2018	C, level 3
General principles of wound care include the provision of physiologically moist wound environment and off-loading the ulcer	2 Diabetes Canada, 2018	D, consensus

Recommendation	Reference	Grade*
Non-viable tissue should be debrided	2 Diabetes Canada, 2018	A, level I
Provided that all other modifiable factors (off-loading, infection, deformity) have been addressed, adjunctive wound-healing therapies, such as topical growth factors and granulocyte colony-stimulating factor (G-CSF) or dermal substitutes, may be considered for non-healing, non-ischaemic wounds	2 Diabetes Canada, 2018	A, level 1
In people stratified as having low-risk feet (where no risk factors or previous foot complications have been identified), foot examination should occur annually	1 NHMRC, 2011	Consensus
In people stratified as having intermediate-risk or high-risk feet (without current foot ulceration), foot examination should occur at least every 3–6 months	1 NHMRC, 2011	Consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Microvascular complications: Nephropathy

Recommendation	Reference	Grade*
At least once a year, assess urine ACR and eGFR in all patients with type 2 diabetes, regardless of treatment	1 American Diabetes Association, 2019	B
To prevent the onset and delay the progression of CKD, people with diabetes should be treated to optimise blood glucose levels and blood pressure	2 Diabetes Canada, 2018	A, level 1A
It is recommended that adults with type 2 diabetes and CKD with either hypertension or albuminuria receive an ACE inhibitor or an ARB to delay progression of CKD	2 Diabetes Canada, 2018	A, level 1A
Combinations of ACE inhibitor, ARB or DRI should not be used in the management of diabetes and CKD	2 Diabetes Canada, 2018	A, level 1
People with diabetes on an ACE inhibitor or an ARB should have their serum creatinine and potassium levels checked at baseline and within 1–2 weeks of initiation or titration of therapy, and during times of acute illness	2 Diabetes Canada, 2018	D, consensus
For patients with type 2 diabetes and chronic kidney disease, consider use of an SGLT2 inhibitor or GLP-1 RA shown to reduce risk of CKD progression, cardiovascular events, or both	1 American Diabetes Association, 2019	C
Adults with diabetes and CKD should be given a 'sick-day' medication list that outlines which medications should be withheld during times of acute illness	2 Diabetes Canada, 2018	D, consensus
All people with diabetes and CKD should be offered a comprehensive, multifaceted program to reduce cardiovascular risk (refer to the section 'Type 2 diabetes and cardiovascular risk')	2 Diabetes Canada, 2018	A, level 1A
People with diabetes should be informed that smoking increases the risk of CKD	3 NHMRC 2009	B
<p><i>ACE, angiotensin-converting enzyme; ACR, albumin-to-creatinine ratio; ARB, angiotensin receptor blocker; CKD, chronic kidney disease; CVD, cardiovascular disease; DRI, direct renin inhibitor; eGFR, estimated glomerular filtration rate; GLP-1 RA, glucagon-like peptide-1 receptor agonist; SGLT2, sodium glucose co-transporter 2</i></p> <p>*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.</p>		

## Managing glycaemic emergencies

Recommendation	Reference	Grade*
Individuals at risk for hypoglycaemia should be asked about symptomatic and asymptomatic hypoglycaemia at each encounter	1 American Diabetes Association, 2019	C
Glycaemic goals for some older adults might reasonably be relaxed as part of individualised care, but hyperglycaemia leading to symptoms or risk of acute hyperglycaemia complications should be avoided in all patients	1 American Diabetes Association, 2019	C
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Mental health and type 2 diabetes

Recommendation	Reference	Grade*
Routinely monitor people with diabetes for diabetes distress, particularly when treatment targets are not met and at the onset of diabetes complications	1 American Diabetes Association, 2019	B
Providers should consider assessment for symptoms of diabetes distress, depression, anxiety, disordered eating and cognitive capacities using patient-appropriate standardised and validated tools at the initial visit, at periodic intervals, and when there is a change in disease, treatment, or life circumstance; including caregivers and family members in this assessment is recommended	1 American Diabetes Association, 2019	B
People with diabetes with any of the following should be referred to specialised mental health care professionals: <ul style="list-style-type: none"> <li>• significant distress related to diabetes management</li> <li>• persistent fear of hypoglycaemia</li> <li>• psychological insulin resistance</li> <li>• psychiatric disorders (ie depression, anxiety, eating disorders)</li> </ul>	2 Diabetes Canada, 2018	D, consensus
Collaborative care by inter-professional teams should be provided for people with diabetes and depression to improve: <ul style="list-style-type: none"> <li>• depressive symptoms</li> <li>• adherence to antidepressant and non-insulin glucose-lowering medications</li> <li>• glycaemic control</li> </ul>	2 Diabetes Canada, 2018	A, level 1
Psychosocial interventions such as the following should be integrated into diabetes care plans: <ul style="list-style-type: none"> <li>• motivational interventions</li> <li>• stress management strategies</li> <li>• coping skills training</li> <li>• family therapy</li> <li>• case management</li> </ul>	2 Diabetes Canada, 2018	D, consensus C, level 3 A, level 1A A, level 1B B, level 2
Antidepressant medication should be used to treat acute depression in people with diabetes and for maintenance treatment to prevent recurrence of depression	2 Diabetes Canada, 2018	A, level 1/level 1A
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Type 2 diabetes, reproductive health and pregnancy

Recommendations	Reference	Grade*
<b>Pre-pregnancy and pregnancy with existing type 2 diabetes</b>		
Before attempting to become pregnant, women with type 1 or type 2 diabetes should receive pre-conception counselling that includes optimal diabetes management, including nutrition, preferably in consultation with a multidisciplinary pregnancy team to optimise maternal and neonatal outcomes	1 Diabetes Canada, 2018	C, level 3
Before attempting to become pregnant, women with type 2 diabetes should strive to attain a pre-conception glycated haemoglobin (HbA1c) as close to normal as is safely possible (ideally $\leq 6.5\%$ ) to decrease the risk of congenital anomalies, pre-eclampsia, macrosomia and other complications	2 American Diabetes Association, 2019	B
Before attempting to become pregnant, women with diabetes should discontinue medications that are potentially embryopathic, including any from the following classes: <ul style="list-style-type: none"> <li>• angiotensin-converting enzyme inhibitors (ACEIs) inhibitors and angiotensin receptor blockers (ARBs) <ul style="list-style-type: none"> <li>– prior to conception in women with hypertension alone</li> <li>– upon detection of pregnancy in women with chronic kidney disease</li> </ul> </li> <li>• statins</li> </ul>	1 Diabetes Canada, 2018	C, level 3 D, consensus D, level 4
Women on metformin and/or sulfonylureas pre-conception may continue on these agents, if glycaemic control is adequate, until pregnancy is achieved	1 Diabetes Canada, 2018	C, level 3
Women on other glucose-lowering medications should switch to insulin prior to conception, as there are no safety data for the use of other glucose-lowering medications agents in pregnancy	1 Diabetes Canada, 2018	D, consensus
Women with pre-pregnancy diabetes should take a 5 mg (but not exceeding) daily dose of folate, starting at least one month prior to conception, for the first trimester, to protect against neural tube defects	3 Scottish Intercollegiate Guidelines Network, 2017 4 RACGP, 2016	B
Pre-pregnancy care provided by a multidisciplinary team is strongly recommended for women with diabetes	3 Scottish Intercollegiate Guidelines Network, 2017	C
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Management of type 2 diabetes in older people and residential aged care facilities

Recommendation	Reference	Grade*
Consider the assessment of medical, psychological, functional (self-management abilities) and social geriatric domains in older adults to provide a framework to determine targets and therapeutic approaches for diabetes management	1 American Diabetes Association, 2019	C
Overtreatment of diabetes is common in older adults and should be avoided	1 American Diabetes Association 2019	B
De-intensification (or simplification) of complex regimens is recommended to reduce the risk of hypoglycaemia in older adults, if achievable within the individualised HbA1c target	1 American Diabetes Association 2019	B
For older adults in residential aged care facilities, individualised care plans should be developed and agreed upon by the individual, their GP and facility staff. This will provide clarity regarding aims of care and metabolic targets, and facilitate screening for diabetes-related complications and annual reviews	RACGP Diabetes Handbook working groups, 2020	Consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Diabetes and end-of-life care

Recommendation	Reference	Grade*
In people taking glucose-lowering medications and who are at risk of hypoglycaemia, a blood glucose range of 6–15 mmol/L is appropriate in most cases for palliative care	1 Diabetes UK, 2018	Consensus
Determine a blood glucose and glycated haemoglobin (HbA1c) range that is safe for the individual and that avoids hypoglycaemia and hyperglycaemia	RACGP Diabetes Handbook working groups, 2020	Consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Managing risks and other impacts of type 2 diabetes

Recommendation	Reference	Grade*
<b>Sick days</b>		
Patients should be educated to develop a sick day management plan after initial diagnosis. This plan should be reviewed at regular intervals	1 Australian Diabetes Educators Association, 2016	None provided
Assist in the development of a sick day care plan and preparation of a home sick day management kit for patients to use during episodes of sickness	1 Australian Diabetes Educators Association, 2016	None provided
<b>Planned surgical procedures</b>		
Patients receiving sodium glucose co-transporter 2 (SGLT2) inhibitors should cease this medication at least three days prior to surgery or procedures that require one or more days in hospital and/or 'bowel preparation', including colonoscopy, to prevent diabetic ketoacidosis (DKA) in the peri-operative period. For day procedures, SGLT2 inhibitors may be ceased just for the day of the procedure	2 Australian Diabetes Society, 2020	Consensus
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Gestational diabetes mellitus

Recommendation	Reference	Grade*
In the first trimester, all women should be assessed for risk of hyperglycaemia (refer to <a href="#">Box 1</a> in the section ' <a href="#">Gestational diabetes mellitus</a> '), and those at high risk should have glycaemic assessment	1 NHMRC, 2019	Consensus
Between 24 and 28 weeks' gestation, recommend testing for gestational diabetes mellitus (GDM) to all women who have not previously been tested in the current pregnancy. Recommend repeat testing to women who were tested early in pregnancy due to risk factors and who had a normal result on an initial test	1 NHMRC, 2019	Consensus
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	2 Scottish Intercollegiate Guidelines Network, 2017	A
Postprandial glucose monitoring should be carried out in pregnant women with GDM	2 Scottish Intercollegiate Guidelines Network, 2017	C
Postnatal education and support are important in preventing or delaying the onset of diabetes in the future, and women should be encouraged to attend postnatal testing	1 NHMRC, 2019	Consensus
Women diagnosed with GDM should have a 75 g two-hour oral glucose tolerance test, preferably at 6–12 weeks postpartum, with classification according to World Health Organization criteria	3 ADIPS, 2014	Consensus
Advise women that physical activity and healthy eating during pregnancy help reduce excessive weight gain but do not appear to directly reduce the risk of developing GDM	1 NHMRC, 2019	Qualified evidence-based recommendation (QEBR)
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		



# Introduction to type 2 diabetes in general practice

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Diabetes is a national health priority. The *Australian National Diabetes Strategy 2016–2020* was released by the Australian Government in November 2015.<sup>1</sup>

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 more than 2.5 million.<sup>2</sup> The most socially disadvantaged Australians are twice as likely to develop diabetes.

The early identification and optimal management of people with type 2 diabetes can significantly reduce the risk of coronary artery disease, stroke, kidney failure, limb amputations and vision loss that is associated with type 2 diabetes. General practice has the central healthcare provider role in managing type 2 diabetes, from identifying those at risk right through to caring for patients at the end of life. These guidelines give up-to-date, evidence-based information tailored for general practice to support general practitioners (GPs) and their teams in providing high-quality management.

In developing the 2020 edition of *Management of type 2 diabetes: A handbook for general practice*, The Royal Australian College of General Practitioners (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 Specific Interests Diabetes Network.

This publication has been produced in accordance with the rules and processes outlined in the RACGP's [Conflict of Interest Policy](#).

This edition represents 21 years of a successful relationship between the RACGP and Diabetes Australia. We acknowledge the support of the RACGP Expert Committee – Quality Care, the Australian Diabetes Society, Australian Diabetes Educators Association, and RACGP staff in the development of these guidelines.

## How to use this handbook

This handbook has been designed to provide pragmatic, evidence-based recommendations for use in general practice, and adopts the most recent recommendations from organisations including the National Health and Medical Research Council (NHMRC), the Scottish Intercollegiate Guidelines Network (SIGN), Diabetes Canada, 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 graded recommendations are not available or current, the writing group has considered the results of systematic reviews and primary research studies to formulate the overall recommendation. References to support these recommendations are included. A 'consensus-based recommendation' denotes a recommendation that was formulated in the absence of high-quality evidence; the RACGP Diabetes Handbook working groups reached a consensus expert opinion to include the point in the resource.

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).

## Person-centred care

Person-centred care is essential to good diabetes management. Management that follows this principle incorporates an individual's experience of care and treats them as partners in their own healthcare.<sup>3</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>4</sup> As a result, the person with diabetes is more likely to engage actively in self-management and achieve optimal health outcomes.<sup>5</sup>

Recommendations and further detail about using person-centred care in practice are provided in the section '[Person-centred care](#)'.

## Recommendations particular to Aboriginal and Torres Strait Islander people

Information specific to the Aboriginal and Torres Strait Islander population is highlighted throughout the text. GPs are also encouraged to refer to the RACGP's [National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people, Chapter 12: Type 2 diabetes prevention and early detection](#).

Recommendations in some areas of diabetes care are different for Aboriginal and Torres Strait Islander people. 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.

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# Defining and diagnosing type 2 diabetes

## Recommendations

Recommendation	Reference	Grade*
Individuals who are not at high risk of type 2 diabetes should be screened for risk of diabetes every three years from 40 years of age using the Australian type 2 diabetes risk assessment tool (AUSDRISK)	1 NHMRC, 2009	C
Aboriginal and Torres Strait Islander people should be screened annually with blood testing (fasting plasma glucose, random venous glucose or glycated haemoglobin [HbA1c]) from 18 years of age	2 RACGP and NACCHO, 2018	Good Practice Point
Individuals with any one of the following risk factors: <ul style="list-style-type: none"> <li>• AUSDRISK score of <math>\geq 12</math></li> <li>• all people with a history of a previous cardiovascular event (acute myocardial infarction or stroke)</li> <li>• women with a history of gestational diabetes mellitus</li> <li>• women with polycystic ovary syndrome</li> <li>• patients on antipsychotic drugs</li> </ul> should be screened <ul style="list-style-type: none"> <li>• with fasting blood glucose (FBG) or HbA1c</li> </ul> <ul style="list-style-type: none"> <li>• every three years</li> </ul>	1 NHMRC, 2009  1 NHMRC, 2009	B  C
Individuals with impaired glucose tolerance test or fasting glucose (not limited by age) should be screened: <ul style="list-style-type: none"> <li>• with FBG or HbA1c</li> </ul> <ul style="list-style-type: none"> <li>• every 12 months</li> </ul>	1 NHMRC, 2009  1 NHMRC, 2009	B  C
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Defining type 2 diabetes

Diabetes is a group of disorders and the 10th leading cause of death in Australia.<sup>3</sup> There are four clinical classes of diabetes:<sup>4</sup>

- **type 1 diabetes** – results from  $\beta$ -cell destruction due to an autoimmune process usually leading to insulin deficiency
- **type 2 diabetes** – results from a progressive insulin secretory defect on the background of insulin resistance
- **gestational diabetes mellitus (GDM)** – defined as glucose intolerance with onset or first recognition during pregnancy
- **other specific types of diabetes** – for example, [monogenic diabetes](#) and diabetes secondary to other causes (refer below).

Type 2 diabetes is a chronic and progressive medical condition that results from two major metabolic dysfunctions: insulin resistance followed by pancreatic islet cell dysfunction, causing a relative insulin deficiency. These occur due to modifiable lifestyle-related risk factors interacting with non-modifiable and genetic risk factors.<sup>5</sup>

The relative insulin deficiency leads to chronic hyperglycaemia and multiple disturbances in carbohydrate, protein and fat metabolism.<sup>5</sup>

## Who is at risk of type 2 diabetes?

Type 2 diabetes is the most common form of diabetes in Australia. Five per cent of adults have a diagnosis of type 2 diabetes, although this is likely to be an underestimate of the true prevalence.<sup>6</sup> Additionally, almost one in six adults are affected by impaired glucose tolerance (IGT) or impaired fasting glucose (IFG).<sup>3</sup>

Clinical suspicion for type 2 diabetes needs to remain high, as type 2 diabetes is often asymptomatic and is increasingly developing in younger people (refer to the section 'Early-onset type 2 diabetes').<sup>4</sup> Causes of secondary diabetes, such as diseases of the exocrine pancreas (eg pancreatic cancer, cystic fibrosis, haemochromatosis), metabolic, or drug-induced causes (eg treatment of human immunodeficiency virus [HIV]), should also be considered in the presence of symptoms suggestive of diabetes.<sup>3</sup>

## Type 2 diabetes in specific populations

There is a higher prevalence of type 2 diabetes among Australians from lower socioeconomic backgrounds compared with higher socioeconomic groups,<sup>6</sup> and certain ethnic groups are more at risk: people with Pacific Islander, Southern European or Asian backgrounds are more than twice as likely as other Australians to develop diabetes within five years.<sup>7</sup>

Aboriginal and Torres Strait Islander people are almost four times more likely to have diabetes than non-Indigenous Australians,<sup>6</sup> and type 2 diabetes is a direct or indirect cause of 20% of Aboriginal and Torres Strait Islander people deaths.<sup>8</sup> Furthermore, the average age of diabetes onset is younger for Aboriginal and Torres Strait Islander people than non-Indigenous Australians,<sup>9</sup> and in some populations, Aboriginal children and adolescents have rates of type 2 diabetes that are 6–20 times higher than non-Indigenous youth.<sup>10</sup>

## Assessing diabetes risk

Patients should be assessed for diabetes risk every three years from 40 years of age using the Australian type 2 diabetes risk assessment tool (AUSDRISK; Table 1).<sup>1</sup>

### Aboriginal and Torres Strait Islander point

Given the high background prevalence of type 2 diabetes in Aboriginal and Torres Strait Islander adults, AUSDRISK has limited use as a screening tool in this population.

Aboriginal or Torres Strait Islander people should instead proceed directly to blood testing for diabetes, in conjunction with other opportunistic screening (such as for cardiovascular risk assessment) from 18 years of age.<sup>2</sup>

An AUSDRISK score of  $\geq 12$  or more is considered 'high risk' for developing type 2 diabetes (Table 1). The following people are also considered at high risk, **regardless** of AUDRISK score:<sup>1,11</sup>

- people aged  $\geq 40$  years who are overweight or obese
- people of any age with IGT or IFG
- people with a first-degree relative with diabetes
- all patients with a history of a cardiovascular event (eg acute myocardial infarction, angina, peripheral vascular disease or stroke)
- people of high-risk ethnicity/background (eg Pacific Islands, Indian subcontinent)
- women with a history of GDM
- women with polycystic ovary syndrome (PCOS)
- people taking antipsychotic medication
- Aboriginal and/or Torres Strait Islander people.

It is recommended that all patients at high risk are tested every three years for diabetes with either FBG or HbA1c (refer to '[Diagnosing diabetes in asymptomatic patients](#)').<sup>1,11</sup> People with IGT or IFG should be tested annually.<sup>1</sup> For recommended management of people at high risk of developing diabetes, refer to the section '[Preventing progression to type 2 diabetes](#)'.

Refer to the section '[Type 2 diabetes, reproductive health and pregnancy](#)' for recommendations on screening in pregnancy.

### Aboriginal and Torres Strait Islander point

Aboriginal and Torres Strait Islander adults who are obese are seven times as likely as those of normal weight or underweight to have diabetes (17% compared with 2.4%).<sup>2</sup>

The AusDiab study found that body mass index (BMI), waist circumference and waist-to-hip ratio all had similar correlations with diabetes and cardiovascular disease (CVD) risk.<sup>12</sup> However, a later study of diabetes risk in an Aboriginal community found that in women, central obesity (defined as waist circumference  $\geq 88$  cm) or BMI  $\geq 25$  kg/m<sup>2</sup> were better predictors of type 2 diabetes and CVD risk; many women with 'normal' BMIs were found to be centrally obese. For men, a BMI  $\geq 25$  kg/m<sup>2</sup> was a better predictor than BMI  $\geq 30$  or waist circumference  $\geq 102$  cm.<sup>13</sup>

**Table 1. AUSDRISK tool for assessing type 2 diabetes risk<sup>7</sup>**

AUSDRISK score	Risk of developing type 2 diabetes within five years*
$\leq 5$	1 in 100
<b>6–8</b>	1 in 50
<b>9–11</b>	1 in 30
<b>12–15</b>	1 in 14
<b>16–19</b>	1 in 7
<b><math>\geq 20</math></b>	1 in 3

\*The overall score may overestimate the risk of diabetes in those aged  $<25$  years and underestimate the risk in Aboriginal and Torres Strait Islander people.<sup>1</sup>

## Impaired fasting glucose and impaired glucose tolerance

The definition of diabetes is based on a collection of symptoms and agreed glycaemic measures associated with escalating retinopathy risk. Patients with elevated glucose not high enough to be diagnosed with type 2 diabetes might have either IFG or IGT, also known as 'dysglycaemic states' or 'intermediate hyperglycaemia'. IFG is identified by a FBG test, and IGT can be identified by a two-hour oral glucose tolerance test (OGTT) – refer to Figure 1.<sup>14</sup>

These states are not considered benign, and they reflect a risk of developing diabetes in the future; however, IFG and IGT have been shown to regress over three years in 18% of cases, if patients follow standard (ie non-intensive) lifestyle recommendations.<sup>15</sup>

As 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.<sup>16</sup>

Refer also to the section '[Preventing progression to type 2 diabetes](#)'.

## Diagnosing type 2 diabetes

Three laboratory tests can be used to diagnose type 2 diabetes:

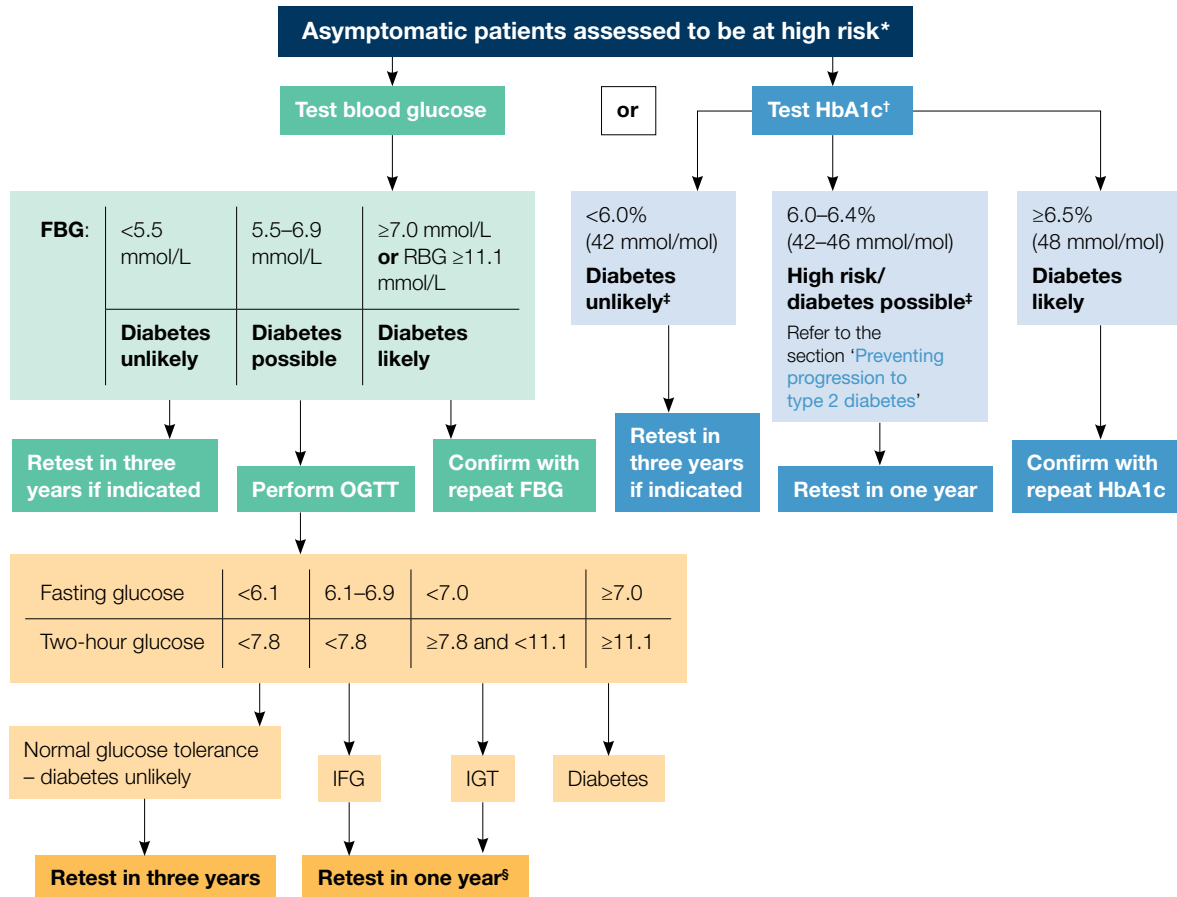
- FBG
- HbA1c
- OGTT.

Notes about the use of each in making a diagnosis can be found in Table 2.

Diagnostic criteria differ depending on whether a patient is symptomatic or asymptomatic (refer below). Asymptomatic patients should be assessed for diabetes risk prior to testing, and screened as shown in Figure 1.

Table 2. Diagnostic tests for type 2 diabetes		
Diagnostic method	Use when diagnosing diabetes	Further notes
FBG	Fasting (eight hours)	May also be used to detect IFG
HbA1c	<p>Non-fasting</p> <p>Abnormal HbA1c values generally should be repeated in asymptomatic patients and confirmed on a different day, unless two abnormal tests (eg FBG and HbA1c) are already available from the same day</p> <p>Note that HbA1c may lack accuracy (specificity and/or sensitivity) in the following cases, in which FBG or OGTT may assist diagnosis:</p> <ul style="list-style-type: none"> <li>• acute-onset glycaemic states such as post-traumatic type 2 diabetes (eg pancreatitis), rapid onset of glycaemia with sepsis and steroid use, etc</li> <li>• within four months post-partum</li> <li>• people with haemoglobinopathy or haemolysis, or advanced chronic kidney disease</li> <li>• people with iron deficiency (artificially elevated)</li> <li>• people who have recently had a blood or iron transfusion<sup>17,18</sup></li> </ul>	<p>Not useful for assessment of IGT</p> <p>Threshold of 6.5% (48 mmol/mol) is linked to escalating microvascular disease, and HbA1c is a better predictor of macrovascular disease than FBG and two-hour post-glucose<sup>19,20</sup></p>
OGTT	<p>Fasting (eight hours)</p> <p>75 g glucose administered orally</p> <p>Blood is collected from a fasting venous sample and two-hour post-glucose challenge venous sample</p>	<p>Only method able to detect IGT.</p> <p>May concurrently detect IFG</p>

*FBG, fasting blood glucose; HbA1c, glycated haemoglobin; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test*

**Figure 1.** Screening and diagnosing type 2 diabetes in asymptomatic people<sup>1,21–23</sup>


FBG, fasting blood glucose; HbA1c, glycated haemoglobin; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test; RBG, random blood glucose

Note: IGT and IFG cannot be diagnosed using HbA1c.

\*Using AUSDRISK (score ≥12) or in specific high-risk categories

†Medicare Benefits Schedule (MBS) item number 66841 allows for diagnostic use only, once every 12 months. The request slip should be annotated as HbA1c or for Service Incentive Payment (SIP) and Practice Incentives Program (PIP) purposes. However, a confirmatory HbA1c test (MBS item number 66551) should be ordered before treatment initiation<sup>21</sup>

‡HbA1c results <6.5% do not exclude diabetes diagnosed by glucose tests<sup>21</sup>

§If confirmatory test is negative, repeat assessment one year or earlier if symptomatic

## Diagnosing diabetes in symptomatic patients

The presence of symptoms suggestive of hyperglycaemia (refer below to 'Clinical symptoms suggestive of diabetes') with **one of the following** is confirmatory of a diagnosis of diabetes:

- a patient presenting with hyperglycaemic crisis
- a single elevated FBG ≥7.0 mmol/L
- single HbA1c ≥6.5%
- a random blood glucose ≥11.1 mmol/L.

A second laboratory test is not required to confirm the diagnosis, unless diagnostic uncertainty remains.

## Clinical symptoms suggestive of diabetes

Symptoms of diabetes include:

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

## Clinical signs of insulin resistance

Signs of insulin resistance may include the following:<sup>24</sup>

- **Acanthosis nigricans** – 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.
- **Hirsutism** – excess facial and body hair, particularly on women.

Box 1 provides information about testing insulin levels.

### Box 1. Testing insulin levels to assess insulin resistance

- There is no role for routinely testing insulin levels to assess insulin resistance in IGT, IFG or in the evaluation of type 2 diabetes.
- Patients with signs of insulin resistance should be screened for diabetes with FBG or HbA1c.

## Diagnosing diabetes in asymptomatic patients

People who do not have symptoms of hyperglycaemia but who fall in the high-risk categories cited above, or people for whom there is clinical suspicion of diabetes, should be tested using FBG, HbA1c or OGTT (Box 2).

**A second concordant laboratory result is required to confirm a diagnosis** of diabetes in asymptomatic patients (Figure 1). It is recommended that the same laboratory test be repeated, using a new blood sample, for a greater likelihood of concurrence.



**Box 2. Diagnostic criteria for type 2 diabetes in asymptomatic patients**

- HbA1c  $\geq 6.5\%$  (48 mmol/mol) on two separate occasions
- or**
- FBG  $\geq 7.0$  mmol/L or random blood glucose  $\geq 11.1$  mmol/L confirmed by a second abnormal FBG on a separate day
- or**
- OGTT before (fasting) and two hours after an oral 75 g glucose load is taken. Diabetes is diagnosed as FBG  $\geq 7.0$  mmol/L or two-hour post-challenge blood glucose  $\geq 11.1$  mmol/L
- These tests are undertaken on venous blood samples.

**Discordant testing**

Due to the different physiological measures of glycaemia, confirmatory tests at times may give discordant results, especially if the second diagnostic test used is not the same as the initial one. For example, HbA1c levels may not be elevated in acute glycaemic states in newly diagnosed diabetes, such that a value of  $<6.5\%$  (48 mmol/mol) does not exclude diabetes in the presence of an elevated blood glucose testing ( $\geq 7.0$  mmol/L fasting or  $\geq 11.1$  mmol/L random).

When the results of more than one type of test are discordant, the result that is above the diagnostic cut-off point should be repeated to make the diagnosis.

Problems with the testing process, such as incorrect fasting or laboratory error, can also lead to discordant results.

**Other types of diabetes**

Alternative types of diabetes include the following.

**Type 1 diabetes**

Type 1 diabetes is typically considered a disease of children and the young; however, the majority of people with type 1 diabetes are adults, and as many as 42% of type 1 diabetes cases have their onset in people between 30 and 60 years of age.<sup>25</sup>

Consider type 1 diabetes if there is the presence of:

- ketosis/ketonuria (which may be absent)
- polyuria, polydipsia
- acute weight loss ( $>5\%$  in less than four weeks)
- $<50$  years of age
- personal and family history of autoimmune disease
- acute onset of symptoms.

If suspicious of type 1 diabetes:

- Management of hyperglycaemia should not be delayed, and should include immediate assessment for possible ketosis and metabolic disorders such as hyperosmolar states while seeking specialist endocrinology assessment. If blood

ketone level is >1.5 mmol/L, seek help immediately. Blood ketones >0.5 mmol/L are abnormal in the presence of hyperglycaemia. Refer to the RACGP's [position statement on emergency management of hyperglycaemia in primary care](#).

- Consider non-urgent confirmatory tests 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. When measuring antibodies, higher rates of false negative results occur early in the development of type 1 diabetes. However, false negative results decrease when two different antibody tests are measured.
- Consider testing for plasma C-peptide level.<sup>26</sup> Levels <0.2 nmol/L on non-fasting sampling support the diagnosis of type 1 diabetes; however, the diagnostic accuracy of this test varies in early-onset type 1 diabetes. Specialist endocrinology evaluation will assist in the case of diagnostic uncertainty.

### Latent autoimmune diabetes of adults

Latent autoimmune diabetes of adults (LADA – also called 'type 1.5' diabetes) is diabetes with  $\beta$ -islet cell antibodies that occurs more commonly in adulthood. LADA often presents similarly to type 2 diabetes, but it involves a more rapid course of  $\beta$ -cell destruction, a poorer metabolic response to non-insulin therapy and a more rapid progression to requiring insulin to control hyperglycaemia due to  $\beta$ -cell failure.<sup>27</sup>

### Monogenic diabetes

Monogenic diabetes is a collection of single-gene mutation disorders that account for 1–2% of diabetes cases. Cases usually develop before 25 years of age and are often non-insulin requiring. Monogenic diabetes can be misdiagnosed as either type 1 or type 2 diabetes.<sup>28</sup>

Monogenic diabetes is genetically heterogeneous, but all forms are dominantly inherited, unless they occur as a result of a de novo mutation. There is variance among the forms, with two main types: neonatal diabetes mellitus, occurring in the first six months of life (rare), and maturity-onset diabetes of the young (MODY). MODY subtypes may vary in the severity of hyperglycaemia. The most prevalent subtypes are due to mutations in the genes *HNF1A*, *GCK* and *HNF4A*. Not all forms of the MODY phenotype have yet been defined.<sup>29</sup> Suspected cases should be referred to a specialist endocrinologist, and management options and possible genetic diagnosis should be considered.<sup>30</sup>

### Gestational diabetes mellitus

Refer to the section '[Gestational diabetes mellitus](#)'.

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## Person-centred care

### Recommendations

Recommendation	Reference	Grade*
To optimise patient health outcomes and health-related quality of life, a person-centred communication style should be used that: <ul style="list-style-type: none"> <li>• uses person-centred and strength-based language</li> <li>• uses active listening</li> <li>• elicits patient preferences and beliefs</li> <li>• assesses literacy, numeracy and potential barriers to care</li> </ul>	1 American Diabetes Association, 2019	B
Care should be aligned with components of the Chronic Care Model (CCM) to ensure productive interactions between a prepared, proactive practice team and an informed, activated patient	1 American Diabetes Association, 2019	A
Care systems should support team-based care, community involvement, patient registries and embedded decision-support tools to meet patient needs	1 American Diabetes Association, 2019	B
Treatment decisions should be timely, based on evidence-based guidelines and tailored to individual patient preferences, prognoses and comorbidities	1 American Diabetes Association, 2019	B
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

### Background: What is person-centred care?

Person-centred care is the holistic treatment of patients based on their assessed clinical condition, considering their individual preferences, priorities and sociocultural contexts.

Studies show that people with diabetes are more likely to engage in self-management and achieve optimal health outcomes if their care plans are person-centred.<sup>2,3</sup>

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

From a position of mutual understanding, using a shared decision-making process (Box 1), management plans can be developed with the patient and tailored to specifically meet their needs, values and choices.

The following are important characteristics of person-centred care:

- care is personalised
- care is coordinated
- care is enabling
- the person is treated with dignity, compassion and respect.

Supporting principles include the following:

- **Partnership:** people are engaged as true partners in their healthcare
- **Compassion and empathy:** healthcare is always delivered with compassion and empathy
- **Trust:** two-way trust is established and maintained
- **Carers and family:** the support and expertise of carers, families and communities is recognised, encouraged and valued
- **Diversity:** diversity is valued, and the different needs of people are understood and provided for
- **Continuous learning:** the person and clinicians strive to continuously improve their knowledge, skills, health literacy and self-management strategies, and foster environments that support ongoing learning

The following key components of person-centred care are discussed in this chapter:

- [self-management](#)
- [patient education](#)
- [health literacy](#)
- [structured multidisciplinary care.](#)

Note that although many of the assessments discussed in this handbook are performed informally during a routine consultation, systems should be developed within the practice to allow appropriate assessment, review and management of individual patients. Some patient-related outcome measures and expectation measures are discussed in an article by [Borg et al \(2019\)](#) and on the [International Consortium for Health Outcomes Measurement \(ICHOM\)](#) website.

For a full recommended structured assessment of the patient with diabetes, refer to the section '[Assessment of the patient with type 2 diabetes](#)'.

### **Box 1. Shared decision-making**

Shared decision-making is a collaborative process between a patient, their doctor and other members of their care team (practice nurses, credentialed diabetes educators, etc) for making treatment decisions. It involves consideration of the evidence, including benefits and harms of treatment, and takes into account the patient's values, preferences and circumstances.<sup>4</sup>

Shared decision-making does not necessarily require the use of decision tools; however, these can be useful.<sup>5</sup> For example, the [ICAN discussion aid](#) is designed for use with chronic conditions. It helps clinicians work with patients to understand their capacity to follow a treatment plan, taking into account factors such as workload and treatment burden.<sup>6</sup>

Other shared decision-making resources can be found at the NSW Health [Agency for Clinical Innovation](#).

## Self-management

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

- understand their condition and various treatment options
- contribute to, review and monitor, a plan of care (eg care plan)
- engage in activities that protect and promote health
- monitor and manage 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 affect the ability of the person to self-manage their diabetes.<sup>7</sup>

Evidence-based, structured self-management training programs are available through the [National Diabetes Services Scheme \(NDSS\)](#).

## My Health Record

My Health Record may help people with type 2 diabetes manage their medical and therapeutic information, and can optimise both emergency and physician care of their diabetes.

## Patient education

Providing education to people with diabetes about their condition and its treatment, including education to support self-management, is an integral part of diabetes care.<sup>8,9</sup> It is important to note that simply providing brochures and other written information is not health education, and is unlikely to change health behaviour. Patients and their carers should be offered a structured, evidence-based education program at the time of diagnosis, with an annual update and review.<sup>10</sup>

In addition to the team members shown in Figure 1, patients can obtain further education and support through Diabetes Australia and the NDSS, or their state or territory diabetes organisation.

Multiple online support and education programs may be available for patients unable to access face-to-face group meetings. However, there are few studies on the individual effectiveness of these programs.<sup>11</sup>

More information is available from:

- [Diabetes Australia](#)
- [NDSS](#)
- [Australian Diabetes Educators Association \(ADEA\)](#).

## Health literacy

Health literacy is defined as an individual's ability to understand and use healthcare information to make decisions and follow instructions for treatment.<sup>12</sup>

A person's degree of health literacy significantly influences their ability to self-manage, participate in shared decision-making and benefit from patient education.

Patients with lower literacy or numeracy skills are at greater risk for poor diabetes outcomes.<sup>13</sup> Literacy and numeracy skills are not always obvious, but GPs may worry that attempting to evaluate them will be uncomfortable or embarrassing for patients. However, this concern is not supported by the evidence.<sup>14</sup> It is appropriate to ask direct questions about a patient's understanding of their medical conditions and to specifically ask what the take-home messages were from a consultation (reflective listening, or 'teach-back').

A patient's health literacy typically improves through self-education and contact with health providers.<sup>14</sup>

Organisations such as [Diabetes Australia](#) provide self-management education and support programs, peer support programs, mental health and diabetes programs, culturally and linguistically appropriate education, and information in several languages. They also have resources to help patients with low literacy skills.

## Structured multidisciplinary care

In a structured care program, a multidisciplinary team of health practitioners provides comprehensive and holistic care to patients, helping them reach individualised health goals.

A multidisciplinary care team allows the patient to benefit from a broad perspective on their health and wellbeing (Figure 1), and can improve clinical outcomes and quality of life.<sup>15</sup> For example, a patient's social difficulties may be detected during a diabetes educator evaluation or by a practice nurse, rather than during a routine medical consultation.

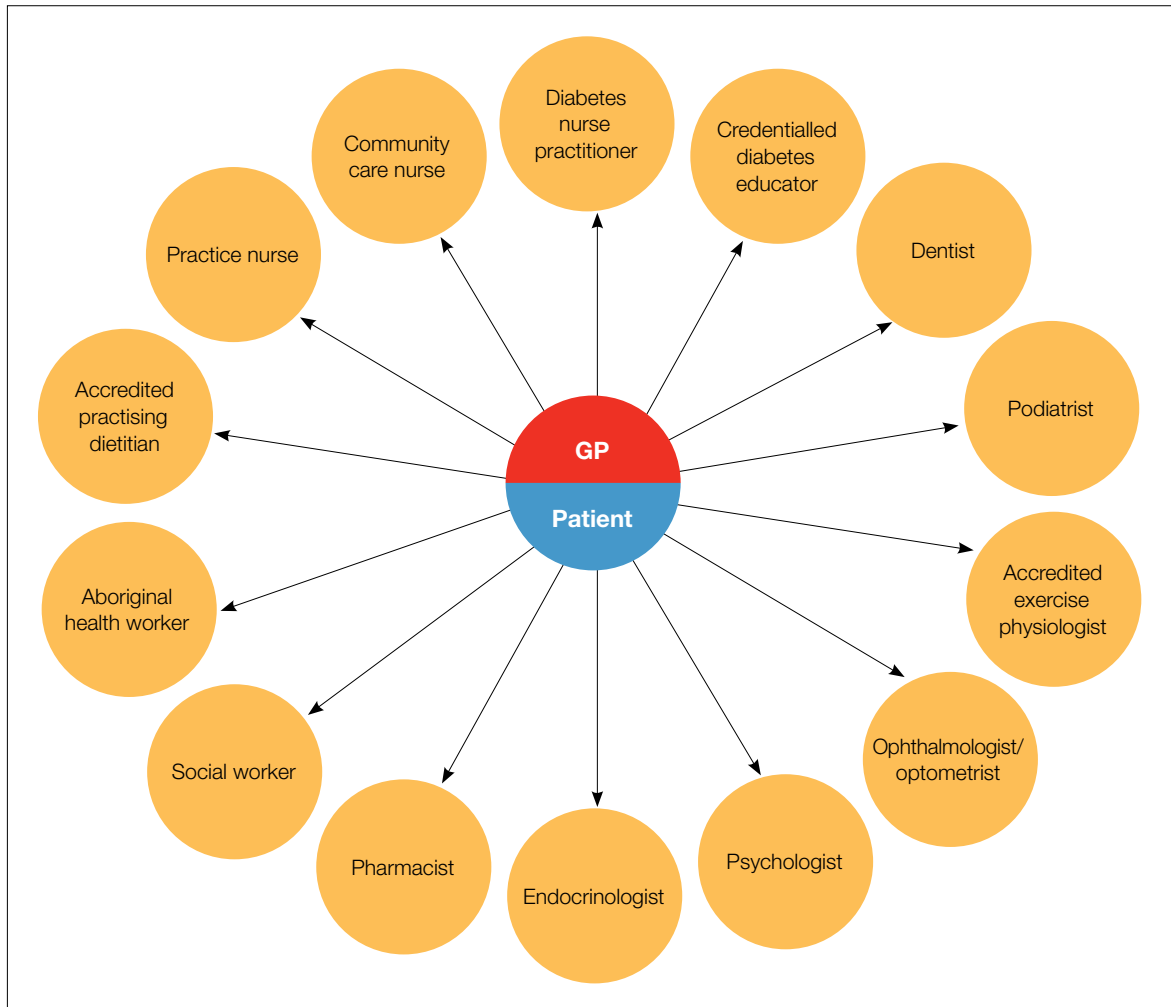
Whatever the composition of the team, care needs to be organised and delivered systematically.

### **Aboriginal and Torres Strait Islander point**

Involvement of an Aboriginal health worker, Aboriginal liaison officer, or Indigenous outreach worker or care coordinator is essential in the care of Aboriginal and Torres Strait Islander people.

Information about Medicare items for allied health referrals can be found on the Australian Government [Department of Health](#) website.

Refer to the section '[Assessment of the patient with type 2 diabetes](#)' for examples of a structured, person-centred care plan.

**Figure 1.** Potential members of the multidisciplinary diabetes care team

## Resources

The **Australian Diabetes Educators Association (ADEA)** website for person-centred care has a number of resources for healthcare professionals, including the '[Person-centred Care Toolkit](#)'.

The Victorian Government **Better Health Channel** has information for patients about [person-centred care](#).

**Diabetes Australia** has a [position statement](#) regarding language and communication with, and about, people with diabetes.

The **Minimally Disruptive Medicine** website has the [ICAN discussion aid](#).

The **National Diabetes Services Scheme (NDSS)** has [resources](#) on more than 40 diabetes topics, many available in over 20 languages.

The **NDSS** has designed an [online course](#) specifically to support people with type 2 diabetes.



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# Assessment of the patient with type 2 diabetes

## Understanding the person: Initial assessment

A detailed assessment of the person with diabetes should be made at diagnosis. The aim of the assessment is to provide a whole-of-person evaluation to determine and understand which factors are affecting the patient's health and quality of life.

Individualised planning for ongoing care should also be developed at this stage, including negotiated goals and expectations.

This assessment should include:

- a full medical and psychosocial history
- appropriate physical assessment
- assessment for complications and cardiovascular risk status
- investigations where required.

A comprehensive list of assessment components, including intervals of assessment, is provided in tables 1–3. Refer also to Box 1 for the Medicare Benefits Schedule (MBS) diabetes 'cycle of care' minimum requirements. Suggestions for which members of the multidisciplinary team should carry out components of assessment are shown in Table 4.

### Aboriginal and Torres Strait Islander point<sup>1</sup>

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.

Developing a doctor–patient (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.

## What needs ongoing assessment?

The purpose of ongoing structured assessment is to determine the impact of care and diabetes on the life of the person with diabetes. Ongoing assessment appointments should include:

- a history and examination to assess the impact of clinical management (Table 1)
- review and re-evaluation of the person's diabetes goals, individualised targets and risk factors (Table 2)
- refining of the management plan (including a review of medication using the principles of the 'review rule' (refer to the section '[Medical management of glycaemia](#)').

Specific areas for ongoing or intermittent review might include:

- patient support, such as structured education about self-management (eg with a credentialled diabetes educator)
- emotional issues, including diabetes-specific distress and/or depressive symptoms
- need for allied health/specialist intervention (eg psychologist, accredited practising dietitian)
- pregnancy planning and contraception
- other diabetes-related issues (eg risks and complications) identified earlier
- medication/therapy
- review every three or six months, following the principles of the 'review rule' (refer to the section '[Medical management of glycaemia](#)')
  - adjust agent, dose, combination or de-prescribe
  - if necessary, specifically ask about symptoms of hypoglycaemia
- complication management – is specific intervention/support/referral indicated?

Measure glycated haemoglobin (HbA1c) on an individual basis:

- three-monthly in newly diagnosed patients, patients undergoing therapeutic changes or those whose HbA1c is outside their individualised target range
- less frequently, if appropriate, in stable patients who have reached agreed targets.

Base further investigations on re-evaluated clinical symptoms and history.

Routine investigations are best organised before the review appointment.

## What should be assessed yearly?

The annual review is an opportunity to coordinate care. It may involve:

- detailed assessment
- updating the problem priority list
- re-establishing goals
- checking agreed arrangements for management.

Additionally, general practitioners (GPs) should:

- renew team care planning with identified specific interventions
- work with the patient to identify therapeutic management changes and additional education goals
- organise appropriate referral where clinically necessary. Some patients may require ongoing specialist or other allied health reviews.

## The diabetes cycle of care

### Box 1. Medicare Benefits Schedule (MBS) diabetes 'cycle of care' minimum requirements<sup>2</sup>

At least six-monthly:

- Measure weight, height and body mass index (BMI)
- Measure blood pressure
- Assess feet for complications

At least annually:

- Review and discuss diet, physical activity, smoking status, medications (need for more frequent review should be individualised, as outlined in Table 1)
- Assess diabetes management by measuring HbA1c
- Review and discuss complication prevention – eyes, feet, kidneys cardiovascular disease (CVD)
- Measure total cholesterol, triglycerides and high-density lipoprotein (HDL) cholesterol
- Assess for microalbuminuria

At least every two years:

- Comprehensive eye examination (more frequently for those at high risk)

**Table 1. Medical history and ongoing assessments for the person with type 2 diabetes**

Components for assessment	Assessment interval		
	Initial	Ongoing	Annual
<b>Diabetes-specific assessments</b>			
Age/year of diagnosis	✓		
Symptoms <ul style="list-style-type: none"> <li>• Hypoglycaemic</li> <li>• Hyperglycaemic: <ul style="list-style-type: none"> <li>– polyuria, polydipsia, polyphagia, weight loss, nocturia</li> </ul> </li> <li>• Sequelae of hyperglycaemia and complications of diabetes: <ul style="list-style-type: none"> <li>– malaise/fatigue</li> <li>– neurological and autonomic symptoms</li> <li>– altered vision</li> <li>– bladder and sexual dysfunction</li> <li>– foot and toe numbness and pain</li> <li>– recurrent infections (especially urinary and skin with delayed wound healing)</li> <li>– gastrointestinal dysfunction (such as gastroparesis and nausea)</li> <li>– poor dental hygiene and gingivitis (refer to the section '<a href="#">Managing multimorbidity in people with type 2 diabetes</a>')</li> </ul> </li> </ul>	✓	Three-monthly or individualised	✓
<b>Predisposing factors</b>			
Pancreatic disease, Cushing's disease, obstructive sleep apnoea Medications (eg corticosteroids, antipsychotics; refer below) Autoimmune diseases (eg hypothyroidism or hyperthyroidism)	✓	Individualised	

Table 1. Medical history and ongoing assessments for the person with type 2 diabetes (cont)			
Components for assessment	Assessment interval		
	Initial	Ongoing	Annual
<b>Other medical history</b>			
Gestational diabetes	✓		
Other secondary causes (eg pancreatic disease)	✓		
Multimorbidities <ul style="list-style-type: none"> <li>• Overweight and obesity</li> <li>• Hypertension</li> <li>• Hyperlipidaemia</li> <li>• CVD</li> </ul>	✓	Three-monthly or individualised	✓
Specialist care <ul style="list-style-type: none"> <li>• Current or past surgical history</li> </ul>	✓	Three-monthly or individualised	✓
Complications <ul style="list-style-type: none"> <li>• Eye</li> </ul>	✓		Every two years; more frequently for <b>those at high risk</b>
Complications <ul style="list-style-type: none"> <li>• Kidney</li> <li>• Feet – discuss appropriate footwear, etc</li> <li>• Other</li> </ul>	✓		✓
<b>Family history</b>			
<ul style="list-style-type: none"> <li>• Haemochromatosis</li> </ul>	✓		
<ul style="list-style-type: none"> <li>• Gestational diabetes</li> </ul>	✓	Individualised	
<b>Psychosocial history</b>			
Lifestyle <ul style="list-style-type: none"> <li>• Physical activity</li> <li>• Smoking</li> <li>• Diet</li> </ul>	✓		✓
Emotional and mental health <ul style="list-style-type: none"> <li>• Using tools (refer to the section '<a href="#">Mental health and type 2 diabetes</a>')</li> <li>• Health literacy</li> <li>• Social support network</li> </ul>	✓	Individualised	✓
<b>Medications</b>			
Past and current medications Complementary therapies	✓	Individualised	✓
Other therapy, glucose monitoring and technology <ul style="list-style-type: none"> <li>• Role of routine and non-routine SMBG</li> <li>• Use of technology</li> </ul>	✓		✓
<b>Immunisations*</b>			
Influenza Pneumococcal Tetanus			

Table 1. Medical history and ongoing assessments for the person with type 2 diabetes (cont)			
Components for assessment	Assessment interval		
	Initial	Ongoing	Annual
<b>Pregnancy and contraception</b>			
Pregnancy planning Contraceptive use	✓	Individualised	✓
<b>Other</b>			
Assess where applicable <ul style="list-style-type: none"> <li>• NDSS enrolment and services</li> <li>• Driving (interval depends on <a href="#">Assessing fitness to drive guidelines</a>)</li> <li>• Occupational factors</li> <li>• Diving</li> </ul>	✓	Individualised	✓
<p><i>CVD, cardiovascular disease; NDSS, National Diabetes Services Scheme; SMBG, self-monitoring of blood glucose</i></p> <p>*For more information, refer to the discussion of 'Immunisations' in the section '<a href="#">Managing risks and other impacts of type 2 diabetes</a>'.</p>			

Table 2. Medical examinations to assess the person with type 2 diabetes			
Components for examination	Examination intervals		
	Initial	Ongoing	Annual
<b>Physical</b>			
General <ul style="list-style-type: none"> <li>• BMI</li> <li>• Waist circumference (cm)</li> <li>• Blood pressure</li> <li>• Central and peripheral vascular systems</li> <li>• Absolute CVD risk assessment (this may require calculation and investigations)</li> </ul>	✓	Three-monthly or individualised	✓
Complications of diabetes <ul style="list-style-type: none"> <li>• Feet – stratify the risk of developing foot complications (refer to the section '<a href="#">Microvascular complications: Foot care</a>') – sensation and circulation, skin condition, pressure areas, interdigital problems, abnormal bone architecture</li> <li>• Peripheral nerves – tendon reflexes, sensation (touch [eg 10 g monofilament] and vibration [eg 128 Hz tuning fork]), existence of peripheral neuropathic changes</li> <li>• Heart – ECG for symptomatic disease or dysrhythmia</li> <li>• Sexual dysfunction – both male and female sexual dysfunction</li> <li>• Eyes – acuity, retinopathy, etc (refer to the section '<a href="#">Microvascular complications: Diabetes-related eye disease</a>')</li> <li>• Skin – for example, lipohypertrophy or dystrophy, acanthosis nigricans, mycotic infections</li> </ul>	✓	Three-monthly or individualised	✓ (Eyes every two years)
<b>Psychological</b>			
Depressive symptoms <ul style="list-style-type: none"> <li>• PHQ-2</li> <li>• If PHQ-2 score <math>\geq 3</math>, progress to PHQ-9</li> </ul> Diabetes distress <ul style="list-style-type: none"> <li>• Problem Areas in Diabetes (PAID)</li> <li>• Diabetes Distress Scale (DDS)</li> </ul> Refer to the section ' <a href="#">Mental health and type 2 diabetes</a> '	✓	Six-monthly or individualised	✓
<i>BMI, body mass index; CVD, cardiovascular disease; ECG, electrocardiogram</i>			

Table 3. Investigations for diabetes and multimorbidity			
Components for assessment	Assessment interval		
	Initial	Ongoing	Annual
<b>HbA1c</b>	✓	Three- to six-monthly	✓
<b>Lipids</b> LDL-c, HDL-c, TC, TG	✓	Six-monthly	✓
<b>Urinalysis</b> <ul style="list-style-type: none"> <li>Urine ACR at least annually:                             <ul style="list-style-type: none"> <li>microalbuminuria ACR <math>\geq 2.5</math> mg/mmol (men) or <math>\geq 3.5</math> mg/mmol (women), or albumin concentration <math>\geq 20</math> mg/L</li> <li>proteinuria (macroalbuminuria) ACR <math>\geq 25</math> mg/mmol (men) or <math>\geq 35</math> mg/mmol (women)</li> </ul> </li> </ul>	✓	Individualised	✓
<b>eGFR</b> <ul style="list-style-type: none"> <li>Normal levels are reported as <math>&gt;90</math> mL/min/1.73m<sup>2</sup>, and as specific values below; refer to the section 'Microvascular complications: Nephropathy' for criteria of CKD stages</li> </ul>	✓	Individualised if abnormal	✓
<b>Other</b> as appropriate for symptomatic presentation or existence of comorbidity or multimorbidity (eg B12 deficiency if on prolonged metformin therapy)			

*ACR, albumin-to-creatinine ratio; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HDC, high-density lipoprotein cholesterol; LDC, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglyceride*

Table 4. Suggested actions and health professionals to provide treatment or service	
Suggested actions	Suggested team resource – Who?*
<b>Ask</b>	
Symptoms	GP
Goal-setting supporting self-management	GP/practice nurse/CDE
Cardiovascular issues (eg BP measurement)	GP/practice nurse
Glycaemic control	GP/practice nurse/CDE
<b>Assess (inclusive within an annual cycle of care)</b>	
Risk factors for modification	GP/practice nurse/CDE
Weight, height	GP/practice nurse
Cardiovascular disease risk assessment	GP/practice nurse
Foot examination	GP/podiatrist/practice nurse

<b>Table 4. Suggested actions and health professionals to provide treatment or service (cont)</b>	
<b>Suggested actions</b>	<b>Suggested team resource – Who?*</b>
Presence of other complications, especially hypoglycaemia risk with insulin or sulfonylureas	GP/practice nurse/endocrinologist
Psychological status	GP/psychologist
Eye examination	GP/optometrist/ophthalmologist
Dental review	GP/dentist
Consider other assessments where appropriate (eg cognitive impairment, obstructive sleep apnoea)	GP/endocrinologist/other specialist (where indicated)
<b>Advise</b>	
Review smoking, nutrition, alcohol, physical activity (SNAP) profiles, including specific issues	GP/practice nurse/CDE
Nutrition	GP/APD
Physical activity levels	GP/AEP/physiotherapist
Pregnancy planning and contraception, including NDSS six-month blood glucose strip access	GP/endocrinologist/obstetrician/CDE/APD
Driving	GP/endocrinologist/other specialist
Immunisation	GP/practice nurse/CDE
Sick day management	GP/practice nurse/CDE
Medication issues	GP/pharmacist/CDE/endocrinologist
Self-monitoring blood glucose	GP/CDE/practice nurse
Insulin/injectable management	GP/CDE/registered nurse/accredited nurse practitioner/endocrinologist
Psychological issues	GP/practice nurse/CDE/psychologist
<b>Assist</b>	
Register for NDSS	GP/CDE/nurse practitioner
NDSS six-month blood glucose strip access, as appropriate, for people not on insulin, particularly during pregnancy planning	GP/CDE/nurse practitioner
General practice management plan and chronic disease management plan	GP/practice nurse
Cultural and psychosocial issues	GP/Aboriginal health worker/social worker/CDE/psychologist
<b>Arrange</b>	
Addition to the practice's 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)
<p><i>AEP, accredited exercise physiologist; APD, accredited practising dietitian; BP, blood pressure; CDE, credentialed diabetes educator; GP, general practitioner; NDSS, National Diabetes Services Scheme</i></p> <p>*An Aboriginal health worker is recommended to assist with all actions regarding Aboriginal and Torres Strait Islander people.</p>	



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# Preventing progression to type 2 diabetes

## Recommendations

Recommendation	Reference	Grade*
People with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) should be referred to lifestyle intervention programs to: <ul style="list-style-type: none"> <li>• achieve and maintain a 7% reduction in weight</li> <li>• increase moderate-intensity physical activity to at least 150 minutes per week</li> </ul>	1 American Diabetes Association, 2019	A
People with glycosylated haemoglobin (HbA1c) 6.0–6.4% may also benefit from a structured weight loss and exercise program to reduce their risk of developing type 2 diabetes	2 Diabetes Canada, 2018	D, consensus

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

## Clinical context

### Defining risk

Risk factors for type 2 diabetes include:<sup>3</sup>

- demographic and social factors – age, family history, ethnicity
- lifestyle factors – obesity, physical inactivity, smoking
- clinical history – high blood pressure, high triglycerides and low high-density lipoprotein cholesterol (HDL-C), gestational diabetes, heart disease, stroke, depression, polycystic ovary syndrome, acanthosis nigrans and non-alcoholic fatty liver disease
- medications – including corticosteroids and antipsychotic medications.

Clinicians should be alert to the possibility of type 2 diabetes in patients with these risk factors, many of which are also risk factors for cardiovascular disease (CVD).

The 'metabolic syndrome' (defined by the presence of at-risk measures for waist circumference, triglycerides, HDL-C, blood pressure and fasting glucose<sup>4</sup>) confers a three- to five-fold risk of type 2 diabetes as well as an increased risk for CVD.<sup>5</sup>

Patients with non-alcoholic fatty liver are at twice the risk of developing type 2 diabetes.<sup>6</sup>

Particular population groups are also at greater risk, such as people with Pacific Islander, Southern European or Asian backgrounds (refer to the discussion of 'Who is at risk of type 2 diabetes?' in the section '[Defining and diagnosing type 2 diabetes](#)'). Aboriginal and Torres Strait Islander peoples have more than three times the prevalence of type 2 diabetes compared with the wider population.<sup>7</sup> Waist circumference has been found to be a strong predictor of the risk of developing type 2 diabetes, especially in Aboriginal women.<sup>8</sup> Prevention programs that are culturally appropriate for Aboriginal and Torres Strait Islander peoples have been implemented successfully, although evidence for their effectiveness is limited – refer to Chapter 12 of The Royal Australian College of General Practitioners' [National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people \(3rd edition\)](#).

Other groups particularly at high risk of developing type 2 diabetes are people with impaired fasting glucose (IFG), impaired glucose tolerance (IGT) or gestational diabetes.<sup>9,10</sup> Refer to the section '[Defining and diagnosing type 2 diabetes](#)' for definitions of these states.

### Progression to type 2 diabetes in people at high risk

About 5–10% of people at high risk develop diabetes annually.<sup>11</sup> Three quarters of people with IFG or IGT will develop type 2 diabetes over their lifetime.<sup>12</sup> People with IFG or IGT whose glucose metabolism returns to normal, either as a result of interventions or spontaneously, have roughly half the risk of developing type 2 diabetes compared with those who are persistently abnormal.<sup>13</sup>

Women with a history of gestational diabetes have approximately a seven-fold elevated risk of future development of type 2 diabetes.<sup>10,14–16</sup>

### Evidence for lifestyle interventions to prevent type 2 diabetes

In randomised controlled trials, intensive lifestyle interventions have been shown to reduce the rates of progression to type 2 diabetes by 27–45% over periods ranging from 10 to 23 years.<sup>17</sup> It remains unclear whether diabetes lifestyle intervention directly reduces complication-related morbidity and mortality.<sup>18</sup>

People at high risk of type 2 diabetes should also be offered lifestyle interventions to help them increase physical activity to at least 150 minutes per week, and to achieve and maintain a 7% reduction in weight. This may involve individual or group education and coaching.

In women with a history of gestational diabetes, beginning lifestyle interventions soon after pregnancy has been shown to reduce the incidence of type 2 diabetes by 25%.<sup>19</sup>

### Other interventions

There is evidence that, in high-risk patients, metformin reduces the relative risk of developing type 2 diabetes by approximately 25%, and also reduces progression to renal and eye complications.<sup>20,21</sup> However, metformin is not licensed by the Therapeutic Goods Administration for this use in Australia.

There have been no randomised controlled trials of the effect of bariatric surgery on preventing progression to type 2 diabetes.

## In practice

### Identifying people at high risk of type 2 diabetes

Identifying risk factors for type 2 diabetes is a routine part of general practice. The RACGP's [Guidelines for preventive activities in general practice \(9th edition\)](#) recommend assessing body mass index (BMI), waist circumference, diet and physical activity in adults every two years. Screening for diabetes risk with the Australian type 2 diabetes risk assessment tool (AUSDRISK) is recommended in all adults aged ≥40 years every three years.<sup>22</sup>

Refer to the section '[Defining and diagnosing type 2 diabetes](#)' for information about assessing diabetes risk and screening recommendations for diabetes, IFG and IGT.

### Interventions to manage diabetes risk

Patients at high risk of type 2 diabetes are also at increased risk of cardiovascular disease. Their cardiovascular risk should thus be assessed, and lifestyle change and medications considered where appropriate.<sup>23</sup> Refer to the section '[Type 2 diabetes and cardiovascular risk](#)'.

Particular lifestyle interventions have been shown to reduce the risk of type 2 diabetes in people with IGT, but not people with IFG alone. These interventions are of moderate intensity; for example, at least 16 sessions of 1–2 hours focusing on diet and physical activity delivered over six months by a range of health professionals. Patients should achieve at least 150 minutes per week of physical activity<sup>24</sup> and a low-energy diet rich in fruit, vegetables and fibre, and low in meat and fat.

Maintaining lifestyle change, especially weight loss, in high-risk patients can be difficult. Technology-assisted modalities, including ‘apps’ that support change in diet and physical activity, activity trackers and websites providing information and referral options, are promising for helping people maintain physical activity and weight loss.<sup>25</sup>

Intensive lifestyle intervention may be beyond the scope of the brief interventions routinely delivered in general practice or practice nurse consultations, or even by those delivered through allied health visits as part of a care plan. Patients might therefore benefit from referral to a diabetes prevention program. A list of state-based diabetes prevention programs can be found on the [Diabetes Australia](#) website.

Telephone coaching programs run by state and territory governments and health insurance funds have also shown promising results.<sup>26</sup>

Refer to the RACGP's [Smoking, nutrition, alcohol, physical activity \(SNAP\)](#) guide for more information.

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## Early-onset type 2 diabetes

### Recommendations

Recommendation	Reference	Grade*
All children, adolescents and young adults (aged <25 years) with type 2 diabetes should be referred to an endocrinologist or, if not accessible, a specialist physician with an interest in diabetes	RACGP Diabetes Handbook working groups, 2020	Consensus
For people aged ≥25 years with early-onset type 2 diabetes, due to the complexity of management and higher risk of complications, consider timely referral to an endocrinologist and/or management through a shared care arrangement	RACGP Diabetes Handbook working groups, 2020	Consensus

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

### Clinical context

In recent years there has been an increase in the incidence and prevalence of type 2 diabetes in children, adolescents and young adults.<sup>1,2</sup> This early-onset (also called 'young-onset') type 2 diabetes is concerning, as it results in a longer lifetime exposure to hyperglycaemia and the consequent complications. There is also emerging evidence that early-onset type 2 diabetes is a more aggressive disease compared with later-onset type 2 diabetes, and is accompanied by earlier onset and more rapid progression of macrovascular and microvascular complications.<sup>2-4</sup>

### Definitions and diagnosis

Early-onset type 2 diabetes is usually defined as occurring under the age of 40 years. This can be further separated into child and adolescent (<18 years) and young adult (<25 years). However, there is no consistency of definitions across the literature, especially of the upper age limit. Although this handbook refers only to the young adult group, there is clearly a continuum across the age groups.

Unlike older-onset type 2 diabetes, this group can offer a diagnostic challenge for general practitioners (GPs) to differentiate between type 1 diabetes, latent autoimmune disease of adults, type 2 diabetes and maturity-onset diabetes of the young (MODY; Table 1). Careful diagnostic assessment is required, as this has a major impact on management and outcome.<sup>5</sup>

For children and adolescents, hyperglycaemia (at levels diagnostic of diabetes) can be a medical emergency, and immediate referral to an emergency department or, if not available, urgent consultation with a specialist is strongly recommended. Refer to The Royal Australian College of General Practitioners' (RACGP's) [Emergency management of hyperglycaemia in primary care](#) for more information.

<b>Table 1. Comparison of type 1 diabetes, type 2 diabetes and maturity-onset diabetes of the young (MODY)<sup>5-7</sup></b>			
	<b>Type 1 diabetes</b>	<b>Type 2 diabetes</b>	<b>MODY</b>
<b>Proportion of cases of diabetes onset at young age</b>	In general population: >90%	In general population: <10% Among Aboriginal and Torres Strait Islander peoples: 89% (20–29 years) 97% (30–39 years) More prevalent in young people of Pacific Islander, Hispanic or Asian background	1–3%
<b>Clinical features</b>			
Usual onset	Acute	Insidious	Variable
Osmotic symptoms	Pronounced	Often not present, but can be severe in some cases	Variable
Ketosis	Usually present	Unlikely to be present (except in people of Afro-Caribbean origin)	Common in neonatal forms; rare in others
Obesity	Can co-exist as per general population	Often obese – up to 85%	Usually not obese
Signs of insulin resistance (eg acanthosis nigricans)	Rare	Often present	Rare
<b>Family history in parents</b>	2–4%	80%	90%
<b>Diagnostic aid biomarkers</b>			
Antibodies	IAA, ICA, GAD, IA-2, IA-2 $\beta$ , or ZnT8 antibodies present in 85–95% of cases	Usually not present	Not present
C-peptide	Below normal range (<0.2 nmol/L) <sup>8</sup>	Normal or above normal range (>0.2 nmol/L) <sup>8</sup>	Normal

## Screening and risk factors

Risk factors for early-onset type 2 diabetes include overweight/obesity, sedentary behaviour, lower socioeconomic status, ethnicity (eg Australian Aboriginal and Torres Strait Islander peoples, Pacific Islander, Hispanic, Asian peoples), a strong family history of type 2 diabetes, previous gestational diabetes, in utero exposure to type 2 diabetes and low birth weight. The risk is also significantly higher in women diagnosed with polycystic ovary syndrome.<sup>2,5,9</sup>

There are no specific tools currently available for screening or early detection of early-onset type 2 diabetes, other than maintaining a high index of suspicion, especially in high-risk groups.

## Treatment challenges

Compared with late-onset type 2 diabetes, the early-onset group is more likely to have sub-optimal glycaemic control, diastolic hypertension, earlier need to initiate insulin, and a greater burden of diabetes-related complications (Box 1), resulting in a reduced quality of life, greater morbidity and premature mortality.

In early-onset type 2 diabetes, life expectancy is reduced by 14 years in males and 16 years in females compared with their non-diabetic cohort.<sup>2</sup> An Australian study showed 11% mortality over 20 years in a cohort of young adults diagnosed between 15 and 30 years of age.<sup>10</sup>

### Box 1. Complications in early-onset type 2 diabetes compared with older-onset type 2 diabetes<sup>2,9</sup>

Lifetime risk of complications greater with onset at a younger age

Life expectancy reduced

Non-alcoholic fatty liver disease is twice as common

Earlier onset of microalbuminuria and end-stage renal failure

Earlier onset and greater prevalence of diabetic retinopathy

Earlier onset of neuropathy

Apolipoprotein B concentration is higher despite statin therapy

Risk of myocardial infarction is 14 times higher compared with age cohort, while older-onset type 2 diabetes risk is 2–4 times higher

Early-onset of diastolic myocardial dysfunction

Reduced fertility, and greater pregnancy complications

Risk of premature decline in cognitive function

Higher rate of diabetes-related psychological distress and psychological issues, especially depression

Limited work capacity and consequent socioeconomic impact

Reduced quality of life

## In practice

Treatment of early-onset type 2 diabetes is limited by a lack of evidence, and current recommended treatment strategies are extrapolated from the evidence base for older-onset type 2 diabetes.<sup>5</sup>

Structured education is fundamental to long-term self-care. However, there are obstacles in engaging young adults, including a lack of specific programs for their needs and higher rates of diabetes-related distress, depression and other socioeconomic issues that may adversely impact their participation.

Lifestyle changes, including weight loss and exercise, are recommended as first-line therapy. However, limited studies are available to inform management. While lifestyle changes can provide benefits, emerging evidence suggests these changes are not maintained once the program ceases, and there is no evidence that the period of benefit provides any protection against future cardiovascular disease. Limited data suggest that metabolic surgery may be a treatment option for some.<sup>9</sup>



Use of glucose-lowering medication is generally extrapolated from management algorithms for older-onset type 2 diabetes patients. There is a paucity of data, especially with the newer therapies, in people aged <18 years. It is likely that early-onset type 2 diabetes patients will require early initiation of insulin.<sup>5</sup>

Treatments to address cardiovascular risk factors are again based on evidence from older patient groups. To reduce lifetime risk of coronary heart disease, early and aggressive treatment of cardiovascular risk factors in young people with type 2 diabetes is recommended;<sup>9,11</sup> however, there is evidence that use of cardioprotective treatments, such as statins and anti-hypertensive medication, in the younger age group is suboptimal.<sup>2</sup> This might be due to reluctance by doctors to prescribe such lifelong therapies to younger people, especially women,<sup>9</sup> and the fact that cardiovascular risk calculators are reliable in older age groups only.

Adherence to medication and follow-up is also a problem in younger age groups. This can be a challenge for adequate management, and it emphasises the need for education and for healthcare providers to ensure they provide accessible, patient-centred, coordinated and continuous effective care during this period.

Pre-pregnancy counselling and/or contraception is imperative in this age group to offset preventable diabetes-related pregnancy and fetal complications (refer to the section '[Type 2 diabetes, reproductive health and pregnancy](#)').

It is recommended that all child, adolescent and young-adult (aged <25 years) patients with type 2 diabetes be referred to an endocrinologist or, if not accessible, a specialist physician with an interest in diabetes. For patients aged ≥25 years with early-onset type 2 diabetes, consider referral and/or shared care, as management can be difficult and there is a high burden of complications.

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## Lifestyle interventions for management of type 2 diabetes

Once diagnosed, in some patients, type 2 diabetes can be managed with diet and physical activity alone.<sup>1,2</sup> In more advanced stages of type 2 diabetes, lifestyle interventions continue to play an important role in managing glycaemia and cardiovascular disease (CVD) risk, and may be supported by allied health and specialist support services.

### Recommendations

Recommendation	Reference	Grade*
<b>Physical activity</b>		
<b>Children and adolescents</b> with type 1 or type 2 diabetes or at high risk of type 2 diabetes should engage in 60 min/day or more of moderate- or vigorous-intensity aerobic activity, with vigorous muscle-strengthening and bone-strengthening activities at least three days/week	3 American Diabetes Association, 2019	C
Most <b>adults</b> with type 2 diabetes should engage in 150 minutes or more of moderate-to-vigorous intensity aerobic activity per week, spread over at least three days/week, with no more than two consecutive days without activity	3 American Diabetes Association, 2019	B
Additionally, adults with type 2 diabetes should engage in resistance exercise: <ul style="list-style-type: none"> <li>• 2–3 sessions/week on non-consecutive days</li> <li>• for a total of at least 60 minutes per week</li> </ul>	3 American Diabetes Association, 2019 4 Exercise & Sports Science Australia, 2012	B  Consensus
All adults, particularly those with type 2 diabetes, should decrease the amount of time spent in daily sedentary behaviour	3 American Diabetes Association, 2019	B
Prolonged sitting should be interrupted every 30 minutes for blood glucose benefits, particularly in adults with type 2 diabetes	3 American Diabetes Association, 2019	C
Flexibility training and balance training are recommended 2–3 times/week for older adults with diabetes; yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength and balance	3 American Diabetes Association, 2019	C
<b>Diet</b>		
Consumption of cereal foods (especially three serves/day of wholegrains) is associated with reduced risk of type 2 diabetes	5 NHMRC, 2013	B
Consumption of at least 1.5 serves/day of dairy foods (eg milk, yoghurt, cheese) is associated with reduced risk of type 2 diabetes	5 NHMRC, 2013	C

Recommendation	Reference	Grade*
<b>Weight</b>		
In people with overweight or obesity with diabetes, a nutritionally balanced, calorie-reduced diet should be followed to achieve and maintain a lower, healthier body weight	6 Diabetes Canada, 2018	A, level 1A
An intensive healthy behaviour intervention program, combining dietary modification and increased physical activity, may be used to achieve weight loss, improve glycaemic control and reduce CVD risk	6 Diabetes Canada, 2018	A, level 1A
Weight management medication may be considered in people with diabetes and overweight or obesity to promote weight loss and improved glycaemic control	6 Diabetes Canada, 2018	A, level 1A
Metabolic surgery should be recommended to manage type 2 diabetes: <ul style="list-style-type: none"> <li>• in people with a body mass index (BMI) <math>\geq 40</math> kg/m<sup>2</sup></li> <li>• in people with a BMI 35.0–39.9 kg/m<sup>2</sup> when hyperglycaemia is inadequately controlled by lifestyle and optimal medical therapy</li> </ul>	7 Diabetes Surgery Summit, 2016	Consensus
Metabolic surgery should also be considered for patients with type 2 diabetes and BMI 30.0–34.9 kg/m <sup>2</sup> if hyperglycaemia is inadequately controlled despite optimal treatment with either oral or injectable medications	7 Diabetes Surgery Summit, 2016	Consensus
<b>Smoking cessation</b>		
All people who smoke should be offered brief advice to quit smoking	8 RACGP, 2020	Strong recommendation; high certainty
<b>Alcohol consumption</b>		
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	9 Scottish Intercollegiate Guidelines Network, 2017	B
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Physical activity

### Clinical context

Physical activity is one of the cornerstones of diabetes management. Regular physical activity of any kind can have a favourable impact on glycaemic control, CVD risk and overall mortality.<sup>6</sup> However, more structured, specialised and individualised exercise prescription can achieve superior benefits.<sup>10</sup>

The goal is for patients with diabetes, impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) to accumulate a minimum of 210 minutes per week of moderate-intensity exercise (or 125 minutes per week of vigorous-intensity exercise), with no more than two consecutive days without training. This weekly total should include at least two moderate-to-vigorous resistance training sessions for a total of at least 60 minutes. These exercise amounts will establish and maintain muscular fitness and aerobic capacity.<sup>4</sup>

It is recommended to refer patients with type 2 diabetes to an accredited exercise physiologist for the prescription of a safe and effective exercise intervention.

## Aerobic exercise

In people with type 2 diabetes, aerobic exercise (eg walking, cycling, swimming) reduces HbA1c, triglycerides, blood pressure and insulin resistance.<sup>10</sup>

Aerobic exercise intensity can be set as a percentage of estimated maximal heart rate ( $HR_{max}$ ) using the equation  $208 - 0.7 \times \text{age} [\text{years}]$ .<sup>11,12</sup> For moderate intensity, 55–69% of  $HR_{max}$  and for vigorous intensity 70–89% of  $HR_{max}$  can be used.<sup>4</sup>

Alternatively, 'moderate'-intensity aerobic exercise is defined on rate of perceived exertion (RPE) scales as 'somewhat hard', and 'vigorous' as 'hard'. Using the talk/sing test, a person is doing moderate-intensity exercise when they can comfortably talk but can't sing, and vigorous is when they are unable to talk comfortably.

## Resistance exercise

Resistance, or strength, training involves activity such as using free weights, resistance machines or body weight. 'Moderate-to-vigorous' resistance training can be defined as 2–4 sets of 8–10 repetitions of 8–10 exercises, with rest intervals of 1–2 minutes.<sup>4</sup>

Resistance training reduces HbA1c, although to a lesser degree than aerobic exercise.<sup>13</sup> However, combining aerobic and resistance training appears to be superior compared with either alone.<sup>14</sup> Both types reduce CVD markers similarly,<sup>13</sup> and a single bout of either may have a similar acute effect.<sup>15</sup>

## In practice

When advising patients about physical activity, general practitioners (GPs) should:

- emphasise that some physical activity is better than none<sup>10</sup>
- discuss the importance of reducing sedentary behaviour – advise patients to interrupt prolonged sitting every 30 minutes for blood glucose benefits
- explore the risks and benefits of different forms of physical activity for the individual, taking into account whether the patient is already physically active
- explain the importance of varying intensity of exercise levels
- explain the importance of following the chest pain/discomfort and/or diabetes symptom management plan.<sup>16</sup>

## Pre-exercise health assessment

Asymptomatic sedentary people with diabetes who wish to undertake low-to-moderate activity should have CVD assessment as part of usual diabetes care; however, those identified as having CVD risk on screening tools, or who have existing atherosclerotic or functional cardiovascular disease, may require more specific physical assessment prior to engaging in moderate- to high-intensity exercise. Existence of diabetes complications may require specific advice – refer below.

When prescribing a physical activity program, the GP should take a careful history and be aware of the following:

- 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.
- For patients with hypertrophic obstructive cardiomyopathy, heavy weightlifting and high-intensity aerobic exercise are not recommended.<sup>17</sup>
- For patients with long QT syndrome, exercise may trigger a cardiac arrhythmic event.<sup>17</sup>

- Vigorous exercise is contraindicated for those with proliferative retinopathy, and for three months after laser retinal treatment.<sup>17</sup>
- Exercise may be relatively contraindicated in patients with peripheral neuropathy, a history of recurrent falls or uncontrolled hypertension.<sup>17</sup>
- A foot assessment should be carried out and patients advised about the importance of appropriate footwear during exercise.
- Referral to an accredited exercise physiologist is recommended.

Any symptoms suggestive of CVD need to be actively investigated.

### Safety advice during and after exercising

People with diabetes should 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 under appropriate clinical supervision.

### Managing blood glucose levels

People using insulin or sulfonylureas (or combinations including these) need to be aware of potential delayed effects of physical activity on blood glucose levels (BGLs) – in particular delayed hypoglycaemia. Post-exercise hypoglycaemia can occur 12–15 hours after exercise, but is still a risk up to 48 hours after cessation of activity.<sup>10</sup>

Advise patients on how to recognise, prevent or manage hypoglycaemic events, including potential post-exercise hypoglycaemia (Box 1). Clinical advice should be given to all patients to stop physical activity if they experience symptoms of hypoglycaemia and to discontinue further physical activity until reviewed by their GP or other health professional.

#### Box 1. Advice for patients to recognise, prevent or manage glycaemic events when exercising

- Do not begin exercising if you have experienced a hypoglycaemic event within the previous 24 hours that required assistance from another person to treat (**severe hypoglycaemia**) or if you are feeling unwell.
- Check BGLs before and during exercise, especially if using insulin or sulfonylureas; check every 30–45 minutes during exercise, and adjust medication and carbohydrate intake as appropriate.<sup>18</sup>
- The ideal pre-exercise range for blood glucose is 5.0–13.9 mmol/L.<sup>10</sup>
- If pre-exercise BGL is <5 mmol/L, and you are taking insulin or a sulfonylurea, you are at risk of a hypoglycaemic episode during or after exercise. Ensure you have access to additional carbohydrates as per the advice of an endocrinologist, credentialled diabetes educator or accredited practising dietitian.
- Be aware that delayed hypoglycaemia can occur up to 48 hours post-exercise.
- Carry a rapid-acting glucose source at all times (eg glucose jelly beans, or glucose gel/drink).

**Other exercise safety advice**

- 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. This advice would also include the appropriateness of ‘jolting’ exercises such as running, skipping and jumping.
- Advise patients with neuropathy or peripheral arterial disease to check their feet daily and after physical activity for blisters, warm areas or redness.

**Aboriginal and Torres Strait Islander point**

Many Aboriginal and Torres Strait Islander people are involved in physically demanding sporting and cultural activities, and this should be encouraged for all people with diabetes.

For Aboriginal and Torres Strait Islander patients, GPs should be aware of activities or programs that are affordable, appropriate and accessible. These might be run by local community groups.

A careful history in the context of a trusting doctor–patient relationship may bring about better understanding and opportunity.

For more information, refer to the Australian Institute of Health and Welfare report on [Healthy lifestyle programs for physical activity and nutrition](#).

**Diet****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 micronutrient-dense foods, including vegetables, fruit and wholegrain cereals.

Key dietary themes for people with type 2 diabetes are eating for cardiovascular protection, and glycaemic management and meal planning.

All patients should be offered and encouraged to seek advice on medical nutrition therapy by referral to an accredited practising dietitian (APD). An APD can help people address core issues around nutrition, such as achieving sustainable healthy eating patterns and, where appropriate, healthy body weight (loss) by reducing energy intake (portion control and type of food). They can also assist with recipe modification, changing cooking techniques, label reading, eating out and understanding of fad diets.

**Glycaemic management and meal planning**

To influence the glycaemic response after eating, meal plans need to consider both the amount and quality of carbohydrates eaten. The total amount of carbohydrate consumed (compared with other macronutrients or the glycaemic index of the meal) may be the major dietary factor that contributes to high postprandial BGLs.<sup>19</sup> Eating low-glycaemic-load foods instead of higher glycaemic-load foods may modestly improve glycaemic control.<sup>20</sup>

Low glycaemic index (GI) foods include dense wholegrain breads, steel-cut oats, lower fat milk and yoghurt, minimally processed (eg wholegrain, low GI) breakfast cereals, pasta, Doongara rice, legumes and most fruits. Intake of high-carbohydrate, low-nutrient-dense foods such as soft drinks, cakes and lollies should be confined to infrequent, small amounts to reduce the risk of weight gain and a worsening cardiometabolic profile.<sup>20</sup>

There is evidence that nutrition education may be particularly important for the prevention of hypoglycaemia in people with type 2 diabetes on insulin or sulfonylureas. Consistent carbohydrate intake, and spaced, regular meal consumption, may help some patients manage BGLs and weight. Inclusion of snacks as part of a person's meal plan should be individualised and should be balanced against the potential risk of weight gain and/or hypoglycaemia.<sup>6</sup>

## In practice

Evaluation of current dietary intake and the eating patterns of an individual is an initial critical step to support the management of type 2 diabetes.

Dietary habit changes are often slow and incremental. There is no need for a 'special' diet for diabetes, just the requirement to follow a sensible, balanced eating plan. Keep advice simple and educate patients about healthy food choices.

Identifying psychosocial issues around eating (eg binge-eating, eating when stressed or bored) is also very important. Often people with diabetes have experienced many years of 'yo-yo' dieting and a cycle of weight loss and gain.

The [Eat for Health](#) website, which includes the *Australian dietary guidelines*, is easy to access and its recommendations easy to implement. The guidelines provide advice about healthy eating patterns, including a daily food selection guide.

Not all dietary sugars need to be eliminated. Small amounts of added simple carbohydrate as part of a high-fibre, modified-fat meal plan increases the choice of food available and may aid adherence. Foods naturally high in sugars, such as fruit and dairy, do not need to be avoided.

Referral to an APD or a credentialed diabetes educator will support implementation and reinforcement of these recommendations. A list of APDs in your area can be found on the [Dietitians Association of Australia](#) website.

Further information about diet for people with diabetes, including a position statement about low-carbohydrate diets for diabetes, can be found on the [Diabetes Australia](#) website.

### 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 and require refrigeration and preparation. 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. For more information specific to nutrition for Aboriginal and Torres Strait Islander peoples, refer to:

- results from the Australian Bureau of Statistics' [Australian Aboriginal and Torres Strait Islander Health Survey](#)
- the Australian Institute of Health and Welfare paper [Healthy lifestyle programs for physical activity and nutrition](#)
- the Department of Health's [evidence for effective nutrition interventions](#).



## Weight

### Clinical context

For people with type 2 diabetes who are overweight or obese, even modest weight loss (5–10%) may provide clinical benefits, including improved glycaemic control, blood pressure and lipid profiles, especially early in the disease process.<sup>20–22</sup> Lifestyle-induced sustained weight loss contributes to the prevention, or delays progression, of diabetes.<sup>23–25</sup>

The relationship between weight loss and clinical benefits is complex, however. The multi-centre, randomised clinical trial Action for Health in Diabetes (Look AHEAD) provided evidence that intensive lifestyle intervention focusing on weight loss did not result in a significant reduction in cardiovascular events in overweight or obese adults with established type 2 diabetes.<sup>26</sup> This was despite greater reductions in HbA1c and greater initial improvement in fitness and all CVD risk factors, except for low-density lipoprotein cholesterol levels. Increasing physical activity, regardless of weight loss, may reduce CVD risk factors,<sup>27</sup> and reduce HbA1c by ~0.6% in adults with type 2 diabetes.<sup>28</sup>

The causes of overweight and obesity are likewise 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. Older people with diabetes may also be at risk of malnutrition.

When managing patients, be mindful that some medications are associated with weight gain, including<sup>29</sup> insulin, sulfonylureas, thiazolidinediones, second-generation antipsychotics (especially olanzapine and clozapine), beta-adrenergic blockers (especially propranolol), tricyclic antidepressants, lithium, pizotifen, sodium valproate and glucocorticosteroids.

#### Practice Point: The concept of diabetes remission

Diabetes ‘remission’ or even ‘reversal’ is often stated as one of the measured outcomes of clinical trials of weight loss interventions, usually defined as reduction or cessation of the use of glucose-lowering agents by participants.

However, the period that normalisation of glycaemia is sustained for varies in the long term, according to study length, intervention methods and time to follow-up. Thus, there is not high-quality evidence to support the concept of ‘reversal’ of diabetes from current interventions.

### In practice

It is important to encourage a degree of healthy weight loss in anyone with type 2 diabetes who is overweight, except where there are other associated risks (eg in the frail and elderly, or those with eating disorders). Because a healthy body weight is sometimes not achievable, setting this as a goal might discourage patients from attempting any dietary change.

The [Australian Obesity Management Algorithm](#) is a practical clinical tool to guide the implementation of existing guidelines for the treatment of obesity in the primary care setting in Australia.

## Weight assessment

Assessing weight is typically done using BMI, which can be a difficult parameter to standardise between different population groups.

For those of European descent, a healthy BMI is 18.5–24.9 kg/m<sup>2</sup>, overweight is 25–29.9 kg/m<sup>2</sup> and obese is  $\geq 30$  kg/m<sup>2</sup>.<sup>6</sup> Different classification criteria may apply to other population groups. Some groups may have equivalent levels of risk of health problems at a lower BMI (eg these BMI thresholds should be reduced by 2.5 kg/m<sup>2</sup> for patients of Asian ethnicity<sup>7</sup>) or higher BMI (eg Torres Strait Islander and Maori peoples).<sup>30</sup>

It is advisable to also assess waist circumference (in centimetres), as this is a good indicator of total body fat and a useful predictor of visceral fat. Waist circumference of  $\geq 94$  cm in men and  $\geq 80$  cm in women conveys increased risk of obesity-related complications;  $\geq 102$  cm in men and  $\geq 88$  cm in women convey high risk.<sup>31</sup> As with BMI, these values may differ for other population groups.<sup>6</sup>

Measuring waist circumference in patients with a BMI  $>35$  kg/m<sup>2</sup> may not add any further to predictive disease risk classification.<sup>32</sup>

## Lifestyle interventions for weight management

In overweight or obese people with diabetes, a nutritionally balanced, energy-reduced diet should be recommended if a lower, healthier body weight is to be achieved and maintained as part of a multi-component lifestyle intervention (including healthy eating, physical activity and support for behavioural change).

Very low energy diets (VLEDs) can be considered as an initial weight loss strategy, when supervised lifestyle interventions have been unsuccessful in reducing weight, or when rapid weight loss is required (eg prior to bariatric or general surgery that is conditional on weight loss).<sup>33</sup> These diets may be considered in adults with diabetes with BMI  $>27$  kg/m<sup>2</sup>, taking into account each individual situation.<sup>34</sup> A primary care-based weight loss study, the Diabetes Remission Clinical Trial (DiRECT), showed that VLED with associated weight loss led to 46% of participants reducing or ceasing diabetes medications after 12 months of intervention.<sup>35</sup>

VLEDs require regular appointments with appropriate health professionals to support the progress of the individual. Caution should be exercised if hypoglycaemia is a risk (people taking sulfonylureas and insulin). Use of sodium glucose co-transporter 2 (SGLT2) inhibitors in people on VLEDs or any high-protein, low-carbohydrate diet is not recommended (due to raised risk of ketoacidosis, which might be euglycaemic).

## Pharmacotherapy

Pharmacotherapy is licensed by the Therapeutic Goods Administration (TGA) for weight management, including for patients with diabetes, but is not currently reimbursed by the Pharmaceutical Benefits Scheme (PBS). There are now four drugs that can be used as adjuncts to dietary changes and physical activity improvement: phentermine (a sympathomimetic amine), orlistat (an inhibitor of intestinal lipase), liraglutide (a glucagon-like peptide-1 receptor agonist [GLP-1 RA]) and combined naltrexone and bupropion.

These drugs may be considered in adults with diabetes with BMI  $\geq 27$  kg/m<sup>2</sup>, taking into account each individual situation.<sup>33</sup>

Each drug has the potential for significant clinical side effects and contraindications associated with its use. They require careful clinical risk–benefit assessment when applied in practice. Refer to the [TGA](#) website for more information.

## Surgical interventions

Surgery for weight loss, also called metabolic or bariatric surgery, may induce weight loss in people who have failed by other means. The following procedures are used in Australia.<sup>7,34</sup>

- **Sleeve gastrectomy** involves removing the greater portion of the fundus and body of the stomach, reducing its volume from up to 2.5 L to about 200 mL. This procedure provides fixed restriction and does not require adjustment like laparoscopic adjustable gastric banding (LAGB).
- **Roux-en-Y gastric bypass** is a combination procedure in which a small stomach pouch is created to restrict food intake and the lower stomach, duodenum and first portion of the jejunum are bypassed to produce modest malabsorption of nutrients and thereby reduce kilojoule intake.
- **Biliopancreatic diversion** is also a combination procedure that involves removing the lower part of the stomach and bypassing the duodenum and jejunum to produce significant malabsorption. This procedure tends to be performed in subspecialty centres.

Used in the past, **LAGB** is less used now in Australia and North America due to less sustained weight loss, fewer metabolic benefits and high surgical complication rates. This procedure involves placing a band around the stomach near its upper end to create a small pouch.<sup>6</sup>

Sleeve gastrectomy, Roux-en-Y gastric bypass and biliopancreatic diversion lead to sustained weight loss and normalisation (refer to 'Practice Point' above) of type 2 diabetes metabolic markers, although techniques vary in efficacy.<sup>6</sup>

The improvement in diabetes metabolic markers for Roux-en-Y gastric bypass surgery at two-year follow-up was 52.7% in one meta-analysis, compared with 0.7% for medical management.<sup>36</sup> For individuals who achieve improvement in diabetes metabolic markers with Roux-en-Y gastric bypass, the median period of sustained improvement is 8.3 years.<sup>7</sup>

Metabolic surgery in patients with type 2 diabetes is associated in non-randomised studies with reduction in microvascular and macrovascular complications as well as reduced mortality.<sup>7</sup> Moreover, studies have also shown that metabolic surgery can prevent or delay the onset of type 2 diabetes in people with obesity.<sup>7</sup>

Taking into account each individual situation, metabolic surgery may be considered for people with a BMI >30 kg/m<sup>2</sup> who have suboptimal BGLs, are at increased CVD risk and are not achieving recommended targets with medical therapy.<sup>7</sup>

GPs should assess the appropriateness of metabolic surgery for each individual patient and provide information on the risks, benefits and appropriateness of the type of procedure. Metabolic surgery performed in a high-volume specialist centre with an experienced surgical team may offer the lowest risks, and GPs should liaise with a specialised surgical team if there are concerns.<sup>33,34</sup>

Metabolic surgery, when indicated, should be included as part of an overall clinical pathway for adult weight management that is delivered by a multidisciplinary team (including surgeons, APDs, nurses, psychologists and physicians), and includes planning for surgery and continuing follow-up.<sup>33</sup>

Adverse events of metabolic surgery, particularly in the long term, need more research;<sup>37</sup> however, suggested follow-up care includes monitoring for nutritional deficiencies and acid reflux disorders.<sup>38</sup>

Women of reproductive age who have had metabolic surgery need particular advice on contraceptive choices; those who plan to have a pregnancy need assessment, before and throughout pregnancy, regarding nutritional status, need for higher multivitamin dosages and close obstetric monitoring. Referral prior to pregnancy to appropriate speciality services is strongly advised, even if the diabetes appears well managed.

## Smoking cessation

### Clinical context

Smoking is associated with an increased risk of type 2 diabetes in men and women,<sup>39</sup> and smoking negatively affects glycaemic control (eg smokers with type 2 diabetes need larger doses of insulin to achieve control similar to that of those who do not smoke).<sup>40</sup>

People with diabetes who smoke also further increase their risk of CVD, peripheral vascular disease and neuropathy (and progression of neuropathy). Smoking also increases the risks associated with surgery.<sup>8</sup>

### In practice

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

In the absence of contraindications, smokers who have evidence of nicotine dependence should be offered pharmacotherapy, along with behavioural support, if they are motivated to stop smoking. The choice of pharmacotherapy is based on efficacy, clinical suitability and patient choice.<sup>8</sup>

Guidelines for smoking cessation and a pharmacotherapy treatment algorithm are available in the RACGP's [Supporting smoking cessation: A guide for health professionals](#).

#### Aboriginal and Torres Strait Islander point

The following organisations provide resources and strategies for smoking cessation for Aboriginal and Torres Strait Islander people:

- [Center for Excellence in Indigenous Tobacco Control \(CEITC\)](#)
- [Tackling Indigenous Smoking](#)
- [Australian Indigenous HealthInfoNET](#).

Specific support for Aboriginal and Torres Strait Islander people is also provided by Quitline.

## Alcohol consumption

### Clinical context

Alcohol affects the management of type 2 diabetes through its effects on diet and control of BGLs:

- Alcohol interferes with the action of insulin, insulin secretagogues and glucagon, thereby increasing the risk of hypoglycaemia in people with type 2 diabetes who take these medications.<sup>5</sup>
- Alcohol can lower BGLs and reduce awareness of hypoglycaemia.

Alcohol and hypoglycaemia have independent but additive adverse effects on cognitive function.<sup>9</sup>

Reduction in energy intake, which should involve assessing alcohol intake, may be important for managing people who are overweight or obese as part of diabetes management.

## In practice

Patients should be educated about safe levels of alcohol intake, according to Australian guidelines, and should be told that there is increased risk of hypoglycaemia if alcohol is consumed while using medications such as sulfonylureas.<sup>41</sup>

Current Australian guidelines to reduce health risks from drinking alcohol recommend no more than 10 standard drinks (a standard drink contains 10 g of alcohol) per week, and no more than four standard drinks on any one day.<sup>42</sup> Low-alcohol beers are an alternative to ordinary or diet beers. The carbohydrate content of low-carbohydrate beer is not significantly less than full-carbohydrate beers, and the alcohol content is often full strength.

It is recommended that people with diabetes abstain from alcohol if they plan to drive.<sup>43</sup>

Australian alcohol guidelines can be found on the [National Health and Medical Research Council \(NHMRC\)](#) website.

## Resources

The **Australian Diabetes Society** has produced the [Australian Obesity Management Algorithm](#).

**Diabetes Australia** has [information about diet and diabetes](#).

**Diabetes Australia** also has a [position statement](#) about low-carbohydrate diets for diabetes.

The **National Health and Medical Research Council (NHMRC)** has produced the [Australian dietary guidelines](#).

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## Glucose monitoring

The aim of determining and achieving glycaemic targets is to achieve the optimal balance between preventing complications associated with hyperglycaemia and mitigating the risk of hypoglycaemia.

In tandem with managing glycaemia (refer to the section '[Medical management of glycaemia](#)'), cardio-renal risk management is of paramount importance. Refer to the section '[Type 2 diabetes and cardiovascular risk](#)'.

### Recommendations

Recommendation	Reference	Grade*
Glycated haemoglobin (HbA1c) measurement should be used to assess long-term blood glucose control	1 NHMRC, 2009	A
Self-monitoring of blood glucose (SMBG) is recommended for patients with type 2 diabetes who are using insulin and have been educated in appropriate alterations in insulin dose	2 Scottish Intercollegiate Guidelines Network, 2017	B
For people with type 2 diabetes not receiving insulin therapy: <ul style="list-style-type: none"> <li>frequency of SMBG should be individualised, depending on type of glucose-lowering medications, level of glycaemic control and risk of hypoglycaemia</li> <li>when glycaemic control is not being achieved, SMBG should be instituted and should include periodic pre- and post-prandial measurements and training of healthcare providers and people with diabetes in methods to modify health behaviours and glucose-lowering medications in response to SMBG values</li> </ul>	3 Diabetes Canada, 2018	D, consensus  B, level 2
A reasonable HbA1c goal for many non-pregnant adults is <7% (53 mmol/mol)	4 American Diabetes Association, 2019	A
Less stringent HbA1c goals (such as <8% [64 mmol/mol]) may be appropriate for patients with a history of severe hypoglycaemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, or long-standing diabetes in whom the goal is difficult to achieve despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin	4 American Diabetes Association, 2019	B
Targets for self-monitoring of blood glucose levels are 4.0–7.0 mmol/L for fasting and preprandial, and 5.0–10.0 mmol/L for two-hour postprandial	3 Diabetes Canada, 2018	B, level 2
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		



## Accuracy and limitations of HbA1c measurements

HbA1c has been the gold standard for monitoring long-term glycaemic management since 1976, and it is one method used to diagnose diabetes. Monitoring is usually recommended at three-month intervals (four per year); however, with stable diabetes a six-month interval may be appropriate.

### HbA1c measurement and natural test variation

HbA1c can be measured and reported using two different standards:

- as a percentage measure of glycated N-terminal residue of the  $\beta$  chain of haemoglobin (eg 7%)
- in units of mmol/mol, according to the International Federation of Clinical Chemistry (IFCC) standardised reporting (eg 53 mmol/mol).

The variability of laboratory HbA1c test results in Australia is acceptably low.<sup>5</sup> However, there may be some variability,<sup>6,7</sup> which needs to be considered when monitoring long-term glucose control. Conditions such as the following that affect HbA1c results also need to be considered.

### Conditions that affect HbA1c results

A number of conditions can cause HbA1c discordance, where HbA1c does not accurately reflect mean blood glucose.

Any condition that shortens erythrocyte survival or decreases mean erythrocyte age will falsely lower HbA1c test results, regardless of the assay method used.

The presence of abnormal haemoglobin variants can occur in people of Mediterranean, African or Southeast Asian heritage. Screening for haemoglobinopathies before HbA1c testing should be considered.<sup>7</sup> If a haemoglobinopathy is suspected, then a haemoglobin electrophoresis is suggested.

Some important clinical situations may indicate the presence of a haemoglobinopathy, such as when:

- results of self-monitoring of blood glucose (SMBG) have a poor correlation with HbA1c results
- an HbA1c result is discordant with measured alternate laboratory glycaemic values
- an HbA1c result is more than 15% or less than 4%
- a patient's HbA1c test result is radically different from a previous test result following a change in laboratory HbA1c measurement methods.

Other causes of HbA1c discordance are shown in Box 1.

Alternative forms of diabetes monitoring such as SMBG, continuous glucose monitoring and flash glucose monitoring (refer to the section '[Use of technology in type 2 diabetes management](#)') should be considered for these patients.

Note that fructosamine as an alternative longer-term glucose measure may not be suitable in people with iron deficiency anaemia, as this condition raises both HbA1c and fructosamine; conversely, iron infusion spuriously lowers both HbA1c and fructosamine.<sup>8-10</sup>

**Box 1. Other causes of HbA1c discordance**

Abnormally low HbA1c can be caused by:

- anaemia
  - haemolytic anaemia – congenital (eg spherocytosis, elliptocytosis)
  - haemoglobinopathies
  - acquired haemolytic anaemias (eg drug-induced, such as with dapsone, methyldopa)
- recovery from acute blood loss
- blood transfusions, iron infusions
- chronic blood loss
- chronic renal failure (variable).

Abnormally high HbA1c can be caused by:

- iron deficiency anaemia<sup>8</sup>
- splenectomy
- alcoholism.

HbA1c is an unreliable measure of glycaemic management in the first four weeks of pregnancy.

## Self-monitoring of blood glucose

SMBG in patients with type 2 diabetes is recommended:<sup>2,3</sup>

- for people on insulin and sulfonylureas, which can cause hypoglycaemia
- for people not on insulin who are having difficulty achieving glycaemic control (patients and their healthcare providers should be trained in methods to modify health behaviours and glucose-lowering medications in response to SMBG values)
- when monitoring hypo/hyperglycaemia arising from intercurrent illness (refer to the sections '[Medical management of glycaemia](#)' and '[Managing risks and other impacts of type 2 diabetes](#)')
- during pre-pregnancy and pregnancy management for people with established diabetes or gestational diabetes
- when there is a clinical need for monitoring, such as during changes in management or lifestyle, or for conditions or medications (such as corticosteroids) that require data on glycaemic patterns that HbA1c cannot provide
- when HbA1c estimations are unreliable (eg haemoglobinopathies).

Routine SMBG for people with type 2 diabetes who are considered low risk and who are using oral glucose-lowering drugs (with the exception of sulfonylureas) is not recommended.<sup>11–15</sup>

The method and frequency of monitoring need to reflect individual circumstances and therapeutic aims. SMBG is most effective 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.

Targets for self-monitored glycaemic control in type 2 diabetes (where stringent glycaemic management is recommended) are shown in Table 1.

The National Diabetes Services Scheme (NDSS) provides subsidised blood glucose monitoring strips for SMBG for a six-month period after an initial diagnosis of diabetes. Ongoing access, in six-monthly increments, is available when assessed as clinically necessary and authorised by a general practitioner, credentialled diabetes educator, endocrinologist, nurse practitioner or other registered medical practitioner, in the following categories: intercurrent illness, medications affecting blood glucose, critical need for self-monitoring, diabetes management change, diabetes management not stable. Refer to the [NDSS](#) website for further information.

There is an emerging role for continuous glucose monitoring and flash glucose monitoring in patients with type 2 diabetes on complex insulin regimens who have not achieved their glycaemic targets; however, this technology is not available through the NDSS for people with type 2 diabetes. Refer to the section '[Use of technology in type 2 diabetes management](#)' for more information.

**Table 1. Targets for self-monitored glycaemic control in type 2 diabetes<sup>3</sup>**

Fasting blood glucose (FBG; mmol/L)	Preprandial blood glucose (mmol/L)	Postprandial blood glucose (mmol/L)	Comment
4.0–7.0	4.0–7.0	5.0–10	Diabetes Canada guidelines

## HbA1c targets and individualisation

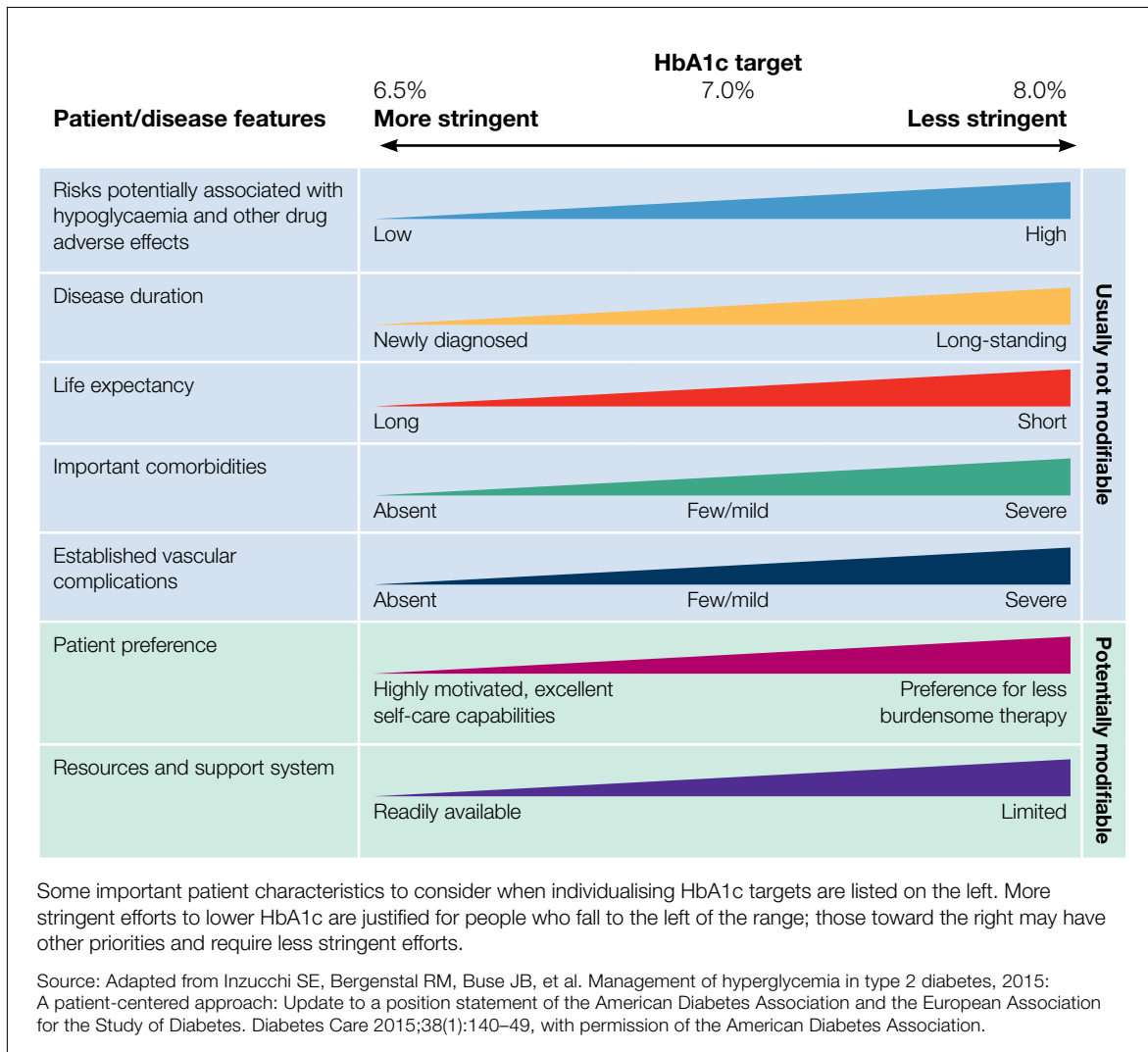
The general HbA1c target in people with type 2 diabetes is HbA1c  $\leq 7\%$  ( $\leq 53$  mmol/mol).<sup>1</sup>

In the vast majority of patients with diabetes, optimising their blood glucose control may improve specific short-term and long-term health outcomes. However, what is 'optimal' will vary, depending on the balance between benefits and risks and the patient's priorities (Figure 1). Thus, there is no single glycaemic target that suits all patients.

For example, HbA1c targets may vary in selected patients as follows:<sup>16</sup>

- A more stringent target of 6.5% (48 mmol/mol) might be appropriate for people with short disease duration, long life expectancy and no significant cardiovascular disease, if this can be easily and safely achieved without hypoglycaemia or other adverse effects of treatment.
- Less stringent targets might be more appropriate for patients with reduced life expectancy or extensive comorbid conditions; those who have difficulty attaining targets despite intensive self-management education, repeated counselling, and effective doses of multiple glucose-lowering agents (including insulin); or those at risk of hypoglycaemia.

Diabetes symptoms (eg polydipsia, polyuria) are related to increasing glycaemia, as measured by HbA1c levels above 8% (64 mmol/mol).<sup>17</sup>

**Figure 1.** Approach to individualising HbA1c targets

## Glycaemic variability and time in range

Glycaemic variability represents the degree of stability of the glucose profile and refers to swings in blood glucose levels. Glycaemic variability can be measured as within-day, between-days or, most commonly, as mean glucose and standard deviation of glucose over two weeks.

Emerging evidence in randomised controlled trials of people using multiple daily insulin shows an association between within-day or between-days glycaemic variability or 'time spent in range' observations and diabetes-related complications;<sup>18</sup> however, more clinical evidence is needed. Additional observational studies have linked same-day or between-days glycaemic variability to higher rates of both hypo- and hyperglycaemia for a given HbA1c, as well as peripheral neuropathy and retinopathy.<sup>19</sup> Lower levels of HbA1c are not directly linked to increased hypoglycaemia risk.<sup>20</sup>

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# Medical management of glycaemia

## Recommendations

Recommendation	Reference	Grade*
<b>Glucose-lowering medication in people newly diagnosed with type 2 diabetes</b>		
A person-centred approach should be used to guide the choice of glucose-lowering medication. Considerations include comorbidities (atherosclerotic cardiovascular disease, heart failure, chronic kidney disease), hypoglycaemia risk, impact on weight, cost, risk for side effects and patient preferences	1 American Diabetes Association, 2019	E <sup>†</sup>
Healthy behaviour interventions should be initiated at diagnosis	2 Diabetes Canada, 2018	B, level 2
If glycaemic targets are not achieved using healthy behaviour interventions alone within three months, glucose-lowering therapy should be added to reduce the risk of microvascular complications	2 Diabetes Canada, 2018	A, level 1A
Metformin should be chosen over other agents due to its low risk of hypoglycaemia and weight gain	2 Diabetes Canada, 2018	A, level 1A
Individuals with metabolic decompensation (eg marked hyperglycaemia, ketosis or unintentional weight loss) should receive insulin with or without metformin to correct the relative insulin deficiency	2 Diabetes Canada, 2018	D, consensus
All healthcare practitioners who initiate or educate patients on injectable glucose-lowering medications should be familiar with, and follow, the recommended guidelines	RACGP Diabetes Handbook working groups, 2020	Consensus
<b>Advancing treatment</b>		
Dose adjustments to, and/or addition of, glucose-lowering medications should be made in order to attain target glycosylated haemoglobin (HbA1c) within 3–6 months	2 Diabetes Canada, 2018	D, consensus
If glycaemic targets are not achieved, other classes of glucose-lowering agents should be added to improve glycaemic control	2 Diabetes Canada, 2018	B, level 2
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		
†E = expert opinion: recommendation in which there is no evidence from clinical trials, in which clinical trials may be impractical, or in which there is conflicting evidence.		

## Introduction

In addition to lifestyle modification, most people with type 2 diabetes will eventually require pharmacotherapy to achieve long-term glycaemic control and prevent complications of diabetes. Patients who are symptomatic of hyperglycaemia may need to start medication without delay, in addition to ongoing lifestyle support.

The benefits of management of hyperglycaemia for the prevention of microvascular complications have been demonstrated in randomised clinical trials.<sup>3-5</sup>

The choice, order and combination of medications used is based on:

- individualised goals for glycaemia (refer to the section 'Glucose monitoring')
- evidence of improved clinical outcomes
- consideration of potential adverse effects
- patient choice and capacity.

The above should all be taken into consideration when implementing the treatment recommendations in these guidelines.

**Note:** Hyperglycaemia-related metabolic dysfunction (eg hyperosmolar states or ketosis) constitutes a medical emergency, and may be present at diagnosis in type 2 diabetes. Information about symptoms and emergency management of hyperglycaemia is available on [The Royal Australian College of General Practitioners' \(RACGP's\) website](#).

## Clinical context

### Glucose-lowering medicines

Many glucose-lowering medicines are available (Table 1). To navigate the many options, the Australian type 2 diabetes management algorithm (Figure 1) was developed by the Australian Diabetes Society in consultation with all key stakeholders, including the RACGP.

Although algorithms are designed to help navigate choice, applying the principles of patient-centred care might mean that choices suggested by algorithm are not always appropriate.

Also note that high-quality clinical trials of the combination therapies that are suggested in current algorithms for glucose treatment in type 2 diabetes may be lacking. Management is also increasingly informed by the outcomes of trials for sodium glucose co-transporter 2 (SGLT2) inhibitors and glucagon-like peptide-1 receptor agonists (GLP-1 RAs), for which long-term data are emerging with respect to both potential benefits and harms.<sup>6-8</sup>

Prescribing algorithms for type 2 diabetes suggest multiple ways of combining agents. Always consult the Pharmaceutical Benefits Scheme (PBS) when combining therapy, as restrictions and reimbursements may change.

Table 1 outlines the clinical considerations for choosing glucose-lowering medications. An evidence table summarising properties of these medications is provided with the full Australian type 2 diabetes management algorithm (Figure 1).

Table 1. Clinical considerations when choosing diabetes medications

Clinical outcome	Medication effects on clinical outcomes			
	Metformin	Sulfonylurea (SU)	Dipeptidyl peptidase-4 inhibitor (DPP-4i)	Acarbose
<b>Patients with established or at high risk of CVD (refer to the section 'Type 2 diabetes and cardiovascular risk')</b>	Neutral effect <sup>3</sup>	Increased risk when compared with metformin monotherapy (excluding gliclazide), but neutral when used in combination with metformin <sup>9</sup>	Neutral effect <sup>7,10-13</sup> Refer to <b>Note A</b>	Neutral effect <sup>14</sup>
<b>Patients at risk of hypoglycaemia</b>	Lower rates compared to SU <sup>9</sup>	Higher clinical risks, both as monotherapy and in combination with other agents <sup>9</sup>  Gliclazide – fewer hypoglycaemia episodes versus other SUs <sup>15</sup>  Glibenclamide – higher rates of hypoglycaemia, especially in older people <sup>16</sup>	Lower rates compared to SU <sup>9</sup>	Neutral effect
<b>Patients at risk of gastrointestinal conditions (eg IBS, IBD and gastroparesis)</b>	Known intolerance as monotherapy or combination therapy – diarrhoea <sup>9,17</sup>	Neutral effect	Neutral effect	Known intolerance – bloating and flatulence <sup>†</sup>
<b>Patients in whom stabilisation of BMI or weight loss is desired</b>	Neutral effect	Neutral effect (gliclazide) <sup>18</sup>  Modest weight gain (other SUs) compared with metformin monotherapy <sup>9</sup>	Neutral effect	Neutral effect
<b>Patients with renal impairment (eg lowered CrC*)</b>	Reduce dose by 50% with eGFR 30–60  Contraindication with CrC <30 mL/min <sup>17</sup>	Contraindication if CrC <15 mL/min  Hypoglycaemia risk increases	Safe with dose reduction but linagliptin can be used in all stages (no dose reduction)  Refer to <b>Note B</b>	Contraindication in severe renal impairment <sup>†</sup>
<b>Other class-specific information</b>	Monotherapy or combination with other agents (DPP-4i or SGLT2i) is available to reduce 'pill burden'	The Australian algorithm (Figure 1) suggests SU may be used as monotherapy or combined with other agents	Contraindication – do not use with a GLP-1 RA  Increased hospitalisation for heart failure with saxagliptin	



**Table 1. Clinical considerations when choosing diabetes medications**

Clinical outcome	Medication effects on clinical outcomes			
	Thiazolidinedione (TZD)	Sodium glucose co-transporter 2 inhibitors (SGLT2i)	Glucagon-like peptide-1 receptor agonists (GLP-1 RAs)	Insulin
<b>Patients with established or at high risk of CVD (refer to the section 'Type 2 diabetes and cardiovascular risk')</b>	Contraindication if symptomatic heart disease, including heart failure <sup>19§</sup> Pioglitazone is the preferred TZD	Selective benefit, depending on individual drug choice <sup>20</sup>	Selective benefit, depending on individual drug choice <sup>21</sup>	Neutral effect <sup>3,4,22</sup>
<b>Patients with risk from hypoglycaemia</b>	Lower rates compared to SU <sup>9</sup>	Lower rates compared to SU <sup>9</sup>	Lower rates compared to SU <sup>9</sup>	Higher clinical risks as monotherapy and in combination with other agents <sup>22,23</sup>
<b>Patients at risk of gastrointestinal conditions (eg IBS, IBD and gastroparesis)</b>	Neutral effect	Neutral effect	Known intolerance – nausea and vomiting, diarrhoea <sup>9  </sup>	Neutral effect
<b>Patients in whom stabilisation of BMI or weight loss is desired</b>	Modest gain compared with other dual combination therapies <sup>9</sup>	Modest weight loss (in monotherapy, plus in combination with metformin versus metformin with alternate dual oral drug combinations) <sup>9#</sup>	Weight loss (in monotherapy, plus in combination with metformin versus metformin with alternate dual oral drug combinations) <sup>9,24,25***</sup>	Modest gain <sup>9,22,23,26</sup>
<b>Patients with renal impairment (eg lowered eGFR)</b>	Neutral effect	Glycaemic-lowering efficacy decreases, thus contraindicated with renal impairment (eGFR ≤45 mL/min) <sup>††</sup>	Contraindication eGFR <30 mL/min (dulaglutide <15)	No contraindication, but hypoglycaemia risk increases
<b>Other class-specific information</b>	Increased atypical fractures (relative risk 1.57), <sup>27</sup> with women more at risk than men <sup>§</sup> Pioglitazone is contraindicated in individuals with bladder cancer or un-investigated haematuria <sup>§</sup>	Modest lowering of BP <sup>9</sup> Increased genitourinary infections (especially females) Refer to <b>Note C</b> Less common – euglycaemic diabetic ketoacidosis <sup>††</sup> (refer also to discussion of surgery in the section 'Managing risks and other impacts of type 2 diabetes')	Once-weekly formulations are available <sup>  </sup> Contraindication – combination with a DPP-4i	Dose required to be titrated to glycaemic goals while mitigating glycaemic variability and hypoglycaemia

BMI, body mass index; BP, blood pressure; CrC, creatinine clearance; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate; IBS, irritable bowel syndrome; IBD, inflammatory bowel disease

\*The product information of most agents refers to CrC as a measure of kidney function. [Kidney Health Australia](#) offers a conversion to eGFR.

†Acarbose product information is available from the [Therapeutic Goods Administration \(TGA\)](#).

‡CrC <25 mL/min.

§Pioglitazone product information is available on the [TGA](#) website.

||Exenatide product information is available on the [TGA](#) website.

#Dapagliflozin product information: -2.14 kg as an add-on to metformin versus placebo at 104 weeks; empagliflozin: -1.63 kg and -2.03 kg at doses 10 mg and 25 mg respectively as an add-on to metformin at 24 weeks.

\*\*Exenatide -1 kg to 3.9 kg in comparative trials with combinations including metformin and SU and TZD.

††Check renal function and individual medication product information before prescribing.

‡‡The [Australian Diabetes Society](#) has a safety advisory for SGLT2i use and the risk of diabetic ketoacidosis.

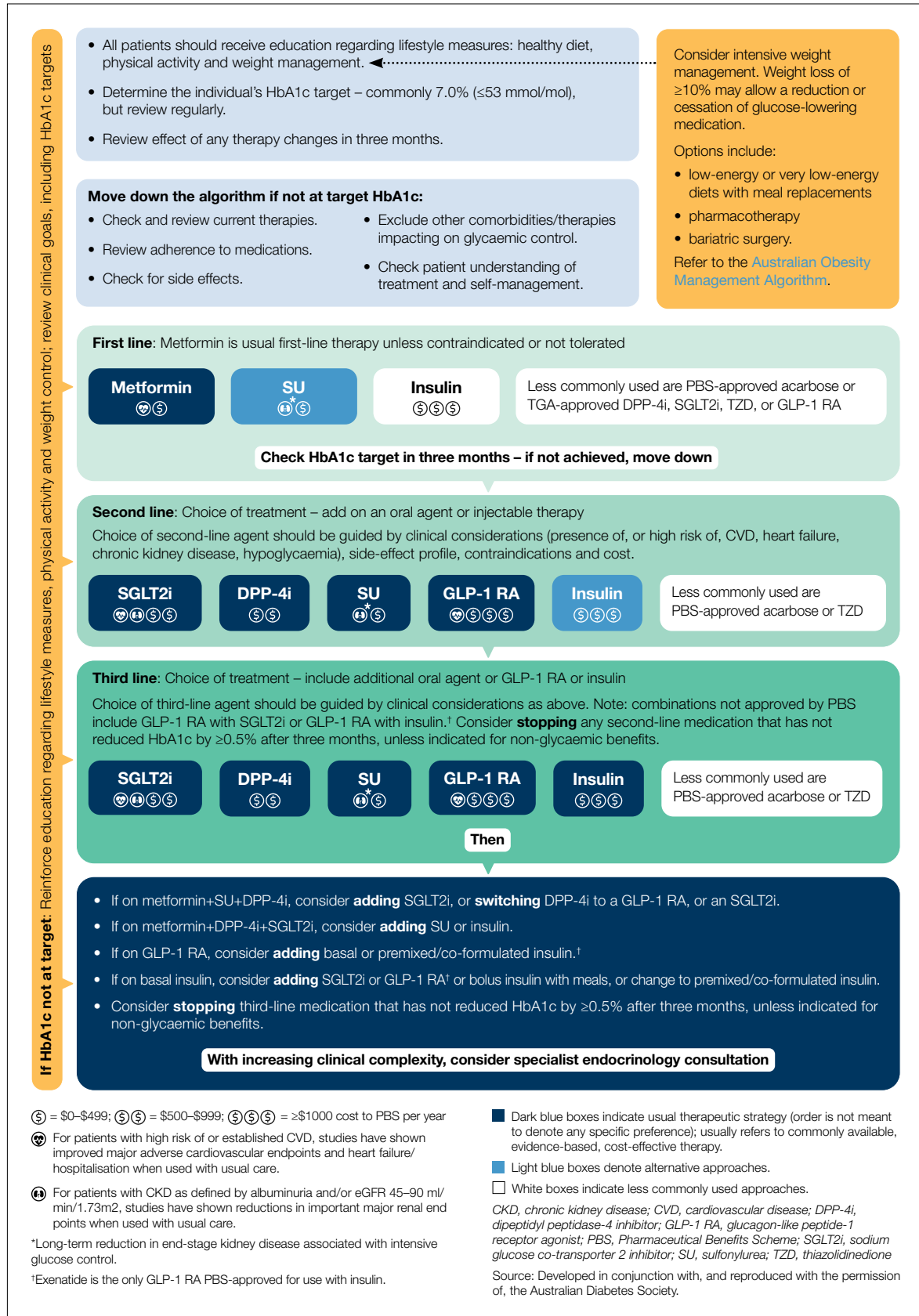
**Note A.** DPP-4i and heart failure: In the SAVOR-TIMI 53 trial, hospitalisations for heart failure (a secondary outcome) increased with saxagliptin with a non-significant (statistically) trend to increased heart failure with alogliptin. In contrast, cardiovascular outcomes trials of sitagliptin and linagliptin failed to show any heart failure signal.<sup>7</sup>

**Note B.** DPP-4i: All except linagliptin (no dose reduction) as this is hepatically metabolised.

**Note C.** All classes: The US Agency for Healthcare Research and Quality (AHRQ) review<sup>9</sup> determined **no** moderate-to-high levels of evidence for the following adverse events (this does not mean no risk):

- lactic acidosis (metformin)
- urinary tract infections/fractures/volume depletion (SGLT2i)
- pancreatitis (DPP-4i and GLP-1 RA)
- bladder cancer risks (pioglitazone)
- thyroid cancer (GLP-1 RA).

Figure 1. Australian type 2 diabetes management algorithm



## In practice

### Commencing glucose-lowering therapy

Healthy eating, physical activity and education remain the foundation of all type 2 diabetes treatment programs.

If acute metabolic decompensation appears (sudden weight loss, polydipsia, polyuria, severe fatigue), assess for hyperglycaemic emergencies. If present, or uncertain, seek specialist assistance.

If lifestyle modification is not effective in meeting glycaemic targets within three months, 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 should be chosen to work synergistically.

The choice of second-line and subsequent medication choices should be informed by:

- the patient's clinical profile – in particular, renal function status and high-risk, or presence, of CVD
- the likely efficacy of the agent with respect to the magnitude of glycaemic lowering required
- issues that might affect safety, such as hypoglycaemia risk or agent-specific side effects
- tolerability
- cost
- the patient's preferences and abilities to engage in the proposed treatment
- prioritisation of weight-management goals
- emerging and evolving data on new medications and whether medication combinations are available (may assist adherence).

Figure 1 provides options based on consideration of efficacy, non-glycaemic effects (eg effects on cardiovascular and renal outcomes), side effects and cost.

Start with the correct dose of each medication and review on an individual basis at least every 3–6 months, keeping in mind the patient's individual glycosylated haemoglobin (HbA1c) target.<sup>1,28</sup>

**Practice Point: What if medication is not working? The ‘review rule’**

The review rule is a call to action. In addition to replacing or intensifying therapies, consideration should also be given to de-prescribing when appropriate.

If, despite optimisation of medication or lifestyle intervention, glycaemic objectives are not being met after three months (six months at the most) **review** and:

- check the patient’s understanding of the medication, its indication and dosing regimen (health literacy)
- assess persistence and adherence to the therapeutic regimen, including lifestyle modification
- exclude potential confounders, such as occult infection (eg urinary), medications that might interfere with glucose control (eg steroids, some antipsychotics) or the presence of unmanaged obesity
- consider alternative diagnoses if not done previously, such as latent autoimmune diabetes of adults (LADA) or maturity-onset diabetes of the young (MODY)
- assess tolerability and safety, particularly hypoglycaemia, and other factors such as planning for pregnancy or adverse effects that might impact patient engagement.

The review rule emphasises that optimisation of the current regimen, including lifestyle modification, should be implemented before advancing through additional glucose-lowering medicines to achieve HbA1c targets within 3–6 months.

**Safety**

Each class of glucose-lowering medication may have common and uncommon side effects that affect quality of life and require careful clinical reassessment. Examples include hypoglycaemia and weight gain with sulfonylureas and insulin,<sup>9</sup> and mycotic infections or euglycaemic diabetic ketoacidosis with SGLT2 inhibitors.

Some patient groups (eg older people and those with multiple comorbidities) may not be represented in the published clinical outcome trials of newer diabetes agents, so caution should be exercised when considering choice of agents for these patients.

When used as monotherapy or in combination, metformin, acarbose, glitazones, GLP-1 RA, DPP-4i and SGLT2 inhibitors have a low propensity for causing hypoglycaemia.

Of the sulfonylureas, gliclazide is less likely to cause hypoglycaemia than long-acting sulfonylureas (eg glimepiride) or sulfonylureas with renally excreted metabolites (eg glibenclamide).<sup>29,30</sup>

Special care needs to be taken with those at increased risk of hypoglycaemia and renal impairment, especially older people.

People with diabetes who drive may need to notify their state motor vehicle licensing authority of their condition, as medications can affect driving performance. For more information, refer to the discussion on driving in the section ‘[Managing risks and other impacts of type 2 diabetes](#)’ or refer to section 3.3.2 of Austroads and National Transport Commission’s [Assessing fitness to drive](#).

## Insulin

The use of insulin can improve glycaemic control in most people, but any benefits need to be balanced against increased risks of hypoglycaemia and possible weight gain.<sup>26</sup>

International and Australian guidelines suggest considering a GLP-1 RA before commencing insulin, unless a person has extreme hyperglycaemic symptoms or an HbA1c of >11%.<sup>31</sup> GLP-1 RAs are associated with weight loss as well as sparing insulin dose. Limitations to this approach include cost, possible side effects of GLP-1 RAs (nausea), and TGA or PBS restrictions on GLP-1 RA use in combination with other therapy that do not apply to insulin.

### Side effects of insulin therapy

Rare adverse events associated with the use of insulin have been reported in observational studies. Such events include congestive heart failure, oedema, lipodystrophy, allergic reactions, reversible transaminitis, reversible nephrotic syndrome and  $\beta$ -cell destruction.<sup>32</sup>

Common side effects include hypoglycaemia and weight gain. Risk factors for hypoglycaemia include:

- inappropriate dose
- timing or type of insulin (refer below)
- incorrect injection technique (eg injecting insulin intramuscularly, rather than subcutaneously, can increase absorption rates by 50%)
- missing meals, or meals with no or insufficient carbohydrate
- alcohol intake
- exercise or unplanned physical activity
- weight loss
- treatment with agents potentiating hypoglycaemia (eg sulfonylureas)
- decreased insulin clearance (eg renal failure)
- changes to other medications (eg reducing or ceasing steroids).

Strategies for preventing hypoglycaemia in patients include education about hypoglycaemic symptoms, structured self-monitoring of blood glucose (SMBG), discussing and individualising glycaemic goals, and continued team-based support.<sup>32</sup>

Weight gain is variable on initiation of insulin and may accompany initial titration such that weight gain may eventually level off. Slower titration can lead to slower weight gain.

Strategies to address weight include:

- referral to a credentialled diabetes educator (CDE) and/or accredited practising dietitian (APD)
- review of other clinical conditions that may impact glycaemic control, such as depression, occult malignancy, thyroid disease
- review of medications that may contribute to weight gain
- advice on increasing physical activity.

## Early insulin intervention

Guidelines outlining the use of insulin in acute hyperglycaemic emergencies (including ketosis-inducing and hyperosmolar crises) are available.<sup>33,34</sup> The use of insulin in these cases may be life-saving, and reassessment of long-term use can occur on metabolic stabilisation.

## Insulin types

Refer to [Appendix 1. Types of insulin available](#).

## Insulin delivery options

A range of devices are available to deliver insulin, including insulin pens, syringes and pumps. Choice will depend on patient preference, need and ability to self-manage injections. A CDE or a diabetes nurse practitioner can help provide patient support.

Insulin 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.

There is mounting evidence of selective beneficial effects of using insulin pumps and insulin patch pumps in people with type 2 diabetes – refer to the section '[Use of technology in type 2 diabetes management](#)'.

The National Diabetes Services Scheme (NDSS) provides subsidised access to insulin pump consumables for people with type 1 diabetes. For people with type 2 diabetes, some health funds cover insulin pumps, but consumables need to be self-funded.

## Recommendations for delivery of insulin and non-insulin injectable medications

Using the correct delivery technique to ensure the optimal effect of insulin and GLP-1 RAs is critical to achieving optimal control of diabetes and reducing the risk of some adverse effects of injectable medications.

The following recommendations for insulin delivery are based on the Forum for Injection Technique and Therapy Expert Recommendations (FITTER).<sup>35</sup>

- Single use of pen needles and syringes is recommended (lipohypertrophy has been associated with reuse of pen needles and syringes).
- Shorter (size 4 mm or shortest available) needles applied to either the abdomen, thigh or buttock are adequate for most adults using insulin pen devices and will lessen the risk of intramuscular injection.
- Lipohypertrophy and lipodystrophy may occur with repeated insulin injections into the same site, and this can affect insulin absorption. This problem is overcome by ensuring rotation of injection sites.

Full recommendations are available on the [Mayo Clinic](#) website.

More information can be found in the *Australian Journal of General Practice (AJGP)* article '[Teaching patients with type 2 diabetes to self-administer insulin](#)'.<sup>36</sup>

## When should patients start insulin?

General practitioners (GPs) should anticipate and proactively address the patient's (and their own) reluctance to start insulin therapy. Early after a diagnosis of diabetes, it is important to discuss with patients that insulin may be used at some point to manage their diabetes.

With the appropriate insulin regimen, insulin therapy can be well managed in general practice, with patients achieving better HbA1c control, fewer hypoglycaemic episodes and less weight gain, thus alleviating many patient concerns.<sup>37</sup>

Insulin is one of the most effective glucose-lowering agents for type 2 diabetes, and can be titrated to suit the individual patient's requirements. Commencement should not be delayed if hyperglycaemia and symptoms cannot be controlled adequately by a patient's existing treatments. Recent evidence suggests that people who decline treatment with insulin when it is recommended to them can take longer to achieve HbA1c targets.<sup>38</sup>

Importantly, insulin is not the end of the road for the person with diabetes, nor does it represent therapeutic or patient failure.

Insulin should be initiated in patients with type 2 diabetes who are taking maximal doses of non-insulin glucose-lowering medicines and who have suboptimal glycaemic control (HbA1c or blood glucose above individualised target), whether they are asymptomatic or symptomatic.<sup>31,39</sup>

Insulin therapy may remain an alternative for older or nursing home patients, even in end-of-life care, with HbA1c >9% (75 mmol/mol), especially if control of symptomatic hyperglycaemia is difficult.

### Before starting insulin

Ensure that other possible causes of hyperglycaemia have been addressed (eg lifestyle, non-adherence to non-insulin glucose lowering medicines, other medications or medical conditions).<sup>40</sup>

Discuss with patients the benefits and costs of using insulin for better glycaemic control. Referral is recommended to a CDE and/or APD to provide the necessary support and education to the person with diabetes in the lead-up to insulin initiation.

A GP or CDE can complete the NDSS medication change registration form to allow patients to access syringes or pen needles through the NDSS scheme.

The NDSS has an [information booklet](#) for people with type 2 diabetes who are starting insulin.

### Patient education

Initial management planning and education (with both patients and carers) should cover:

- self-management – timing and frequency of SMBG, timing of meals, dose adjustment
- the impact of diet, in particular carbohydrate content (both type and amount)
- the effects of altered eating patterns, such as for religious fasts or weight loss strategies (eg intermittent fasting, 5:2 diets, very-low-calorie diets)
- the impact of physical activity
- hypoglycaemia management
- insulin delivery techniques (Box 1)
- weight management and the mitigation of weight gain with insulin therapy
- sick day management (refer to the section '[Managing risks and other impacts of type 2 diabetes](#)')
- exercise, illness and travel considerations
- identification, roads and maritime services notifications.

This should be followed up regularly with structured education sessions.

### Box 1. Insulin delivery

Fundamental information for patients about insulin delivery includes:

- insulin can be stored at room temperature for up to one month
- pre-mix insulin must be resuspended prior to each use
- insulin pen needles should be used only once, as re-use increases the risk of lipohypertrophy<sup>41</sup>
- when using a new insulin pen needle, use 1–2 units to expel air prior to dialling up the prescribed dose
- the abdomen is the preferred site for injecting
- insulin needs to be injected only into subcutaneous tissue – injecting into muscle can not only be painful, but can increase the absorption rate of insulin<sup>42</sup>

Patients should also be educated about:

- how to [safely dispose](#) of used needles
- how to rotate injection sites – patients should be taught and provided with an easy-to-follow injection site rotation plan, reviewed regularly, to reduce risk of lipohypertrophy<sup>43</sup>
- how to time insulin injections
- the importance of regular inspection of injection sites.

## Initiating insulin

All insulins can work effectively.<sup>37</sup> Selecting an insulin for initiation will depend on patient as well as disease characteristics. At the selection of the insulin preparation, consider which injecting device is most suitable for the patient.

Set an individualised target (refer to the section '[Glucose monitoring](#)'), following the principle of 'start low, go slow' to gain patient confidence and reduce the risk of hypoglycaemia.<sup>44</sup>

Select one of two insulin schedules:

- basal insulin (eg glargine U100 or U300) once daily, irrespective of meals
- co-formulated insulin (eg degludec–aspart) or premixed (biphasic) insulin (eg lispro–lispro protamine or aspart–protamine insulin) once daily before the largest carbohydrate-containing meal of the day. Premixed insulins have various combinations of intermediate-acting basal insulins and rapid-acting insulins. Common combinations are 25/75, 30/70 and 50/50 (rapid-acting/basal insulins), by percentage.

Basal insulin alone has a slightly lower risk of hypoglycaemia, especially if the fasting glucose is consistently above target.<sup>31,45</sup>

Premixed or co-formulated insulin may be more appropriate and simpler for a patient where fasting and postprandial glucose are both consistently elevated.

Dosage adjustment can be more complex with premixed and co-formulated insulins, as both insulin components are adjusted simultaneously, possibly increasing the risk of hypoglycaemia and weight gain compared with basal insulin.<sup>45,46</sup>

Non-insulin glucose-lowering medicines should generally be continued, as:

- cessation of non-insulin glucose-lowering medicines before blood glucose targets are achieved may result in significant hyperglycaemia<sup>44</sup>
- ongoing use can mitigate weight gain (particularly SGLT2i and GLP-1 RAs)<sup>31</sup>
- ongoing use may be insulin-sparing and can reduce the risk of hypoglycaemia as well as hyperglycaemia.<sup>44</sup>



Careful review of use of sulfonylureas should be considered if risks of hypoglycaemia are present (commencing insulin in older people, or up-titration of insulins containing prandial/rapid-acting insulins).

A low starting dose for premixed, co-formulated or basal insulins of 10 units or 0.1–0.2 units/kg in the evening will usually be a safe dose; **however, titration is needed**, as this low dose will be insufficient for achieving glycaemic targets in most people.

[Appendix 2. Guide to insulin initiation and titration](#) provides detailed information about insulin doses, titration and intensification.

## Resources

The **Australian Diabetes Educators Association** has produced the [Clinical guiding principles for subcutaneous injection technique](#).

The **National Diabetes Services Scheme** has produced a [fact sheet](#) for people with type 2 diabetes starting on insulin.

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# Type 2 diabetes and cardiovascular risk

## Recommendations

Recommendation	Reference	Grade*
<b>Assessing cardiovascular disease risk</b>		
Calculate cardiovascular disease (CVD) risk level using an evidence-based tool, for example: <ul style="list-style-type: none"> <li>• <a href="#">Australian absolute cardiovascular disease risk calculator</a></li> <li>• <a href="#">Australian cardiovascular risk charts</a></li> </ul>	RACGP Diabetes Handbook working groups, 2020	Consensus
Adults with any of the following conditions do not require absolute CVD 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 aged &gt;60 years</li> <li>• diabetes with microalbuminuria (&gt;20 mcg/min or urine albumin-to-creatinine ratio [UACR] &gt;2.5 mg/mmol for men and &gt;3.5 mg/mmol for women)</li> <li>• moderate or severe chronic kidney disease (persistent proteinuria or estimated glomerular filtration rate [eGFR] &lt;45 mL/min/1.73 m<sup>2</sup>)</li> <li>• a previous diagnosis of familial hypercholesterolaemia</li> <li>• systolic blood pressure ≥180 mmHg or diastolic blood pressure ≥110 mmHg</li> <li>• serum total cholesterol &gt;7.5 mmol/L</li> </ul>	1 NVDPA, 2012	D
Aboriginal and Torres Strait Islander peoples are generally assumed to be at higher risk	1 NVDPA, 2012	D
Patients with pre-existing CVD are at high risk	2 Baker IDI, 2015	None given
<b>Managing CVD risk</b>		
Adults at high absolute risk of CVD should be simultaneously treated with lipid and blood pressure-lowering pharmacotherapy in addition to lifestyle advice, unless contraindicated or clinically inappropriate	1 NVDPA, 2012	B
Sodium glucose co-transporter 2 (SGLT2) inhibitors are recommended in patients with type 2 diabetes in the setting of CVD and insufficient glycaemic control despite metformin, to decrease the risk of cardiovascular events and decrease the risk of hospitalisation for heart failure	3 Heart Foundation, 2018	Strong; high-quality evidence
<b>Antihypertensive medication</b>		
Antihypertensive therapy is strongly recommended in patients with diabetes and systolic blood pressure ≥140 mmHg	4 Heart Foundation, 2016	Strong; level I evidence
In patients with diabetes and hypertension, any of the first-line antihypertensive drugs that effectively lower blood pressure are recommended	4 Heart Foundation, 2016	Strong; level I evidence
In patients with diabetes and hypertension, a blood pressure target of <140/90 mmHg is recommended	4 Heart Foundation, 2016	Strong; level I evidence
A systolic blood pressure target of <120 mmHg may be considered for patients with diabetes in whom prevention of stroke is prioritised	4 Heart Foundation, 2016	Weak
In patients with diabetes where treatment is being targeted to <120 mmHg systolic, close follow-up is recommended to identify treatment-related adverse effects including hypotension, syncope, electrolyte abnormalities and acute kidney injury	4 Heart Foundation, 2016	Strong

Recommendation	Reference	Grade*
<b>Lipid-lowering medications</b>		
Use statins as first-line for lipid-lowering therapy	1 NVDPA, 2012	A
All adults with type 2 diabetes and known prior CVD (except haemorrhagic stroke) should receive the maximum tolerated dose of a statin, irrespective of their lipid levels  Note: The maximum tolerated dose should not exceed the maximum available dose (eg 80 mg atorvastatin, 40 mg rosuvastatin)	2 Baker IDI, 2015	A
In people with type 2 diabetes and known prior CVD, fibrates should be commenced in addition to a statin or on their own (for those intolerant to statin) when fasting triglycerides are greater than or equal to 2.3 mmol/L, or high-density lipoprotein cholesterol (HDL-C) is low†  Note: When used in combination with statins, fenofibrate presents a lower risk of adverse events than other fibrates combined with statins	2 Baker IDI, 2015	B
For adults with type 2 diabetes and known prior CVD already on maximally tolerated statin dose or intolerant of statin therapy, if fasting low-density lipoprotein cholesterol (LDL-C) levels remain $\geq 1.8$ mmol/L, consider commencing one of: <ul style="list-style-type: none"> <li>ezetimibe</li> <li>bile acid binding resins, or</li> <li>nicotinic acid</li> </ul>	2 Baker IDI, 2015	Consensus
<b>Antithrombotic medication</b>		
All adults with type 2 diabetes and known prior CVD should receive long-term antiplatelet therapy unless there is a clear contraindication	2 Baker IDI, 2015	A
All adults with type 2 diabetes and a history of ischaemic stroke or transient ischaemic attack should receive: <ul style="list-style-type: none"> <li>low-dose aspirin, or</li> <li>clopidogrel, or</li> <li>combination low-dose aspirin and extended-release dipyridamole</li> </ul>	2 Baker IDI, 2015	A A B
Patients with a history of stroke and non-valvular atrial fibrillation who have adequate renal function should be initiated on direct oral anticoagulants (DOACs) in preference to warfarin	5 Stroke Foundation, 2019	Strong recommendation
All adults with type 2 diabetes and recent acute coronary syndrome and/or coronary stent should receive, for 12 months after the event or procedure: <ul style="list-style-type: none"> <li>combination low-dose aspirin and clopidogrel, or</li> <li>combination low-dose aspirin and prasugrel, or</li> <li>combination low-dose aspirin and ticagrelor</li> </ul>	2 Baker IDI, 2015	B B C
All adults with type 2 diabetes and a history of coronary artery disease, but no acute event in the past 12 months, should receive <ul style="list-style-type: none"> <li>long-term low-dose aspirin, or</li> <li>long-term clopidogrel if intolerant to aspirin</li> </ul>	2 Baker IDI, 2015	A B
In the presence of atrial fibrillation or other major risk factors for thromboembolism, there should be consideration of anticoagulant therapy according to other relevant guidelines	2 Baker IDI, 2015	Practice Point
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		
†HDL < 1.0 mmol/L (based on the cut-offs reported in the ACCORD and FIELD studies)		

## Clinical context

Cardiovascular disease (CVD) is the leading cause of death in people with diabetes, making assessment, prevention and management of CVD risk a vital part of diabetes care.

It is important to note that although myocardial infarction and stroke are commonly used as primary outcomes in type 2 diabetes trials, other common manifestations of CVD in people with type 2 diabetes are in fact peripheral arterial disease and heart failure.<sup>6</sup> General practitioners (GPs) therefore need to consider these risks when addressing CVD risk in patients with type 2 diabetes.

## Assessment of CVD risk

Assessment of combined multiple risk factors (absolute CVD risk) is more accurate than the use of individual risk factors.<sup>1</sup>

All patients with type 2 diabetes should be assessed for absolute CVD risk, using a validated tool, at diagnosis. Note that all patients with type 2 diabetes and existing CVD are considered to be at high risk for another event.<sup>2</sup>

Depending on level of risk, patients should be reassessed at the following intervals:

- low absolute risk (<10%): every two years
- moderate risk (10–15%): every 6–12 months
- high risk (>15%): as clinically indicated.<sup>7</sup>

Absolute CVD risk assessment tools are available from:

- National Vascular Disease Prevention Alliance – [Australian absolute cardiovascular disease risk calculator](#)
- New Zealand Ministry of Health – [cardiovascular risk charts](#)
- [National Heart Foundation of New Zealand](#).

Coronary artery calcium (CAC) scoring: the clinical utility of CAC scoring in this situation is controversial and under current review.

People with type 2 diabetes and any of the following are already known to be at clinically determined high risk of CVD and **do not** require absolute CVD risk assessment:<sup>1</sup>

- aged >60 years
- pre-existing CVD
- microalbuminuria (>20 mcg/min or urine albumin-to-creatinine ratio [UACR] >2.5 mg/mmol for men and >3.5 mg/mmol for women)
- moderate or severe chronic kidney disease (persistent proteinuria or estimated glomerular filtration rate (eGFR) <45 mL/min/1.73 m<sup>2</sup>)
- a previous diagnosis of familial hypercholesterolaemia
- systolic blood pressure ≥180 mmHg or diastolic blood pressure ≥110 mmHg
- serum total cholesterol >7.5 mmol/L.

Aboriginal and Torres Strait Islander people aged >74 years are also generally assumed to be at high risk of CVD. Refer to The Royal Australian College of General Practitioners' (RACGP's) *National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people*, [Chapter 11: Cardiovascular disease prevention](#).

## Prevention and management of CVD

Interventions to manage CVD risk include:

- [lifestyle modification](#)
- [antihypertensive medication](#)
- [lipid-lowering medication](#)
- [antithrombotic therapy](#)
- [glucose-lowering medications that show novel non-glycaemic effects.](#)

In addition to lifestyle modification, **all people at high absolute CVD risk** should be treated with both antihypertensive medication and lipid-lowering medication (refer below), unless contraindicated or clinically inappropriate.<sup>1</sup>

GPs should set individual treatment targets for patients, balancing the benefits and risks of interventions. For example, the CVD risk associated with lipid and blood pressure levels is continuous; hence, specific targets are somewhat arbitrary and should be used as a guide to treatment, not as mandatory goals. It's important to understand that there might be small absolute benefits required to reach suggested goals. However, any reduction in risk factor values will be associated with some benefit.<sup>1</sup>

When developing a management plan for patients, refer to the National Vascular Disease Prevention Alliance's *Guidelines for the management of absolute cardiovascular disease risk*.<sup>1</sup>

### Lifestyle modification

Lifestyle changes in nutrition, physical activity and smoking status underpin a general practice approach to CVD risk minimisation. Lifestyle changes show excellent cost-effectiveness in lowering the burden of disease and remain the basis for the management of all CVD risk levels.<sup>8,9</sup>

In people with type 2 diabetes and obesity (average BMI 36 kg/m<sup>2</sup>), the Look AHEAD study found that a lifestyle intervention that focused on weight loss improved glycated haemoglobin (HbA1c) and quality of life, but did not significantly reduce risk of cardiovascular morbidity or mortality.<sup>10</sup>

For further information, refer to the section '[Lifestyle interventions for management of type 2 diabetes](#)'.

### Antihypertensive medication

Lowering blood pressure reduces cardiovascular events and all-cause mortality in people with type 2 diabetes. While no difference is noted between different classes of blood pressure-lowering therapy for CVD outcomes, there is clear evidence that in people with type 2 diabetes, antihypertensive therapy with an angiotensin receptor blocker (ARB) or angiotensin-converting enzyme inhibitor (ACEI) decreases the rate of progression of albuminuria, promotes regression to normoalbuminuria and may reduce the risk of decline in renal function. Combining an ARB and an ACEI is not recommended.<sup>1,11</sup>

### Blood pressure targets

The target level for optimum blood pressure is controversial. A number of international guidelines have changed their blood pressure targets to <140/90 mmHg,<sup>3,12</sup> while others remain at <130/80 mmHg.<sup>13</sup> Some suggest that low targets such as <130/80 mmHg could be appropriate for people at high risk of CVD, if achievable without undue treatment burden.<sup>12</sup>

Considering these guidelines, the RACGP recommends a blood pressure target of <140/90 mmHg for people with diabetes, with lower targets considered for younger people and those at high risk of stroke, as long as the treatment burden is not high.

**For secondary prevention of CVD**, the target blood pressure for people with diabetes and microalbuminuria or proteinuria (emergent chronic kidney disease) remains <130/80 mmHg. As always, treatment targets should be individualised and people with diabetes monitored for side effects from the use of medications to achieve lower targets.

## Lipid-lowering medication

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

Statins remain the clear first-line choice when commencing pharmacotherapy.

The results from several systematic reviews are consistent, and suggest that people with diabetes gain at least similar benefits as people without diabetes. The data clearly demonstrate that statin therapy results in a significant decrease in coronary artery disease morbidity and mortality in type 2 diabetes for those at high CVD risk.<sup>1,14,15</sup> This benefit is in contrast to the contentious effects of improved glycaemic control in CVD risk management.

### Statin use for primary prevention of CVD

Statins are indicated for people with diabetes at high absolute risk of CVD, at any cholesterol level.<sup>1</sup>

### Statin use for secondary prevention

Statin therapy is recommended for all patients with CVD (unless exceptional circumstances apply).

### Other lipid-lowering medications

The evidence for using lipid-lowering medications other than statins to decrease the risk of coronary artery disease is still accumulating.

#### Ezetimibe

Ezetimibe has been studied in the IMPROVE-IT trial in people with diabetes and existing acute coronary syndrome. Compared with a statin alone, ezetimibe combined with a statin showed an absolute risk reduction of 5.5% (40% versus 45.5%) for the composite primary endpoint of cardiovascular death, major coronary events or non-fatal stroke over seven years.<sup>16</sup>

Thus, in adults, ezetimibe combined with a statin (simvastatin) in diabetes patients with acute coronary syndrome may provide additional low-density lipoprotein cholesterol (LDL-C) lowering (if >1.8 mmol/L on statin therapy) and CVD risk reduction.

#### Nicotinic acid, bile-acid resins and fibrates

These agents have been suggested as alternatives for people who cannot tolerate statins.

Nicotinic acid (niacin) has been shown in one trial to reduce CVD outcomes, although the study was done in a cohort of people without diabetes.<sup>17</sup> More recent trials 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 (fenofibrate, gemfibrozil) to decrease CVD is contentious. Fibrates, preferably fenofibrate, should be commenced in addition to a statin or on their own (for those intolerant to statin) when fasting triglycerides are  $\geq 2.3$  mmol/L, or HDL-C is low.<sup>2</sup>



### **Proprotein convertase subtilisin/kexin type 9 inhibitors (PCSK9)**

PCSK9 are injectable lipid-lowering agents, some of which have restricted Therapeutic Goods Administration (TGA) and Pharmaceutical Benefits Scheme (PBS) approval for use in select high-risk patients. Long-term outcome studies on safety are needed. For more information, refer to the websites for the TGA and the PBS.

### **Antithrombotic therapy**

It is not usually recommended that antiplatelet therapy (eg aspirin, clopidogrel) be used in primary prevention of CVD. For secondary prevention, the strong positive effects in the conditions outlined in the '[Recommendations](#)' need to be weighed against individual patient risks.

### **Glucose-lowering medications (novel non-glycaemic effects)**

In populations with existing CVD, cardiovascular outcome trials have been conducted for newly developed diabetes drugs to demonstrate, primarily, cardiovascular safety and various secondary non-glycaemic endpoints. Some trials did include people with multiple risk factors for CVD. The trials were not glycaemic efficacy trials.

### **Summary of outcomes**

**Refer to the individual trial designs and outcomes for specific drug effects.**

#### **Sodium glucose co-transporter 2 (SGLT2) inhibitors**

A 2019 meta-analysis of the cardiovascular outcomes trials showed that SGLT2 inhibitors led to:<sup>18</sup>

- 11% reduction in major adverse cardiovascular events, seen only in those with established CVD, but not those without CVD
- 23% reduction in CVD death or hospitalisation for heart failure in those with or without atherosclerotic disease or heart failure.

Future clinical trials are focused on specific non-glycaemic benefits in heart failure (with or without diabetes) and renal outcomes. The exact mechanism of action on CVD and heart failure has not been fully elucidated.

#### **Glucagon-like peptide-1 receptor agonists (GLP-1 RAs)**

A 2018 meta-analysis showed that GLP-1 RAs led to:<sup>19</sup>

- 10% reduction in primary endpoints for major adverse cardiovascular outcomes
- 13% reduction in cardiovascular mortality
- 12% reduction in all-cause mortality.

Non-significant effects were demonstrated on fatal and non-fatal myocardial infarction, fatal and non-fatal stroke, hospital admission for unstable angina, and hospital admission for heart failure.

The exact mechanism of action has not been fully elucidated.

#### **Dipeptidyl peptidase-4 inhibitors (DPP-4i)**

Recent meta-analyses for DPP-4i showed:<sup>20-22</sup>

- safety, but non-significant benefits for cardiovascular outcomes in those with high risk for cardiovascular events or with established CVD
- statistically non-significant 5% increased risk of hospitalisation for heart failure.

## Sulfonylureas

Meta-analyses of randomised clinical trials for sulfonylureas have shown:

- no excess cardiovascular risks associated with this class<sup>23,24</sup>
- lower all-cause and cardiovascular mortality associated with gliclazide and glimepiride compared with glibenclamide.<sup>25</sup>

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# Microvascular complications: Diabetes-related eye disease

## Recommendations

Recommendation	Reference	Grade*
Individuals with type 2 diabetes should be screened and evaluated for retinopathy by an optometrist or ophthalmologist at the time of diagnosis	1 Diabetes Canada, 2018	A, level 1
Follow-up screening interval for people with retinopathy should be tailored to the severity of retinopathy	1 Diabetes Canada, 2018	D, consensus
The recommended interval for those with no or minimal retinopathy is 1–2 years	1 Diabetes Canada, 2018	A, level 1
Examine higher risk patients (eg longer duration of diabetes; suboptimal glycaemic management, blood pressure or blood lipid control; people from a non-English-speaking background) who don't have diabetic retinopathy at least annually	2 NHMRC, 2008  3 RANZCO, 2019	None provided Level I evidence; level IV regarding people from non-English-speaking background Consensus
Conduct annual diabetic retinopathy screening for Aboriginal or Torres Strait Islander people with diabetes	2 NHMRC, 2008	None provided Level IV evidence
Results of eye examinations and the follow-up interval plan should be communicated clearly to all members of the diabetes healthcare team	1 Diabetes Canada, 2018	D, consensus
To delay onset and progression of diabetic retinopathy, people with type 2 diabetes should be treated to achieve optimal control of: <ul style="list-style-type: none"> <li>• blood glucose</li> <li>• blood pressure</li> </ul>	1 Diabetes Canada, 2018	A, level 1A A, level 1A
Fenofibrate, in addition to statin therapy, may be used in people with type 2 diabetes to slow the progression of established retinopathy	1 Diabetes Canada, 2018	A, level 1A
Individuals with sight-threatening diabetic retinopathy should be assessed by an ophthalmologist	1 Diabetes Canada, 2018	D, consensus
Pharmacological intervention, laser therapy and/or vitrectomy may be used to manage diabetic retinopathy	1 Diabetes Canada, 2018	A, level 1A
Women with pre-existing type 2 diabetes who are planning for pregnancy or pregnant should be counselled on the risk of development and/or progression of diabetic retinopathy	4 American Diabetes Association, 2019	B
Eye examinations should occur before pregnancy or in the first trimester in patients with pre-existing type 2 diabetes; patients should then be monitored every trimester and for one year postpartum as indicated by the degree of retinopathy	4 American Diabetes Association, 2019	B
The presence of retinopathy is not a contraindication to aspirin therapy for cardioprotection, as aspirin does not increase the risk of retinal haemorrhage	4 American Diabetes Association, 2019	A

\*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.

## Diabetes-related retinopathy

### Clinical context

Diabetes-related retinopathy (DR) occurs as a result of microvascular disease of the retina. It affects up to one in three people with diabetes, and can cause visual impairment and blindness.<sup>5</sup> DR also impairs quality of life and ability to manage diabetes.<sup>6</sup>

Three distinct forms of DR are:

- macular oedema, which includes diffuse or focal vascular leakage within the macula
- DR caused by microvascular changes
  - non-proliferative DR includes micro-aneurysms, intra-retinal haemorrhage, malformation and torturous vessels; may be asymptomatic
  - proliferative DR – abnormal vessel growth on the optic disc or retina
- retinal capillary non-perfusion.

**Sight-threatening DR** includes:

- severe non-proliferative DR
- proliferative DR
- foveal-threatening diabetic macular oedema.

Non-proliferative DR affects 19.3% of people with diabetes, while 2.1% may have proliferative DR and 3.3% may have macular oedema.<sup>7</sup> Proliferative DR and macular oedema are associated with elevated cardiovascular disease risk.<sup>8</sup>

### In practice

Risk factors for the onset or progression of DR include:

- existing DR
- poor glycaemic control
- raised blood pressure
- duration of diabetes >10 years
- microalbuminuria
- dyslipidaemia
- anaemia
- pregnancy.

Visual impairment due to diabetes can be avoided for the vast majority of patients through good screening and care. This involves regular review of fundi, early detection and optimisation of therapy.

Monitoring for diabetic eye disease involves assessment of:

- changes in visual acuity (with correction)
- lens disease – for example, cataracts ([refer below](#))
- fundal disease – for example, fundoscopy with dilation or retinal camera, or refer to an optometrist or ophthalmologist.

Screening methods and intervals for retinopathy are shown in Box 1.

Strategies for delaying the onset and progression of DR include:

- optimising blood glucose.<sup>9–11</sup> Refer to the section ‘[Glucose monitoring](#)’ for suggested glycated haemoglobin (HbA1c) targets. Note that intensive glucose control in people with DR that is more severe than moderate non-proliferative DR on the International Clinical Diabetic Retinopathy Disease Severity Scale may not be beneficial<sup>12</sup>
- controlling blood pressure<sup>13</sup>
- adding fenofibrate – indicated for the reduction in the progression of DR in patients with type 2 diabetes who have existing DR. Fenofibrate does not replace controlling blood pressure, blood glucose and blood lipids as strategies to delay the progression of DR<sup>14,15</sup>
- ophthalmological specialist care
  - laser therapy
  - intraocular anti-vascular endothelial growth factor (VEGF) agents – ranibizumab, aflibercept and off-label use of bevacizumab (refer to the Pharmaceutical Benefits Scheme for further information)
  - vitreo-retinal surgery.

[KeepSight](#) is a free online reminder system for people with diabetes about their next diabetes eye examination. It is managed by Diabetes Australia and Vision 2020.

The National Diabetes Services Scheme (NDSS) and Diabetes Australia send alerts and reminders to people with diabetes registered on the NDSS to have their eyes checked.

**Box 1. Screening for retinopathy in type 2 diabetes****When to initiate screening<sup>3</sup>**

- At diagnosis

**Screening methods<sup>1</sup>**

- Seven-standard field, stereoscopic-colour fundus photography with interpretation by a trained reader
- Direct ophthalmoscopy or indirect slit-lamp fundoscopy through dilated pupil
- Digital fundus photography

**If retinopathy is present<sup>1,3</sup>**

- Grade retinopathy severity, refer to ophthalmologist as appropriate, and establish appropriate monitoring intervals ( $\leq 1$  year)
- Sight-threatening retinopathy may be treated with laser, pharmacological or surgical therapy\*
- Review glycaemic, blood pressure and lipid control, and adjust therapy to reach targets as per guidelines
- Screen for other diabetes complications

**If retinopathy is not present**

Rescreen every year:<sup>3</sup>

- people with duration of diabetes  $>15$  years
- suboptimal glycaemic control (HbA1c  $>8\%$  or 64 mmol/mol)
- systemic disease – poorly controlled hypertension, lipids; other diabetes complications; foot ulcers
- Aboriginal and Torres Strait Islander people
- people from a non-English-speaking background

Rescreen every two years:<sup>3</sup>

- all other patients with type 2 diabetes

Review glycaemic, blood pressure and lipid control, and adjust therapy to reach targets as per guidelines

Screen for other diabetes complications

For more information, refer to the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) [screening and referral algorithm for diabetic retinopathy](#).

\*Treatment options include fenofibrate, laser therapy, intra-ocular anti-VEGF agents, vitreoretinal surgery.

## The role of retinal photography

Retinal photography is technically simple and is now usually performed within the Australian community by general practitioners, optometrists and ophthalmologists. Training is required to ensure quality of image interpretation.

Aboriginal health services are providing their own retinal photography services with support through telemedicine to promote access to screening.

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 assessment by an ophthalmologist.

Retinal photography may serve as a screening tool for retinopathy; however, it is not a substitute for a comprehensive eye exam.<sup>4</sup>

Note: A [Medicare Benefits Schedule \(MBS\) item number](#) for retinal photography with a non-mydiatric retinal camera is available for general practice use.

## Other ophthalmological effects

### Refractive errors

Refractive errors occur as the lens shape alters with changes in blood glucose concentrations and results in blurred vision. Correction of refractive errors should be postponed until blood glucose levels are stabilised. Detection is done with pinhole test – blurred vision due purely to refractive error corrects with the pinhole test.

### 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 fundus may be difficult to see.

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

### Maculopathy

Maculopathy other than oedema is difficult to diagnose ophthalmoscopically; however, it is the most common cause of vision loss in people with diabetes.

### Glaucoma

The incidence of glaucoma in people with diabetes is approximately twice that of the general population. All patients with type 2 diabetes should be monitored for glaucoma.<sup>16</sup>

### Ischaemic optic neuropathy

Ischaemic optic neuropathy is a cause of sudden vision loss and has a poor prognosis for sight.

### Sudden blindness

Sudden loss of vision is an emergency, and may be caused by:

- 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.



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# Microvascular complications: Diabetes-related neuropathy

## Recommendations

Recommendation	Reference	Grade*
All patients should be screened for diabetic peripheral neuropathy, starting at diagnosis of type 2 diabetes and at least annually thereafter	1 American Diabetes Association, 2019	B
Screening for peripheral neuropathy should be conducted by assessing loss of sensitivity to the 10 g monofilament, or loss of sensitivity to vibration at the dorsum of the great toe	2 Diabetes Canada, 2018	A, level 1
The following agents may be used alone or in combination to relieve painful peripheral neuropathy: <ul style="list-style-type: none"> <li>• anticonvulsants <ul style="list-style-type: none"> <li>– pregabalin</li> <li>– gabapentin</li> <li>– valproate</li> </ul> </li> <li>• antidepressants <ul style="list-style-type: none"> <li>– amitriptyline</li> <li>– duloxetine</li> <li>– venlafaxine</li> </ul> </li> <li>• topical nitrate spray</li> <li>• opioid analgesics</li> </ul>	2 Diabetes Canada, 2018	A, level 1 B, level 2 B, level 2 B, level 2  B, level 2 B, level 2
People with type 2 diabetes should be treated with intensified glycaemic control to prevent the onset and progression of neuropathy	2 Diabetes Canada, 2018	B, level 2
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Clinical context

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.

Symptoms include pain and paraesthesia, and if the autonomic nervous system is involved, gastrointestinal, bladder and sexual problems may arise. These increase the patient's burden of self-care and overall management. Foot ulceration and amputation are important and costly sequelae of diabetic neuropathy<sup>2</sup> (refer to the section '[Microvascular complications: Foot care](#)').

## Peripheral neuropathy

Manifestations of diabetes-related peripheral neuropathy include:

- polyneuropathy – diffuse and symmetrical neuropathy (most common)
- mononeuropathy
- polyradiculoneuropathy

- thoracic radiculopathy
- cranial neuropathy.

### 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, chronic constipation, reduced anal sphincter control
- delayed/incomplete bladder emptying, urinary incontinence
- erectile dysfunction and retrograde ejaculation in males
- reduced vaginal lubrication with arousal in women
- loss of cardiac pain, 'silent' ischaemia or myocardial infarction
- sudden, unexpected cardiorespiratory arrest, especially under anaesthetic or treatment with respiratory-depressant medications
- difficulty recognising hypoglycaemia (hypoglycaemic unawareness)
- unexplained ankle oedema.

### In practice

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

The clinical focus is on prevention via optimising glycaemic management and early recognition, facilitated by good history and routine sensory testing.

### Assessment

People with type 2 diabetes should be checked for diabetic peripheral neuropathy at diagnosis, and at least annually thereafter.<sup>1</sup>

Tests to assess for diabetic peripheral neuropathy are shown in Box 1. Combinations of more than one test have >87% sensitivity in detecting diabetic peripheral neuropathy. Loss of 10 g monofilament perception and reduced vibration perception predict foot ulcers.<sup>3</sup>

Several neuropathy scoring systems (diabetic neuropathy symptom score, neuropathy impairment score and Michigan neuropathy screening instrument) may be used with examination to confirm diagnosis and assess severity.<sup>4-6</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.

Cardiovascular autonomic neuropathy should be suspected with resting tachycardia (>100 beats per minute) or orthostatic reduction in blood pressure (a fall in systolic blood pressure >20 mmHg on standing without an appropriate heart rate response). This applies to patients not currently on antihypertensive agents that may cause variations in blood pressure responsiveness, such as  $\beta$ -blockers. It is associated with increased cardiac event rates.

**Box 1. Tests to assess for peripheral neuropathy<sup>3</sup>**

- Small fibre:
  - pinprick sensation
- Large fibre:
  - 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
  - loss of protective sensation (10 g monofilament)

**Management**

Management of diabetes-related neuropathy mainly involves professional assessment and foot care to prevent diabetes-associated foot disease. The appearance of peripheral neuropathy should prompt review of glycaemic control and consideration of intensified management to prevent progression.<sup>2</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 could be considered as a first-line treatment.
- Gabapentin provides pain relief of a high level in approximately one-third of people who take this medication for 'painful neuropathic pain'.<sup>7</sup>
- Pregabalin at daily oral doses of 300–600 mg provides high levels of benefit for some patients experiencing neuropathic pain, including painful diabetic neuropathy.<sup>8</sup>

For information about the Foot Forward program to prevent amputation, contact [Diabetes Australia](#).

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# Microvascular complications: Foot care

## Recommendations

Recommendation	Reference	Grade*
Assess all people with diabetes and stratify their risk of developing foot complications	1 NHMRC, 2011	C
Assess risk stratification by enquiring about previous foot ulceration and amputation, visually inspecting the feet for structural abnormalities and ulceration, assessing for neuropathy using either the neuropathy disability score or a 10 g monofilament, and palpating foot	1 NHMRC, 2011	C
People assessed as having intermediate-risk or high-risk feet should be offered a foot protection program. This includes foot care education, podiatry review and appropriate footwear	1 NHMRC, 2011	C
Pressure reduction, otherwise referred to as 'redistribution of pressure' or 'off-loading', is required to optimise the healing of plantar foot ulcers	1 NHMRC, 2011	B
Off-loading of the wound can be achieved with the use of a total contact cast or other device rendered irremovable	1 NHMRC, 2011	B
People with diabetes-related foot ulceration are best managed by a multidisciplinary foot care team	1 NHMRC, 2011	C
There is insufficient evidence to recommend any specific dressing type for typical diabetic foot ulcers	2 Diabetes Canada, 2018	C, level 3
General principles of wound care include the provision of physiologically moist wound environment and off-loading the ulcer	2 Diabetes Canada, 2018	D, consensus
Non-viable tissue should be debrided	2 Diabetes Canada, 2018	A, level I
Provided that all other modifiable factors (off-loading, infection, deformity) have been addressed, adjunctive wound-healing therapies, such as topical growth factors and granulocyte colony-stimulating factor (G-CSF) or dermal substitutes, may be considered for non-healing, non-ischaemic wounds	2 Diabetes Canada, 2018	A, level 1
In people stratified as having low-risk feet (where no risk factors or previous foot complications have been identified), foot examination should occur annually	1 NHMRC, 2011	Consensus
In people stratified as having intermediate-risk or high-risk feet (without current foot ulceration), foot examination should occur at least every 3–6 months	1 NHMRC, 2011	Consensus

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

## Clinical context

Foot ulceration and limb amputation are among the major drivers of disability and healthcare costs in people with diabetes. Foot ulceration is a leading cause of hospitalisation for people with diabetes,<sup>1</sup> and in 2012–13, 3570 people with diabetes had a lower limb amputation in Australia.<sup>3</sup>

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

For information about the Foot Forward program to prevent amputation, contact [Diabetes Australia](#).

## In practice

### Patient education and support

Foot care education should be provided to all people with diabetes to assist with prevention of foot complications.

Patient education and support regarding foot care should include:

- emphasising the importance of appropriate footwear and foot care (improper footwear and tinea infection are associated with increased problems)
- establishing a regular self-monitoring schedule (including visual checks)
- developing an action plan to respond to early problems (eg skin breakdown).

Regular podiatric review should be considered.

### Assessing risk of foot complications

A careful foot assessment should be performed to stratify the risk of developing foot complications. Stratification is dependent on four risk factors:<sup>1</sup>

- 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 pressure index (ABI) testing, toe brachial index (TBI) testing or absolute toe pressure
- peripheral neuropathy – which can be assessed using a neuropathy disability score or a 10 g monofilament
- deformities
- previous amputation or ulceration.

The following factors might also increase the risk of foot complications:<sup>1</sup>

- visual impairment
- kidney disease
- sub-optimal glucose control
- ill-fitting footwear
- socioeconomic disadvantage.

Table 1 shows risk stratification and corresponding foot care. People at intermediate and high risk should be assessed by a diabetic high-risk foot service. The intensity of monitoring and review increases according to the level of risk.

Refer to the section '[Microvascular complications: Diabetes-related neuropathy](#)' for practice-based tools for assessing circulation and foot deformity.

Table 1. Guidance on risk categorisation for complications, and elements to consider during foot assessment <sup>1</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 (ie neuropathy, PAD) and no previous history of foot ulceration or amputation	C	Offer program that includes foot care education, podiatry review every six months and footwear assessment
High risk	Two or more risk factors (ie 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 (eg a high-risk foot service)
High risk	Aboriginal or Torres Strait Islander people with diabetes	Practice Point	Offer program that includes foot care education, podiatry review and footwear assessment (eg a high-risk foot service)

*NHMRC, National Health and Medical Research Council; PAD, peripheral arterial disease*  
 \*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.

Indications for **immediate** referral to a multidisciplinary foot care clinic include active foot disease:

- foot ulcer, with or without local Infection
- suspected Charcot neuroarthropathy (eg unilateral, red, hot, swollen, possibly aching foot).

Any patients presenting with acute limb ischaemia should be referred immediately to an emergency department.

Patients with chronic, limb-threatening ischaemia require urgent referral to a vascular specialist.

## Foot ulceration

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

### Assessment

Several wound classifications have been developed to provide objective assessment of severity of foot ulcers.

- The International Working Group on Diabetic Foot (IWGDF) guidelines recommend using IWGDF/Infectious Diseases Society of America (IDSA) classification criteria to assess infection severity.<sup>4</sup>
- The wound, ischaemia, foot infection (Wlfi) system is recommended for use in people with PAD to stratify amputation risk and revascularisation benefit.<sup>4</sup>
- The SINBAD system – Site, Ischaemia, Neuropathy, Bacterial infection, Area, Depth – is recommended for communication between health professionals (Table 2).<sup>5</sup>

If arterial insufficiency is suspected, assessment and management of the peripheral vasculature is mandatory before debridement.

Referral to a vascular surgeon, high-risk foot clinic and/or multidisciplinary team is suggested in this situation.

Table 2. The SINBAD wound classification system <sup>5</sup>		
Clinical domain	Condition	Score*
Site	Forefoot	0
	Mid foot/hind foot	1
Ischaemia	Pedal blood flow intact (at least one pulse palpable)	0
	Clinical evidence of reduced pedal blood flow	1
Neuropathy	Protective sensation intact	0
	Protective sensation lost	1
Bacterial infection	None present	0
	Present	1
Area	Ulcer <1 cm <sup>2</sup>	0
	Ulcer ≥1 cm <sup>2</sup>	1
Depth	Ulcer confined to skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon or deeper	1
*Highest total possible score is 6.		

## Wound management

Patient ability to understand and undertake management should always be a factor in choosing a treatment and in counselling the patient regarding the treatment plan.

### Debridement

Local sharp debridement of non-ischaemic wounds improves healing. Other methods of debridement that might be appropriate in certain cases include larval therapy, hydrosurgical debridement and autolytic debridement.<sup>6</sup>

The priority of debriding wound tissue is to prepare the surface and edges of a wound to facilitate healing. Debridement also reduces pressure on the wound, allows for full inspection of tissue underneath the debrided tissue and helps drain secretions or pus.<sup>6</sup>

### Wound dressings

Currently, there is insufficient evidence to demonstrate the superiority of any one type of wound dressing over another in the management of ulcers. Dressings should therefore be tailored to the specific characteristics of the wound.

- In **non-ischaemic ulcers**, create a moist wound environment.
- Appropriate management of wound exudate levels should be a guiding principle in dressing selection and frequency of dressing change.
- In **ischaemic ulcers**, maintain a dry wound environment using a dry, non-adherent dressing until someone with experience in PAD has reviewed the wound.

A full list of considerations for dressing choice can be found on page 15 of Wounds International's [Best practice guidelines: Wound management in diabetic foot ulcers](#).



### Off-loading devices

Ongoing weight bearing on an insensate foot causes continued trauma and results in poor wound healing.

Pressure on the wound should be off-loaded, using padding or other off-loading devices such as total-contact casts and removable prefabricated devices (eg controlled ankle-movement walkers, half-shoes, therapeutic shoes).

Ulcers are often caused by patients' footwear; if this is the case, advise the patient not to continue wearing the same shoes.

Guidelines on footwear for people with diabetes can be found in an article by [van Netten et al.](#)

### 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.

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

Infected ulcers should be treated with antimicrobial therapy according to published antibiotic guidelines.

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

## Resources

**Diabetic Foot Australia** has [resources](#) for health professionals and people with diabetes.

**Wounds International's** [guidelines for management of diabetic foot ulcers](#) provide detailed and practical information.

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# Microvascular complications: Nephropathy

## Recommendations

Recommendation	Reference	Grade*
At least once a year, assess urine ACR and eGFR in all patients with type 2 diabetes, regardless of treatment	1 American Diabetes Association, 2019	B
To prevent the onset and delay the progression of CKD, people with diabetes should be treated to optimise blood glucose levels and blood pressure	2 Diabetes Canada, 2018	A, level 1A
It is recommended that adults with type 2 diabetes and CKD with either hypertension or albuminuria receive an ACE inhibitor or an ARB to delay progression of CKD	2 Diabetes Canada, 2018	A, level 1A
Combinations of ACE inhibitor, ARB or DRI should not be used in the management of diabetes and CKD	2 Diabetes Canada, 2018	A, level 1
People with diabetes on an ACE inhibitor or an ARB should have their serum creatinine and potassium levels checked at baseline and within 1–2 weeks of initiation or titration of therapy, and during times of acute illness	2 Diabetes Canada, 2018	D, consensus
For patients with type 2 diabetes and chronic kidney disease, consider use of an SGLT2 inhibitor or GLP-1 RA shown to reduce risk of CKD progression, cardiovascular events, or both	1 American Diabetes Association, 2019	C
Adults with diabetes and CKD should be given a 'sick-day' medication list that outlines which medications should be withheld during times of acute illness	2 Diabetes Canada, 2018	D, consensus
All people with diabetes and CKD should be offered a comprehensive, multifaceted program to reduce cardiovascular risk (refer to the section ' <a href="#">Type 2 diabetes and cardiovascular risk</a> ')	2 Diabetes Canada, 2018	A, level 1A
People with diabetes should be informed that smoking increases the risk of CKD	3 NHMRC 2009	B

*ACE, angiotensin-converting enzyme; ACR, albumin-to-creatinine ratio; ARB, angiotensin receptor blocker; CKD, chronic kidney disease; CVD, cardiovascular disease; DRI, direct renin inhibitor; eGFR, estimated glomerular filtration rate; GLP-1 RA, glucagon-like peptide-1 receptor agonist; SGLT2, sodium glucose co-transporter 2*

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

## Clinical context

Diabetic nephropathy is the single leading cause of end-stage renal disease.<sup>4</sup>

Diabetic nephropathy occurs in one in four women and one in five men with type 2 diabetes,<sup>5</sup> and is more common in Aboriginal and Torres Strait Islander peoples.<sup>6</sup>

Some non-European groups (eg Southeast Asian, African American, Afro-Caribbean, Maori peoples) have high rates of end-stage diabetic nephropathy, possibly, but not entirely, due to later diagnosis and sub-optimal care.<sup>7</sup>

There is strong evidence that treatment in the early stages of chronic kidney disease (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.

Systolic blood pressure appears to be the best indicator of the risk of CKD in type 2 diabetes. However, the optimal and safest lower limit of systolic blood pressure has not been clearly defined. Refer to the section '[Type 2 diabetes and cardiovascular risk](#)' and the table '[Type 2 diabetes: Goals for optimum management](#)' for appropriate individual targets for blood pressure.

Independent of diabetes, proteinuria and reduced estimated glomerular filtration rate (eGFR) have been associated with increased risk of major cardiovascular disease; the additional presence of type 2 diabetes increases this risk to 2.4–4.6 times that of people without diabetes.<sup>8</sup>

## In practice

### Assessment

CKD is diagnosed by the persistent presence of elevated urine albumin excretion, low eGFR, or other manifestations of kidney damage.

Screening for CKD can be performed by either of the following two laboratory tests:

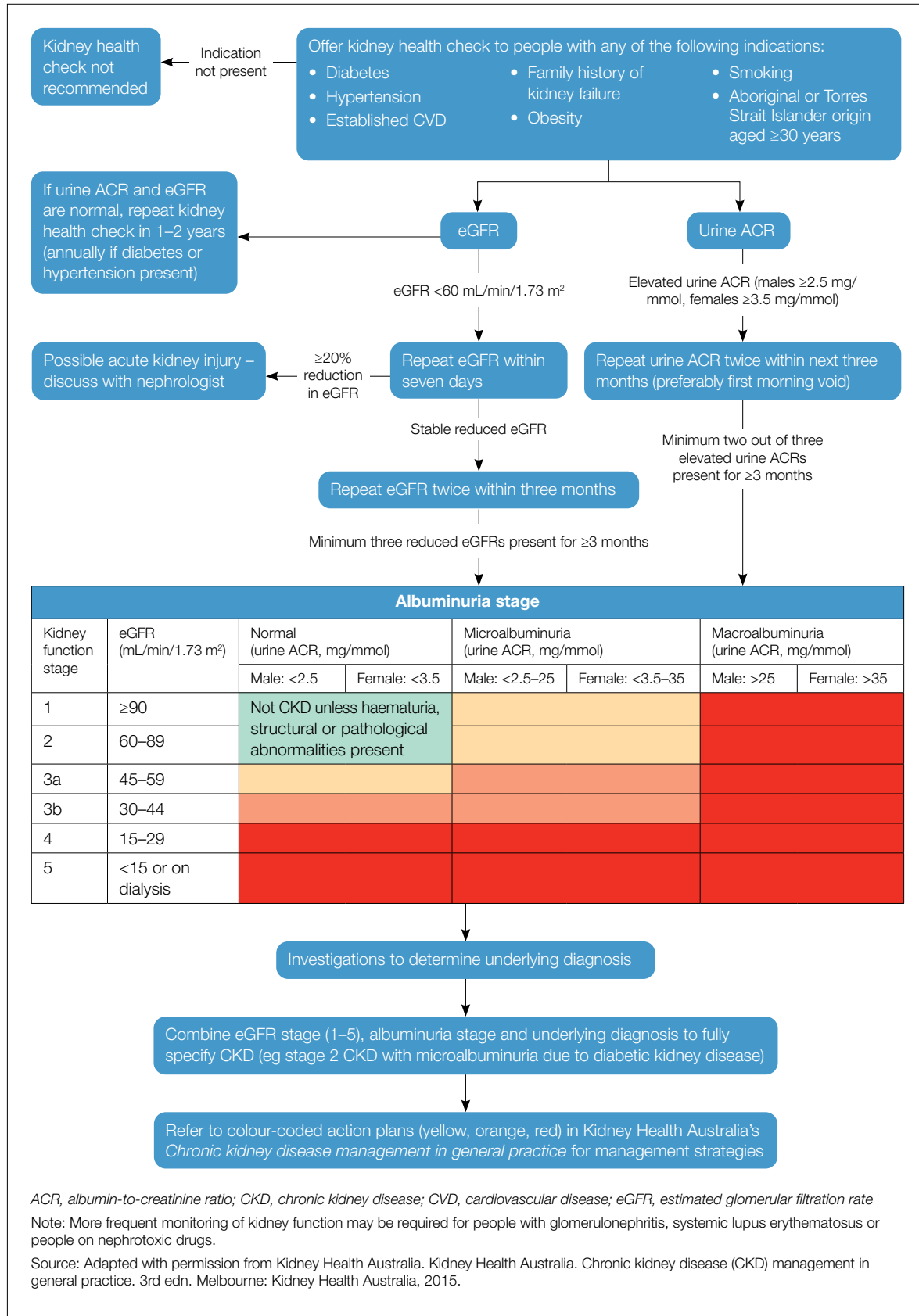
- random spot urine albumin-to-creatinine ratio (UACR; preferred method)
- serum creatinine converted into eGFR (eGFR is now automatically calculated from measurement of serum creatinine in Australia).

Any positive UACR needs to be confirmed with a repeated collection, and other possible contributors to transient albuminuria should be considered – for example:<sup>2</sup>

- urinary tract infection
- decompensated congestive heart failure
- menstruation
- acute severe elevation in blood glucose or blood pressure
- recent major exercise
- febrile illness.

Figure 1 provides an algorithm for the initial detection of CKD.

Figure 1. Algorithm for initial detection of chronic kidney disease<sup>9</sup>



ACR, albumin-to-creatinine ratio; CKD, chronic kidney disease; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate  
 Note: More frequent monitoring of kidney function may be required for people with glomerulonephritis, systemic lupus erythematosus or people on nephrotoxic drugs.

Source: Adapted with permission from Kidney Health Australia. Kidney Health Australia. Chronic kidney disease (CKD) management in general practice. 3rd edn. Melbourne: Kidney Health Australia, 2015.

## Management of CKD

The baseline approach to managing CKD in people with type 2 diabetes is as follows:

- review medications
- exclude treatable causes of kidney disease such as renal artery stenosis, obstructive nephropathy and acute kidney injury due to dehydration
- perform CVD risk assessment – refer to the section '[Type 2 diabetes and cardiovascular risk](#)'
- refer eligible patients to specialist renal care (Box 1), including an accredited practising dietitian or a credentialed diabetes educator for help with renal dietary recommendations.

Considerations regarding diabetes medications are as follows.

- **Metformin:** use with caution (as risks of lactic acidosis increase). Dose reduction is needed for eGFR 30–60 mL/min/1.73 m<sup>2</sup>. Metformin should be ceased if eGFR falls below 30 mL/min/1.73 m<sup>2</sup>.
- **Dipeptidyl peptidase-4 (DPP-4) inhibitors:**<sup>10</sup> no dose adjustment required for linagliptin in renal impairment due to hepatic metabolism. Reduction of dose of alogliptin, saxagliptin, sitagliptin and vildagliptin is required with eGFR <60 mL/min/1.73 m<sup>2</sup>, due to pharmacologic accumulation without toxicity. Saxagliptin is not recommended with eGFR <15 mL/min/1.73 m<sup>2</sup>, while others may be used with appropriate dose adjustment.<sup>11</sup>
- **Sulfonylureas:**<sup>10</sup> dose review is required, as CKD increases the risk of hypoglycaemia.
- **Sodium glucose co-transporter 2 (SGLT2) inhibitors:**<sup>12–14</sup> these require renal function for glycaemic effect. Dapagliflozin, empagliflozin and ertugliflozin may be used if eGFR >45 mL/min/1.73 m<sup>2</sup>; however, non-glycaemic effects on reduction of progression of microalbuminuria and macroalbuminuria, and progression of renal disease and end-stage renal disease, have been demonstrated in recent trials down to an eGFR of 30 mL/min/1.73 m<sup>2</sup>.<sup>15–17</sup>
- **Acarbose:**<sup>10</sup> avoid if creatinine clearance rate (CrCl) <25 mL/min.
- **Glitazones:** dose adjustment in patients with CKD is not needed.<sup>10</sup> Glitazones should not be used in people on dialysis, as safety in this patient group has not been established.
- **Glucagon-like peptide-1 receptor agonists (GLP-1 RAs):**<sup>10</sup> avoid using exenatide and liraglutide if CrCl <30 mL/min.<sup>18,19</sup> Initiate and escalate exenatide dose with caution if CrCl 30–50 mL/min. Dulaglutide may be used down to 15 mL/min, with no dose adjustment required.<sup>20</sup> GLP-1 RAs have been shown to slow microalbuminuria in recent trials.<sup>16</sup>
- **Insulin:** regular review of dose is indicated, as CKD increases risks of hypoglycaemia.
- Any potentially nephrotoxic medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs), should be avoided.

Consider referral to a credentialed diabetes educator or accredited practising dietitian for advice on nutritional adjustments in advanced diabetic kidney disease.

**Box 1. Referral criteria for specialist renal care<sup>9</sup>**

- Estimated glomerular filtration rate (eGFR) <30 mL/min/1.73 m<sup>2</sup>
- Stage 4 or 5 chronic kidney disease (CKD) of any cause
- Persistent significant albuminuria ≥30 mg/mmol
- Sustained decrease in eGFR of ≥25%, **or**
- Sustained decrease in eGFR of 15 mL/min/1.73 m<sup>2</sup> within 12 months
- CKD with hypertension despite at least three antihypertensive agents

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# Managing glycaemic emergencies

Hypoglycaemia and hyperglycaemia-related emergency presentations such as diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar states (HHS) form the basis of this section. Refer to '[Appendix 3. Detailed information on glycaemic emergencies](#)' for more information.

## Recommendations

Recommendation	Reference	Grade*
Individuals at risk for hypoglycaemia should be asked about symptomatic and asymptomatic hypoglycaemia at each encounter	1 American Diabetes Association, 2019	C
Glycaemic goals for some older adults might reasonably be relaxed as part of individualised care, but hyperglycaemia leading to symptoms or risk of acute hyperglycaemia complications should be avoided in all patients	1 American Diabetes Association, 2019	C

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

## Clinical context

In patients with type 2 diabetes, very high and low glycaemic states can occur. Both have significant impacts and implications. Patients should be well educated and informed about both states, and an active management plan should be developed.

### Hypoglycaemia

Hypoglycaemia is defined as a blood glucose level (BGL) of  $\leq 3.9$  mmol/L and/or to a level that causes neurogenic and neuroglycopenic symptoms and signs.<sup>2,3</sup> Rarely, a person who has normal BGLs can display symptoms (known as 'pseudo-hypoglycaemia'); this might occur, for example, when someone has experienced persistent, prolonged hyperglycaemia and the elevated glucose levels have become normalised.<sup>4,5</sup>

Hypoglycaemia in people with type 2 diabetes is common,<sup>5</sup> and its impact must not be underestimated, particularly in patients where the morbidity of hypoglycaemia poses particular problems and symptoms may be unrecognised. Higher risk patients include older people, people with renal impairment, people with poor cognitive function and those with low health literacy.<sup>6,7</sup>

Symptoms of hypoglycaemia vary between people, and include:

- adrenaline activation symptoms, including pale skin, sweating, shaking, palpitations and a feeling of anxiety or dizziness
- neuroglycopenic symptoms, including hunger, change in intellectual processing, confusion and changes in behaviour (eg irritability), paraesthesia, then coma and seizures.

Hypoglycaemia is more common in people taking insulin, alone or in combination with other glucose-lowering medications; it can also occur with sulfonylurea therapy. Other causative factors are insufficient carbohydrate intake, renal impairment and excessive alcohol ingestion, and change in physical activity.



**Asymptomatic hypoglycaemia** (or biochemical hypoglycaemia) occurs when someone's BGLs are low ( $\leq 3.9$  mmol/L), but the typical symptoms of hypoglycaemia are not present.<sup>4</sup>

**Severe hypoglycaemia** is defined as signs of hypoglycaemia whereby the person requires the assistance of another person to actively administer corrective action such as carbohydrate, and/or glucagon and glucose infusion. A BGL of  $< 3.0$  mmol/L may carry a risk for severe hypoglycaemia.<sup>4</sup>

**Impaired hypoglycaemia awareness** occurs where the pathophysiologic symptoms that arise in response to mild or severe hypoglycaemia (refer to [Appendix 3](#)) are reduced or absent and the patient loses the ability to detect the early symptoms of hypoglycaemia. In such cases, symptoms may be recognised by other family members and carers before the patient, and the patient is more likely to have episodes of severe hypoglycaemia.

The development of impaired hypoglycaemia awareness is associated with recurrent episodes of hypoglycaemia and longer duration of type 2 diabetes. Patients with impaired hypoglycaemia awareness may benefit from options such as review of pharmacological and hypoglycaemia management, and continuous or ambulatory glucose monitoring, as this condition may be reversible.

## Hyperglycaemia

Hyperglycaemic states include emergencies such as HHS (formerly known as hyperosmolar non-ketotic coma [HONC]) and DKA. Signs of hyperglycaemic states include:

- severe dehydration with polyuria and polydipsia
- abdominal pain, nausea and vomiting
- altered consciousness
- shock
- ketotic breath, in patients with DKA.

These conditions occur due to very unstable glucose levels, implying diabetes management issues or underlying causes such as infection or myocardial infarction, which require concomitant management. DKA is rare in people with type 2 diabetes relative to type 1 diabetes, but it has increased with sodium glucose co-transporter 2 (SGLT2) inhibitor use and is important to recognise ([Appendix 3](#)).

Hyperglycaemic thresholds related to acute elevations of venous or self-monitoring of blood glucose results  $> 15$  mmol/L on two subsequent occasions, two hours apart, with clinical symptoms of metabolic disturbance, should be considered a hyperglycaemic emergency and require assessment and intervention; refer below or to The Royal Australian College of General Practitioners (RACGP) and Australian Diabetes Society (ADS) clinical position statement [Emergency management of hyperglycaemia in primary care](#).

More information about management of hypoglycaemia and hyperglycaemia can be found in [Appendix 3](#). Sick day management of hyperglycaemia is discussed in the section '[Managing risks and other impacts of type 2 diabetes](#)'.

## In practice

All patients with type 2 diabetes on insulin and/or sulfonylureas, and their families or carers, should be informed about the risk factors, signs and symptoms of hypoglycaemia and hyperglycaemia, and actions to be taken.

If a patient has experienced severe hypoglycaemia, it may help to identify a carer who can be trained in glucagon administration to assist with early intervention and avoid recurrence. The Australian Diabetes Educators Association sick day management guidelines may be used to assist practical patient management.

You may also refer to the National Diabetes Services Scheme and Diabetes Australia's advice on [sick day management for people with type 2 diabetes](#).

### Hypoglycaemia: Practice points

- People can experience episodes of hypoglycaemia at any glycated haemoglobin (HbA1c) level, even if it is at target. Regular BGL monitoring should be used to monitor for hypoglycaemia. Real-time continuous glucose monitoring may help reduce risks of hypoglycaemia, but the cost and availability of this technology and its use in at-risk populations such as older people needs further evaluation.<sup>8</sup>
- De-prescribing of medication may be needed to manage risk of hypoglycaemia.
- Patients are often not forthcoming about symptoms of hypoglycaemia. GPs should therefore ask appropriate questions to detect hypoglycaemia (adrenergic and neuroglycopenic symptoms) to help with interpretation of BGLs. This is particularly important for older people and those with renal dysfunction.
- All people with diabetes with impaired hypoglycaemic awareness should be referred to an endocrinologist or specialist physician with an interest in diabetes for assessment.

### Managing hyperglycaemic emergencies: General advice

- Look for an underlying cause – for example, sepsis, myocardial infarction.
- Post-event: review medications, dietary intake and hyperglycaemic and sick day management.

For more detailed information on DKA and HHS, refer to:

- the RACGP and ADS position statement on [Emergency management of hyperglycaemia in primary care](#)
- the ADS alert regarding [periprocedural DKA with SGLT2 inhibitor use](#)
- [Appendix 3](#) for detailed information on glycaemic emergencies.

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# Mental health and type 2 diabetes

## Recommendations

Recommendation	Reference	Grade*
Routinely monitor people with diabetes for diabetes distress, particularly when treatment targets are not met and at the onset of diabetes complications	1 American Diabetes Association, 2019	B
Providers should consider assessment for symptoms of diabetes distress, depression, anxiety, disordered eating and cognitive capacities using patient-appropriate standardised and validated tools at the initial visit, at periodic intervals, and when there is a change in disease, treatment, or life circumstance; including caregivers and family members in this assessment is recommended	1 American Diabetes Association, 2019	B
People with diabetes with any of the following should be referred to specialised mental health care professionals: <ul style="list-style-type: none"> <li>• significant distress related to diabetes management</li> <li>• persistent fear of hypoglycaemia</li> <li>• psychological insulin resistance</li> <li>• psychiatric disorders (ie depression, anxiety, eating disorders)</li> </ul>	2 Diabetes Canada, 2018	D, consensus
Collaborative care by inter-professional teams should be provided for people with diabetes and depression to improve: <ul style="list-style-type: none"> <li>• depressive symptoms</li> <li>• adherence to antidepressant and non-insulin glucose-lowering medications</li> <li>• glycaemic control</li> </ul>	2 Diabetes Canada, 2018	A, level 1
Psychosocial interventions such as the following should be integrated into diabetes care plans: <ul style="list-style-type: none"> <li>• motivational interventions</li> <li>• stress management strategies</li> <li>• coping skills training</li> <li>• family therapy</li> <li>• case management</li> </ul>	2 Diabetes Canada, 2018	D, consensus C, level 3 A, level 1A A, level 1B B, level 2
Antidepressant medication should be used to treat acute depression in people with diabetes and for maintenance treatment to prevent recurrence of depression	2 Diabetes Canada, 2018	A, level 1/ level 1A
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Clinical context

People with diabetes can face a number of psychosocial challenges, which can change over the course of their lives with the condition (Figure 1). It is common for people with diabetes to sometimes feel overwhelmed, guilty or frustrated by the considerable burden of self-care and management required by diabetes. They might also feel worried about their current or future diabetes management and health outcomes,<sup>3</sup> and can face stigma, discrimination or a lack of understanding from friends or family members about their condition.

Diabetes distress is a clinically recognised emotional response to living with diabetes and the medical, financial and social impacts of diabetes. Other common diabetes-specific psychological responses are fear of hypoglycaemia and psychological insulin resistance (refer below).

In addition, people with diabetes are more likely to experience other mental health problems:

- Diabetes has a bi-directional relationship with some psychological conditions, particularly major depression (however, the mechanisms of this relationship are as yet unknown).<sup>2</sup>
- Anxiety disorders and disordered eating are more common in people with diabetes.<sup>4</sup>
- People with psychotic disorders (eg schizophrenia) have significantly increased rates of type 2 diabetes.<sup>4</sup>

Diabetes distress and other psychological conditions can negatively affect health outcomes due to sub-optimal self-management and glycaemic outcomes.<sup>3,5,6</sup>

General practitioners (GPs) also need to be aware that the metabolic effects of some psychotropic medications (eg the antipsychotic medications olanzapine and clozapine)<sup>7</sup> can increase the complexity of type 2 diabetes management or add additional burdens such as obesity (refer to the section '[Managing multimorbidity in people with type 2 diabetes](#)').

**Figure 1.** Psychosocial challenges experienced by people with diabetes at different phases of life

		Continuum of psychosocial issues and behavioural health disorders in people with diabetes	
		Non-clinical (normative) symptoms and behaviours	Clinical symptoms and behaviours
Phase of living with diabetes	Behavioural health disorder prior to diabetes diagnosis	None	<ul style="list-style-type: none"> <li>Mood and anxiety disorders</li> <li>Psychotic disorders</li> <li>Intellectual disabilities</li> </ul>
	Diabetes diagnosis	Normal course of adjustment reactions, including distress, fear, grief, anger, initial changes in activities, conduct or personality	<ul style="list-style-type: none"> <li>Adjustment disorders*</li> </ul>
	Learning diabetes self-management	Issues of autonomy, independence and empowerment. Initial challenges with self-management demonstrate improvement with further training and support	<ul style="list-style-type: none"> <li>Adjustment disorders*</li> <li>Psychological factors affecting medical condition<sup>†</sup></li> </ul>
	Maintenance of self-management and coping skills	Periods of waning self-management behaviours, responsive to booster educational or supportive interventions	<ul style="list-style-type: none"> <li>Maladaptive eating behaviours</li> <li>Psychological factors<sup>†</sup> affecting medical condition</li> </ul>
	Life transitions impacting disease self-management	Distress and/or changes in self-management during times of life transition <sup>‡</sup>	<ul style="list-style-type: none"> <li>Adjustment disorders*</li> <li>Psychological factors affecting medical condition<sup>†</sup></li> </ul>
	Disease progression and onset of complications	Distress, coping difficulties with progression of diabetes/onset of diabetes complications impacting function, quality of life, sense of self, roles, interpersonal relationships	<ul style="list-style-type: none"> <li>Adjustment disorders*</li> <li>Psychological factors affecting medical condition<sup>†</sup></li> </ul>
	Ageing and its impact on disease and self-management	Normal age-related forgetfulness, slowed information processing and physical skills potentially impacting diabetes self-management and coping	<ul style="list-style-type: none"> <li>Mild cognitive impairment</li> <li>Alzheimer's disease or vascular dementia</li> </ul>
			^ <b>All care-team members (general practitioners, nurses, diabetes educators, dietitians) and other behavioural providers</b>
<b>Providers for psychosocial and behavioural health intervention</b>			

\*With depressed mood, anxiety, or emotion and conduct disturbance  
<sup>†</sup>Personality traits, coping style, maladaptive health behaviours or stress-related physiological response  
<sup>‡</sup>Examples include changing schools, moving, job/occupational changes, marriage or divorce, experiencing loss

Source: Adapted with permission from Young-Hyman D, de Grood M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: A position statement of the American Diabetes Association. *Diabetes Care* 2016;39:2126–40.

## Diabetes distress

Diabetes distress is a condition distinct from other psychological disorders and is estimated to affect 18–45% of people with diabetes.<sup>4</sup> Severe diabetes distress is experienced by 20% of people with insulin-treated type 2 diabetes and 11% of those with non-insulin-treated type 2 diabetes.<sup>8</sup>

Although some symptoms often overlap with depressive symptoms, diabetes distress is a separate psychological condition that should be assessed for separately (Table 1).<sup>9</sup> It is associated with sub-optimal diabetes self-care and glycaemic outcomes.<sup>3,6</sup>

Causes of diabetes distress differ between individuals, but are commonly related to the following domains:<sup>10</sup>

- emotional and cognitive distress – for example:
  - worries about long-term diabetes-related complications
  - fears about loss of quality of life
  - guilt, anger, frustration or burnout associated with the ongoing need for care
- interpersonal distress – for example:
  - feeling unsupported or misunderstood by loved ones
- regimen or management distress – for example:
  - difficulty keeping up with dietary recommendations
  - stress from changes to treatment (eg changing from oral to injectable therapy)
  - stress related to the need for ongoing glucose self-monitoring
  - fear associated with reviews of glycated haemoglobin (HbA1c) and not achieving target levels
- distress arising from interactions with healthcare professionals – for example:
  - feeling that treating clinicians don't understand concerns or take them seriously.

## Psychological insulin resistance

Psychological insulin resistance refers to a person's strong negative thoughts and feelings about starting, using or intensifying insulin therapy.<sup>2</sup>

This may be due to fear and anxiety about having to self-administer injections, concerns about insulin and its effects (eg hypoglycaemia or weight gain) or misplaced beliefs (eg that requiring insulin means they have failed to self-manage their diabetes or that the condition has become much more serious).

The National Diabetes Services Scheme (NDSS) and Diabetes Australia have developed resources to support people starting and using insulin to manage their diabetes:

- [Starting insulin](#) (booklet)
- ['Concerns about starting insulin'](#) (fact sheet).

## Fear of hypoglycaemia

Experiences of hypoglycaemia, especially severe (requiring assistance) or nocturnal episodes, can be traumatic. Some level of concern about hypoglycaemia is adaptive and is a motive to respond to low glucose levels on time. However, fear of

hypoglycaemia (extreme fear in response to risk or occurrence of hypoglycaemia) can lead to unhelpful strategies to avoid hypoglycaemia, such as:

- maintaining a higher blood glucose level (compensatory hyperglycaemia)
- treating perceived symptoms without confirming hypoglycaemia by self-monitoring.

Left unmanaged, in the long term these behaviours can affect glycaemic outcomes and reduce quality of life. Technology such as continuous glucose monitoring or flash monitoring may help people who are averse to finger-pricking.

## Other psychological and psychiatric conditions

Other mental health conditions that can affect or are affected by diabetes include major depression, schizophrenia spectrum disorders, bipolar disorder, eating disorders and anxiety.<sup>2</sup>

## In practice

Given the high prevalence of diabetes distress and other mental health conditions, patients with type 2 diabetes should be assessed at the initial visit, at periodic intervals (eg at annual review) and when there is a change in condition, treatment or life circumstance. It is recommended to assess for diabetes distress, depression, anxiety, disordered eating, and cognitive capacities.<sup>1,4</sup> GPs may decide to prioritise assessment of conditions according to each patient's phase of living with diabetes (Figure 1) – for example, assessing for cognitive impairment in older patients.

Information and guidance about how to have conversations with people about diabetes and mental health, including tips for using the screening tools detailed below, can be found in the NDSS publication *Diabetes and emotional health: A handbook for health professionals supporting adults with type 1 or type 2 diabetes*.

If necessary, patients should be referred to a mental health professional, preferably with experience in psychosocial care for people with diabetes (Box 1).<sup>4</sup>

## Screening

GPs can identify clinically significant diabetes distress and other mental health issues by having ongoing conversations with patients about how they feel about their diabetes. Informal, open-ended questions can help to get a sense of what the likely problems are for a person. For example:

- 'How is diabetes bothering you at the moment?'
- 'What is the most difficult part of living with diabetes for you?'

If indicated, standardised tools can then be used to further assess for symptoms.

Tools for assessing diabetes distress (Table 1) are freely available.

The Patient Health Questionnaire (PHQ)-2 or PHQ-9 can be used to screen for depressive symptoms.

- A PHQ-2 total score of 3 or more, in a person who is not currently receiving treatment for depression, requires assessment with the PHQ-9.<sup>11</sup>
- PHQ-9 scores are interpreted as follows:<sup>12</sup>
  - 0–4 indicates no depressive symptoms (or a minimal level)
  - 5–9 indicates mild depressive symptoms – these people will benefit from watchful waiting
  - 10–27 indicates moderate-to-severe depressive symptoms – these people will benefit from a more active method of intervention.

If depression is suspected from a PHQ-9, a formal clinical assessment for depression and management should be undertaken.

To effectively use screening tools, GPs should be mindful of the person's health literacy, being sure to explain what the tool is for and how it can help the person receive individualised support.

**Table 1. Tools to assess diabetes distress in people with diabetes**

Tool	Scoring	Validated population
Problem Areas in Diabetes (PAID) <sup>13</sup>	Patients receive a total score out of 100; a score $\geq 40$ indicates severe diabetes distress	Adults with type 1 and type 2 diabetes Paediatric, teen and parent versions are also available
Diabetes Distress Scale (DDS) <sup>14,15</sup>	A 17-item questionnaire measuring diabetes-specific distress in four domains: emotional burden, interpersonal distress, physician-related distress, and regimen-related distress. A mean score $\geq 3$ in any domain indicates 'high' distress	Adults with type 1 and type 2 diabetes

## Management

The '7As' model is a practical way to structure mental health care for people with diabetes, adapted from the '5As' model often used for counselling in other areas (eg smoking cessation, obesity).<sup>9</sup> The 7As model encourages healthcare professionals to:

- be **aware** that people with diabetes might have emotional or mental health problems
- **ask** about these problems, using open-ended questions
- **assess** for emotional or mental health problems using a validated tool
- **advise** patients about identified problems
- **assist** them with developing an achievable action plan
- **assign** care, where appropriate, to another healthcare professional (eg psychologist, diabetes specialist or credentialled diabetes educator)
- **arrange** follow-up care.

More information about this model can be found in the NDSS publication *Diabetes and emotional health: A handbook for health professionals supporting adults with type 1 or type 2 diabetes*.

Versions of this model to specifically manage diabetes distress, fear of hypoglycaemia, psychological barriers to insulin use, depression, anxiety disorders and eating disorders can be found in the NDSS handbook [summary cards](#).

Management of mental health problems should be offered within diabetes care settings and general practices, using current supported care such as mental health care planning. Mental health assessments can form part of a GP Management Plan (GPMP), and psychologist visits can be incorporated into a team care arrangement to help with costs for the patient. Refer to the Services Australia [Education guide: Chronic disease GP Management Plans and Team Care Arrangements](#) for more information.



**Box 1. Referring patients with diabetes to a mental health provider**

Patients with diabetes who display any of the following should be referred to a mental health provider:<sup>4</sup>

- diabetes distress and impaired self-care despite tailored diabetes education
- positive screen for depressive symptoms on a validated screening tool
- symptoms or signs of disordered eating behaviour, an eating disorder or disrupted patterns of eating
- deliberate omission of insulin or oral medication to cause weight loss
- positive screen for anxiety or fear of hypoglycaemia on a validated screening tool
- positive screen for cognitive impairment
- declining or impaired ability to self-care.

Patients should be referred before undergoing bariatric surgery, and after, if assessment reveals an ongoing need for adjustment support.<sup>4</sup>

## Resources

### Patients

The **National Diabetes Services Scheme (NDSS)** and **Diabetes Australia** have a range of [resources regarding emotional health and diabetes](#).

### Healthcare professionals

The **NDSS** and **Diabetes Australia** have published [Diabetes and emotional health: A handbook for health professionals supporting adults with type 1 or type 2 diabetes](#).

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# Managing multimorbidity in people with type 2 diabetes

## Clinical context

Multimorbidity is defined as the co-existence of two or more chronic conditions in the same patient.<sup>1</sup> About half of the patients seen by general practitioners (GPs) in Australia meet this definition.<sup>2</sup>

Multimorbidity increases the risk of premature death, hospitalisation, functional impairment and deterioration in quality of life, in addition to increasing healthcare use and associated cost, polypharmacy and the complexity of self-care.<sup>3,4</sup>

Type 2 diabetes is associated with multimorbidity, which increases in prevalence and changes in composition over time. More than 80% of people with type 2 diabetes will have multimorbidity within 16 years of being diagnosed, and 47.6% have two or more conditions other than diabetes.<sup>5</sup> The number of associated conditions increases with age, as people with diabetes live longer, partly as a consequence of improved treatment.<sup>6</sup>

Other well established determinants of multimorbidity include socioeconomic status and gender (higher prevalence in females).<sup>3</sup> The prevalence of multimorbidity among Australian Aboriginal and Torres Strait Islander peoples is 2.59 times that of non-Indigenous Australians, a factor that contributes significantly to higher mortality.<sup>4,7</sup>

Multimorbidity in people with type 2 diabetes can lead to:<sup>8,9</sup>

- premature mortality
- reduced quality of life
- increased healthcare use
- high burden of treatment
- loss of physical functioning
- increased mental health problems
- polypharmacy, with increased risk of drug interactions and adverse drug events
- fragmentation of care.

Multimorbidities may or may not be diabetes-related, and can be either concordant or discordant with diabetes care.<sup>6</sup>

**Concordant conditions** have a similar risk profile to type 2 diabetes and share the same management goals. They are usually incorporated in the single-disease guidelines.

**Discordant conditions** are not related in pathogenesis to type 2 diabetes and do not share similar management goals. This may impact on quality of care.<sup>10–12</sup>

Common multimorbidity clusters found in people with type 2 diabetes are shown in Figure 1. Because of the complex relationships between co-existing conditions, guidelines based on single diseases may not provide evidence for optimal care.<sup>13–15</sup> While many conditions have a concordant treatment focus (eg hypertension, dyslipidaemia, cardiovascular disease [CVD] and renal disease), others, such as depression, chronic obstructive pulmonary disease and painful conditions, may be discordant.<sup>14,16</sup>

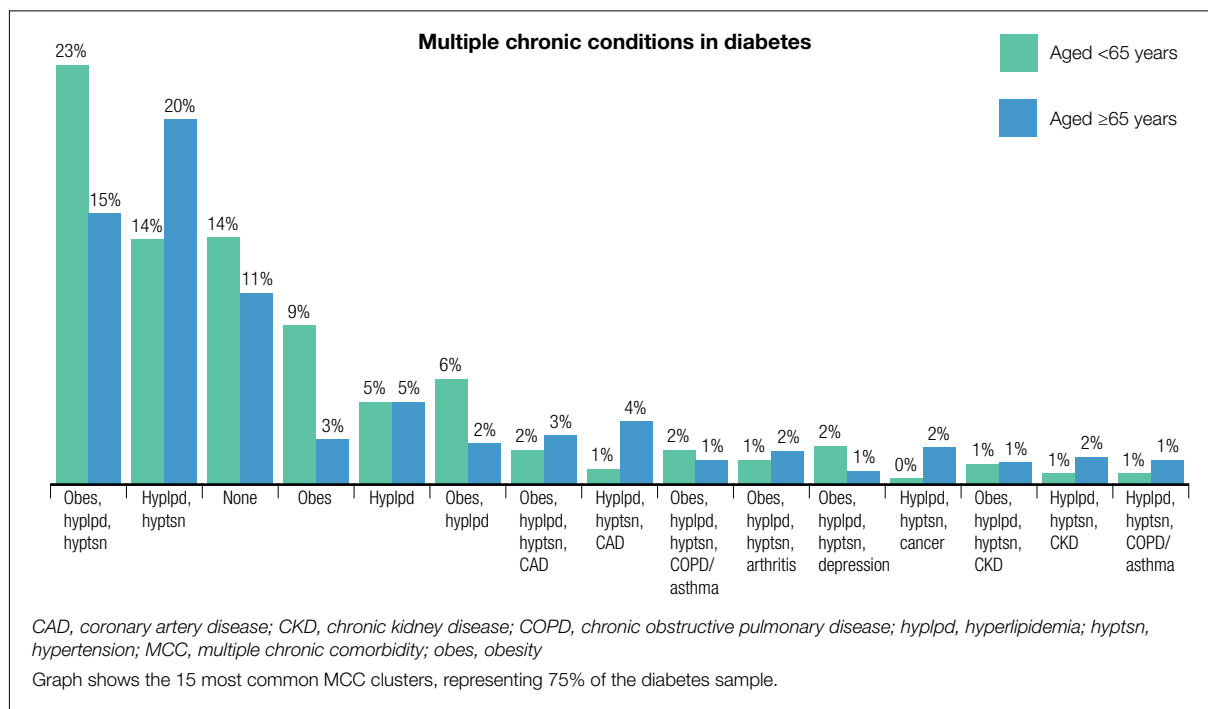
Few studies have examined the effectiveness of specific interventions to improve outcomes in people with multimorbidity. Findings have been mixed, but suggest there is an improvement in health outcomes when interventions target specific risk factors for the comorbid conditions (eg CVD and depression) or areas of functional difficulty.<sup>8</sup>

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.<sup>6,14</sup> In particular, people with discordant comorbidities will likely require extra support to prioritise goals of care and to self-manage diabetes.<sup>17</sup>

The literature suggests that care for multimorbidity should be person-centred, promoting achievement of agreed goals through self-management and focusing on quality of life.

The challenge for general practice is to optimise the care for these patients, taking into account co-existing physical or mental health disorders, age, and socioeconomic and cultural issues.

**Figure 1.** Prevalence of the 15 most common comorbidity clusters in type 2 diabetes<sup>18</sup>



Adapted with permission from Lin P, Kent D, Winn A, Cohen J, Neumann P. Multiple chronic conditions in type 2 diabetes mellitus: Prevalence and consequences. *Am J Manag Care* 2015;21(1):e23–e34.

## Common comorbidities with diabetes

Be aware of the following common comorbidities with type 2 diabetes.

- Macrovascular disease
  - Includes coronary artery disease, hypertension, chronic heart failure and cerebrovascular disease
- Obesity
- Painful conditions (acute and chronic)
  - Common in patients with type 2 diabetes. Peripheral neuropathies and arthritis account for most causes of pain. Tendinopathy is also a common cause

- 
- Arthritis
    - Arthritis is particularly problematic, as it can reduce capacity for self-management
  - Fractures
    - Research has shown that overall fracture risks are significantly higher for men and women with type 2 diabetes
  - Obstructive sleep apnoea (OSA)
    - OSA or sleep deprivation from any cause can aggravate insulin resistance, hypertension and hyperglycaemia
  - Cancer
    - Diabetes is associated with increased cancer risk, including substantially elevated risks of pancreatic and liver cancer, and moderately increased risk of ovarian, cervical, breast, kidney, bladder and colorectal cancer<sup>19</sup>
  - Renal impairment
    - Diabetes-related kidney disease is one of the most frequent complications of diabetes. It is the leading cause of end-stage renal disease, accounting for approximately 50% of cases in the developed world.<sup>20</sup> Refer also to the section [‘Microvascular complications: Nephropathy’](#)
  - Cognitive impairment
    - Type 2 diabetes is associated with cognitive impairment<sup>21,22</sup> and higher rates of dementia<sup>23</sup>
  - Mental health issues
    - Conditions such as diabetes-related distress, depression and anxiety can adversely affect practitioner–patient communication and the patient’s ability to live and apply the principles of a diabetes management plan and glycaemic control. They can also add to the burden of disease and reduce 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<sup>24</sup>
  - Dental problems
    - Dental problems such as periodontitis (ie 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
    - There is a two-way relationship between diabetes and periodontitis – the management of periodontitis may lead to a modest reduction in glycated haemoglobin (HbA1c) of approximately 0.4%.<sup>25–28</sup> Inversely, improving glycaemic management may also improve the severity and complications associated with periodontitis
    - Early prevention and intervention may prevent permanent dental loss and aid in glycaemic control
    - Oral and periodontal health reviews should be incorporated into the systematic individualised care of patients with diabetes. GPs should ask patients about

smoking status, pain, swelling or bleeding in the gums, and loose teeth. Examination of the gums should include looking for signs of inflammation, such as swelling and redness, recession of the gums and build-up of plaque/tartar

- Information about dental health and diabetes can be found on the [Diabetes Australia](#) website

## In practice

### Approach to managing multimorbidity

Given the lack of clear evidence for specific multimorbidity interventions and the difficulty with following individual clinical guidelines, the following clinical principles are suggested to guide general practice management of multimorbidity in patients with type 2 diabetes.

Refer also to the chapter on 'Multimorbidity' in the *RACGP aged care clinical guide (Silver Book)*.

### Recognise clinical context and prognosis

Consider clinical management decisions within the context of risks, burdens, benefits, and prognosis of a patient's life (eg remaining life expectancy, functional status, quality of life).<sup>29–31</sup>

### Promote person-centred care

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>6,31–34</sup>

Recognise and manage mental health issues, cognitive decline and socioeconomic deprivation.

### Recognise the limitations of the evidence base

Many of the patterns of multimorbidity have similar pathogenesis and therapeutic management strategies (eg diabetes, hypertension, coronary artery disease). Focus on functional optimisation and on shared (concordant) risk factors.

Clinical guidance regarding discordant conditions, such as steroid-dependent conditions (which destabilise glycaemic control), or conditions that alter medication pharmacokinetics (eg renal disease, cardiac failure, liver disease, malabsorptive states), is often lacking or sparse.

A degree of clinical judgement and a 'best care given the circumstances' is required in these situations.<sup>9</sup>

### Manage medication

Adherence to therapy can be much more difficult for patients taking numerous medications for multiple conditions. De-prescribing and reviewing medications, where indicated, may reduce medication burden.

### Important drug interactions and side effects

People with diabetes may be taking multiple glucose-lowering 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.

## Polypharmacy

Polypharmacy (taking >5 medications) is one consequence of following single-disease guidelines in people with multimorbidity.<sup>15,31,35-37</sup>

Polypharmacy can be appropriate and has been said to be the price of success in creating effective treatments. However, 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>38</sup> or have cognitive impairment.

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

Plan regular (at least annual) reviews of medications.

## Coordinate care

Provide continuity of care, preferably through a single healthcare provider.

Ensure adequate time for consultations and set up practice systems to ensure regular review and best use of practice resources (eg scheduling concurrent practice nurse and doctor consultations) to address problems and develop patient-oriented solutions. This should allow adequate time for reaching management decisions.<sup>9</sup>

Use a coordinated, multidisciplinary team approach where appropriate.

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# Type 2 diabetes, reproductive health and pregnancy

## Recommendations

Recommendations	Reference	Grade*
<b>Pre-pregnancy and pregnancy with existing type 2 diabetes</b>		
Before attempting to become pregnant, women with type 1 or type 2 diabetes should receive pre-conception counselling that includes optimal diabetes management, including nutrition, preferably in consultation with a multidisciplinary pregnancy team to optimise maternal and neonatal outcomes	1 Diabetes Canada, 2018	C, level 3
Before attempting to become pregnant, women with type 2 diabetes should strive to attain a pre-conception glycosylated haemoglobin (HbA1c) as close to normal as is safely possible (ideally $\leq 6.5\%$ ) to decrease the risk of congenital anomalies, pre-eclampsia, macrosomia and other complications	2 American Diabetes Association, 2019	B
Before attempting to become pregnant, women with diabetes should discontinue medications that are potentially embryopathic, including any from the following classes: <ul style="list-style-type: none"> <li>• angiotensin-converting enzyme inhibitors (ACEIs) inhibitors and angiotensin receptor blockers (ARBs) <ul style="list-style-type: none"> <li>– prior to conception in women with hypertension alone</li> <li>– upon detection of pregnancy in women with chronic kidney disease</li> </ul> </li> <li>• statins</li> </ul>	1 Diabetes Canada, 2018	C, level 3 D, consensus D, level 4
Women on metformin and/or sulfonylureas pre-conception may continue on these agents, if glycaemic control is adequate, until pregnancy is achieved	1 Diabetes Canada, 2018	C, level 3
Women on other glucose-lowering medications should switch to insulin prior to conception, as there are no safety data for the use of other glucose-lowering medications agents in pregnancy	1 Diabetes Canada, 2018	D, consensus
Women with pre-pregnancy diabetes should take a 5 mg (but not exceeding) daily dose of folate, starting at least one month prior to conception, for the first trimester, to protect against neural tube defects	3 Scottish Intercollegiate Guidelines Network, 2017  4 RACGP, 2016	B
Pre-pregnancy care provided by a multidisciplinary team is strongly recommended for women with diabetes	3 Scottish Intercollegiate Guidelines Network, 2017	C
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Contraception

Contraception advice should follow guidelines that apply to women without diabetes. However, as the risks associated with pregnancy in women with diabetes are high, it is particularly important to consider long-acting reversible contraception (LARC) as a first-line option to avoid unplanned pregnancy.<sup>5</sup> Use of the non-hormonal copper intrauterine contraceptive device (IUCD) might be preferred over the combined oral contraceptive pill, depending on any risks or contraindications caused by the presence of diabetes complications.

In all cases, contraception choice should be based on the woman's preferences, considering the risks and benefits and the presence of diabetes-related complications.

**Smoking combined with diabetes and the use of the combined oral contraceptive pill significantly elevates vascular risks.**

For more information, refer to the World Health Organization [Medical eligibility criteria for contraceptive use](#).

Information about contraceptive choice is available from the [National Diabetes Services Scheme \(NDSS\)](#) website.

## Sexual problems

### Men

Men with diabetes are three times more likely to develop erectile dysfunction than men without diabetes.<sup>6</sup> The prevalence in men aged >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, with occurrence approximately a decade earlier.<sup>6,7</sup> In addition, diabetes is associated with lower testosterone levels in men.<sup>8</sup> This might contribute to reduced libido and aggravate or exacerbate erectile dysfunction.

Healthy Male: Andrology Australia provides a [clinical summary guide for the management of male erectile dysfunction](#).

### Women

Sexual dysfunction in women is often under-reported and could co-exist with underlying depression.

Women with diabetes might experience higher rates of sexual dysfunction than women without diabetes: rates of depression, anxiety and psychological distress are higher in people with diabetes and may contribute to sexual dysfunction in women and men.<sup>9,10</sup> It is also fair to say that sexual dysfunction in women could be linked to complications of diabetes, namely vascular and neuropathic complications; however, more research is needed to assess this.<sup>11,12</sup>

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
- a degree of anorgasmia
- dryness in the vaginal area, leading to dyspareunia.

Genital infections such as monilial vaginitis occur more frequently in women with diabetes and may contribute to sexual dysfunction. People taking sodium glucose co-transporter 2 (SGLT2) inhibitors are at higher risk of genital infections.<sup>13</sup>

More information about evaluating and managing female sexual dysfunction can be found in a paper by [Krakowsky and Grober](#).<sup>14</sup>

It is important to enquire about sexual problems in the annual review and manage physical and emotional aspects. A sexual desire questionnaire or screening tool (eg the Decreased Sexual Desire Screener<sup>15</sup>) will help with diagnosis and treatment.

## Managing hyperglycaemia in pregnancy

For information about gestational diabetes mellitus, please refer to the section '[Gestational diabetes mellitus](#)'.

### Pregnancy with pre-existing diabetes

#### Clinical context

Sub-optimal glycaemic management at conception and early in pregnancy is associated with increased risk of congenital malformations and first trimester miscarriages.

Women with pre-existing diabetes (types 1 and 2) are more prone to the complications of pregnancy such as higher rates of pre-eclampsia prematurity and caesarean section.<sup>16</sup> In addition, pregnancy may accelerate maternal complications of diabetes, such as diabetic retinopathy (see the section '[Microvascular complications: Diabetes-related eye disease](#)').<sup>17</sup> Both maternal and fetal complications are increased by diabetes. Risk is progressive with increasing glycaemia.<sup>18</sup>

Optimising glycaemic management can mitigate these risks, the likelihood of birth trauma, and the risk of early induction of labour and need for caesarean section.

Women of reproductive age with existing diagnoses of diabetes should be advised of the benefits of contraception to prevent inadvertent pregnancy before glycaemia can be optimised. Women should be advised of the need for advice, education and support to achieve optimal glycaemic control before pregnancy.

Women with type 2 diabetes and polycystic ovary syndrome or irregular periods must be advised that improved fertility may accompany use of therapies, including metformin.

#### In practice

##### Pre-pregnancy

Where possible and practicable, formal, diabetes-specific pregnancy planning should occur prior to pregnancy.

This should be patient-focused, support self-management and involve a multidisciplinary team. Planning should include assessment of diabetes-related complications, review of all medications and commencement of folic acid (no more than 5 mg/day).<sup>4</sup>

Deferring pregnancy should be recommended until glycaemic control is optimal. Women should be reassured that any reduction in glycated haemoglobin (HbA1c) towards the individualised target is likely to reduce the risk of congenital malformations.

Refer to the NDSS for [advice on pre-pregnancy blood glucose targets](#).

Medications should be reviewed and ceased or replaced as appropriate, ideally before pregnancy during the planning period, or urgently once pregnancy is confirmed. Consultation with local specialist services is advised. Agents such as sulfonylureas, glitazones, SGLT2 inhibitors and incretin-based therapies will need to be reviewed or ceased, and insulin therapy instituted.

Table 1 presents safety profiles and advice for diabetes medications in pregnancy.

**Practice Points: Before and during pregnancy**

- Counsel the patient that the risks associated with diabetes in pregnancy can be reduced, but not eliminated.
- Recommend a reliable form of contraception until blood glucose control is optimised.
- Advise that optimising HbA1c with a balanced diet, physical activity, healthy weight management and appropriate diabetes medication may positively affect pregnancy outcomes.
- Review sick day management plans, and discuss the need for insulin therapy possibly prior to conception and throughout the pregnancy.
- Revise hypoglycaemia prevention and management.
- Advise that nausea and vomiting in pregnancy may affect blood glucose control.
- Aim for blood glucose to be as close to the normal (non-diabetic) range as possible, ensuring risks of maternal hypoglycaemia are minimised. This reduces risk of spontaneous abortion, congenital abnormalities, pre-eclampsia, retinopathy progression and stillbirth.<sup>1</sup>
- Review self-monitoring of blood glucose (SMBG) and/or continuous glucose monitoring (CGM) to determine if medication adjustment and/or commencement of insulin is required, and assess risk of hypoglycaemia. Some patients may be eligible for NDSS-subsidised access.
- Recommend higher folate supplementation (up to 5 mg per day), starting one month before pregnancy<sup>4</sup> and continuing until 12 weeks of gestation, to reduce the risk of neural tube defects.
- Be aware that women treated for hypothyroidism may require higher doses of thyroid hormone replacement therapy. Based on reassessment, a suggested dose change is an increase of 30% once there is a positive pregnancy test (eg if on one tablet per day, increase by two tablets per week).<sup>19</sup>
- Advise examination of the retina prior to conception and during each trimester for women with types 1 and 2 diabetes. More frequent assessment may be required if retinopathy is present. Patients with active, moderate–severe non-proliferative retinopathy or with proliferative retinopathy who have not had an ophthalmological assessment within the preceding six months should undergo testing prior to pregnancy to see if the retinopathy is stable enough for pregnancy.
- Test renal function if this has not been done within the preceding three months. Elevated creatinine or estimated glomerular filtration rate (eGFR)  $<45$  mL/min/1.73 m<sup>2</sup> or an albumin-to-creatinine ratio  $>30$  mg/mmol is an indication for pre-pregnancy nephrology assessment.<sup>20</sup>

Table 1. Safety and risks of common diabetes medications before and during pregnancy		
Medication	Category in pregnancy	Advice
<b>Sulfonylureas</b>	C	Review or cease and institute insulin therapy
<b>SGLT2 inhibitors</b>	D	
<b>Incretin-based therapies (eg DPP4i, GLP-1 RA)</b>	B3/C (exenatide)	
<b>Glitazones</b>	B3	
<b>Metformin</b>	C	Not associated with an increase in congenital malformation or early pregnancy loss, but remains category C <sup>21</sup> Could be used as an adjunct to other therapies, including insulin, in type 2 diabetes, both pre-conception and during pregnancy. <sup>22</sup> Consult with specialist endocrine and obstetric services
<b>Insulin</b>		
Aspart, lispro	A	Safe to use
Detemir	A	Safe to use (PBS-listed for type 1 diabetes only)
Glargine	B3	Insufficient evidence about use. Patients already stabilised on glargine may continue, but the B3 category rating should be discussed with patient
Isophane, or NPH insulin		NPH is the most common long-acting insulin choice during pregnancy for women with type 2 diabetes
<b>Antihypertensives<sup>23</sup></b>		ACE inhibitors and ARBs should be discontinued during the pregnancy planning period, or as soon as pregnancy is confirmed
Methyldopa	A	Safe
Clonidine	B3	May cause temporary rise in glucose
Spirolactone	B3	Seek advice
Moxonidine	B3	Seek advice
Calcium channel blocker	C	Avoid (except nifedipine)
β-blockers	C	Avoid (except labetalol and oxprenolol)
Thiazide and loop diuretics	C	Seek advice
ACE inhibitors	D	Contraindicated
ARBs	D	Contraindicated
<b>Statins</b>		Discontinue during the pregnancy planning period, or as soon as pregnancy is confirmed

\*For definitions of the Australian categories for prescribing medicines in pregnancy, visit the Therapeutic Goods Administration, [Australian categorisation system for prescribing medicines in pregnancy](#).

ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers; DPP4i, dipeptidyl peptidase-4 inhibitors; GLP-RA, glucagon-like peptide-1 receptor agonists; NPH, neutral protamine Hagedorn; PBS, Pharmaceutical Benefits Scheme; SGLT2, sodium glucose co-transporter 2

### Antenatal care

Insulin therapy will need regular review and titration to achieve glycaemic goals.

Intensive glycaemic control guided by SMBG or CGM, versus SMBG alone, has been shown to improve neonatal outcomes in type 1 diabetes in pregnancy.<sup>24</sup> However, studies that included people with type 2 diabetes in pregnancy have failed to demonstrate this benefit.<sup>25</sup>

Close surveillance for new diabetes complications and monitoring of existing complications should occur routinely.

GPs should provide timely and appropriate support and referral for women who are experiencing an unplanned pregnancy where risks of abnormal pregnancy outcomes are elevated.

Ultrasound screening is advised at 10–13 weeks' gestation (with biochemistry) for trisomies, and at 18–20 weeks for congenital cardiac and other malformations. Pregnant women with diabetes should be offered ultrasound monitoring of fetal growth and amniotic fluid volume every four weeks from 28–36 weeks.<sup>20</sup> Fetal growth and wellbeing monitoring should occur under specialist supervision. It is recommended to refer to your local specialist endocrine and obstetric services.

### During pregnancy

Patients should be referred to specialised diabetes antenatal care as soon as possible, as multidisciplinary shared care is considered best practice.<sup>20</sup> A multidisciplinary team ideally involves:

- GP
- endocrinologist
- midwife
- obstetrician
- credentialled diabetes educator
- accredited practising dietitian
- psychologist.

### Postpartum

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 breastfeeding and to review medications.

Metformin may be continued while breastfeeding with minimal effect on the baby.<sup>26</sup> Breastfeeding may alter glucose levels, so glycaemic monitoring, oral medications and insulin need careful review during breastfeeding to minimise the risk of hypoglycaemia.

Re-establishing glycaemic management goals, reassessment of complications and timely contraceptive advice are also appropriate in the postpartum period.

## Resources

The **Australian Government Department of Health** has produced a practice summary for managing diabetes in pregnancy in its *Clinical practice guidelines: Pregnancy care*. The relevant extract has been reproduced in [Appendix 4](#).

**Diabetes Australia** has produced a [pregnancy planning list](#).

**Diabetes UK** has developed a [guide to pregnancy for women with diabetes](#).

**The NDSS and Diabetes Australia** have produced a [guide to planning and managing pregnancy for women with type 2 diabetes](#).

**The Royal Australian College of General Practitioners** has information on antenatal care for Aboriginal and Torres Strait Islander people with diabetes in [Chapter 2 of the National guide to a preventive health assessment in Aboriginal and Torres Strait Islander people](#).

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# Management of type 2 diabetes in older people and residential aged care facilities

## Recommendations

Recommendation	Reference	Grade*
Consider the assessment of medical, psychological, functional (self-management abilities) and social geriatric domains in older adults to provide a framework to determine targets and therapeutic approaches for diabetes management	1 American Diabetes Association, 2019	C
Overtreatment of diabetes is common in older adults and should be avoided	1 American Diabetes Association 2019	B
De-intensification (or simplification) of complex regimens is recommended to reduce the risk of hypoglycaemia in older adults, if achievable within the individualised HbA1c target	1 American Diabetes Association 2019	B
For older adults in residential aged care facilities, individualised care plans should be developed and agreed upon by the individual, their GP and facility staff. This will provide clarity regarding aims of care and metabolic targets, and facilitate screening for diabetes-related complications and annual reviews	RACGP Diabetes Handbook working groups, 2020	Consensus

\*Refer to '[Explanation and source of recommendations](#)' for explanations of the levels and grades of evidence.

## Clinical context

The number of Australians aged  $\geq 65$  years in 2016 was 3.7 million, and this number is expected to more than double by 2057.<sup>2</sup> Approximately 15% of this population have type 2 diabetes.<sup>2</sup> Every year, around 280,000 Australians receive residential aged care,<sup>2</sup> and 10–20% of these residents have diagnosed type 2 diabetes.<sup>3</sup>

The 'older' or 'elderly' age group is often defined administratively and in clinical studies as  $\geq 65$  years; however, there is movement to raise this definition to  $\geq 75$  years, as the physical and mental functioning of the ageing population is improving.<sup>4</sup> The status of 'elderly' might be better defined based on function, cognition, ability to self-care and quality of life. Therefore, the principle of individualised care still applies to older people with type 2 diabetes, and people in this group who are otherwise well and functionally independent should be treated in the same way as any other patient.<sup>5</sup>

There are, however, differences that GPs must consider in older patients, regarding the signs and symptoms of type 2 diabetes in older people and the goals of treatment. These may be particularly relevant to residents of aged care facilities, where management of diabetes can be inadequate or inappropriate.

## In practice

### Diagnosing type 2 diabetes in older people

Many of the symptoms of type 2 diabetes in older people are the same as in younger people; however, they can often be overlooked or mistakenly attributed to 'old age'. It is important to be alert to the clinical features of diabetes in older patients, such as:

- lethargy
- urinary incontinence as part of polyuria
- recurrent infections
- slow wound-healing
- cognitive changes.

GPs should also be aware that type 1 diabetes does occur in older people; clear identification of diabetes type is therefore vital.

For more information, refer to [The McKellar guidelines for managing older people with diabetes in residential and other care settings](#).<sup>6</sup>

### Assessment

The following additional assessment should be undertaken in elderly patients with type 2 diabetes:<sup>1</sup>

- full assessment of physical, mental and social health, including falls risk, nutrition and immunisation status
- careful screening and monitoring for cognitive impairment.

Information about frailty screening, assessment and management can be found in:

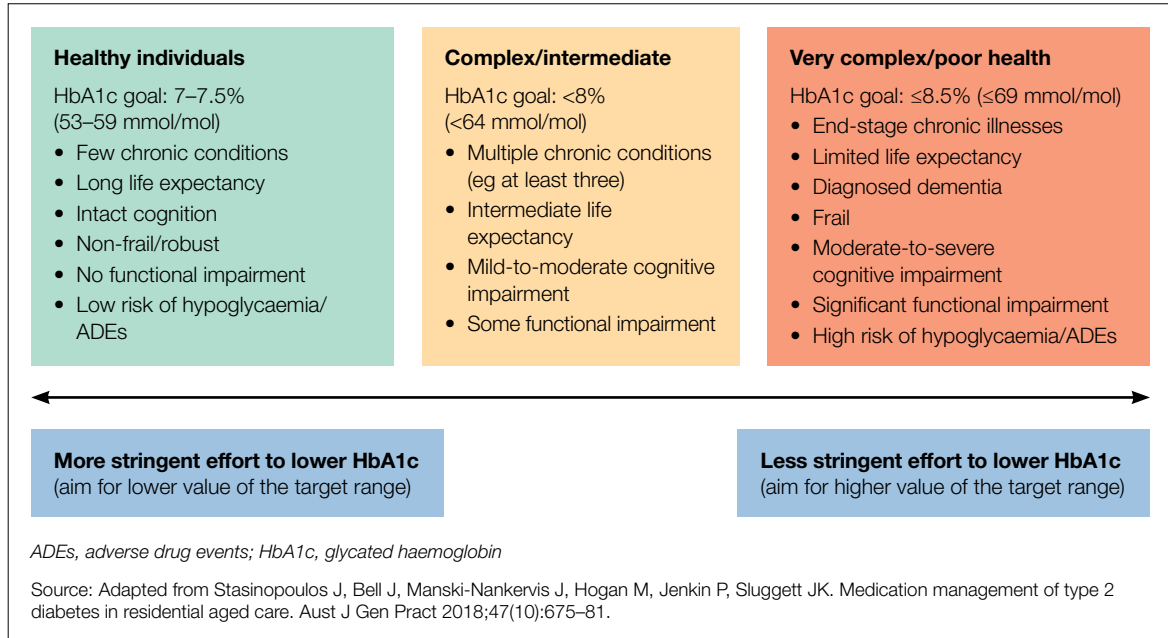
- ['Frailty' in the RACGP aged care clinical guide](#)
- [Identifying frailty](#) (State Government of Victoria)
- ['Diabetes in long-term care'](#) in *Diabetes in older people* (Diabetes Canada)
- a [statement of key principles](#) from Diabetes UK.

### Management and care planning

Care planning is vitally important in older people with diabetes. It can provide clarity regarding aims of care and help avoid reactive management to problems. Care planning should include up-to-date care plans, regular reviews, documented sick day management plans, and hyper- and hypoglycaemia risk assessment.

Management of diabetes in elderly patients should take into account quality of life, life expectancy and functioning (Figure 1). In some patients, glycaemic control may be less important than risk minimisation and maintaining quality of life. Blood glucose targets may therefore be higher than for younger adults with type 2 diabetes (refer to ['Medical considerations'](#), below).

**Figure 1.** Consensus framework for individualising targets and therapeutic approach to glycaemic management across the continuum of care for older people with type 2 diabetes mellitus<sup>7</sup>



Older people with diabetes have higher rates of conditions that might impair ability to self-manage diabetes compared with younger people. These include functional disability, accelerated muscle loss, osteoporosis, cognitive impairment, urinary incontinence, injurious falls and persistent pain.<sup>1</sup>

Refer to the section ‘[Managing multimorbidity in people with type 2 diabetes](#)’ for approaches to managing comorbidities.

### Medical considerations

Older people are at higher risk of hypoglycaemia, so medication regimens should aim to avoid hypoglycaemia.<sup>1</sup> Where needed, individualised targets should be redefined, and treatment regimens de-intensified (if possible) to reduce the risk of hypoglycaemia and avoid polypharmacy.<sup>1</sup>

Older people with diabetes should have an individualised hypoglycaemia management plan, which may need to include an order for glucagon.

Glycaemic targets for some elderly people may be higher than for the non-elderly (eg a glycated haemoglobin [HbA1c] target of 8% [64 mmol/mol], rather than 7% [53 mmol/mol]). Intensive glycaemic management reduces microvascular but not macrovascular complications, and may increase adverse events and mortality. However, optimising glycaemia might help prevent acute symptoms of diabetes such as polyuria, weight loss, confusion and falls.<sup>7</sup> Note that HbA1c levels greater than 8–8.5% (64–69 mmol/mol) are associated with greater morbidity and mortality in older patients.<sup>8,9</sup>

Refer to Figure 1 for suggested glycaemic targets in older people with diabetes.

Insulin can be used to reduce symptoms of hyperglycaemia in combination with oral glucose-lowering medications. Complex regimens should be avoided, and prefilled insulin pens can reduce dosing errors.<sup>10</sup> Nursing or carer support may be needed to

administer injections; however, older people who have been self-injecting their insulin at home should be enabled to continue to do so in a residential aged care facility, subject to their capability.

Insulin regimens should be reviewed regularly, including review of doses and timing of administration relative to food intake, activity, frailty or clinical changes and glycaemic profile. There should not be a 'set and forget' approach.

Table 1 presents prescribing considerations of different glucose-lowering medications in elderly patients.

<b>Table 1. Considerations for selecting, monitoring and de-intensifying glucose-lowering medications in elderly people with type 2 diabetes*</b>	
<b>Medication</b>	<b>Considerations for elderly populations</b>
Metformin	<ul style="list-style-type: none"> <li>• May cause weight loss and gastrointestinal upset</li> <li>• Cease if diarrhoea continues for a few days after starting, even after dose reduction</li> <li>• Extended-release form has fewer gastrointestinal side effects and may reduce regimen complexity</li> <li>• In renal impairment, cease if at risk of further decline in renal function</li> </ul>
Sulfonylureas	<ul style="list-style-type: none"> <li>• Efficacy may reduce over time as <math>\beta</math>-cell function is lost</li> <li>• Long-acting sulfonylureas (glimepiride, glibenclamide and slow-release gliclazide) have a higher risk of hypoglycaemia. Avoid in frail people or when eating patterns are irregular</li> </ul>
DPP-4i	<ul style="list-style-type: none"> <li>• Given once daily, except vildagliptin (once or twice daily)</li> <li>• Dose reduction is required in renal impairment, except linagliptin (excreted unchanged in bile)</li> </ul>
GLP-1 RAs	<ul style="list-style-type: none"> <li>• May cause weight loss. Avoid in people who are frail and underweight</li> <li>• Gastrointestinal effects are more common in older people</li> <li>• Liraglutide is not recommended in people aged <math>\geq 75</math> years and in end-stage renal disease (no experience in these groups)</li> </ul>
Acarbose	<ul style="list-style-type: none"> <li>• Limited role because of gastrointestinal side effects and inferior glycaemic effect compared with metformin and sulfonylureas</li> </ul>
Thiazolidinediones	<ul style="list-style-type: none"> <li>• May worsen heart failure, oedema and bone fracture risk</li> <li>• Change in glycaemic control may take up to 12 weeks after initiation, dose changes or cessation</li> </ul>
SGLT2 inhibitors	<ul style="list-style-type: none"> <li>• Watch for increased urinary frequency or incontinence, genitourinary infections and dehydration, which can contribute to delirium</li> <li>• Not recommended with loop diuretics, due to volume depletion concerns</li> <li>• May be problematic in people with urinary incontinence and those who require assistance getting to the toilet</li> <li>• Care should be taken with use in people aged <math>\geq 75</math> years and in end-stage renal disease (limited experience in these groups)</li> </ul>
Insulin	<ul style="list-style-type: none"> <li>• Appropriate meal planning is essential</li> <li>• Basal insulin may have a lower hypoglycaemia risk than premixed insulin in some cases</li> <li>• Administration by syringe increases risk of overdose; a pen device is preferred in residential aged care facilities</li> </ul>

*DPP-4i, dipeptidyl peptidase-4 inhibitors; GLP-1 RAs, glucagon-like peptide-1 receptor agonists; SGLT2, sodium glucose co-transporter 2*

Source: Adapted from Stasinopoulos J, Bell J, Manski-Nankervis J, Hogan M, Jenkin P, Sluggett JK. Medication management of type 2 diabetes in residential aged care. *Aust J Gen Pract* 2018;47(10):675–81.

## Lifestyle interventions

### Diet

Nutritional interventions can help reduce the risk of adverse diabetes events in older people, such as hypoglycaemia, undesired weight loss, frailty and falls.<sup>1,11</sup> It is important to consider the different nutritional needs of elderly people compared with younger people, including the healthy weight range in people aged >65 years.

Elderly people may lack awareness of thirst, and can experience reduced appetite. Adequate hydration and nutrition can therefore be a problem. Other areas to assess and monitor include constipation, oral hygiene and the ability to cook or shop for food.

Refer also to the National Diabetes Services Scheme (NDSS) booklet *Healthy eating: A guide for older people living with diabetes*.

### Physical activity

The Australian Government's [physical activity guidelines](#) recommend all people aged >64 years do at least 30 minutes of moderate-intensity physical activity (eg walking, dancing, mowing the lawn) a day and reduce sedentary behaviour as much as possible.

Even in older adults with multiple chronic diseases, the risks associated with exercise are considered to be less than those of inactivity. Targeted exercise programs (aerobic, resistance, balance training, or a combination) have been shown to provide clinically significant symptom relief for osteoarthritis, peripheral vascular disease, mobility impairment, peripheral neuropathy and elevated fall risk, depression and cognitive impairment.<sup>12</sup>

Therefore, exercise training is an essential component of any treatment plan for all elderly people who have, or are at risk of, type 2 diabetes.<sup>12</sup> An accredited exercise physiologist can safely prescribe exercise programs. Refer to the section '[Lifestyle interventions for management of type 2 diabetes](#)' for more information.

### Sick day management

Sick days should be planned for as usual, with the additional inclusion of advice for nurses or carers. Refer to the section '[Managing risks and other impacts of type 2 diabetes](#)'.

## Diabetes management in residential aged care facilities

The [McKellar guidelines](#) provide comprehensive and detailed information about managing older patients with type 2 diabetes in aged care facilities, including hyperglycaemia management guidelines (pages 25–28) and hypoglycaemia management guidelines and a risk tool (pages 29–33). Medical considerations for care plans are also presented in [Appendix 5](#).

The key considerations in residential care are the same as for other elderly patients; however, optimising care will necessarily involve collaboration with health professionals such as nurses, aged care staff, pharmacists, dietitians, diabetes educators and residential-based allied health teams.

Staff clinical knowledge and communication is critical. Page 15 of the McKellar guidelines outlines to residential care staff how to consult with GPs in terms of care context and preparation for a GP consultation. Refer to the 'Resources' list at the end of this section for links to guidebooks specifically for residential care staff.

In addition to the [considerations listed above](#), medication management in residential aged care facilities requires management of the complex processes that underpin prescription, supply, administration and monitoring of glucose-lowering medication in residential aged care facilities.

- Consider residents' goals of care and susceptibility to adverse drug events.<sup>7</sup>
- Aim for optimisation of care, de-prescribing, reducing polypharmacy and avoiding hypoglycaemia.
- Conduct medication reviews with facility pharmacists and nurses.<sup>7</sup>
- Appropriate training for nursing staff (preferably annually) will help with care, and should include safe management of insulin, understanding insulin profiles, monitoring blood glucose levels, and when to increase monitoring.

Refer also to the [RACGP aged care clinical guide](#) for more information about medicine management, de-prescribing and polypharmacy.

## Resources

The **Royal Australian College of General Practitioners** provides general guidance on aged care in the [RACGP aged care clinical guide \(Silver Book\)](#).

### Assessment and management

**Diabetes UK** has produced a [statement of key principles](#) of management, including the assessment of frailty, in older people with type 2 diabetes.

### Lifestyle interventions

The **Australian Government** has developed [physical activity guidelines for older adults](#).

The **NDSS** has produced a [guide to healthy eating for older people living with diabetes](#).

### Aged care facilities

**Diabetes Australia** has produced a [checklist for management of aged care residents](#).

**Deakin University and Barwon Health** have published [The McKellar guidelines for managing older people with diabetes in residential and other care settings](#), which includes tools for assessing the risk of adverse drug events from glucose-lowering medication.

The **NDSS** has developed a [handbook and fact sheet on diabetes management in aged care](#).

The **NDSS** has devised a [quality review tool for management of aged care residents with diabetes](#).

### Palliative and end-of-life care for older people with diabetes

The **Centre for Quality and Patient Safety Research** has information on palliative and end-of-life care for [older patients](#), [families](#) and [healthcare professionals](#).

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# Diabetes and end-of-life care

## Recommendations

Recommendation	Reference	Grade*
In people taking glucose-lowering medications and who are at risk of hypoglycaemia, a blood glucose range of 6–15 mmol/L is appropriate in most cases for palliative care	1 Diabetes UK, 2018	Consensus
Determine a blood glucose and glycated haemoglobin (HbA1c) range that is safe for the individual and that avoids hypoglycaemia and hyperglycaemia	RACGP Diabetes Handbook working groups, 2020	Consensus
*Refer to 'Explanation and source of recommendations' for explanations of the levels and grades of evidence.		

## Clinical context

End-of-life care for people with type 2 diabetes should not be viewed as a failure of care, but as a complement to usual diabetes care.<sup>2</sup> The general aims are to:

- consider ethical and legal aspects of care
- improve and maintain dignity and quality of life
- help the person achieve life goals
- manage pain and distressing symptoms
- talk honestly about prognosis and the person's concerns, values and goals
- achieve a dignified death in a place of the person's choosing
- support family and carers.

Clinically, this will usually involve modifying the person's usual care so that an appropriate level of intervention is provided, according to stage of diabetes, prognosis, symptoms, personal values and dignity. This can be challenging, and requires general practitioners (GPs) to manage:<sup>1</sup>

- changes to glycaemic targets
- individual and carer expectation
- risk of hyperglycaemia and hypoglycaemia
- effects of other medications such as corticosteroids
- tailoring of glucose-lowering medications.

## In practice

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>2</sup> Liaison with a palliative care team and community diabetes team is recommended as part of a multidisciplinary approach to end-of-life diabetes care.<sup>3</sup>



## Managing glycaemia

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>4,5</sup>

Multiple factors can affect glycaemic control in terminally ill people (Box 1). Glucose-lowering therapy should be tailored to minimise the risks of hypoglycaemia and hyperglycaemic states and symptoms.

Hyperglycaemia can worsen pain, confusion, thirst, cognition, confusion and incontinence. Blood glucose levels >15 mmol/L may cause polyuria and increase risks of infection. Diabetic ketoacidosis can mimic terminal illness. If not recognised and treated, it can severely impair quality and even duration of life.

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

### Box 1. Factors affecting glycaemic control in people with type 2 diabetes at end of life

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

## 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.

The key considerations for decision making regarding glucose-lowering medication are risk minimisation and quality of life. The following classes of medications should be avoided in certain cases:<sup>1</sup>

- long-acting sulfonylurea preparations (eg glibenclamide, glimepiride), if small meals are being taken
- sodium glucose co-transporter 2 (SGLT2) inhibitors, if dietary intake is reduced; reduced intake can increase ketone production and may increase the risk of ketoacidosis, which can be euglycaemic
- glucagon-like peptide-1 receptor agonists (GLP-1 RAs), if patients have reduced or poor appetites.

Renal function may also decline, and several non-insulin glucose-lowering medications should be discontinued in response to this.

The Diabetes UK guideline *End of life diabetes care: Clinical care recommendations* provides recommendations for tailoring medication at different stages of end-of-life care. An algorithm for managing diabetes in the last days of life is also provided.

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

## Resources

### For health professionals

**Deakin University** has produced comprehensive information about end-of-life care for people with diabetes, including advance care planning, in the [Guidelines for managing people with diabetes at the end of life care: Final report](#).

### For carers

**Palliative Care Australia** has produced [information for family members and carers](#) on diabetes and palliative care.

Refer also to the section '[Management of type 2 diabetes in older people and residential aged care facilities](#)'.

## References

1. Diabetes UK. End of life diabetes care: Clinical care recommendations. London: Diabetes UK, 2018.
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4. Cox DJ, Kovatchev BP, Gonder-Frederick LA, et al. Relationships between hyperglycemia and cognitive performance among adults with type 1 and type 2 diabetes. *Diabetes Care* 2005;28(1):71–77.
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# Managing risks and other impacts of type 2 diabetes

## Recommendations

Recommendation	Reference	Grade*
<b>Sick days</b>		
Patients should be educated to develop a sick day management plan after initial diagnosis. This plan should be reviewed at regular intervals	1 Australian Diabetes Educators Association, 2016	None provided
Assist in the development of a sick day care plan and preparation of a home sick day management kit for patients to use during episodes of sickness	1 Australian Diabetes Educators Association, 2016	None provided
<b>Planned surgical procedures</b>		
Patients receiving sodium glucose co-transporter 2 (SGLT2) inhibitors should cease this medication at least three days prior to surgery or procedures that require one or more days in hospital and/or 'bowel preparation', including colonoscopy, to prevent diabetic ketoacidosis (DKA) in the peri-operative period. For day procedures, SGLT2 inhibitors may be ceased just for the day of the procedure	2 Australian Diabetes Society, 2020	Consensus
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Insurance and advocacy

Insurance can be an area difficult to navigate for people with diabetes and other chronic conditions. [Diabetes Australia](#) and other advocacy organisations can provide advice about rights, responsibilities and other tips regarding:

- private health insurance
- life and disability insurance
- income protection
- travel insurance.

## Immunisations

Recommended vaccines for people with type 2 diabetes are as follows.

- **Influenza** – annual vaccination is recommended for people with chronic conditions, including diabetes, that require regular medical follow-up or have required hospitalisation in the past year.<sup>3</sup>
- **Diphtheria, tetanus, pertussis** – for all adults aged ≥65 years if they have not had one in the previous 10 years.
- **Hepatitis B** – consider for travellers to hepatitis B–endemic areas.
- **Herpes zoster** – consider for ages 70–79 years (available for free in this age group under the National Immunisation Program).

- **Pneumococcus** – diabetes is considered a ‘Category B’ condition for increased risk of invasive pneumococcal disease. It is recommended that all adults with type 2 diabetes receive three lifetime doses of the 23-valent pneumococcal polysaccharide vaccine (23vPPV), as follows:<sup>3</sup>

1. first dose at around age 18 years, or at time of diagnosis of type 2 diabetes
2. second dose 5–10 years later
3. third dose at least five years later or at age 65 years, whichever is later.

Children who have received four doses of 13-valent pneumococcal conjugate vaccine (13vPCV) are recommended to receive two lifetime doses of 23vPPV.

## Sick days

‘Sick days’ are periods of minor illness (due to other causes) of around 1–4 days’ duration that require changes to a person’s usual diabetes self-management.

People with diabetes require careful individualised management during these periods to prevent:

- hyperglycaemic and hypoglycaemic emergencies
- hyperosmolar hyperglycaemic state
- diabetic ketoacidosis (DKA).

A warning regarding use of sodium glucose co-transporter 2 (SGLT2) inhibitors and DKA: SGLT2 inhibitors carry a small but definite risk of DKA, sometimes without significantly raised blood glucose levels (euglycaemic DKA).<sup>2</sup> Patients should be periodically warned that the chance of developing DKA (which can be euglycaemic) is low, but advised of the symptoms and told to present to an emergency department if they develop any of these symptoms. They should inform treating doctors that they are taking an SGLT2 inhibitor. Risk factors and warning signs should be incorporated into their management plan.<sup>2</sup>

General practices and general practitioners (GPs) should consider routinely incorporating sick day plans in patients’ documented management plans.

The Australian Diabetes Educators Association (ADEA) has developed clinical guiding principles for health professionals and a consumer resource on sick day management.<sup>1,4</sup>

Patient information is also available from state and territory diabetes organisations.

## In practice

A clear and specific action plan for management of sick days (Table 1) ensures that patients can either self-manage or have access to their healthcare team for advice and early intervention, supervision and support.

Action plans should be updated regularly (at least once during the annual cycle of care) and provided to patients and their support people.

Sick day management should be tailored to the individual patient and involve the following.

- Identify the underlying cause, and treat as appropriate. Underlying causes include:
  - intercurrent illnesses, infections (eg skin, urinary tract and chest infections), trauma, acute myocardial infarction and stroke
  - use of medications such as corticosteroids.

- Increase self-monitoring of blood glucose (SMBG), if required by individual circumstances (eg patients at risk of hypoglycaemia or using insulin). Refer to the [NDSS](#) website for necessary forms.
- Ensure continuity of advice and accessibility – provide telephone access or after-hours support.
- Review medications – refer to Table 1.

### Special considerations

Different patient groups have different considerations for sick day management.

#### Type 2 diabetes managed with diet alone

- For worsening glycaemia, consider the introduction of medication and symptomatic management of hyperglycaemia.
- Patients with type 2 diabetes may have impaired body immune mechanisms that will make recovery slower.
- In addition, patients may become dehydrated because of the osmotic diuresis.

#### Type 2 diabetes managed with oral or non-insulin glucose-lowering medication

- Worsening glycaemia may require urgent review by the GP or referral to a specialist diabetes service or hospital emergency department, or contact with an endocrinologist.
- Insulin may be temporarily required for persistent and extreme symptomatic hyperglycaemia ( $\geq 15$  mmol/L), which may also require hospital admission.
- In patients with nausea, vomiting and/or diarrhoea:
  - consider stopping metformin and glucagon-like peptide-1 receptor agonists (GLP-1 RAs) temporarily. Metformin may aggravate these symptoms, and GLP-1 RAs may aggravate nausea or vomiting. There may be a risk of acute renal impairment due to dehydration
  - review and cease SGLT2 inhibitors, metformin and GLP-1 RAs if acute gastrointestinal illness is present, as these medicines may further aggravate dehydration and hypovolaemia.
- Note that DKA/euglycaemic DKA should be considered in patients who are taking SGLT2 inhibitors if they display abdominal pain, nausea, vomiting, fatigue or metabolic acidosis.<sup>2</sup>

#### Type 2 diabetes managed on insulin

- All patients should be [self-monitoring blood glucose](#), have adequate [pen needles](#) and advised to seek an urgent review by their GP or health professional when unwell or if their blood glucose is  $>15$  mmol/L on two consecutive SMBG readings, as per the action plan.
- Blood glucose monitoring should be increased to every 2–4 hours if unwell. Patients may need to increase their morning intermediate or long-acting insulin dose by 10–20% if the glucose reading remains elevated, and, depending on further blood glucose levels, modify subsequent doses of short-acting insulin during the day. For people on ultra-long-acting basal insulins, including glargine U300 or degludec insulins, GPs may need to seek advice from an appropriate specialist regarding dose adjustment, as dose changes may take 4–7 days for effect. Advice on the additional use of oral agents and GLP-1 RAs is listed in Table 1.

- Additional blood ketone testing (with appropriate self-monitoring equipment) may be incorporated if there are symptoms suggestive of ketosis (eg nausea, vomiting, shortness of breath or fruity odour, abdominal pains, altered consciousness), there is a history of DKA, or if the patient is using an SGLT2 inhibitor. This should be a documented strategy in the patient's sick day management plan.
- Note that many patients are only on basal insulin or a premixed insulin. These patients require appropriate medical advice, and may need acute medical advice or prescription for additional rapid-acting insulin to use as a supplemental insulin dose.<sup>1</sup> If uncertain, consult an appropriate specialist.
- Patients with gastrointestinal upset who are not eating, but who feel well and continue their usual activities, may need to reduce their insulin according to SMBG readings (especially rapid-acting insulin) to avoid hypoglycaemia.

For more information, refer to the ADEA's clinical guiding principles for sick day management 2016.<sup>1</sup>

**Table 1. Action plan for management of sick days in people with type 2 diabetes<sup>1,4</sup>**

Commence action plan	Commence: <ul style="list-style-type: none"> <li>• when patient starts to feel unwell, or</li> <li>• if blood glucose &gt;15 mmol/L on two consecutive readings</li> </ul>
Frequency of blood glucose monitoring	Monitor 2–4-hourly, or more frequently if blood glucose is low
Medication	Continue insulin or diabetes medications, but assess use of metformin, SGLT2 inhibitors (dapagliflozin, ertugliflozin and empagliflozin) and GLP-1 RAs, which may require cessation if vomiting or dehydration is a concern
Food and water intake	<ul style="list-style-type: none"> <li>• There is increased risk of hypoglycaemia from insulin and sulfonylureas if appropriate intake of meals is not maintained</li> <li>• Patients should try to maintain their normal meal plans if possible</li> <li>• Fluid intake (eg water or oral rehydration solutions) 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 vomiting or diarrhoea, SGLT2 inhibitors and metformin should be ceased</li> <li>• If illness is causing loss of appetite and marked reduction of carbohydrate intake, SGLT2 inhibitors should be ceased</li> <li>• If blood glucose &gt;15 mmol/L, use non-glucose-containing fluids</li> <li>• If blood glucose &lt;15 mmol/L, use oral rehydration solutions (may contain glucose) if needed</li> <li>• If unable to tolerate oral fluids and blood glucose continues to drop, advise patient to attend medical care</li> </ul>
Seek assistance	Individuals and support people need to assess whether the person is well enough or able to follow the plan; if they are not well enough, they should call for help or attend hospital
<i>GLP-1RAs, glucagon-like peptide-1 receptor agonists; SGLT2, sodium glucose co-transporter 2</i>	

## Planned surgical procedures

People with diabetes should be seen several weeks before surgery for an assessment of glycaemic control and anaesthetic suitability, including their cardiovascular disease risks, and any treatment modifications instituted and stabilised from the time of referral before proceeding to surgery.

Attaining glycaemic control (ie a glycated haemoglobin [HbA1c] approaching 7%, or 53 mmol/mol) in the pre-operative period has been shown to result in fewer complications and shorter hospital stays after surgery.<sup>5</sup> A patient with an HbA1c of  $\geq 9\%$  (75 mmol/mol) may need to have their surgery delayed until glycaemic management is optimised.<sup>5</sup>

Pre-operative care is the same for minor and major surgery. For prolonged procedures, blood glucose levels should be monitored intra- and post-operatively for several days.

Insulin may be required post-operatively for some people with type 2 diabetes.

Further information can be found in the Australian Diabetes Society's [Peri-operative diabetes management guidelines](#).

Rural GPs who perform operations and GPs who administer anaesthetics should refer to these guidelines.

## In practice

### Ceasing medication before surgery

Appropriate written instructions should be given to the patient beforehand.

Patients who are prescribed oral glucose-lowering medications **except** SGLT2 inhibitors, and patients on injectable GLP-1 RAs:

- can continue their diabetes medications on the day prior to surgery (be aware that gastric emptying is affected by GLP-1 RAs)
- should omit their oral glucose-lowering medications on the morning of surgery, irrespective of whether they are on the morning or afternoon list.

SGLT2 inhibitors should be ceased at least three days prior to surgery and procedures that require one or more days in hospital and/or require bowel preparation, including endoscopy/colonoscopy (two days prior to and the day of the procedure), to prevent DKA in the peri-operative period.<sup>2</sup> Other glucose-lowering medications may need to be increased in this period.<sup>2</sup>

For day procedures (including gastroscopy), SGLT2 inhibitors may be ceased just for the day of procedure. However, fasting before and after the procedure should be minimised.

Further advice on SGLT2 inhibitor use in the peri-operative period can be found in the Australian Diabetes Society's [alert](#) regarding SGLT2 inhibitors and DKA risk during surgery.

Insulin requires individualised advice as follows, and is usually not completely omitted (never withhold basal insulin):

- Long-acting insulin – continue as usual (including morning doses)
- Short-acting insulin – omit rapid/short-acting insulin if not eating. Depending on timing of procedure
  - morning: withhold short-acting insulin (and all oral glucose-lowering medication)
  - afternoon: take half the normal morning rapid/short-acting dose in the morning before a light breakfast
- Premixed insulin – take one-third to half of the usual morning dose

People taking intermediate-acting insulin who are booked for afternoon procedures or on prolonged fasting may need a reduced dose. Seek specialist endocrinology and anaesthetic advice before planned procedures.

Patients on a multiple daily insulin regimen might require peri-operative glucose infusion and the associated close blood glucose monitoring. Many hospitals have a protocol or working plan that should be followed for the individual patient in that service.

## Recommencing oral medication

Patients on oral glucose-lowering medication, with the exception of SGLT2 inhibitors, can generally recommence medications when they are able to eat meals. Specific advice is available in Australian Diabetes Society's *Peri-operative diabetes management guidelines*.

SGLT2 inhibitors should only be recommenced post-operatively when the patient is eating and drinking normally or close to discharge from hospital. People who have had day surgery should only recommence SGLT2 inhibitors once they are on full oral intake. It may be prudent to delay recommencement for another 24 hours; however, this must be balanced against risk of hyperglycaemia.<sup>2</sup>

Metformin can generally be recommenced 24 hours after major surgery, provided there has been no deterioration in serum creatinine.<sup>5</sup> For patients pre- and post-operatively using metformin and SGLT2 inhibitors, maintenance of hydration and carbohydrate intake is important.

## Patients undergoing colonoscopy

For colonoscopy preparation, ColonLYTELY or Glycoprep, rather than Fleet or PhosphoPrep, should be used in patients with renal impairment, who may become severely hyperphosphataemic with phosphate preparations.<sup>6</sup>

The dietary modifications that are advised for colonoscopy preparation might alter glucose management and hypoglycaemic risks; instruction on appropriate SMBG testing may be required. It is also essential to avoid excessive carbohydrate restriction during the bowel preparation period if the patient has been using SGLT2 inhibitors.

On preparation days and day of procedure, commence SMBG and withhold all oral medications. Note that SGLT2 inhibitors should be ceased three days before colonoscopy and only recommenced when the patient is eating and drinking normally.<sup>2</sup>

Basal and/or rapid-acting insulin should be managed as above.

Premixed insulin should be managed as follows.

- On the day of bowel preparation, reduce premixed dose by half for all doses.
- On the day of procedure, arrange a morning procedure and use half usual dose and glucose infusion.

## Driving

Diabetes is identified as one of the medical conditions that may impair driving ability. Impairment can be caused by:

- unexpected hypoglycaemia for drivers on insulin or sulfonylureas (main hazard)
- sensory or end-organ complications, particularly reduced vision or reduced sensation in the feet
- other comorbidities, such as sleep apnoea and cardiovascular problems.

Drivers with diabetes must meet specific national standards to ensure that their health status does not increase the risk of a crash. However, GPs should be aware that there are variations to these standards in individual states and territories, and should check with the relevant transport authority.



## In practice

National medical standards for private and commercial licensing, and a flowchart to assist with the management of diabetes and driving, are found in section 3.3.2 of 'Austroads' and the National Transport Commission's *Assessing fitness to drive*. This document was updated in 2016, with a number of changes to the assessment criteria regarding drivers with diabetes. Note that HbA1c measurements are not used to assess fitness to drive, and, for clarity, all references to HbA1c have been removed from the updated criteria.<sup>7</sup>

### Private licences

**People taking glucose-lowering medications other than insulin** do not necessarily require a conditional licence; however, they must have a medical review by their treating doctor every five years.<sup>7</sup>

A person on glucose-lowering medication other than insulin is **not** fit to hold an unconditional licence if they:

- have end-organ complications that may affect driving, as defined by the national medical standards, or
- have had a recent 'severe hypoglycaemic event', defined as 'an event of hypoglycaemia of sufficient severity such that the person is unable to treat the hypoglycaemia themselves and thus requires an outside party to administer treatment'.<sup>7</sup>

In this case, a conditional licence may be granted as long as the following are achieved:

- any end-organ effects are satisfactorily treated
- the person is following a treatment regimen that minimises the risk of hypoglycaemia
- the person experiences early warning symptoms (awareness) of hypoglycaemia or has a documented management plan for lack of early warning symptoms
- any recent 'severe hypoglycaemic event' has been satisfactorily treated.

**People on insulin** may have a conditional licence, requiring a two-yearly review. This must be granted as outlined in the national medical standards, with similar criteria as above.

### Commercial licences

People with diabetes on any form of glucose-lowering therapy, including insulin, may be granted a conditional commercial licence. Specialist referral is required.

This licence is subject to yearly specialist review; if the person is on metformin alone, this review may be carried out by the treating GP, by mutual agreement with the treating specialist. The initial recommendation of a conditional licence must, however, be based on the opinion of a diabetes specialist.

### Severe hypoglycaemia

The minimum period of time before returning to drive after an episode of severe hypoglycaemia is generally six weeks. A specialist's assessment and agreement is required for all licensing categories.

## Patient education and resources

The National Diabetes Service Scheme's (NDSS's) consumer booklet *Driving and diabetes* 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 and should be actively promoted.

For example, drivers are required to perform a blood glucose check before they drive and again during the journey, if driving for more than two hours.

## Diving

People with type 2 diabetes, including those who use medication, 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 that were developed in 2005.

When evaluating persons with diabetes for medical fitness to dive, first ensure that no other exclusionary conditions (eg 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.

The Australian Diabetes Society has [recommendations](#) for people with insulin-treated diabetes, regarding suitability for diving, scope of diving and blood glucose management on the day of diving.

## 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 should return to normal once a more usual lifestyle has been resumed at the destination.

Patients should ideally have a medical consultation at least six weeks before the proposed travel, particularly if they are on insulin. This allows time to assess control and alter management as required. Patients might benefit from referral to a credentialled diabetes educator to go through their travel plans and help prepare a detailed travel management plan, including sick day management.

Before travelling, patients should:

- check routine immunisation status and other medical conditions
- obtain a covering letter from their doctor (refer below)
- pack extra food (if allowed by customs) and double the quantity of supplies of medication and monitoring equipment, dividing them between checked-in and carry-on luggage in case one is lost or stolen (it is not advisable to pack extra insulin in checked-in luggage, as insulin exposed to extreme temperatures of the cargo hold will lose efficacy)
- get advice about special insurance
- familiarise themselves with Australian/other air security guidelines (refer below).

## Travelling by air: Security guidelines

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

- All diabetes supplies that include testing equipment, insulin and glucagon delivery devices (eg syringes, pen needles, 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.
- 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, whether 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 on 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 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 the security staff request 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, consult the travel advice on the websites of [Diabetes Australia](#) and the [Department of Home Affairs](#).

## Diabetes management during Ramadan

Fasting during Ramadan is one of the five pillars of Islam, and all healthy adult Muslims are obliged to refrain from eating and drinking from sunrise to sunset during this lunar month. The fast may last 11–19 hours, depending on where and at what time of year Ramadan occurs. People with an acute illness such as influenza may postpone fasting to other days when their acute illness has resolved. People with chronic illnesses such as diabetes are not obliged to fast, and are able to donate to a charity as atonement; however, many still choose to fast.

Some Muslim patients with diabetes might be more inclined to discuss fasting during Ramadan with their local imam rather than their GP; GPs may therefore need to ask patients specifically if they intend to fast.<sup>8</sup>

The main concern for diabetes management during Ramadan is hypoglycaemia. Fasting can disrupt normal glucose homeostasis and lead to serious consequences. Patients who choose to fast should be warned of these complications.

People in the 'very high' or 'high' risk groups shown in Box 1 should be actively discouraged from fasting during Ramadan.<sup>8</sup> This includes people at high risk of hypoglycaemia.

A post-Ramadan GP assessment is recommended.

## **Taking oral glucose-lowering agents during Ramadan**

Guidelines have recommended therapeutic choices to help minimise risk of hypoglycaemia in Ramadan.<sup>8,9</sup>

### **Insulin use during Ramadan**

People taking insulin who wish to fast during Ramadan should have renal and liver function tests ordered, as both renal and hepatic impairment may precipitate or prolong hypoglycaemia in people with diabetes.

People taking insulin should be instructed on SMBG and individual adjustment of insulin doses based upon glucose goals discussed before commencing Ramadan.

People taking long-acting basal insulin analogue glargine have been shown to be able to fast safely with no significant increases in hypoglycaemic episodes.<sup>8</sup> Rapid-acting (mealtime) insulin should be given at fast-breaking evening mealtimes.

If weight loss occurs due to fasting, patients may need a reduction in basal insulin dose in the second half of the Ramadan period.

Patients with type 2 diabetes on premixed insulin twice daily should reduce the morning breakfast dose by 25–50% and take the normal evening dose with their evening meal.<sup>8</sup> If postprandial hyperglycaemia develops as a result of the larger-than-usual sunset meal (iftar), which breaks the day's fast, then consider changing the premixed insulin to 50:50 (for patients on 30:70 or 25:75 premixed insulin). Alternatively, the premixed insulin dose can remain the same, with additional rapid-acting insulin given to cover the iftar meal. Rapid-acting insulin might also be required for people who have an additional evening meal before bedtime, when iftar is early.

Because eating patterns can vary significantly from person to person during Ramadan, individualised plans for insulin use should be developed for each person.

### Box 1. Risk categories for people with diabetes who are considering fasting during Ramadan<sup>8</sup>

#### Very high risk

People with any of the following:

- Severe or recurrent episodes of hypoglycaemia in the three months before Ramadan
- History of recurrent hypoglycaemia
- History of hypoglycaemic unawareness
- Poor glycaemic control before the month of Ramadan
- DKA episode or hyperosmolar hyperglycaemic state within three months before Ramadan
- Acute illness
- Pregnancy with pre-existing diabetes or GDM treated with glucose-lowering medication\*
- Poorly controlled type 1 diabetes
- Comorbidities such as chronic kidney disease (stage 4 or 5) or cardiovascular disease

#### High risk

People with any of the following:

- Sustained poor glycaemic control
- Well-controlled type 1 diabetes
- Well-controlled type 2 diabetes on multiple-dose or mixed insulin
- Pregnancy with pre-existing diabetes or GDM controlled by diet only\*
- Chronic kidney disease stage 3 or lower
- Stable macrovascular complications
- Comorbid conditions that present additional risk factors
- Diabetes and performing intense physical labour
- Treatment with drugs that may affect cognitive function

#### Moderate–low risk

People with well-controlled type 2 diabetes treated with one or more of the following:

- Lifestyle interventions
- Metformin
- DPP-4 inhibitors
- GLP-1 RAs
- SGLT2 inhibitors or thiazolidinediones
- Basal insulin

*DKA, diabetic ketoacidosis; DPP-4, dipeptidyl peptidase-4; GDM, gestational diabetes mellitus; GLP-1 RAs, glucagon-like peptide-1 receptor agonists; SGLT, sodium glucose co-transporter 2*

\*Note that it is not advised for pregnant women to fast, and they are considered exempt from fasting during Ramadan if they wish.

## Exercising and diet during Ramadan

Regular or light exercise is allowed during Ramadan and should be encouraged. However, care should be taken to avoid hypoglycaemia and dehydration.<sup>8</sup> This is particularly an issue when Ramadan falls in summer months, due both to the higher ambient temperature and the greater number of daylight hours.

Patients should try to divide their daily calories between the breakfast (suhour) meal and iftar. They should endeavour to eat well-balanced, low-glycaemic-index foods that are high in fibre, such as fruits and vegetables.

**Diabetes UK** has information about fasting during Ramadan for people with diabetes and for imams.

## Resources

### Sick day management

The **ADEA** has a [resource](#) for patients regarding sick day management.

### Surgery

The **Australian Diabetes Society** has published the [Peri-operative diabetes management guidelines](#).

### Driving

The **NDSS** has published the [Driving and diabetes](#) consumer booklet.

### Diabetes and Ramadan

The **International Diabetes Federation** has published [Diabetes and Ramadan: Practical guidelines](#).

**Diabetes UK** has [information about fasting during Ramadan](#) for people with diabetes and for imams.

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# *Use of technology in type 2 diabetes management*

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## **Clinical context**

Recently there has been an acceleration of uptake of technology for managing diabetes: as an adjunct to conventional therapy, to improve self-management and to provide education. This presents both challenges and opportunities for general practitioners (GPs) and their patients.

The technology available to help manage diabetes falls into three main categories:

- Information technology – such as mobile phone apps, SMS messaging, wearable technology (eg fitness trackers, smartwatches), web-based programs and clinic-based chronic disease care programs
- Technological innovations for monitoring of glycaemia – such as continuous glucose monitoring (CGM) and flash glucose monitoring, which provide greater insights into glycaemic patterns
- Technology for medication delivery – such as evolving insulin pen devices and continuous subcutaneous infusion of insulin (insulin pumps). Although insulin pumps have, traditionally, been used mainly by people with type 1 diabetes, they are increasingly being used in type 2 diabetes

## **Information technology**

A recent meta-analysis found that information technology such as mobile phone apps and web-based applications combined with standard diabetes care resulted in clinically significant reduction in glycated haemoglobin (HbA1c) in people with type 2 diabetes.<sup>1</sup> Additionally, there is emerging evidence that information technology interventions are associated with:

- reduced sedentary behaviour (computer, mobile and wearable technologies)<sup>2</sup>
- increased physical activity (online self-tracking program)<sup>3</sup>
- improvements in diet and exercise, including understanding of nutrition (counselling delivered via mobile phone messaging).<sup>4</sup>

## **Continuous glucose monitoring**

### **What is it?**

CGM involves a small sensor being implanted in the subcutaneous tissue to monitor interstitial glucose. 'Real-time' CGM continuously records and reports glucose levels, with some devices using alarms to alert users to hypoglycaemia or hyperglycaemia. CGM measures interstitial glucose, and therefore is not the same as capillary blood glucose measurement, which remains the standard for confirmation of high and low blood glucose levels and treatment decisions.

Flash glucose monitoring (FGM), also called 'intermittently viewed CGM', uses a disc device, worn on the arm, that can be scanned with a reader to obtain interstitial glucose results instantly.<sup>5</sup> Currently, these devices do not alert the user to either low or high blood glucose levels.

## How does it help?

HbA1c is the standard for assessing long-term glycaemic control; however, it does not reflect within-day and day-to-day glycaemic variability that might lead to hypoglycaemia or postprandial hyperglycaemia.<sup>6</sup>

CGM can be a useful clinical tool to detect glycaemic patterns, and evaluate quality of glycaemic control, glycaemic variability and patterns of hypoglycaemia.

Increasingly, standardised reporting that uses the ambulatory glucose profile (AGP) is being adopted. AGP represents the modal distribution of interstitial glucose in a graphic form, which allows identification of issues such as hypoglycaemic risk, glycaemic variability and excessive glycaemic excursions, which informs clinical intervention such as modifying pharmacotherapy or implementing medical nutrition therapy.

The minimum duration of CGM to obtain enough data to effectively characterise and interpret glycaemia patterns has been reported as at least 14 days.<sup>7</sup>

## Accuracy of CGM

The accuracy of CGM is often reported as the 'mean absolute relative difference' (MARD) between the CGM system values and matched reference values. A MARD of 10% is considered desirable.<sup>7</sup>

To be accurate, real-time CGM requires calibration with self-monitoring of blood glucose (SMBG). Calibration is best performed when glucose levels are not changing rapidly.<sup>6</sup>

FGM sensors do not require calibration; however, discrepancy with SMBG can occur when glucose levels are changing rapidly or in a lower glucose range. Compression on the sensor (eg when lying on it while asleep) can lead to false reporting of hypoglycaemia, due to restriction of flow of interstitial fluid around the sensor. Glucose levels should be confirmed with a finger-prick test if:<sup>5</sup>

- glucose levels are changing rapidly
- sensors indicate hypoglycaemia or possible hypoglycaemia
- a person displays symptoms inconsistent with reported glucose levels.

## Continuous subcutaneous insulin infusion (insulin pumps)

Continuous subcutaneous insulin infusion (CSII) allows for more controlled delivery of insulin compared with injectable insulin, particularly for basal insulin. Pumps deliver basal plus bolus (prandial and correction) doses that can be programmed to change in response to the user's changing needs (eg mealtimes, exercise).

## In practice

### Mobile apps, web-based programs, text messaging

Many practices already use web- and phone-based messaging for recalls, reminders and appointment scheduling.

More work needs to be done to determine the most effective interventions and the optimal integration of technology with validated models of care for chronic disease management.

### CGM and CSII

The decision to implement CSII or CGM is a case-by-case assessment based on cost-benefit analysis, individualising the decisions according to patient's needs, wishes and capacity. These technologies can be costly and resource intensive, and might increase stress and distress to the patient.



The introduction, implementation and ongoing use of any complex technology requires high levels of professional support to instruct users about the appropriate use and interpretation of outcomes.<sup>8,9</sup>

Clinicians who recommend these technologies should be experienced in their use or co-opt experts in the domain (endocrinologists, credentialed diabetes educators). The National Association of Diabetes Centres has developed [national standards for diabetes technology](#).

Individuals who might benefit most from CGM or FGM are those:<sup>7</sup>

- at high risk of hypoglycaemia
- with hypoglycaemic unawareness
- with high glycaemic variability.

Intermittent use of CGM or FGM by the patient can be a useful adjunct to SMBG.

Those likely to benefit from CSII most are those:

- with the poorest glycaemic control
- with recurrent hypoglycaemia
- who are engaged with the additional offerings of the technology beyond insulin delivery.

When paired with CSII, the benefits of CGM are added to those of CSII.

Potential barriers include:

- cost (insulin pumps are covered by most private health insurers, but consumables are not; the National Diabetes Services Scheme subsidises consumables only for type 1 diabetes)
- lack of technical or IT literacy (users need to navigate pump menus, upload pump and/or CGM data, be able to 'troubleshoot')
- level of clinical and technological support that is required from family, healthcare professionals and purveyors of technology
- the dexterity required to apply infusion sets, CGM sensors and transmitters.

Recommended glycaemic targets for users of CGM/FGM with type 1 or type 2 diabetes (not during pregnancy) are as follows.<sup>10</sup>

- Time in range – a target of 3.9 mmol/L to 10 mmol/L should be maintained at least 70% of the time.
- Time below range – blood glucose levels <3.9 mmol/L should occur for less than 4% of the day (approximately one hour); very low levels (<3.0 mmol/L) should occur for no more than 1% of the day (15 minutes).
- Time above range – blood glucose levels >10 mmol/L should occur less than 25% of the time; very high levels (>13.9 mmol/L) should occur less than 5% of the time.

The following targets are recommended for older or high-risk individuals with type 1 or type 2 diabetes.<sup>10</sup>

- Time in range – a target of 3.9 mmol/L to 10 mmol/L should be maintained more than 50% of the time.
- Time below range – avoiding hypoglycaemia is a priority in this population, so blood glucose levels <3.9 mmol/L should occur for less than 1% of the day, or 15 minutes.
- Time above range – very high blood glucose levels of >13.9 mmol/L should be allowed for less than 10% of the time.

Battelino et al<sup>10</sup> have published detailed information about [clinical glucose targets for CGM](#).

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# Gestational diabetes mellitus

## Recommendations

Recommendation	Reference	Grade*
In the first trimester, all women should be assessed for risk of hyperglycaemia (Box 1), and those at high risk should have glycaemic assessment	1 NHMRC, 2019	Consensus
Between 24 and 28 weeks' gestation, recommend testing for gestational diabetes mellitus (GDM) to all women who have not previously been tested in the current pregnancy. Recommend repeat testing to women who were tested early in pregnancy due to risk factors and who had a normal result on an initial test	1 NHMRC, 2019	Consensus
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	2 Scottish Intercollegiate Guidelines Network, 2017	A
Postprandial glucose monitoring should be carried out in pregnant women with GDM	2 Scottish Intercollegiate Guidelines Network, 2017	C
Postnatal education and support are important in preventing or delaying the onset of diabetes in the future, and women should be encouraged to attend postnatal testing	1 NHMRC, 2019	Consensus
Women diagnosed with GDM should have a 75 g two-hour oral glucose tolerance test, preferably at 6–12 weeks postpartum, with classification according to World Health Organization criteria	3 ADIPS, 2014	Consensus
Advise women that physical activity and healthy eating during pregnancy help reduce excessive weight gain but do not appear to directly reduce the risk of developing GDM	1 NHMRC, 2019	Qualified evidence-based recommendation (QEBR)
*Refer to ' <a href="#">Explanation and source of recommendations</a> ' for explanations of the levels and grades of evidence.		

## Clinical context

**Gestational diabetes mellitus** (GDM) is defined as glucose intolerance that begins, or is first diagnosed, during pregnancy. It may appear in the first half of pregnancy, particularly in women at high risk for GDM.

**Diabetes mellitus in pregnancy** (DMiP) is defined by the Australasian Diabetes in Pregnancy Society (ADIPS) and the World Health Organization as pregnant women whose blood glucose levels in pregnancy meet the criteria used for diagnosing diabetes outside pregnancy.<sup>4</sup> Some of these women may have previously undiagnosed diabetes (usually type 2).

Most published data that report on GDM include both DMiP and GDM, and indeed most women will fit the specific criteria for GDM.

Note that not all of these women will continue to have diabetes following delivery. One Australian study reported that 41% of women with DMiP returned to normal glucose tolerance by 6–8 weeks postpartum.<sup>5</sup>

The 2008 Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study reported a correlation between increasing maternal glucose levels at 24–32 weeks' gestation and a range of adverse maternal and fetal outcomes.<sup>6</sup> The study suggested that the relationship between increasing blood glucose levels and adverse effects was continuous, with no threshold or inflection point at which lower levels confer protection.

In response to the HAPO study, the International Association of the Diabetes and Pregnancy Study Groups developed new consensus guidelines for the testing and diagnosis of GDM. Although the Royal Australian and New Zealand College of Obstetricians and Gynaecologists and the ADIPS<sup>9</sup> have recommended that these consensus guidelines be implemented, there has been controversy nationally and internationally.<sup>7</sup> Important differences in these guidelines are universal testing of all women (not already diagnosed with diabetes) in pregnancy, and a one-step diagnostic framework with a changed glucose threshold (versus the previous two-step process).

A comparison of current clinical guidelines for GDM can be found in a paper by [Wilkinson et al.](#)

It is important that each general practitioner (GP) be aware of their local obstetric service's diagnostic criteria, and support and manage patients in a manner congruent with their specialist team guidelines, to avoid conflict and patient confusion.

## In practice

### Identifying GDM

Identifying women at risk of GDM, or who have previously undetected hyperglycaemia, enables the GP to advise women appropriately on risk minimisation and provide support and treatment. Hyperglycaemia is increasing in pregnancy parallel to rising rates of diabetes and obesity. Of women giving birth in 2015–16, approximately 15% were diagnosed with GDM.<sup>8</sup>

Australian clinical guidelines for care during pregnancy recommend that women who are at risk of hyperglycaemia, including GDM (Box 1), are tested in the first trimester of pregnancy.<sup>1</sup> Women tested in the first trimester of pregnancy but who have a normal test result should be advised to re-test between 24 and 28 weeks' gestation.<sup>1</sup>

All pregnant women not already tested should be advised to have testing for hyperglycaemia between 24 and 28 weeks' gestation.<sup>1</sup>

Discussion to inform a woman's decision making about testing for hyperglycaemia should take place before testing.

**Box 1. Identifying women at risk of gestational diabetes mellitus**

The following are risk factors for GDM:<sup>1</sup>

- Obstetric history of GDM
- Increased age
- Increased body mass index (risk threshold varies by ethnic group)
- Excessive weight gain early in pregnancy
- Polycystic ovary syndrome
- Obstetric history of high birth-weight baby
- Obstetric history of pregnancy loss
- A family history of diabetes
- Belonging to an ethnic group with a high prevalence of type 2 diabetes (eg Aboriginal and Torres Strait Islander, Hispanic, African, South or East Asian and Pacific Islander peoples)
- Being a migrant to a country

**Diagnosing GDM**

Diagnostic criteria for GDM are shown in Box 2. Glycated haemoglobin (HbA1c) is not recommended to test for GDM due to lack of sensitivity.<sup>1</sup>

At present there are limited data demonstrating clinical benefit for women identified by the changed screening criteria compared with those identified by the 1991 ADIPS consensus criteria, which then became the National Health and Medical Research Council recommendations.<sup>9–12</sup> Therefore, these remain the preferred Royal Australian College of General Practitioners (RACGP) criteria until evidence of such benefit is forthcoming, including the health economic costs of any such consensus for change.

Acknowledging that in Australian general practice there are alternative diagnostic criteria for GDM, the RACGP (preferred) and ADIPS (alternative) diagnostic criteria are both presented below. Furthermore, it is important that each GP be aware of their local obstetric service diagnostic criteria, and support and manage patients in a manner confluent with their specialist team guidelines to avoid conflict and patient confusion.

**Box 2. Screening and diagnosis of gestational diabetes mellitus**

RACGP criteria (preferred criteria):

- fasting plasma glucose  $\geq 5.5$  mmol/L, or
- two-hour plasma glucose  $\geq 8.0$  mmol/L (75 g oral glucose tolerance test [OGTT]).

ADIPS criteria (alternative criteria):

- fasting plasma glucose 5.1–6.9 mmol/L, or
- one-hour plasma glucose (75 g OGTT)  $\geq 10.0$  mmol/L, or
- two-hour plasma glucose (75 g OGTT) 8.5–11.0 mmol/L

## Oral glucose tolerance testing in pregnancy

The correct procedure for a 75 g OGTT is as follows:

- 8–12-hour overnight fast
- start test before 9.30 am
- patients should consume the glucose drink within five minutes, remaining seated throughout the two-hour test period
- ideally, the drink should be chilled to improve tolerance.

The OGTT should be postponed if the woman has an acute illness.

Some women may vomit during the OGTT. In such cases, if the recorded fasting glucose meets the criteria for GDM, the woman should be referred to start GDM management. If her fasting glucose level is normal, repeat the OGTT with the woman taking metoclopramide beforehand. Metoclopramide does not appear to alter glucose absorption, but ondansetron may lead to falsely lower post-load glucose levels. Recliner chairs can also reduce the tendency to vomit.

**Women who have had metabolic surgery** should not be sent for an OGTT as they might not be able to tolerate the test due to dumping syndrome.<sup>13</sup> Seek specialist advice from your local diabetes-in-pregnancy service regarding alternative testing options.

Although none will exactly equate to an OGTT, alternatives include giving a different source of 75 g carbohydrate, measuring blood glucose concentrations using continuous glucose monitoring, measuring fasting and postprandial blood glucose concentrations with capillary (finger-prick) blood testing, measuring HbA1c, or using a combination of these methods.

Women who have had metabolic surgery also need particular assessment throughout pregnancy regarding nutritional status, need for higher multivitamin dosages and close obstetric monitoring.<sup>13</sup> Referral to appropriate specialty services is strongly advised prior to and during pregnancy, even for women in this group who do not have diabetes or GDM.

## Management of GDM

Lifestyle interventions and insulin remain the mainstay of treatment for GDM.

All women with GDM should be offered individualised management, including education, appropriate blood glucose monitoring and dietary advice.

### Education

In most cases, GDM responds positively to lifestyle management, and women should be referred to an accredited practising dietitian and a credentialled diabetes educator, if these are not provided by their obstetric service.

All women with GDM who qualify for Medicare access should be registered with the National Diabetes Services Scheme on the [National Gestational Diabetes Register](#).

If diabetes is diagnosed during pregnancy, points for discussion include:<sup>1</sup>

- the role of diet, physical activity and pregnancy/gestational weight gain in managing diabetes
- the role of insulin or oral hypoglycaemic agents in the management of diabetes (ie if diet and physical activity do not adequately control blood glucose levels)
- the importance of monitoring and controlling blood glucose levels during pregnancy, labour, birth and early feeding of the baby to reduce the likelihood of the baby having macrosomia and associated risks (eg fractures, shoulder dystocia, jaundice)

- the possibility of the baby requiring admission to a special care nursery/neonatal intensive care unit to manage possible hypoglycaemia or respiratory distress
- the woman's increased risk of developing type 2 diabetes, and the importance of reviewing glucose tolerance postpartum and maintaining a healthy weight
- the benefits of registering with the National Gestational Diabetes Register (eg reminders for glucose tolerance assessment)
- the benefits of breastfeeding in reducing the risk of the woman developing type 2 diabetes in the future
- the risk of the baby developing obesity, heart disease and/or diabetes in the future.

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

Women diagnosed with GDM have approximately a 40% risk of a recurrence of GDM in a subsequent pregnancy and an increased risk of developing future type 2 diabetes.<sup>14</sup> Regular ongoing surveillance is required.<sup>3</sup> Box 3 provides the RACGP criteria for follow-up of patients with a history of GDM.

#### Box 3. Follow-up of patients with a history of gestational diabetes mellitus

- Conduct a 75 g two-hour oral glucose tolerance test (OGTT) at 6–12 weeks postpartum
- If results are normal, conduct a fasting blood glucose and glycated haemoglobin (HbA1c) test every three years. Screening and diagnostic criteria for type 2 diabetes follow those set out in the section 'Defining and diagnosing type 2 diabetes'
- Women with HbA1c  $\geq 6.0\%$  (42 mmol/mol) may require further investigation and advice before another pregnancy occurs
- Women contemplating another pregnancy should have an OGTT annually<sup>3</sup>

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## Appendix 1. Types of insulin available

Type	Brand name	Manufacturer	Nature
<b>Mealtime or prandial insulins</b>			
<b>Ultra rapid-acting (onset in 5–10 minutes, peak at 30 minutes, duration for 3.5–4 hours)</b>			
Faster insulin aspart	FiAsp	Novo Nordisk	Analogue
<b>Rapid-acting (onset in 15–20 minutes, peak at one hour, duration for 3.5–4.5 hours)</b>			
Insulin lispro	Humalog	Lilly	Analogue
Insulin aspart	NovoRapid	Novo Nordisk	Analogue
Insulin glulisine	Apidra	Sanofi	Analogue
<b>Short-acting (onset in ~1 hour, peak at two to five hours, duration for six to eight hours)</b>			
Neutral	Actrapid	Novo Nordisk	Human
	Humulin R	Lilly	Human
<b>Basal insulins</b>			
<b>Intermediate-acting</b>			
Isophane	Humulin NPH	Lilly	Human
	Protaphane	Novo Nordisk	Human
Insulin detemir Onset in three to four hours, peak at three to eight hours, duration for 20–24 hours	Levemir	Novo Nordisk	Analogue
Insulin glargine (U100) Onset in one to two hours, flat, duration for 18–24 hours	Optisulin	Sanofi	Analogue
	Semglee	Alphapharm	Analogue
Insulin glargine (U300) Onset in one to two hours, flat, duration for 24–36 hours	Toujeo	Sanofi	Analogue
<b>Premixed insulins</b>			
Lispro 25%/lispro protamine 75% Onset in 15–20 minutes, peak at one hour, duration for 14–24 hours	Humalog Mix 25	Lilly	Analogue
Lispro 50%/lispro protamine 50% Onset in 15–20 minutes, peak at one hour, duration for 14–24 hours	Humalog Mix 50	Lilly	Analogue

Type	Brand name	Manufacturer	Nature
Insulin aspart 30%/insulin aspart protamine 70% Onset in 15–20 minutes, peak at one hour, duration for 14–24 hours	NovoMix 30	Novo Nordisk	Analogue
Neutral 30%/isophane 70% Onset in one to two hours, peak at two to five hours, duration for 12–18 hours	Humulin 30/70	Lilly	Human
	Mixtard 30/70	Novo Nordisk	Human
Neutral 50%/isophane 50% Onset in one to two hours, peak at two to five hours, duration for 12–18 hours	Mixtard 50/50	Novo Nordisk	Human
<b>Insulin co-formulation</b>			
Insulin degludec 70% and insulin aspart 30% Onset in 5–20 minutes, peak at one hour, duration for 36–48 hours	Ryzodeg 70/30	Novo Nordisk	Analogue
<p>Ultra-rapid acting insulin should be administered from up to two minutes before a meal, or at the start of a meal, or up to 20 minutes after starting a meal.</p> <p>Rapid-acting, pre-mixed and co-formulated insulin should be administered 15 minutes prior to a meal.</p> <p>Short-acting insulin should be administered 20–30 minutes prior to a meal.</p> <p>Intermediate- and long-acting basal insulins can be given irrespective of a meal.</p>			

## *Appendix 2. Guide to insulin initiation and titration*

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For fasting and preprandial blood glucose targets, please refer to the section '[Glucose monitoring](#)'. Note that adjustments given below are based on average blood glucose levels over at least 2–3 days.

### **Principles of insulin titration by regimen<sup>1</sup>**

Basal (intermediate- or long-acting insulin):

- Adjust the dose based on previous average fasting glucose levels

Premixed insulin at breakfast and dinner:

- Adjust the breakfast dose based on average previous dinner readings (as long as a dose increase does not cause hypoglycaemia at lunchtime)
- Adjust the dinner dose based on previous average fasting glucose levels (as long as a dose increase does not cause hypoglycaemia at bedtime)

Basal–bolus:\*

- Adjust the dose at mealtime based on the previous day's glucose level measured either two hours after the corresponding mealtime or before the next mealtime (eg adjust the breakfast dose based on the previous 2–3 days' average two-hour post-breakfast value or the pre-lunch value)

\*Rapid- or short-acting insulin is used for bolus dose.

## Starting and adjusting basal insulin<sup>1-3</sup>

**STEP 1. SELECT** basal insulin and injecting device

**STEP 2. START** basal insulin: 0.1 units/kg or 10 units at bedtime or morning

**CONTINUE** oral glucose-lowering medication

If fasting blood glucose (FBG) is high (pre-breakfast), consider evening or morning insulin dosing of a long-acting (>24 hours) basal insulin

If FBG is on target, but pre-dinner blood glucose level (BGL) is high, consider morning insulin dosing of intermediate-acting insulin

**STEP 3. TITRATION**

If using long-acting basal insulin doses (morning or evening doses), adjust doses to achieve FBG targets

If using intermediate-acting basal insulin, use pre-dinner glucose targets to adjust the morning doses and FBG targets to adjust any additional evening doses

Practitioner-led titration (below left) can achieve target in a shorter time period than patient-led titration (below right)

Practitioner-led titration OR Patient-led titration

Adjust insulin dose twice weekly as shown, until FBG target is achieved	
Mean FBG over previous two days (mmol/L)*	Insulin dose adjustment
≥10.0	↑ by 4 units
8.0–9.9	↑ by 2–4 units
7.0–7.9	No change or ↑ by 2 units
6.0–6.9	No change
4.0–5.9	No change or ↓ by 2 units
<4.0	↓ by 2–4 units

Adjust insulin dose every three days. Increase by 2 units until FBG target is achieved	
Mean FBG over previous three days (mmol/L)*	Insulin dose adjustment
≥6.0 mmol/L but ≤8.0 mmol/L	No change
4.0–6.0 mmol/L	↓ insulin dose by 2 units
<4.0 mmol/L	↓ insulin dose by 4 units

\*Do not increase insulin dose if FBG <4.0 mmol/L at any time in the preceding week.

## Starting and adjusting pre-mixed (biphasic) and co-formulated insulin

**STEP 1. SELECT** premixed or co-formulated insulin and injecting device

**INSULIN-NAÏVE** patients

**STEP 2. START** premixed or co-formulated insulin **10 units** immediately before or soon after the largest meal (usually evening meal)

**CONTINUE** metformin if indicated; consider tapering sulfonylureas as glycaemic control improves

**STEP 3. TITRATION**

Adjust the evening pre-mixed insulin dose once or twice a week according to the schedule below to FBG<sup>2,3</sup>

Co-formulated insulin should be titrated once a week

Lowest BGL reading (mmol/L) of the previous three days – fasting or preprandial	Insulin dosage adjustment
≥10	↑ by 6 units
8.0–9.9	↑ by 4 units
6.0–7.9	↑ by 2 units
4.0–5.9	No change
<4.0	↓ by 2 units

If a morning insulin dose is given, adjust the insulin dose according to evening preprandial BGL according to the same titration recommendations

Hypoglycaemia should prompt a review of other oral therapy. Which insulin is adjusted depends on regimen and target glucose

**STEP 4. INTENSIFICATION:** Once-daily insulin to twice-daily premixed insulin

**When?**

- With FBG at target, if evening preprandial BGL > FBG, or if evening preprandial BGL is high, or
- After three months if glycated haemoglobin (HbA1c) > target, despite FBG and evening preprandial BGL at target

**How?**

- Calculate any increased total daily insulin dose and divide this into two doses, considering the continued need to maintain FBG and postprandial targets
- Give the increased dose adjustment as twice-daily injections (pre-breakfast and pre-dinner). This may not be a 50/50 split, as prandial targets may require a higher proportion to be given at the largest meal of the day (eg 60/40)
- Monitor pre-dinner BGL and FBG against targets
- 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

## Guide to basal plus insulin intensification schedules

**STEP 1. SELECT** rapid-acting (prandial) insulin and injecting device to be added in addition to basal insulin

**STEP 2. START** rapid-acting insulin (4 units) to be given before the meal with the largest carbohydrate content

**CONTINUE** basal insulin at the current dose

**CONTINUE** metformin, consider tapering sulfonylureas as glycaemic control improves

**MONITOR** two-hour postprandial BGL. Continue to assess FBG and preprandial glucose levels – goal is 4.0–7.0 mmol/L

### STEP 3. TITRATION

Increase rapid-acting (prandial) insulin dose by 2 units every three days to achieve target

Two-hour postprandial BGL (mmol/L)	Rapid-acting (prandial) insulin dosage adjustment
≥8 (for three consecutive days)	No change or ↑ by 2 units
6.0–7.9	No change
4.0–5.9	No change or ↓ by 2 units
<4.0 on any day	↓ by 2–4 units

### STEP 4. Basal plus titration to basal bolus – intensification

#### When?

If HbA1c is not at target after three months, add a further prandial insulin dose to another meal (eg 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 three days until postprandial target is achieved as per Step 3 above

## References

1. Lau ANC, Tang T, Halapy H, Thorpe K, Yu CHY. Initiating insulin in patients with type 2 diabetes. CMAJ 2012;184(7):767–76.
2. Wong J, Tabet E. The introduction of insulin in type 2 diabetes mellitus. Aust Fam Physician 2015;44(5):278–83.
3. Howard-Thompson A, Khan M, Jones M, George CM. Type 2 diabetes mellitus: Outpatient insulin management. Am Fam Physician 2018;97(1):29–37.

## Appendix 3. Detailed information on glycaemic emergencies

### Hypoglycaemia

#### Managing an episode of hypoglycaemia

If a patient with diabetes is showing signs of potential hypoglycaemia, first make sure that the patient is safe (eg seated securely and not at risk of falling).

If possible, confirm that the symptoms are due to hypoglycaemia by performing a finger-prick blood glucose level (BGL). If the person is awake, alert and can swallow, hypoglycaemia may be managed according to the Rule of 15 (Box A3.1). If the patient is symptomatic, but blood glucose or capillary glucose cannot be performed to confirm that the episode is due to hypoglycaemia, use the Alternative Rule of 15 (Box A3.2).

#### Box A3.1. Rule of 15 (hypoglycaemia confirmed)

BGL <4.0 mmol/L:

- Provide 15 g of quick-acting carbohydrate that is easy to consume (eg half a can of regular – non-diet – soft drink, half a glass of fruit juice, three teaspoons of sugar or honey, six or seven jellybeans, three 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
- Provide some longer acting carbohydrate if the patient's next meal is more than 15 minutes away (eg a sandwich; one glass of milk or soy milk; one piece of fruit; two or three pieces of dried apricots, figs or other dried fruit; one tub of natural low-fat yoghurt; six small dry biscuits and cheese)
- Test glucose every 1–2 hours for the next four hours

#### Box A3.2. Alternative Rule of 15

Patients and carers should be made aware of the use of an alternative Rule of 15.

If the patient is symptomatic, but blood glucose or capillary glucose cannot be performed to confirm that the episode is due to hypoglycaemia, treat the patient as if they have hypoglycaemia:

- administer 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.

## Severe hypoglycaemia

Severe hypoglycaemia is an emergency. Clinical status can progress to impaired consciousness or coma.

Management is as follows:

- Commence appropriate resuscitation protocols.
- If available, give an injection of glucagon 1 mg intramuscularly or subcutaneously into the thigh, buttock or upper arm (with usual precaution to avoid vulnerable anatomical structures).
- If intravenous access is obtained, deliver glucose 50% – 20 mL intravenously via a securely positioned cannula (optimally the antecubital veins). Use 10% glucose in children, as hyperosmolality has caused harm.
- Phone for an ambulance (dial 000) stating a 'diabetic emergency'.
- Wait with the patient until the ambulance arrives.
- When the person regains full consciousness and can swallow, they can be orally given a source of carbohydrate.

If glucagon is administered, always review the monitored capillary glucose after 15 minutes to ensure effective management of hypoglycaemia has occurred and the blood glucose remains  $\geq 4$  mmol/L. Test again one hour after severe hypoglycaemia to ensure stable glucose levels.

## Post-hypoglycaemia

After any severe hypoglycaemic episode, a patient review is mandatory. Reassess the patient's circumstances, medication dosages and dietary intake, as well as overall need for glucose monitoring, with the patient and/or with their immediate family or support persons. Also discuss implications for driving competence and other similar areas (eg operation of machinery). The patient should be advised not to drive for at least six weeks while diabetes re-stabilisation is undertaken. If a patient's healthcare professional believes they will not follow this advice, the relevant driving authority should be notified.

Refer to the discussion of driving in the section '[Managing risks and other impacts of type 2 diabetes](#)', and the Austroads and National Transport Commission publication [Assessing fitness to drive](#).

# Managing hyperglycaemic emergencies

## Diabetic ketoacidosis

Diabetic ketoacidosis (DKA) is a medical emergency requiring specialist care and should generally be managed in hospital. Whatever the setting, it is important that treatment commences as early as possible.

Biochemical criteria for DKA are shown in Box A3.3. Once thought to typify type 1 diabetes, DKA can occur in patients with type 2 diabetes under stress (eg during surgery, trauma, infections, high-dose steroids). The very young, older people and pregnant people are also at greater risk of DKA.<sup>1</sup>

There is a small but definite risk of DKA with sodium glucose co-transporter 2 (SGLT2) inhibitor use. This can sometimes occur without significantly raised blood glucose levels (euglycaemic DKA).<sup>1,2</sup> Because of the absence of extreme hyperglycaemia, euglycaemic DKA may be overlooked and diagnosis and treatment delayed.



GPs should inform all patients commencing SGLT2 inhibitors about the risks of DKA/euglycaemic DKA, including potential symptoms and signs, and provide management advice. Please refer also to the section '[Managing risks and other impacts of type 2 diabetes](#)' and the Australian Diabetes Society [alert regarding SGLT2 inhibitors and DKA](#),<sup>2</sup> for specific recommendations pertaining to SGLT2 inhibitor use perioperatively, and/or in the presence of significant intercurrent illness.

### Box A3.3. Biochemical criteria for DKA

- Hyperglycaemia, defined by a BGL >11 mmol/L\*
- Venous pH <7.3 or bicarbonate <15 mmol/L
- Presence of blood ketones or urinary ketones (abnormal ketone level is  $\geq 0.6$  mmol/L, severe ketosis is >3.0 mmol/L)

\*Note that euglycaemic DKA, characterised by only mild–moderately elevated BGL, can occur in people who are taking SGLT2 inhibitors, people who are pregnant, after excessive alcohol intake, post-surgery/colonoscopy, or people on extremely low carbohydrate diets.

## Assessment and management

Blood ketone testing is preferred. Blood ketone testing equipment should be made available for medical practices and 'at-risk' patient use.

Where possible, patients with DKA should be urgently transferred to a specialist medical unit in a hospital, due to the complexity of metabolic disturbances, especially in people aged >60 years, or in the presence of diabetes complications or comorbidity.<sup>3,4</sup>

The main aim in treating DKA is to progressively normalise the blood pH and clear the body of excessive ketones, achieved by aggressive fluid replacement and insulin therapy. This also improves blood glucose concentration. Hyperglycaemia corrects before acidosis; therefore, intravenous glucose is required to allow insulin infusion to continue to suppress ketone production while acidosis resolves.<sup>5</sup>

## Hyperosmolar hyperglycaemic state

Hyperosmolar hyperglycaemic state (HHS) in type 2 diabetes occurs most often in the elderly or those with newly diagnosed type 2 diabetes. It is characterised by severe hyperglycaemia (usually >25 mmol/L), hyperosmolality, dehydration and a change in mental state, with little or no ketoacidosis. It may present as hypovolaemic shock and coma in severe cases.<sup>5</sup> HHS is usually a result of illness or infection; however, it can also be due to sub-optimal use of diabetes medications.

## General outline for the management of HHS

Wherever possible, the patient with HHS should be managed in a specialist medical unit, due to the risk of hypovolaemic shock and coma.<sup>6</sup> 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. Rapid correction of the hyperosmolar state is dangerous and should not be attempted.

## Rural practice: Management of DKA and HHS

In remote rural practice, with both DKA and HHS, management in a specialist medical unit may not be possible. In this situation it is advisable to contact the most appropriate diabetes resource person (an endocrinologist or similarly qualified specialist) or regional tertiary hospital for advice while promptly commencing treatment.

## References

1. Rosenstock J, Ferrannini E. Euglycemic diabetic ketoacidosis: A predictable, detectable, and preventable safety concern with SGLT2 inhibitors. *Diabetes Care* 2015;38:1638–42.
2. Australian Diabetes Society and New Zealand Society for the Study of Diabetes. Alert update January 2020: Periprocedural diabetic ketoacidosis (DKA) with SGLT2 inhibitor use. ADS and NZSSD, 2020.
3. Umpierrez G, Korytkowski M. Diabetic emergencies: Ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. *Nat Rev Endocrinol* 2016;12:222–32.
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5. Expert Group for Endocrinology. Endocrinology guidelines, version 5. In: eTG complete [Internet]. Melbourne: Therapeutic Guidelines Limited, 2014.
6. The Royal Australian College of General Practitioners and Australian Diabetes Society. Emergency management of hyperglycaemia in primary care. East Melbourne, Vic: RACGP and ADS, 2018.

## Appendix 4. Practice summary: Diabetes in pregnancy

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**When:** Assess risk of undiagnosed diabetes or prediabetes at the first antenatal visit and offer testing to women with risk factors

At 24–28 weeks offer testing to women not already tested and repeat testing to women with risk factors with a previous normal blood glucose level

**Who:** Midwife; GP; obstetrician; Aboriginal and Torres Strait Islander Health Practitioner; Aboriginal and Torres Strait Islander Health Worker; multicultural health worker; accredited practising dietitian, diabetes educator; endocrinologist; accredited exercise physiologist

- **Discuss the reasons for testing blood glucose levels:** Explain that diabetes in pregnancy can have effects on the pregnancy and the baby and that early identification and taking steps to manage raised blood glucose as soon as possible can reduce the risk of these effects.
- **Take a holistic approach:** Provide women with practical advice on healthy eating and physical activity [...], taking into consideration the availability of foods and ways of being physically active that are appropriate to the woman's cultural practices and preferences. Consider a health promotion program to improve community understanding of the effects of diabetes in pregnancy and the importance of healthy lifestyle patterns.
- **Consider referral:** Where possible, women diagnosed with pre-existing diabetes should be referred for specialist assessment (by an endocrinologist or obstetric physician) and education on nutrition, monitoring and management (eg to a multidisciplinary team involving an accredited practising dietitian, diabetes educator, endocrinologist, obstetric physician). Where specialist allied health professionals are not available, other sources of information (eg written information, video or audio resources, telehealth services) may be useful.
- **Document and follow up:** When a woman's blood glucose is tested, tell her the results and note them in her antenatal record. Have a system in place so that women diagnosed with diabetes receive ongoing follow-up, including further testing of blood glucose levels after pregnancy. Postnatal education and support are important in preventing or delaying the onset of diabetes in the future and women should be encouraged to attend postnatal testing.

Source: Australian Government Department of Health. Clinical practice guidelines: Pregnancy care. Canberra: DoH, 2019; p. 191.

## *Appendix 5. Medication-related care plan considerations for residents with type 2 diabetes mellitus*

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- Carefully evaluate resident's comorbidities, overall health and resident/carer preferences.
- Ensure a sensitive discussion and documentation of an individualised treatment plan, glycaemic targets and strategies for medication management.
- Start low and go slow with doses when initiating and/or changing medications, using appropriate investigations.
- Assess and minimise the risk of hypoglycaemia and other ADEs related to GLMs. Consider use of the following resources when assessing medication use:
  - GLM-related ADEs risk assessment tool (available from the McKellar guidelines for managing older people with diabetes in residential and other care settings)
  - Beers criteria for potentially inappropriate medication use in older adults
  - STOPP: screening tool of older people's potentially inappropriate prescriptions, and START: screening tool to alert doctors to right treatments
  - Medication appropriateness index
  - Australian inappropriate medication use and prescribing tool
  - Australian Medicines Handbook *Aged care companion*
  - Australian type 2 diabetes management algorithm
- Consider use of non-pharmacological alternatives where possible.
- Simplify treatment regimens.
- Avoid sliding scale insulin.
- Conduct annual testing of eGFR (by a blood test) for screening and monitoring of CKD, for residents who are otherwise 'healthy' and whose care resembles standard care.
- Seek multidisciplinary input (eg from credentialed diabetes educators, aged care staff, pharmacists, allied health) where necessary.

- Consider reviewing management when hypoglycaemia, falls, urinary tract or other infections, confusion or non-specific 'incidents' occur.
- Ensure the resident, family members and aged care provider staff are educated regarding resident self-monitoring, documentation of BGLs, symptoms of hypoglycaemia and hyperglycaemia, and sick-day medication management strategies. A comprehensive approach to sick-day management is available from current Australian RACF guidelines.

*ADEs, adverse drug events; BGLs, blood glucose levels; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GLMs, glucose lowering medications; RACF, residential aged care facilities*

Source: Adapted with permission from Stasinopoulos J, Bell J, Manski-Nankervis J, Hogan M, Jenkin P, Sluggett JK. Medication management of type 2 diabetes in residential aged care. *Aust J Gen Pract* 2018;47(10):675–81.



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