

# Glycaemic Control for Type 2 Diabetes

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## Contents

Disclaimer.....	1
<b>Red Flags.....</b>	<b>2</b>
<b>Background – About Glycaemic Control .....</b>	<b>2</b>
<b>Assessment .....</b>	<b>4</b>
<b>Management .....</b>	<b>5</b>
<b>Referral.....</b>	<b>6</b>
<b>Information.....</b>	<b>7</b>
For health professionals.....	7
For patients.....	7
<b>References.....</b>	<b>7</b>
Disclaimer.....	7

## Red Flags

- Hyperglycaemia > 16 mmol/L, unresponsive to initial outpatient management
- Ketones +++ on urine testing or > 1.5 mmol/L on finger prick blood testing, in conjunction with elevated blood glucose or clinical features suggesting impending ketoacidosis

## Background – About Glycaemic Control

There are 4 measures of glycaemic control:

- **HbA1c**

*HbA1c is a measure of glycaemic control over the last 120 days (the life a red blood cell).*

- *It can also be used as a measure to countercheck the accuracy of blood glucose levels (BGLs) recorded in the patient's home BGL record book using the **HbA1c Targets** table.*

### Individualisation of HbA1c Targets

Specific clinical situation	Therapy	Equivalent HbA1c target expressed in (mmol/mol)	Target HbA1c (%) <sup>1</sup>
Diabetes of short duration <b>and</b> no clinical CV disease	<i>Lifestyle modification with or without metformin</i>	≤ 42	≤ 6.0
	<i>Requiring any antidiabetic agents other than metformin or insulin</i>	≤ 48	≤ 6.5
	<i>Requiring insulin</i>	≤ 53	≤ 7
Planning pregnancy		≤ 48	≤ 6.5
Pregnancy		≤ 42	≤ 6.0
Diabetes of longer duration or clinical CV disease <sup>2</sup>	Any	≤ 53	≤ 7.0
Recurrent severe hypoglycaemia or hypoglycaemia unawareness	Any	≤ 64	≤ 8.0
Patients with major co-morbidities likely to limit life expectancy <sup>3</sup>	Any	Symptomatic therapy of hyperglycaemia	Symptomatic therapy of hyperglycaemia <sup>4</sup>

Notes:

<sup>1</sup> Achievement of HbA1c targets must be balanced against risk of severe hypoglycaemia, especially in the elderly

<sup>2</sup> In an older adult long duration might be considered to be > 10 to 20 years, but for a person who develops type 2 diabetes at a young age it may be considerably longer.

<sup>3</sup> Examples of major co-morbidities include chronic medical conditions such as chronic kidney disease stage IV or V, NYHA Heart Failure stages III or IV, incurable malignancy, and moderate to severe dementia.

<sup>4</sup> Where practical suggest BGL target < 15 to help minimise risk of infection.

- HbA1c can be inaccurate if, in the last 120 days, the patient has had:

- anaemia.
- transfusion.
- operation-related blood loss.
- other haemoglobinopathies.
- The alternative measure in these circumstances is fructosamine levels (assesses the control of blood glucose over the last 7 to 21 days).

- **Fasting blood glucose levels (BGLs)**

- NHMRC recommends fasting and preprandial target BGL for type 2 diabetes (6 to 8 mmol/L).
- Fasting BGL is generally the first glycaemic value to bring to target in the newly diagnosed diabetic.
- When setting targets for fasting BGL, consider:
  - tighter targets in patients with:
    - newer diagnosis of diabetes.
    - longer life expectancy.
    - absence of significant co morbidities, especially vascular disease.
    - higher risks associated with hypoglycaemia e.g., occupational.
    - high motivation and resources.
  - risk factors.
  - therapy side-effects, especially hypoglycaemia.
  - diabetic complications and co-morbidities.
  - the patient's cognition, social circumstances, and choices.
- High morning BGL, with no obvious explanation, can occur due to rebound response from overnight hypoglycaemia.
- Overnight hypoglycaemia should be addressed with a supper snack or adjustment of medication dosage.

- **Two-hour after-meal BGLs**

- NHMRC recommends 2-hour after-meal target for type 2 diabetes – 6 to 10 mmol/L.
- After-meal BGL is generally the second glycaemic value to bring to target (after fasting BGL) in the newly diagnosed diabetic.
- When setting targets for 2-hour after-meal BGL, consider:
  - risk factors.
  - therapy side-effects, especially hypoglycaemia.
  - diabetic complications and co-morbidities.
  - the patient's cognition, social circumstances, and informed choices.
- Inconsistent high and low BGLs:
  - Can be due to testing technique, other medications, emotional stress, alcohol, illness and pain, as well as changes in food consumed and exercise.
  - BGL recording books with space to graph results can help patients identify dietary habits or activity levels that result in BGL being out of target ranges.

- **Hypoglycaemia events**

Hypoglycaemia is defined as  $BGL \leq 4$  mmol/L.

- More likely to occur to patients taking a sulphonylurea or insulin.
- Symptoms include hunger, sweating, shakiness, weakness, confusion, loss of consciousness.
- Impaired hypoglycaemic awareness, where BGLs  $\leq 4$  recurrently occur **without** these warning symptoms, is especially dangerous.

See the [Hypoglycaemia pathway](#).

No one target fits all patients – individualised planning is important.

Modest goal setting is suitable for patients with long-standing diabetes and established vascular disease. Also consider cognition, social circumstances, and informed patient choices.

## Assessment

### 1. Measure HbA1c:

- 6-monthly, if diabetes is stable,  
or
- 3-monthly, following any changes in treatment or if diabetes is unstable.

Measurements may be unreliable if the patient has a condition that affects haemoglobin e.g., anaemia, rapid red cell turnover, haemoglobinopathies.

### 2. Determine a target HbA1c for each patient:

- General goal – HbA1c  $\leq$  53 mmol/mol (7%). However, it is safer to set an [individualised target](#).
- In some patients, it is advisable to set:

#### **Lower HbA1c targets**

Are advisable in the:

- *first few years after diagnosis.*
- *presence of diabetic complications.*
- *presence of multiple risk factors for complications.*

#### **Higher HbA1c targets**

May be advisable in:

- *patients with:*
  - *frequent hypoglycaemic episodes.*
  - *hypoglycaemic unawareness.*
- *elderly patients who are frail or have significant co-morbidities.*
- *patients at risk of severe hypoglycaemia, who live alone, or who have poor social support.*

### 3. Self-[Self-monitoring of blood glucose \(SMBG\)](#) – for patients in the first 6 months of diagnosis or when concerns exist.

### 4. Ask about [hypoglycaemic](#) events if the patient is on sulphonylureas or insulin.

### 5. Assess for **complications of inadequate glycaemic control**

- *Diabetic ketoacidosis or suspected diabetic ketoacidosis e.g., abdominal pain, dehydration, confusion, nausea and vomiting*
- *Hyperosmolar hyperglycemic state*
- *Diabetes and severe vomiting*
- *Acute, severe hyperglycaemia*
- *Acute, severe hypoglycaemia*
- *Suspected Charcot's neuroarthropathy e.g., unilateral, red, hot, swollen, possibly aching foot*
- *Foot ulceration with absent pulses*

- *Type 2 diabetes not responding to a combination of dietary and medical management (i.e. has tried at least three glucose-lowering medicines), with HbA1c > 64 mmol/mol or 8%*
- *Patients with type 2 diabetes with complications e.g., cardiovascular disease, kidney disease, retinopathy, cerebral vascular disease, neuropathy*
- *Unstable glycaemia due to concomitant use of medicines that impact on glycaemic control e.g., corticosteroids, chemotherapy protocols*

6. Enquire if patient:

- requires assessment for commercial driver's licence.
- is planning for pregnancy.

## Management

1. Monitor HbA1c and aim to reach the patient's [individualised target](#).
2. Consider other targets and what the patient may need to alter to reach these:
  - Ideal fasting BGL for type 2 diabetes – 6 to 8 mmol/L before meals.
  - Two-hour after-meal BGL for type 2 diabetes – 6 to 10 mmol/L.
  - Hypoglycaemic events – avoiding a BGL  $\leq$  4 mmol/L.
3. Look at lifestyle modification, compliance with therapies, injection technique (if on insulin), and psychosocial and medical issues.
4. Emphasise that achieving tighter glycaemic control early on after diagnosis has long-term benefits for years (the "legacy effect").
5. If the patient is not reaching their individualised HbA1c target and reasonable time has been given for lifestyle modification, start metformin (or alternative if this is contraindicated or not tolerated).
6. If inadequate glycaemic control, make adjustments by:
  - increasing dose of oral hypoglycaemic agents, or
  - adding a second agent, or
  - starting [insulin](#) or [GLP-1 agonists](#).
7. Always review for [hypoglycaemia](#) especially in older patients on sulfonylureas. Think about the cause, adjust medication as needed, and educate the patient on ways to avoid recurrence.
8. Review the patient every 3 to 6 months to assess whether the target HbA1c has been reached.
9. Refer for [immediate diabetes referral or admission](#) if **complications of inadequate glycaemic control**.

### **Complications of inadequate glycaemic control**

- *Diabetic ketoacidosis or suspected diabetic ketoacidosis e.g., abdominal pain, dehydration, confusion, nausea and vomiting*
- *Hyperosmolar hyperglycemic state*
- *Diabetes and severe vomiting*
- *Acute, severe hyperglycaemia*

- *Acute, severe hypoglycaemia*
- *Suspected Charcot's neuroarthropathy e.g., unilateral, red, hot, swollen, possibly aching foot*
- *Foot ulceration with absent pulses*

**10.** Consider referral for [urgent or routine diabetes assessment](#) if:

- type 2 diabetes not responding to a combination of dietary and medical management (i.e. has tried at least three glucose-lowering medicines), with HbA1c > 64 mmol/mol or 8%.
- patients with type 2 diabetes with complications e.g., cardiovascular disease, kidney disease, retinopathy, cerebral vascular disease, neuropathy.
- unstable glycaemia due to concomitant use of medicines that impact on glycaemic control e.g., corticosteroids, chemotherapy protocols.
- uncertainty about type of diabetes.
- patient is planning for pregnancy.
- patient requires assessment for commercial driver's licence.

**11.** For help with dietary and lifestyle modifications, consider referral to a:

- [dietitian](#).
- [exercise physiologist](#).
- [diabetes educator](#).

## Referral

- Arrange [immediate diabetes referral or admission](#) if:
  - diabetic ketoacidosis or suspected diabetic ketoacidosis e.g., abdominal pain, dehydration, confusion, nausea and vomiting.
  - hyperosmolar hyperglycemic state.
  - diabetes and severe vomiting.
  - acute, severe hyperglycaemia.
  - acute, severe hypoglycaemia.
  - suspected Charcot's neuroarthropathy e.g., unilateral, red, hot, swollen, possibly aching foot.
  - foot ulceration with absent pulses.
- Consider [urgent or routine diabetes assessment](#) if:
  - type 2 diabetes not responding to a combination of dietary and medical management (i.e. has tried at least three glucose-lowering medicines), with HbA1c > 64 mmol/mol or 8%.
  - patients with type 2 diabetes with complications e.g., cardiovascular disease, kidney disease, retinopathy, cerebral vascular disease, neuropathy.
  - planning for pregnancy.
  - management of unstable glycaemia due to concomitant use of medicines that impact on glycaemic control e.g., corticosteroids, chemotherapy protocols.
  - assessment for commercial driver's licence.
  - diagnosis of type of diabetes if uncertain.
- For help with dietary and lifestyle modifications, consider referral to a:
  - [dietitian](#).
  - [exercise physiologist](#).
  - [diabetes educator](#).

## Information

### For health professionals

#### Further information

- Australian Diabetes Educators Association (ADEA):
  - [Understanding HbA1c Measurements and Reports](#)
  - [Use of Blood Glucose Meters](#)
- NHMRC – [National Evidence Based Guideline for Blood Glucose Control in Type 2 Diabetes](#)
- RACGP – [Management of Type 2 Diabetes: A Handbook for General Practice](#)

### For patients

Diabetes UK (YouTube channel) – [Diabetes and the Body?](#) [animation about diabetes and the body]

## References

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