National Diabetes Services Scheme

An Australian Government Initiative

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National Diabetes Nursing Education Framework

Learning workbook

ADEA is a National Health Professional Body Agent for the NDSS.

The NDSS is administered by Diabetes Australia

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Diabetes Australia takes no responsibility for any adverse consequences that arise as a result of using the content of the resources for clinical purposes. Trainees and other health professionals need to consider the individual circumstances and needs of people with diabetes when they are applying the skills outlined in this resource in their clinical practice information.

Contact details

If you require further information about this resource, please contact the Australian Diabetes Educators Association on **(02) 6287 4822**.

To find out more about diabetes education and the pathway to becoming a Credentialled Diabetes Educator (CDE), go to the ADEA website **adea.com.au.**

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Contents

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Introduction

Overview

This workbook forms part of the learning package developed to support the National Diabetes Nursing Education Framework. It is designed for those who are unable to access the associated online learning modules (available at **healthprofessionals.learnupon.com**) or who prefer a workbook-style learning.

Nurses are central to providing and coordinating care and education for people with diabetes. The Framework is designed to support and prepare all nurses to provide high quality diabetes care and education regardless of their practice setting. The Framework outlines the expected diabetes specific responsibilities and activities, and minimum knowledge and skills required by nurses working at different practice levels.

The modules in the learning package are designed to support attainment of knowledge and skills at the 'all nurses' practice level. Refer to the National Diabetes Nursing Education Framework for full details about the nursing practice levels.

Rationale

Diabetes is the fastest growing chronic condition in Australia.[1] It was declared a national health priority in 1997 by the Federal Government and continues to be one the biggest challenges facing the Australian health system.[2]

The National Diabetes Strategy aims to prioritise Australia's response to diabetes and identify approaches to reduce the impact of diabetes in the community.[3] An identified area for action in the Strategy is to improve workforce capacity, to upskill the existing generalist health workforce and provide clear competencies for the diabetes workforce and other health professionals involved in diabetes care. Nurses work across all practice settings and are key providers of diabetes care and education. It is important for their baseline knowledge and skills to be enough to support people living with diabetes to achieve quality health outcomes.

Using this workbook

At the beginning of each module, you will find an overview of the learning outcomes. At the end of each module, you will be asked to complete several multiple-choice questions to assess your knowledge. Throughout the modules you will find links to recommended reading or short videos to watch to further your knowledge and understanding. As you progress, you will be asked to reflect on your responses to the information, and to consider how you might apply your learning in your own practice and/or workplace. Case studies and workplace activities are incorporated throughout the course to provide opportunities for participants to achieve a deeper understanding of the information within a clinical context. You are encouraged to complete these activities in writing, to discuss your answers with a supervisor or mentor and add to or correct your responses, and to consider how to apply the learnings in your work with people with diabetes.

Scope of practice

As a nurse, you have a duty of care to apply knowledge and skills appropriate to your scope of practice. More on this can be found in the NMBA Code of Conduct for Nurses and Code of Conduct for Midwives. When applying the National Diabetes Nursing Education Framework it is assumed that you have competency in general nursing care. The Framework has been developed to help you assess your competency within your scope of practice. This provides an opportunity to identify areas for further professional development in your current practice level to progress your diabetes management knowledge and skills development. You are not expected to achieve the knowledge and skill statements across all aspects of care in this framework – only those required in your role and scope. Some aspects of diabetes care and education are specialty areas of practice that require care to be provided only by a specialist in that area. This framework supports you to practice within your scope and skill level, and advocates for referral to experts and specialised services when required.

Your learning goals

Your mentor/supervisor:

Your mentor/supervisor contact details:

Your personal learning goals:

Abbreviations

ADEA	Australian Diabetes Educators Association
ADIPS	Australasian Diabetes in Pregnancy Society
AEP	Accredited exercise physiologist
AIHW	Australian Institute of Health and Welfare
APD	Accredited practising dietitian
BMI	Body Mass Index
CDE	Credentialled Diabetes Educator
CGM	Continuous Glucose Monitor
COPD	Chronic Obstructive Pulmonary Disease
DVA	Department of Veterans' Affairs
FBG	Fasting blood glucose
HHS	Hyperosmolar Hyperglycaemic State
HMR	Home Medicines Review
IAH	Impaired awareness of hypoglycaemia
IFG	Impaired fasting glucose
IGT	Impaired glucose tolerance
LADA	Latent Autoimmune Diabetes of Adulthood
NDSS	National Diabetes Services Scheme
NHMRC	National Health and Medical Research Council
NPH	Neutral Protamine Hagedorn
OGTT	Oral glucose tolerance test
RACGP	Royal Australian College of General Practitioners
RMMR	Residential Medication Management Review
SMBG	Self-monitoring of blood glucose
SNAP	Smoking nutrition alcohol and physical
TGA	Therapeutic Goods Administration
WC	Waist Circumference
WHR	Waist-to-hip ratio

Diabetes statistics

Diabetes is Australia's fastest growing chronic condition and a major challenge confronting our health system.

Around
1.7 million
Australians have diabetes – this includes 1.2 million who have been diagnosed and another estimated 500 000 with undiagnosed type 2 diabetes.[5,6]

According to Diabetes Australia, 280 Australians develop diabetes every day – one person every 5 minutes.[6]

The prevalence of all types of diabetes in increasing.[6]

Rates of diabetes in Aboriginal and Torres Strait Islander people are more than three times those of non-Indigenous Australians.[7]

3X

FRIDAY

The annual cost impact of diabetes in Australia is estimated to be
$14.6 billion.[8]

Figure 1: **Statistics about diabetes in Australia**

Module 1: Diabetes prevention screening and diagnosis

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 1: Diabetes pathophysiology, prevention, screening, and diagnosis.

Learning objectives

On completion of this module, you will be able to:

- [ ] **1.** Outline the pathophysiology of diabetes.
- [ ] **2.** Outline the differences between type 1, type 2 and gestational diabetes.
- [ ] **3.** Explain glucose metabolism functions and describe the role of insulin.
- [ ] **4.** Describe the symptoms and clinical presentation of diabetes.
- [ ] **5.** Describe the trends in prevalence of diabetes in Australia.
- [ ] **6.** Outline the progression and long-term health consequences of diabetes.
- [ ] **7.** Describe pre-diabetes and the clinical significance of pre-diabetes.
- [ ] **8.** Describe the risk factors for developing pre-diabetes and type 2 diabetes.
- [ ] **9.** Identify individuals who are at risk of pre-diabetes and diabetes and should be screened.
- [ ] **10.** Explain the importance of preventing and delaying the onset of type 2 diabetes.
- [ ] **11.** Describe healthy lifestyle principles to prevent or delay onset of pre-diabetes and type 2 diabetes, including weight management, nutrition, physical activity, stress management and sleep management.

What is diabetes?

Diabetes is a complex chronic health condition affecting many Australians.

There are three main types of diabetes: type 1 diabetes, type 2 diabetes and gestational diabetes[4]. There are also several less common types of diabetes that are outside the scope of this learning module.

Diabetes occurs when:

- the pancreas does not produce any insulin
- the pancreas does not produce enough insulin
- the body does not use insulin properly (insulin resistance).

This results in elevated blood glucose levels (hyperglycaemia), which can cause both short-term and long-term adverse health outcomes.

Types of diabetes

Type 1 diabetes[4,9] is an autoimmune condition where the body is no longer able to make insulin. Accounts for around 10% of all people with diabetes.

- Autoimmune condition resulting in destruction of insulin-producing beta-cells in the pancreas.
- The hormone insulin is no longer produced by the pancreas and so needs to be replaced via injections or an insulin pump.
- Usually presents in childhood or young adults (after 12 months of age) but can develop at any age.
- Symptoms usually have a rapid onset.
- If not diagnosed and treated quickly, can develop life-threatening Diabetic Ketoacidosis (DKA) due to insulin deficiency and the inability to use glucose as a fuel.
- More common if there is a family history of type 1 diabetes or in the presence of other autoimmune conditions such as thyroid or coeliac disease.
- Latent Autoimmune Diabetes of Adulthood (LADA) is a form of type 1 diabetes that occurs later in life and tends to have a slower onset of symptoms so is sometimes initially mistaken for type 2 diabetes.

Type 2 diabetes[4,10] is a condition of insulin resistance, where insulin is unable to work effectively. Accounts for around 85% of all people with diabetes.

- Results from a combination of insulin deficiency and insulin resistance, where muscle cells are resistant to the action of insulin being produced by the body.
- Can often be treated initially with lifestyle changes but many people progress to needing medication and possibly insulin over time.
- Usually develops slowly and many people have no symptoms.
- Usually diagnosed in older adults (over 40 years) but can also develop in children.
- More common in those who are overweight or obese (particularly abdominal obesity).
- More common in people with a family history of type 2 diabetes.
- More common among Indigenous Australians and individuals from Pacific Islander, Indian and Chinese ethnic backgrounds.

Gestational diabetes[4,11] is diabetes which develops during pregnancy and resolves after the birth. It affects 12-14% of pregnant women.

- Occurs in pregnancy and resolves after the placenta is delivered.
- All women should be screened at 24-28 weeks gestation or earlier if in a high-risk group.
- Women manage their gestational diabetes with diet and exercise. Many will need insulin injections if lifestyle changes alone are unable to maintain blood glucose levels in the recommended target range.
- More common in women with a family history of type 2 diabetes.
- More common in women over 40 years of age and those who are overweight or obese.
- More common in women with polycystic ovary syndrome (PCOS) or pre-diabetes.
- More common in Indigenous women and those from certain ethnic groups including Polynesian, Indian or Chinese backgrounds.
- Increases the risk of the mother and child developing type 2 diabetes in the future.

Glucose metabolism

The pancreas produces two hormones which help to manage blood glucose levels: insulin and glucagon.

When blood glucose levels rise e.g. after eating, this signals the pancreas to produce insulin, which takes glucose from the blood into the muscles and cells, where it is used for energy, returning blood glucose levels to normal.

When blood glucose levels fall e.g. after fasting or exercising, this signals the pancreas to produce glucagon, which causes the liver to release stored glucose into the bloodstream, returning blood glucose levels to normal.

In people with diabetes, insulin is either not produced or does not work as effectively as it does in those without diabetes, resulting in elevated blood glucose levels. This is explained further on the following pages.

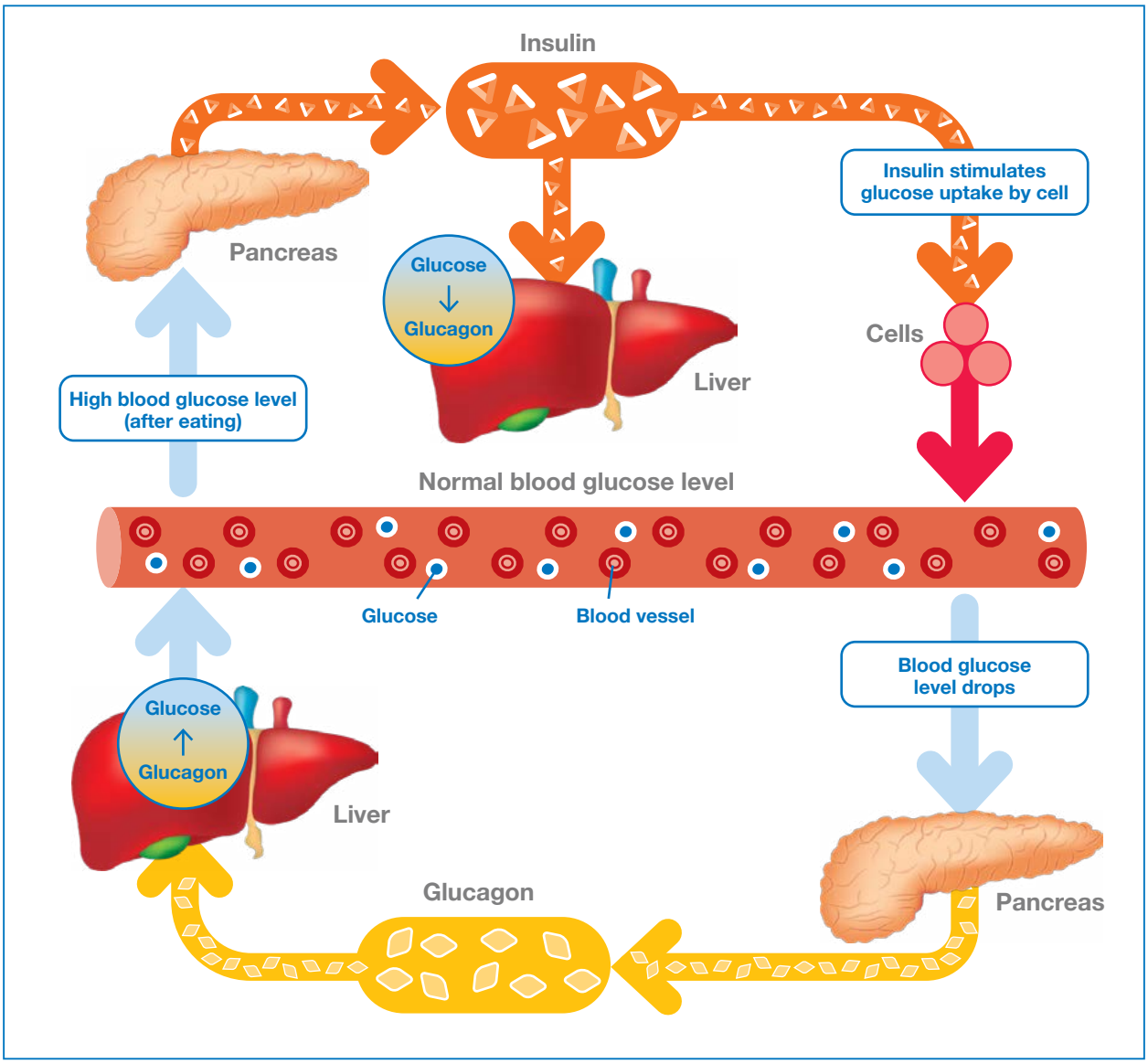

Figure 2: **Glucose metabolism**

Type 1 diabetes

In individuals with type 1 diabetes, the pancreas no longer produces insulin so glucose is unable to enter the cells and builds up in the bloodstream.

Without insulin therapy, glucose levels continue to build up in the blood resulting in very high blood glucose levels. Ketones are then produced due to an inability to use glucose as a fuel and the body breaking down fat as an alternative energy source.

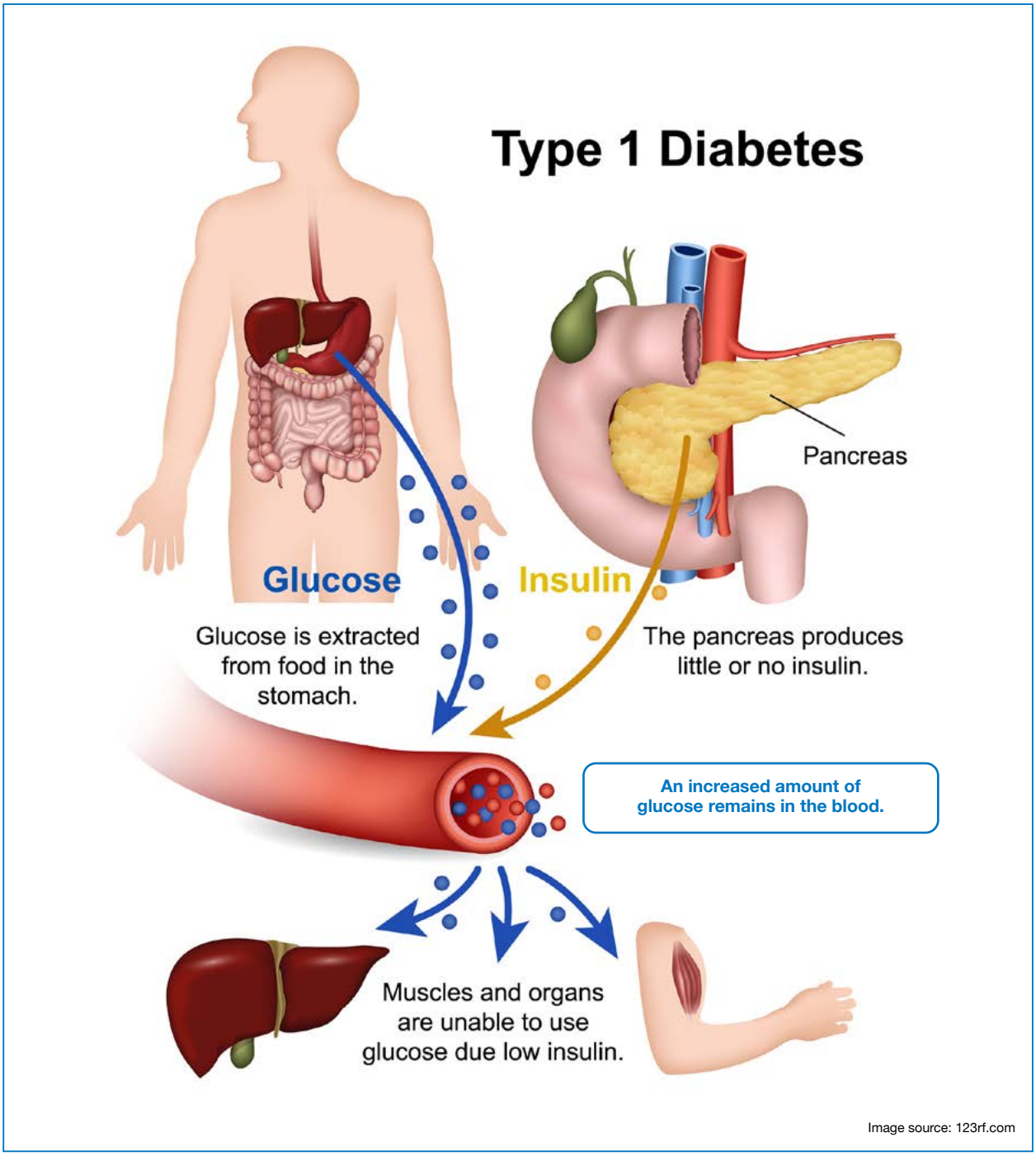

Figure 3: **Type 1 diabetes**

Type 2 diabetes

In people with type 2 diabetes, the pancreas produces insulin but cells in the body are resistant to its action.

Initially, the pancreas produces more insulin to overcome this resistance, helping to maintain normal blood glucose levels. However, over time, the capacity to produce extra insulin is reduced. Inadequate insulin production results in high blood glucose levels.

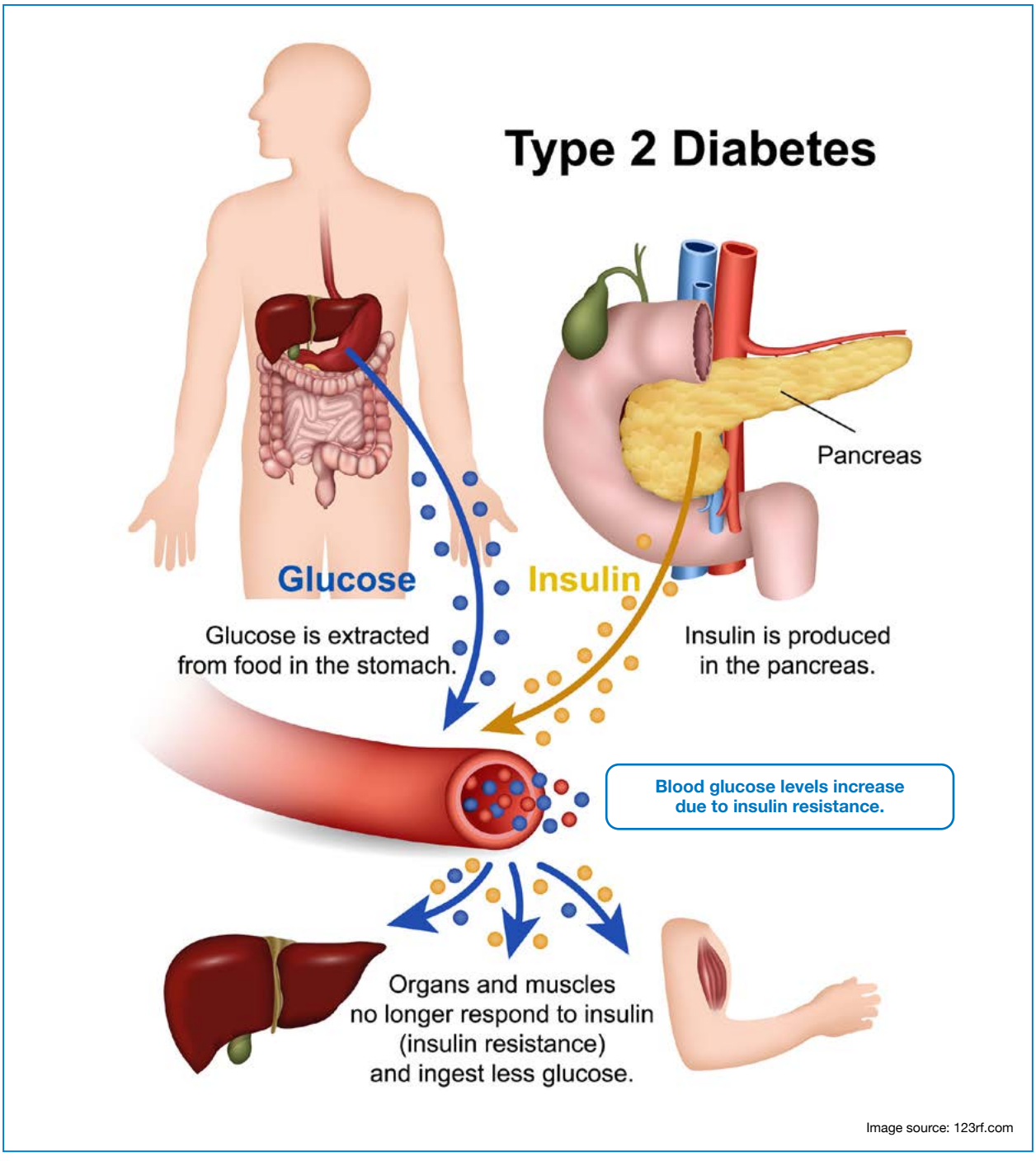

Figure 4: **Type 2 diabetes**

Further learning

To learn more about the pathophysiology of diabetes, watch these short videos:

- **What is diabetes mellitus?**
  khanacademy.org/science/health-and-medicine/endocrine-system-diseases/diabetes/v/what-is-diabetes-mellitus
- **Types of diabetes**
  khanacademy.org/science/health-and-medicine/endocrine-system-diseases/diabetes/v/types-of-diabetes
- **Pathophysiology – type 1 diabetes**
  khanacademy.org/science/health-and-medicine/endocrine-system-diseases/diabetes/v/pathophysiology-type-i-diabetes.
- **Pathophysiology – type 2 diabetes**
  khanacademy.org/science/health-and-medicine/endocrine-system-diseases/diabetes/v/pathophysiology-type-ii-diabetes

Symptoms of diabetes

Common symtoms of diabetes include[1]:

- excessive thirst
- polyuria
- tiredness/lethargy
- always feeling hungry
- slow healing wounds
- itching
- skin infections
- blurred vision
- mood swings
- headaches
- feeling dizzy
- leg cramps
- weight loss – common and often rapid in type 1 diabetes but can also occur in some people with type 2 diabetes.

Figure 5: **Symptoms of diabetes**

For detection of type 1 diabetes, Diabetes Australia recommends being aware of the 4T early signs: tired, thirst, thinner, toilet. Watch a short video on detection of type 1 diabetes here: **itsabouttime.org.au/type-1-diabetes**

Many people with type 2 diabetes have no symptoms or their symptoms may be overlooked. Regular screening is the key to early detection and should occur in those assessed to be at high risk. Watch a short video on detection of type 2 diabetes here: **itsabouttime.org.au/type-2-diabetes**

Adverse diabetes-related health outcomes

People with all types of diabetes can develop long-term health problems associated with elevated blood glucose levels. These include:

- macrovascular adverse health outcomes include cardiovascular disease, stroke and peripheral vascular disease
- microvascular adverse health outcomes include retinopathy, nephropathy and neuropathy.

The adverse diabetes-related health outcomes and their impact are explored further in the National Diabetes Nursing Education Framework online learning modules, which can be accessed at **healthprofessionals.learnupon.com**

What is pre-diabetes?

Pre-diabetes is a condition where the blood glucose levels are elevated but not high enough for a diagnosis of diabetes.[12]

Pre-diabetes:[12]

- reflects a decline in pancreatic beta-cell function
- includes impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT)
- usually asymptomatic
- an estimated 2 million Australians currently affected
- increases the risk of developing type 2 diabetes and cardiovascular disease
- without lifestyle changes, around 30% will develop type 2 diabetes
- management focuses on lifestyle modification to reduce the risk of progression.

Risk factors for pre-diabetes and type 2 diabetes

Risk factors for pre-diabetes and type 2 diabetes are the same and include:[12]

- family history of type 2 diabetes
- age
- being overweight or obese, particularly abdominal obesity
- having high blood pressure
- being a person with Aboriginal or Torres Strait Islander background
- being a person with Pacific Island, Indian subcontinent or Chinese background
- being a woman who has polycystic ovarian syndrome (PCOS) or who has given birth to a child over 4.5 kgs (9 lbs) or had gestational diabetes
- having an unhealthy diet
- lack of physical activity/excessive sedentary time
- smoking
- poor sleep.

While research is making progress, we do not currently know how to prevent type 1 diabetes and there is no cure. You can find out more about research into the treatment, prevention and cure of type 1 diabetes on the JDRF Australia website: **jdrf.org.au**

Type 2 diabetes prevention

While genetics and age play a part, a number of modifiable lifestyle factors are associated with developing **type 2 diabetes.**[12]

- Carrying excess weight, particularly abdominal obesity, significantly increases the risk of pre-diabetes and type 2 diabetes.
- Including regular physical activity and reducing sedentary time help to reduce the risk of developing pre-diabetes and type 2 diabetes.
- The risk of pre-diabetes and type 2 diabetes can be reduced by a diet based around fruits, vegetables, legumes and minimally processed, high fibre wholegrain carbohydrate foods, healthy fats (monounsaturated and polyunsaturated sources) and healthy protein foods but limited in refined carbohydrate, saturated and trans fats.
- Poor sleep and smoking are associated with a higher risk of developing pre-diabetes and type 2 diabetes.

Structured intensive lifestyle modification programs (including healthy eating, exercise and weight management) have been shown to reduce the risk of developing type 2 diabetes by up to 58% in those at high risk.[12,13]

Further learning

Download and read this article, which provides an overview of the main diabetes prevention trials and how the findings can be used with individuals to reduce their diabetes risk.

Prevention of diabetes: a strategic approach for individual patients (Shin, 2012) **onlinelibrary.wiley.com/doi/full/10.1002/dmrr.2357**

The authors of this study conclude that:

- Lifestyle modification is the first choice of intervention for diabetes prevention because it has good cost- and treatment-effectiveness.
- Individuals with an inadequate response to lifestyle intervention, weight reduction using moderate-intensity exercise and diet control during a period of 6–12 months should be considered for a more aggressive lifestyle intervention program.
- In those with additional cardiovascular risk factors, such as hypertension, current smoking, dyslipidaemia, obesity and a family history of cardiovascular diseases, pharmacological intervention using drugs with proven cost-effectiveness could be added to lifestyle treatment.

Early detection and screening for type 2 diabetes

The progression from insulin resistance to pre-diabetes to a diagnosis of type 2 diabetes is usually a gradual process which occurs over many years. Symptoms do not usually develop until blood glucose levels are high (usually above 10mmol/L, and often higher) and the person has already developed type 2 diabetes. Because people are often asymptomatic in the early stages, by the time someone is diagnosed with type 2 diabetes, they may have had undiagnosed diabetes for some time and may have already developed long-term diabetes-related adverse health outcomes. An awareness of risk factors and regular screening of those at risk provides the opportunity for prevention and/or early detection and treatment of type 2 diabetes, which in turn reduces the risk of long-term adverse health outcomes.

There are three steps to screening for type 2 diabetes and pre-diabetes:

Step 1: AUSDRisk Screening

Individuals should be screened for diabetes every three years using the AUSDRISK tool.[14] Screening should start at 40 years of age or from age 15 in Aboriginal and Torres Strait Islander people.

The following groups do not need assessment with AUSDRISK and can proceed to steps 2 or 3:

- people with Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG)
- women with a history of gestational diabetes
- women with a history of PCOS
- individuals with a history of cardiovascular event (e.g. myocardial infarction or stroke)
- individuals taking antipsychotic medicines.

Step 2: Measurement of fasting blood glucose or HbA1c

Individuals with any of the following risk factors should be screened with a fasting blood glucose or HbA1c every three years:

- people with an AUSDRISK score of 12 or above
- women with a history of gestational diabetes
- women with a history of PCOS
- individuals with a history of cardiovascular event (e.g. myocardial infarction or stroke)
- individuals taking antipsychotic medicines.

Diagnostic criteria for type 2 diabetes include a fasting blood glucose (FBG) ≥7.0 mmol/L or random blood glucose ≥11.1 mmol/L confirmed by a second abnormal FBG on a separate day, or a glycated haemoglobin (HbA1c) ≥48 mmol/mol (6.5%) on two separate occasions (see flowcharts on the next page).[15]

Step 3: Oral Glucose Tolerance Test (OGTT)

Individuals at risk of diabetes with a fasting blood glucose of 5.5-6.9 mmol/L on initial screening should be referred to have a 2-hour oral glucose tolerance test (OGTT) to determine whether they have type 2 diabetes, impaired glucose tolerance or impaired fasting glucose, or normal glucose tolerance.[16] The diagrams on the following page shows the criteria for diagnosis of IFG, IGT and type 2 diabetes.

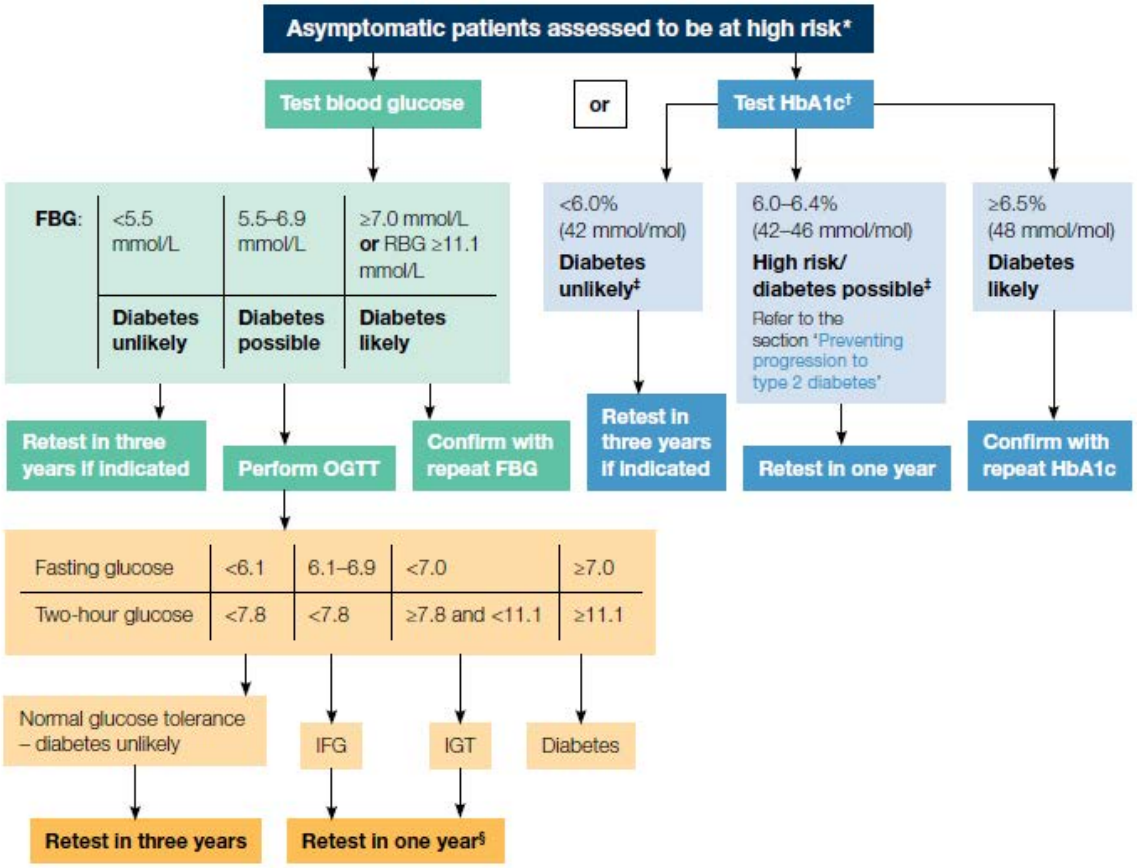

Figure 6: **Screening protocol for asymptomatic patients assessed to be at high risk for diabetes.**

Reproduced with permission from The Royal Australian College of General Practitioners from: Management of type 2 diabetes: A handbook for general practice. East Melbourne, Vic: RACGP, 2020. Available at racgp.org.au/clinical-resources/clinical-guidelines/key-racgp-guidelines/view-all-racgpguidelines/diabetes/introduction

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes. Download these fact sheets on understanding diabetes:

- **Understanding type 1 diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/understanding-type-1-diabetes-fact-sheet
- **Understanding type 2 diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/understanding-type-2-diabetes-fact-sheet
- **Understanding gestational diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/understanding-gestational-diabetes-fact-sheet
- **Understanding pre-diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/understanding-pre-diabetes-fact-sheet

Assessment questions

Question 1: **The three most common types of diabetes are:**

- [ ] **a.** Type 1, type 2 and type 3
- [ ] **b.** Type 1, type 2 and gestational
- [ ] **c.** Type 1, type 2 and pre-diabetes
- [ ] **d.** Type 1, type 2 and insulin resistance
- [ ] **e.** Type 2, pre-diabetes and gestational diabetes

Question 2: **Choose the two correct statements:**

- [ ] **a.** Children can only be diagnoses with type 1 diabetes
- [ ] **b.** Older adults can only be diagnosed with type 2 diabetes
- [ ] **c.** LADA is only diagnosed in adults
- [ ] **d.** Gestational diabetes is only a risk in women who are overweight
- [ ] **e.** Type 1 diabetes and LADA are both a result of autoimmune destruction of the pancreatic beta-cells

Question 3: **The pancreas produces two hormones involved in regulating blood glucose levels – these are:**

- [ ] **a.** Insulin and cortisol
- [ ] **b.** Insulin and glucose
- [ ] **c.** Insulin and growth hormone
- [ ] **d.** Insulin and glucagon
- [ ] **e.** Insulin and thyroid hormones

Question 4: **Which of the following are not common symptoms of type 1 diabetes:**

- [ ] **a.** Thirst and polyuria
- [ ] **b.** Unintentional weight loss
- [ ] **c.** Fatigue and lethargy
- [ ] **d.** Blurred vision, headaches and dizziness
- [ ] **e.** Weight gain and high blood pressure

Question 5: **Which of the following about the diagnosis of type 2 diabetes is incorrect?**

- [ ] **a.** Symptoms may be absent or go undetected for many years
- [ ] **b.** Many people already have complications at the time of diagnosis
- [ ] **c.** Symptoms may include thirst, polyuria and blurred vision
- [ ] **d.** Early detection can help to prevent long-term complications
- [ ] **e.** An oral glucose tolerance test is always needed to confirm the diagnosis

Assessment answers

1. b
2. c and e
3. d
4. e
5. e
6. a, b, c and e
7. d
8. c
9. a, b, d and e
10. d

Question 6: **Which of the following are used in screening for type 2 diabetes (Choose all that apply)**

- [ ] **a.** The AUSDRISK assessment tool
- [ ] **b.** A fasting blood glucose level
- [ ] **c.** An oral glucose tolerance test
- [ ] **d.** A urinary glucose level
- [ ] **e.** Measurement of HbA1c level

Question 7: **If someone has a fasting blood glucose of 6.2mmol/L and a 2-hour glucose of 8.5mmol/L on an OGTT, they have:**

- [ ] **a.** Normal glucose tolerance
- [ ] **b.** Impaired fasting glucose (IFG)
- [ ] **c.** Impaired glucose tolerance (IGT)
- [ ] **d.** Impaired fasting glucose and impaired glucose tolerance
- [ ] **e.** Type 2 diabetes

Question 8: **Which of the following is not associated with an increased risk of developing type 2 diabetes?**

- [ ] **a.** Being overweight
- [ ] **b.** Having high blood pressure
- [ ] **c.** Having delivered a small baby
- [ ] **d.** Having a family history of type 2 diabetes
- [ ] **e.** Being a person from an Aboriginal or Torres Strait Islander background

Question 9: **Which of the following lifestyle habits can reduce the risk of developing type 2 diabetes (Choose all that apply)**

- [ ] **a.** Eating a healthy diet
- [ ] **b.** Exercising regularly
- [ ] **c.** Getting less than 6 hours sleep per night
- [ ] **d.** Managing stress levels
- [ ] **e.** Maintaining a healthy weight

Question 10: **Over time, elevated blood glucose levels can lead to long-term health consequences. Which of the following is not considered an adverse diabetes-related health outcome?**

- [ ] **a.** Heart disease
- [ ] **b.** Peripheral vascular disease
- [ ] **c.** Chronic kidney disease
- [ ] **d.** Hypothyroidism
- [ ] **e.** Retinopathy

Module 2: Blood glucose and ketone monitoring

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 7: Blood glucose and ketone monitoring.

Learning objectives

On completion of this module you will be able to:

- ☐ **1.** State the recommended target blood glucose range and target glycated haemoglobin (HbA1c) range.
- ☐ **2.** Explain that targets for glucose levels are individualised.
- ☐ **3.** Identify that people with diabetes may use various technology to monitor blood glucose.
- ☐ **4.** Explain how to interpret blood glucose levels, identify results which are outside the individual's target range, treat if required and report appropriately.
- ☐ **5.** Explain what ketones are, when to monitor for ketones and what ketone level is significant and requires action.
- ☐ **6.** Explain how to check a blood glucose level and blood ketone level, using a portable blood glucose meter according to manufacturer's instructions.
- ☐ **7.** Describe how to access blood glucose and ketone monitoring supplies in the workplace.
- ☐ **8.** Describe how to educate the person with diabetes how to achieve an accurate and safe technique for blood glucose monitoring, frequency of monitoring, interpretation of results and any action required.
- ☐ **9.** Explain local procedures about the disposal of sharps.

The role of monitoring

Blood glucose and ketone monitoring are important tools in the management of diabetes. Monitoring may be performed at home by the person with diabetes or their carer, by a pathology lab or in a healthcare setting.

Both capillary blood glucose monitoring and glycosylated haemoglobin (HbA1c) can be used to assess glycaemic management.

- Capillary blood glucose monitoring is used to monitor day-to-day glucose levels.
- HbA1c is used to monitor longer-term glycaemic management.

Ketone monitoring is important in those with type 1 diabetes and individuals taking SGLT2 inhibitors.

- It is usually used as part of sick day management.
- Both blood and urine monitoring can be used, but blood ketone monitoring is preferable and is more accurate.

HbA1c

Glycosylated haemoglobin (HbA1c) is used to assess long-term glycaemic management and reflects average blood glucose levels over the past 10-12 weeks. It should be measured every 3-6 months depending on the recommendations of the individual treating team.

HbA1c targets need to be individualised, taking into account risks and priorities of the individual.[17] Higher or lower targets may be appropriate for different individuals. In all cases, achievement of HbA1c targets must be balanced against risk of severe hypoglycaemia, especially for the elderly, young children and those with impaired awareness of hypoglycaemia. Where the aim is avoidance of symptomatic hyperglycaemia, a target of <15mmol/L (140mmol/mol) is recommended to help minimise risk of infection.

HbA1c targets for type 1 diabetes[17,18]

Clinical situation	Target
General target including children and adolescents	≤ 53mmol/mol (7.0%)
Pregnancy or planning a pregnancy	≤ 48mmol/mol (6.5%) without frequent hypoglycaemia
Recurrent severe hypoglycaemia or hypoglycaemia unawareness	≤ 64mmol/mol (8%)
Major comorbidities likely to limit life expectancy	Minimise symptoms of hyperglycaemia and avoid ketosis.

HbA1c targets for type 2 diabetes[15,17,18]

Clinical situation	Therapy	Target
General target		≤ 53mmol/mol (7%)
Diabetes of short duration and no clinical cardiovascular disease	Requiring lifestyle modification ± metformin	≤ 42mmol/mol (6.0%)
	Requiring any glucose lowering agents other than metformin or insulin	≤ 48mmol/mol (6.5%)
	Requiring insulin	≤ 53mmol/mol (7.0%)
Pregnancy or planning a pregnancy	Any	≤ 48mmol/mol (6.5%) without frequent hypoglycaemia
Diabetes of longer duration or clinical cardiovascular disease	Any	≤ 53mmol/mol (7.0%)
Recurrent severe hypoglycaemia or hypoglycaemia unawareness	Any	≤ 64mmol/mol (8%)
Presence of major comorbidities likely to limit life expectancy	Any	Minimise symptoms of hyperglycaemia.

There are several factors to consider in setting glycaemic targets.[19]

- risks associated with hypoglycaemia and other medication side effects
- duration of diabetes
- presence of other comorbidities
- presence of established vascular health conditions
- preferences of the person with diabetes
- resources and support systems of person with diabetes.

The graphic below illustrates how these factors impact the targets.[19]

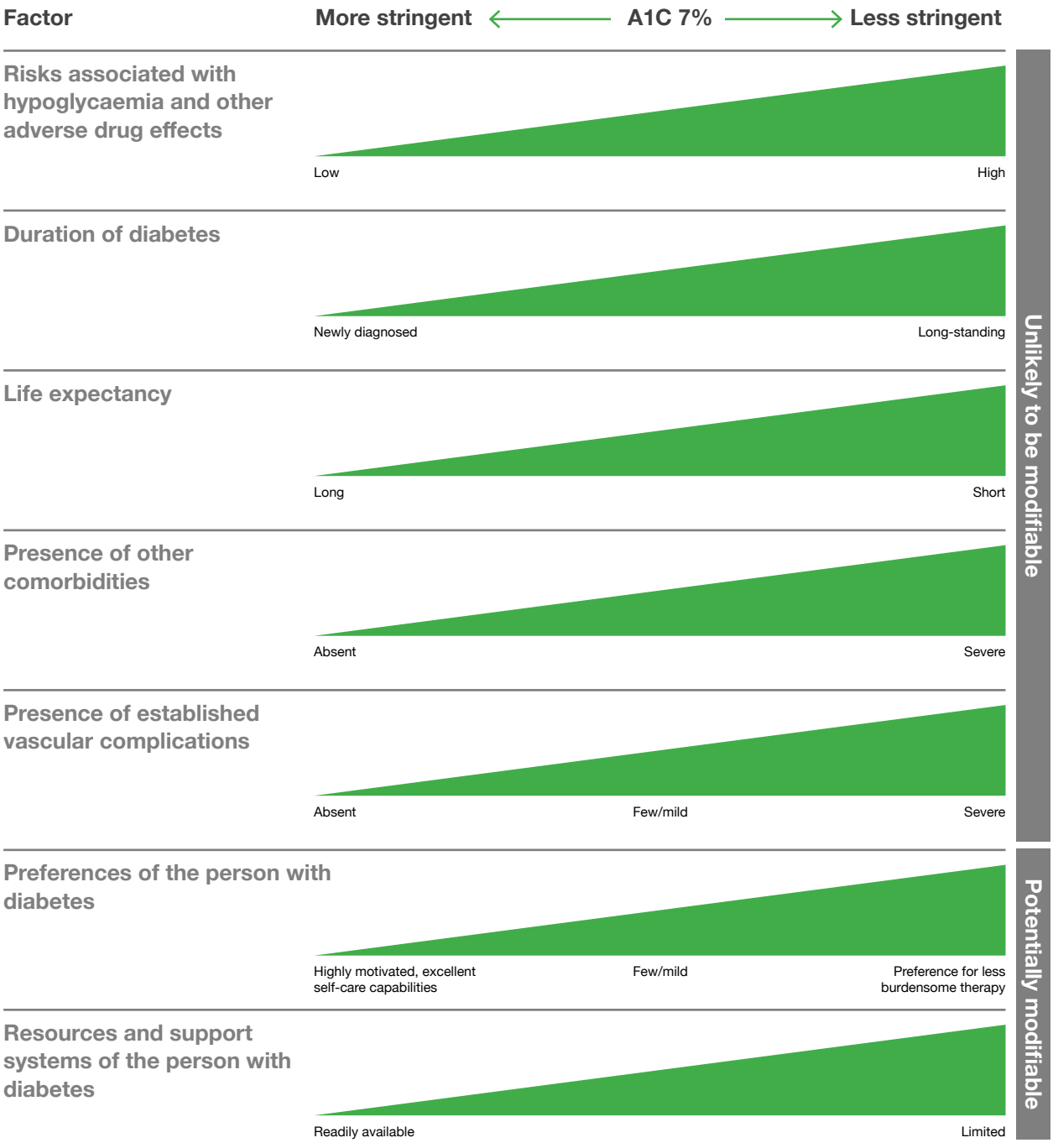

Figure 7: **Factors to consider for glycaemic targets**

A 2018 report entitled Burden of Diabetes in Australia: It's time for more action found that only 50% of Australians are meeting the general HbA1c target of ≤ 7.0%.[20] Indigenous Australians, people with type 1 diabetes and those with longer duration of diabetes were less likely to achieve HbA1c targets.

Self-monitoring of blood glucose

Self-monitoring of blood glucose levels (SMBG) is recommended for:

- all individuals who inject insulin
- women with gestational diabetes
- those taking oral diabetes medications which could cause hypoglycaemia
- individuals with an intercurrent illness or who are taking non-diabetes medications which may be affecting their blood glucose
- those with unstable blood glucose levels or who are undergoing a change in their diabetes management
- those with cystic fibrosis or steroid-induced diabetes.

For people not prescribed insulin, the need for and frequency of SMBG should be individualised, depending on type of glucose-lowering medications, level of glycaemic management and risk of hypoglycaemia, as an aid to self-management.[15]

After education about SMBG, the person with diabetes can use SMBG to:[19]

- identify and reduce the risk of hypoglycaemia
- differentiate fasting, pre-prandial and postprandial hyperglycaemia
- detect glycaemic excursions
- better understand the effect of food choices, physical activity and medication on blood glucose
- adjust their insulin dose for optimal glycaemic management
- know when they need to see their diabetes health care team to adjust their diabetes management plan.

Monitoring devices

As technology becomes more advanced, the range of monitoring devices available to people with diabetes increases.

People with diabetes may use a blood glucose meter and strips, a Continuous Glucose Monitor (CGM) or a Flash Glucose Monitor.

Blood glucose monitoring[21] involves pricking the skin with a lancet device to draw blood, then applying the blood onto a testing strip that is placed in a blood glucose meter. This device measures the glucose levels in the blood and provides the user with a blood glucose reading. Read more about blood glucose monitoring here: **ndss.com.au/about-diabetes/resources/find-a-resource/blood-glucose-monitoring-fact-sheet**

Continuous glucose monitoring[22] involves wearing a small wearable device that measure and displays glucose levels throughout the day and night. CGM devices consist of a sensor, inserted just under the skin and a transmitter which attaches to the sensor and sends glucose readings to a wireless receiver, insulin pump or compatible smartphone. The receiver, pump or smartphone (via an app) allow the wearer to view their glucose data, which can also be shared with 'followers' such as a parent or partner. The device also displays trend arrows to show whether and how quickly glucose levels are rising, falling or steady and can be programmed to sound alarms if the wearer's glucose levels are outside their set target range. There are several CGM devices currently available in Australia. Read more about CGM here: **ndss.com.au/about-diabetes/resources/find-a-resource/continuous-glucose-monitoring-fact-sheet**

Flash glucose monitoring[23] is similar to continuous glucose monitoring but there is no transmitter, so the wearer needs to scan the sensor with a reader or smartphone (via an app) to view their glucose data and trend arrows, and the device doesn't have alarms or alerts if glucose levels move outside their target range. Read more about flash glucose monitoring here: **ndss.com.au/about-diabetes/resources/find-a-resource/flash-glucose-monitoring-fact-sheet**

While an increasing number of people are using continuous and flash glucose monitoring, particularly those with type 1 diabetes, these devices are considerably more expensive than blood glucose monitoring. The cost is only subsidised by the government for certain groups including children and young people under 21 years with type 1 diabetes, women with type 1 diabetes who are pregnant or planning a pregnancy, and adults with type 1 diabetes who have a valid concessional status.[24]

Blood glucose targets

Target blood glucose ranges will vary from one individual to the next, depending on several factors including:

- the type of diabetes they have
- whether they are taking insulin or medication that could cause hypoglycaemia
- whether they are experiencing problematic hypoglycaemia or impaired awareness of hypoglycaemia
- their age
- whether they have any other health comorbidities
- for women, whether they are pregnant or planning a pregnancy.

However, the following are general recommendations.[16,18,25,26]

Type of diabetes	Target
Type 1 diabetes	4 - 8mmol/L before meals <10mmol/L 2 hours after starting a meal
Type 2 diabetes	6 - 8mmol/L before meals 6 - 10mmol/L 2 hours after starting a meal
Type 2 diabetes not at risk of hypoglycaemia (i.e. not taking insulin or sulphonylureas)	4.0 - 7.8mmol/L Could aim for blood glucose levels as close as possible to someone without diabetes
Gestational diabetes*	≤ 5.0mmol/L fasting ≤ 7.4mmol/L 1 hour after starting a meal ≤ 6.7mmol/L 2 hours after starting a meal
Type 1 or type 2 diabetes during pregnancy	4.0 - 5.3 mmol/L fasting 5.5-7.8mmol/L 1 hour after starting a meal 5.0-6.7mmol/L 2 hours after starting a meal

* Note: The Australasian Diabetes in Pregnancy Society (ADIPS) targets may vary between health services and ADIPS acknowledge that there are demonstrated benefits for a fasting target <5.3mmol/L and 2-hour target <7.0mmol/L.[26]

Blood ketone monitoring

Ketones are a by-product of fat breakdown, produced when the body has insufficient insulin to use glucose as a fuel.[27]

- When the body has insufficient insulin to use glucose as a fuel, it starts breaking down fat, resulting in the production of ketones by the liver.
- Ketones can usually be used by the cells for energy and are excreted by the kidneys but without sufficient insulin, they are overproduced and accumulate in the bloodstream.
- Ketones can be measured in the blood or urine, but blood ketone monitoring is more accurate so is recommended over urine monitoring.[28]

In individuals with type 1 diabetes, ketone production can lead to diabetic ketoacidosis (DKA). DKA is a medical emergency and requires hospitalisation.

Treatment involves:

- correcting fluid and electrolyte imbalances
- reversal of the hyperglycaemia (usually with an insulin infusion)
- treatment of the precipitating causes, if relevant (e.g. giving antibiotics for an infection).

DKA is discussed in more detail in module 4.

Learning how to monitor ketones at home is important for all individuals with type 1 diabetes.

People with type 2 who are taking sodium-glucose transport protein (SGLT2) inhibitors may also be educated on ketone monitoring as cases of euglycaemic DKA (where blood glucose levels are within the target range) have been associated with use of this medication, particularly related to illness, poor oral intake or fasting.[29,30]

If ketone production is detected early and treated appropriately, the risk of developing DKA can be reduced.

A blood ketone level of less than 0.6mmol/L is considered normal. If ketones are above this, people with diabetes should follow their sick day management plan. If blood ketones are more than 3.0mmol/L urgent medical care is required.[28]

Blood glucose and ketone monitoring in your workplace

The procedure for monitoring an individual's blood glucose and ketone levels may vary depending on the setting in which you work and your workplace policies and procedures. It is important that you are familiar with the requirements of your own workplace but consider the following key steps:[31,32]

Step 1: Prepare equipment required and perform hand hygiene.

Prepare equipment for blood glucose/ketone monitoring including:

- soap and water
- disposable gloves
- blood/ketone meter and strips
- disposable lancets
- cotton balls
- sharps bin
- contaminated clinical waste receptacle and general waste receptacle.

Note: The equipment required can either belong the workplace or the person with diabetes. Check the preference of the person with diabetes.

Step 2: Introduce yourself to the person with diabetes and obtain consent.

- ensure privacy
- check their identity
- explain the procedure
- obtain their verbal consent to perform blood glucose/ketone monitoring.

Step 3: Perform the blood glucose or ketone check according to the meter instructions.

- assemble equipment and check expiry date on strips
- have the person with diabetes wash and dry their hands
- attend to own hand hygiene and put on disposable gloves
- place blood glucose or blood ketone test strip into meter
- select or adjust lancet for appropriate penetration depth
- obtain drop of blood from the side of the person's fingertip and apply to the test strip
- wait for blood glucose or ketone reading to be displayed and record result as per workplace requirements
- dispose of sharps and contaminated waste appropriately.

Step 4: Record the blood glucose or ketone level and take appropriate action.

- Take appropriate action, if required (e.g. treatment of hypoglycaemia, checking ketones if blood glucose above 15mmol/L in a person with type 1 diabetes*or at any blood glucose level for people with type 2 if unwell) and report readings outside of target range, according to workplace policies and procedures.

  Note: ketones and management of *hyperglycaemia are discussed further in module 4*.
- Repeat blood glucose or ketone check if the result is not consistent with the individual's symptoms (i.e. if they have symptoms of hypo or hyperglycaemia that does not match their blood glucose or ketone reading).

Workplace activity

Determine which blood glucose meter you have in your workplace. If you are not already familiar with its use, locate the online instruction video for your workplace meter and watch the relevant video. You will find links to most of the blood glucose meters available in Australia below.

Record the name of the blood glucose meter used in your workplace and key considerations for its use below:

Blood glucose meter instruction videos

Company and Website	Meters
Accu-Chek **accu-chek.com.au/meter-systems**	Accu-Chek Performa/Performa II/Performa Nano, Accu-Chek Guide, Accu-Chek Aviva Expert, Accu-Chek Aviva Connect, Accu-Chek Mobile, Accu-Chek Active
Abbott Freestyle **myfreestyle.com.au/category/meter-system**	Freestyle Optium Neo, Freestyle Freedom Lite, Freestyle Lite, Freestyle Insulinx
Ascensia Contour **contournextone.com.au/getting-started**	Contour Next, Contour Next One
One Touch **samsldiabetes.com.au/item/onetouchglucosemeters**	One Touch Verio IQ, One Touch Verio Flex
CareSens **pharmacodiabetes.com.au/products/meters**	CareSens N, CareSens N POP, CareSens N Voice, CareSens N Premier, CareSens Dual
Trividia Health **trividiahealth.com/products/blood-glucose-meters-test-strips**	TrueMextrix Air, TrueMetrix Go

Note: as diabetes technology changes rapidly, the available meters will change over time. This information was up to date at the time of publishing.

Workplace activity

Review your workplace policies and procedures for blood glucose and ketone monitoring including guidelines on quality control testing, meter calibration, identification, treatment and reporting of out-of-range blood glucose levels.

Record the main points you need to know about monitoring here:

Describe to your supervisor or mentor what you would do if someone with diabetes has a blood glucose level above or below their target range.

Ask your supervisor or mentor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

SMBG education

In addition to being familiar with how to perform blood glucose and ketone monitoring in your workplace, it is important that you know how to provide education to individuals with diabetes who need to learn how to perform self-monitoring of blood glucose or that you refer the person to a diabetes educator where available. Following are the key considerations when providing education on self-monitoring of blood glucose.

How to use the meter

The person with diabetes should be provided with instruction on the use of their personal meter including:

- setting and changing the time and date
- turning on or off alerts/alarms
- changing the battery or charging the meter
- cleaning and performing control checks
- logging additional data (such as meal markers, food, activity or insulin doses) and using data sharing capabilities, if applicable.

Correct monitoring technique

The person with diabetes should be provided with education on correct monitoring technique including:

- organising their equipment (e.g. meter, lancet device and lancets, strips, tissues) and checking that their test strips are in date, particularly if they are monitoring irregularly
- washing their hands, ensuring they are clean and dry before monitoring
- using the lancet device to obtain a drop of blood from the side if the fingertip and applying this to the test strip
- recording results in a record book (or within the meter memory, with correct time and date)
- disposing of the lancet in an approved sharps container (lancets are recommended for single use only).

When to check blood glucose levels

When and how often an individual checks their blood glucose levels will depend on the type of diabetes they have and how it is being managed (e.g. multiple insulin injections, insulin pump, oral or injectable diabetes medications, diet and/or exercise). Recommendations will be provided by their diabetes team. In general, however, recommended times to monitor may include:

- on waking (fasting), before meals, 2 hours after meals, before bed
- for those at risk of hypoglycaemia: before driving, before and after exercise, when drinking alcohol and occasionally overnight (around 2-3am)
- when unwell or when experiencing symptoms of hypoglycaemia or hyperglycaemia
- when out of usual routine (e.g. travel or periods of fasting).

Interpretation of readings and acting on results

The person with diabetes should be provided with education on how to interpret their readings, including:

- being familiar with their individualised target range
- knowing when and how to treat hypoglycaemia, if at risk
- knowing when and how to treat hyperglycaemia
- managing sick days and knowing when more regular monitoring and ketone monitoring is needed
- identification of patterns and when to contact their health professional team for review of their diabetes management.

Workplace activity

Have your supervisor or mentor observe you providing education to a person with diabetes on blood glucose monitoring.

Consider each of the steps on the previous page.

Your notes:

Supervisor or mentor signature:

Safe sharps disposal

Lancets used for blood glucose and ketone monitoring must be disposed of safely. This includes by the person with diabetes in their own home.

It is important that you are familiar with the policies and procedures for managing sharps and safe sharps disposal in your workplace.

All individuals with diabetes who use injectable medications should be provided with education on safe sharps disposal. People with diabetes can purchase an Australian-standard approved plastic container from NDSS Access Points (usually a community pharmacy) or from their local public hospital, community health centre or local council office. Filled sharps containers can be disposed of at some public hospitals, participating pharmacies, community sharps disposal bins and some councils.

Individuals can locate their local community sharps disposal facilities by:

- visiting **safesharps.org.au**
- calling the NDSS Helpline on **1800 637 700**
- contacting their local council.

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes.

Download this fact sheet on blood glucose monitoring:

- Blood glucose monitoring
  ndss.com.au/living-with-diabetes/managing-diabetes/blood-glucose-monitoring

Assessment questions

Question 1: **Glycaemic management in people with diagnosed diabetes can be measured using:**

- [ ] **a.** Blood glucose levels and glycosylated haemoglobin (HbA1c).
- [ ] **b.** Blood glucose levels and blood ketones.
- [ ] **c.** Blood glucose levels and urinary ketones.
- [ ] **d.** HbA1c and blood ketones.
- [ ] **e.** HbA1c and urinary ketones.

Question 2: **Choose all that apply. Self-monitoring of blood glycose levels (SMBG) can help a person with diabetes to:**

- [ ] **a.** Identify hypoglycaemia.
- [ ] **b.** Understand how food and activity impacts their blood glucose levels.
- [ ] **c.** Detect hyperglycaemia.
- [ ] **d.** Avoid the need to see their doctor for monitoring their diabetes.
- [ ] **e.** Adjust their insulin doses.

Question 3: **The target blood glucose level for a person with diabetes is:**

- [ ] **a.** Less than 4mmol/L before meals and less than 8mmol/L after meals.
- [ ] **B.** Less than 6mmol/L before meals and less than 8mmol/L after meals.
- [ ] **C.** Less than 6mmol/L before meals and less than 10mmol/L after meals.
- [ ] **D.** Individualised, depending on their type of diabetes, treatment and other health conditions.
- [ ] **E.** 4-8mmol/L before meals and 4-10mmol/L after meals.

Question 4: **Which of the following is incorrect about HbA1c targets in people with type 2 diabetes?**

- [ ] **a.** The general target is ≤ 7.0% (53mmol/mol).
- [ ] **b.** The target for women who are pregnant or planning a pregnancy is ≤ 6.0% (42mmol/mol).
- [ ] **c.** The target for those with impaired awareness of hypoglycaemia is ≤ 8.0% (64mmol/mol).
- [ ] **d.** The target for those with limited life expectancy is ≤ 8.0% (64mmol/mol).
- [ ] **e.** The target for those requiring insulin is ≤ 7.0% (53mmol/mol).

Question 5: **Choose all that are correct. The glycosylated haemoglobin (HbA1c):**

- [ ] **a.** Is used to assess long-term glycaemic management.
- [ ] **b.** Reflects average blood glucose levels over the past 10-12 weeks.
- [ ] **c.** Reflects average blood glucose levels over the past 6-12 months.
- [ ] **d.** Should be measured every 3-6 months, or more often if required.
- [ ] **e.** Should be ≤ 7.0% (53mmol/mol) for all individuals with diabetes.

Question 6: **Choose all that apply. Which of the following are a consideration in setting individual HbA1c targets?**

- ☐ **a.** Life expectancy.
- ☐ **b.** Diabetes duration.
- ☐ **c.** Risk of hypoglycaemia.
- ☐ **d.** Presence of vascular complications.
- ☐ **e.** Current HbA1c level.

Question 7: **Education on self-monitoring should include:**

- ☐ **a.** Instruction on use of the meter.
- ☐ **b.** Correct monitoring technique.
- ☐ **c.** Interpretation of readings.
- ☐ **d.** Frequency and timing of monitoring.
- ☐ **e.** All of the above.

Question 8: **Which of the following statements about ketones is incorrect?**

- ☐ **a.** They are produced when the body breaks down fat.
- ☐ **b.** They are a sign of insulin deficiency.
- ☐ **c.** They are only seen in people with type 1 diabetes.
- ☐ **d.** High ketone levels can be life-threatening in a person with diabetes.
- ☐ **e.** High ketone levels can lead to diabetic ketoacidosis (DKA).

Question 9: **Choose all that apply. Which of the following statements about ketone monitoring are correct?**

- ☐ **a.** All individuals with type 1 diabetes should be educated on ketone monitoring.
- ☐ **b.** All individuals with diabetes should be educated on ketone monitoring.
- ☐ **c.** Blood ketone monitoring is more accurate than urine ketone monitoring.
- ☐ **d.** Some individuals with type 2 diabetes who take SGLT2-inhibitors may need education on ketone monitoring.
- ☐ **e.** Individuals with type 1 diabetes should perform daily ketone monitoring.

Question 10: **Which of the following statements about sharps disposal is incorrect?**

- ☐ **a.** Sharps include syringes, insulin pen needles and lancets.
- ☐ **b.** The website safesharps.org.au can be used to locate local community sharps disposal facilities.
- ☐ **c.** Used sharps should be placed in an Australian-standard approved plastic container.
- ☐ **d.** Filled sharps containers can be sealed and placed in the rubbish bin.
- ☐ **e.** Individuals with diabetes who are monitoring their blood glucose levels should be provided with education on safe sharps disposal.

Assessment answers

1. a
2. a, b, c and e
3. d
4. d
5. a, b and d
6. a, b, c and d
7. e
8. c
9. a, c and d
10. d

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Module 3: Hypoglycaemia

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 10: Hypoglycaemia.

Learning objectives

On completion of this module you will be able to:

- ☐ **1.** State the target blood glucose range and define mild and severe hypoglycaemia.
- ☐ **2.** Identify those at risk of hypoglycaemia.
- ☐ **3.** List possible causes of hypoglycaemic episodes.
- ☐ **4.** Describe signs and symptoms of hypoglycaemia.
- ☐ **5.** Describe the need for individualised blood glucose targets; knowing that symptoms of hypoglycaemia may occur while in target range and to treat for hypoglycaemia if symptomatic.
- ☐ **6.** Describe treatment for hypoglycaemia accommodating preferences of person with diabetes and according to local guidelines.
- ☐ **7.** Describe actions to take if hypoglycaemia is not resolved with initial treatment.
- ☐ **8.** Explain how to access and administer oral treatment for hypoglycaemia.
- ☐ **9.** Describe the indications for use and administration of Glucagon or intravenous dextrose, and precautions required.
- ☐ **10.** Describe how to prepare and safely administer Glucagon.
- ☐ **11.** Explain when strict glycaemic management may not be appropriate e.g. end of life, the elderly.
- ☐ **12.** Describe the dangers of hypoglycaemia in the elderly.
- ☐ **13.** Describe how to promote safety in activities of daily living with the person with diabetes e.g. driving.
- ☐ **14.** Outline when and how to refer on to specialist diabetes services for assessment and medication review.

What is hypoglycaemia?

Hypoglycaemia is a low blood glucose level, defined as a blood glucose level below 4.0mmol/L. It can occur in those taking insulin and some types of oral diabetes medications (sulphonylureas). Immediate treatment is required to avoid progression to severe hypoglycaemia and loss of consciousness.

Hypoglycaemia is classified in levels of deterioration:[19]

- Level 1 (also referred to as mild hypoglycaemia)
  Glucose of < 3.9mmol/L and above 3.0mmol/L
- Level 2 (also referred to as moderate hypoglycaemia)
  Glucose of < 3.0mmol/L
- Level 3 (also referred to as severe hypoglycaemia)
  Severe event characterised by altered mental state and/or physical status requiring assistance.

Common causes of hypoglycaemia

Several factors can increase the risk of hypoglycaemia including:[33]

- not consuming adequate carbohydrate at a meal or snack, including fasting
- delaying or missing a meal or snack
- taking too much insulin or oral diabetes medication
- excess alcohol intake
- prolonged physical activity without additional food intake or reducing insulin dose
- vomiting or diarrhoea.

Signs and symptoms of hypoglycaemia

Symptoms of hypoglycaemia will vary from one individual to the next. Each person with diabetes may experience different signs and symptoms of hypoglycaemia, and these may change over time.[19,33]

It is important that the person with diabetes knows their usual signs and symptoms of hypoglycaemia. Carers, friends, house mates and work colleagues should also be aware of signs and symptoms to watch out for and how to respond. Young children are often unable to articulate that they are having a hypo so it is important for carers to look for associated behaviour patterns.

Neurogenic symptoms usually occur first due to activation of the autonomic nervous system.[34] They include:

- sweating
- shaking
- tingling around the mouth
- hunger
- weakness
- palpitations.

If not treated early, **neuroglycopenic symptoms** follow, due to lack of glucose to the brain.[34] These include:

- confusion
- unsteadiness
- blurred vision
- difficulty speaking/slurred speech
- changes in concentration
- aggressive behaviour
- loss of consciousness
- fitting/seizures.

Some people with diabetes develop impaired awareness of hypoglycaemia (IAH) resulting in a lack of early (neurogenic) warning signs of hypoglycaemia. IAH is more common in people with longstanding diabetes, those who have recurrent episodes of hypoglycaemia, those with tight glycaemic management, people who have autonomic neuropathy and the elderly.[35] Having IAH can increase the risk of severe hypoglycaemia and the need for help from others for treatment.

Treatment of hypoglycaemia

The procedure for treatment of hypoglycaemia may vary depending on the setting in which you work, your workplace policies and procedures and the preferences of the person with diabetes.

It is important that you are familiar with the requirements of your own workplace but following is the key steps to consider.

Step 1: If a person with diabetes reports or displays symptoms of hypoglycaemia, firstly ensure that they are safe i.e. seated and not at risk of falling.

Where possible, check the person's blood glucose level to confirm hypoglycaemia. However, if a confirmatory blood glucose check is not possible, treatment of hypoglycaemia should proceed.

Step 2: If the person is awake, alert and able to swallow, treat with quick-acting carbohydrate.

Initial treatment should be with 15g of quickly absorbed carbohydrate (young children will need smaller amounts). This could be one of the following but refer to your workplace treatment guidelines:

- glucose tablets, gels or powders equal to 15g carbohydrate
- 6-7 regular or 4 large jellybeans
- 125mls fruit juice
- 150mls sugar-sweetened soft drink
- 3 teaspoons honey or sugar (honey should not be given to children under 12 months)
- 100mls Lucozade®

Note: a liquid form of glucose should be used for those with gastroparesis.

Step 3: After 15 minutes, re-check the person's blood glucose level to ensure it is above 3.9mmol/L (ensuring they have washed their hands after eating), or if unable to check, ensure their symptoms have subsided. If their blood glucose remains low or symptoms persist, repeat the treatment.

Step 4: Once the person's blood glucose level is above 3.9mmol/L, provide them with an extra serve of slowly absorbed carbohydrate to maintain blood glucose levels if it is more than 30 minutes until the next meal or snack. Examples include a piece of fruit, slice of bread or glass of milk. This is not required for those on an insulin pump.

Step 5: Notify the person's diabetes/medical team, according to your workplace policy.

> **Prompt treatment of hypoglycaemia is essential. In a healthcare setting, all individuals who are at risk of hypoglycaemia should always have access to appropriate hypoglycaemia treatment and should be aware of how to access available hypoglycaemia treatments.**

Treatment of level 3 (severe) hypoglycaemia

Level 3 hypoglycaemia is where a person is confused or unconscious and requires outside assistance. Treatment depends on whether or not the person is conscious and still able to eat.[36]

If the person is conscious and can swallow:

- give quickly absorbed carbohydrate – glucose gels or honey are a good choice as they can reduce the risk of choking
- note: honey is not suitable for children under 12 months.

If the person is non-responsive or unconscious:

- do not give anything by mouth
- if unconscious, apply basic first aid as for any unconscious person: lie the person on their side and maintain a clear airway.

A Glucagon injection or IV dextrose can be administered to treat severe hypoglycaemia.

- Glucagon can be given by a health professional, relative or friend trained to administer it, depending on the setting (i.e. within or outside a healthcare facility). *Further information on the use of glucagon is provided on the following page.*
- IV dextrose can be given by a medical officer or ambulance officer.

Once the person is conscious:

- follow the treatment steps for mild hypoglycaemia
- continue to observe and monitor blood glucose levels until the blood glucose level is stable within the target range.

Notify all required people including the person's diabetes/medical team and family/carers, according to your workplace policy.

Glucagon

Glucagon is a hormone which can be injected in cases of severe hypoglycaemia. It works by stimulating the release of glucose from the liver and raises blood glucose within about 10 minutes after injection.[37.]

Key facts about glucagon:[36–38]

It is available on prescription to individuals with diabetes who use insulin and in healthcare settings.

- It can be administered by a health professional, family member or friend, depending on the setting (i.e. without or outside a healthcare facility).
- All individuals who may need to administer glucagon to a person with diabetes must be instructed in its use.
- In the hospital setting glucagon must be written on the medication chart and checked by two nurses prior to administration. Always follow your workplace policies and procedures.
- It can be injected subcutaneously or intramuscularly (IM) into the upper arm, thigh or the buttocks. In a hospital setting it is usually given IM but it is important to follow your hospital policies and procedures.
- It should be followed by oral hypoglycaemia treatment, once the person is conscious.
- It is dispensed as a dry powder in a vial together with a pre-filled liquid containing syringe and the powder and liquid need to be mixed together before administering.
- Can be stored at controlled room temperature (20-25 degrees Celsius) for up to 24 months.
- The expiry date must be checked before use and should be discarded and replaced if out of date.
- Side effects may include nausea, vomiting, temporary tachycardia and high blood pressure.
- Contraindications include allergies to glucagon or lactose, pheochromocytoma (adrenal tumour) or insulinoma (pancreatic tumour).
- It is less effective in type 2 diabetes as it stimulates insulin secretion as well as glycogenolysis but may be suitable in those treated with intensive insulin therapy, who have little of their own insulin production.
- It may not be effective for treatment of hypoglycaemia following excess alcohol intake.

Further learning

To learn more about glucagon:

- Watch this short video on administering glucagon: **youtube.com/watch?v=ZUlx6F63gj0**
- Read more about the Glucagen Hypokit here: **glucagenhypokit.com**

Workplace activity

Locate and review your workplace policies and procedures for the treatment of hypoglycaemia and identify where hypoglycaemia treatments (oral treatments and glucagon) are located in your workplace and which treatments are available.

Explain to a supervisor or mentor when you would use the different treatments for hypoglycaemia including when you would administer glucagon.

Your notes:

Supervisor or mentor signature:

Hypoglycaemia in the elderly

The elderly are at higher risk of hypoglycaemia due to reduced counter-regulatory mechanisms and polypharmacy.

The signs of hypoglycaemia may also be mistaken for neurological symptoms or dementia in an older person.

The consequences of hypoglycaemia in the elderly can be serious and include:[39–41]

- acute and long-term neurological changes
- cardiac events
- serious falls
- frailty
- repeat hospital admissions.

Taking steps to reduce the risk of hypoglycaemia in these individuals is therefore essential.

Further reading

If you work with older people with diabetes, it is particularly important to understand the risks of hypoglycaemia and how to reduce these risks. The following articles and resources provide further information on diabetes management in the elderly, including management of hypoglycaemia.

- Management of hypoglycemia in older adults with type 2 diabetes (Freeman, 2019)
  ncbi.nlm.nih.gov/pubmed/30724638
- Review of Hypoglycemia in the Older Adult: Clinical Implications and Management (Sicar, 2016)
  canadianjournalofdiabetes.com/article/S1499-2671(15)00814-X/pdf
- Diabetes Management in Aged Care handbook (NDSS)
  ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-management-in-aged-care
- McKellar Guidelines for Managing Older People with Diabetes in Residential and Other Care Settings
  adma.org.au/download/the-mckellar-guidelines

Workplace activity

Elsie is a 92yo woman living with type 2 diabetes prescribed insulin. She also has renal impairment, cardiovascular disease and peripheral neuropathy. Elsie is taking nine different medications for her various health conditions.

Elise has recently been experiencing episodes of confusion and agitation. Her appetite and food intake has also been variable, and she has lost 1.5kgs over the past month.

Explain to a supervisor or mentor Elsie's risk factors for hypoglycaemia and what you would recommend for her management.

Your notes:

Ask your supervisor or mentor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

Hypoglycaemia education

Individuals with diabetes who are at risk require education regarding hypoglycaemia including:

- recognising symptoms, treatment and prevention
- the need to always carry a source of fast-acting glucose for treatment
- the importance of prompt treatment of symptoms
- the use of glucagon (including training of a family member, friend or carer in its administration)
- the need to avoid hypoglycaemia while driving and during other potentially dangerous activities (e.g. operating machinery, swimming or diving)
- the importance of regular monitoring to detect and prevent hypoglycaemia, particularly before high-risk activities
- the need to inform their doctor/diabetes specialist if they are experiencing regular episodes of hypoglycaemia or have had a recent episode of severe hypoglycaemia (requiring assistance).

Driving

People with diabetes who drive and are at risk of hypoglycaemia should be aware of the need to:[42,43]

- check blood glucose levels before and every 2 hours during driving and not drive when below 5.0mmol/L
- always carry a blood glucose meter and quick-acting carbohydrate in the car
- pull over, stop the car and treat hypoglycaemia urgently if an episode occurs while driving
- wait at least 30 minutes after treating an episode of hypoglycaemia, and until their blood glucose level has returned to above 5mmol/L, and they are feeling well, before driving
- notify their doctor as soon as possible if they experience an episode of severe hypoglycaemia (in this case, they are unable to drive until they have medical clearance).

Having an episode of severe hypoglycaemia can increase the risk of a subsequent episode and puts a person with diabetes at risk when they drive. When someone has had an episode of severe hypoglycaemia they should be advised not to drive until they have medical clearance.[43] This is for the safety of everyone on the road.

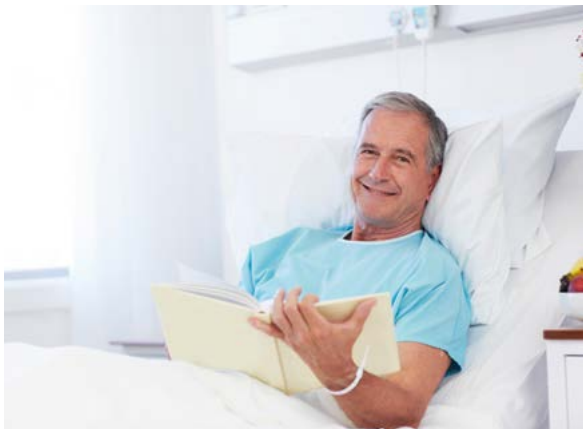
Being unable to drive can impact a person's independence and livelihood. For this reason, some people with diabetes may be hesitant to report an episode of severe hypoglycaemia to their health professionals. However, they should be encouraged to do so, so they can receive the help and support needed to reduce their risk of further episodes of hypoglycaemia.

More information can be found in the Austroads Assessing Fitness to Drive guidelines which can be found at: **austroads.com.au/drivers-and-vehicles/assessing-fitness-to-drive**

Workplace activity

John is a 58yo man living with type 2 diabetes. He was recently admitted to hospital after developing chest pain and has had a cardiac stent.

John has been prescribed insulin due to significant hyperglycaemia during his hospital admission. He will be discharged tomorrow and will remain on insulin until further review by his GP.



Explain to your supervisor or mentor what education would you provide to John about hypoglycaemia.

Your notes:

Supervisor or mentor signature:

When to refer

A person with diabetes should be referred to specialist diabetes services for assessment and medication review if:

- they are experiencing regular episodes of hypoglycaemia
- they have had an episode of severe hypoglycaemia (requiring assistance)
- they have impaired awareness of hypoglycaemia.

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes.

Download these resources related to hypoglycaemia and diabetes:

- **Managing hypoglycaemia**
  ndss.com.au/about-diabetes/resources/find-a-resource/managing-hypoglycaemia-fact-sheet
- **Diabetes and driving booklet**
  ndss.com.au/about-diabetes/resources/find-a-resource/understanding-type-2-diabetes-fact-sheet
- **Diabetes and driving: a quick guide**
  ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-and-driving-quick-guide

Assessment questions

Question 1: **Hypoglycaemia is defined as a blood glucose level below**

- [ ] **a.** 2.0mmol/L.
- [ ] **b.** 3.0mmol/L.
- [ ] **c.** 4.0mmol/L.
- [ ] **d.** 4.5mmol/L.
- [ ] **e.** 5.5mmol/L.

Question 2: **Hypoglycaemia is a risk:**

- [ ] **a.** Only in individuals with type 1 diabetes.
- [ ] **b.** Only in individuals taking insulin.
- [ ] **c.** In all individuals with diabetes.
- [ ] **d.** In all individuals with type 1 and some individuals with type 2 diabetes.
- [ ] **e.** In individuals taking either insulin or any type of oral glucose lowering agents.

Question 3: **Which of the following is not a common cause of hypoglycaemia?**

- [ ] **a.** Missing a meal or snack.
- [ ] **b.** Doing more exercise than usual.
- [ ] **c.** Drinking large amounts of alcohol.
- [ ] **d.** Eating a meal high in carbohydrate.
- [ ] **e.** Taking too much insulin with a meal.

Question 4: **Which of the following statements about hypoglycaemia is incorrect?**

- [ ] **a.** Symptoms can vary from one person to the next.
- [ ] **b.** Neurogenic symptoms include sweating, shaking and weakness.
- [ ] **c.** Neuroglycopenic symptoms occur before neurogenic symptoms.
- [ ] **d.** Some individuals lose their ability to detect early warning signs/symptoms.
- [ ] **e.** Immediate treatment is essential.

Question 5: **Choose all that are correct. Impaired awareness of hypoglycaemia:**

- [ ] **a.** Results in a loss of early warning signs of hypoglycaemia.
- [ ] **b.** Is more common in those with longstanding diabetes.
- [ ] **c.** Is less common in those who have recurrent episodes of hypoglycaemia.
- [ ] **d.** Is more common in those with tight glycaemic management.
- [ ] **e.** Increases the risk of severe hypoglycaemia.

Assessment answers

1. c
2. d
3. d
4. c
5. a, b, d and e
6. d
7. b, c and e
8. b
9. a, b, c and e
10. e

Question 6: **Which of the following is incorrect about the treatment of mild hypoglycaemia?**

- **a.** Initial treatment should be with 15g of rapid-acting carbohydrate.
- **b.** Treatment should be repeated if the blood glucose remains low after 15 minutes.
- **c.** Good choices for a hypo treatment include glucose tablets, glucose gels, fruit juice or regular (not diet) soft drink.
- **d.** Good choices for a hypo treatment include chocolate and boiled lollies.
- **e.** Initial treatment should be followed by a snack containing 15g of slowly absorbed carbohydrate, unless a meal is due within 30 minutes.

Question 7: **Choose all that apply: Glucagon:**

- **a.** Is an injection of glucose used to treat hypoglycaemia?
- **b.** Is a hormone which stimulates the release of glucose from the liver.
- **c.** Is used if a person with diabetes is unconscious due to hypoglycaemia.
- **d.** Can only be administered by a medical practitioner.
- **e.** Should only be administered by someone trained in its use.

Question 8: **Which of the following is incorrect about hypoglycaemia in the elderly?**

- **a.** The risk of hypoglycaemia is higher in the elderly.
- **b.** The risk of hypoglycaemia is lower in the elderly.
- **c.** The signs of hypoglycaemia may be mistaken for neurological symptoms or dementia in the elderly.
- **d.** Hypoglycaemia may result in serious falls in the elderly.
- **e.** It is important to minimise the risk of hypoglycaemia in the elderly.

Question 9: **Choose all that apply. People with diabetes at risk of hypoglycaemia:**

- **a.** Should be provided with education on the symptoms, treatment and prevention of hypoglycaemia.
- **b.** Should be encouraged to always carry a source of fast-acting glucose for treatment of hypoglycaemia.
- **c.** Should understand the importance of prompt treatment of symptoms.
- **d.** Should not be concerned about frequent episodes of hypoglycaemia unless they need assistance with treatment.
- **e.** Should be encouraged to inform their doctor/diabetes specialist if they are experiencing regular episodes of hypoglycaemia.

Question 10: **Which of the following is incorrect? People with diabetes who are at risk of hypoglycaemia and drive should:**

- **a.** Check their blood glucose before and every 2 hours during driving.
- **b.** Not drive when their blood glucose level is below 5.0mmol/L.
- **c.** Always keep food for treatment of hypoglycaemia in their car.
- **d.** If they experience hypoglycaemia when driving, stop and treat their hypo urgently.
- **e.** Resume driving as soon as they have consumed their hypo treatment.

Module 4: Hyperglycaemia

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 11: Hyperglycaemia.

Learning objectives

On completion of this module you will be able to:

- ☐ **1.** State typical blood glucose range and define hyperglycaemia.
- ☐ **2.** Describe signs and symptoms of hyperglycaemia, and when care requires escalation.
- ☐ **3.** Identify possible causes of hyperglycaemia e.g. forgotten or missed medication, concurrent illness.
- ☐ **4.** Describe the effect of hyperglycaemia on the development of health issues.
- ☐ **5.** Describe basic information about steroid-induced hyperglycaemia, identify individuals at risk and identify when to escalate care.
- ☐ **6.** Recognise when monitoring of glucose levels is required for those at increased risk of steroid-induced hyperglycaemia and recognise when to refer on for specialist advice.
- ☐ **7.** Define diabetic ketoacidosis (DKA) and possible causes of DKA.
- ☐ **8.** Describe signs and symptoms of DKA.
- ☐ **9.** Describe DKA management guidelines.
- ☐ **10.** Define Hyperosmolar Hyperglycaemic State (HHS) and people at risk of HHS.
- ☐ **11.** Describe appropriate monitoring for hyperglycaemia and treatment for type 1 and 2 diabetes.

What is hyperglycaemia?

Hyperglycaemia is defined as a high blood glucose level – a level which is above an individual's target blood glucose range. Hyperglycaemia can occur in all individuals with diabetes, regardless of the type of diabetes they have or the treatment. It can develop slowly or rapidly, depending on the circumstances.

Common causes of hyperglycaemia

Common causes of hyperglycaemia include:

- concurrent infection or illness
- emotional or physical stress
- decreased activity levels
- diabetes medication issues including insufficient diabetes medication, forgetting or omitting diabetes medication or incorrect administration or timing of diabetes medication
- certain medications e.g. steroids (discussed further on the next page)
- excess food intake or food not matched with insulin or medication.

Signs and symptoms of hyperglycaemia

With mild hyperglycaemia, a person may not have any obvious symptoms. If they develop gradually, symptoms may go unrecognised or be attributed to other factors such as ageing. For many people symptoms may not occur until blood glucose levels are significantly elevated (e.g. around 15mmol/L).

In undiagnosed or untreated type 2 diabetes, symptoms often develop gradually over time while in undiagnosed type 1 diabetes, or situations of insulin deficiency in type 1 diabetes, symptoms usually develop rapidly. In situations of illness or infection, in both type 1 and type 2 diabetes, symptoms can develop rapidly.

Common symptoms include:[28]

- polyuria
- polydipsia
- fatigue/lethargy
- blurred vision
- recurrent and persistent infections (e.g. thrush, skin infections)
- weight loss.

If not detected and treated early, hyperglycaemia can develop into a hyperglycaemic emergency:

- Diabetic ketoacidosis (DKA) – usually in type 1 diabetes
- Hyperosmolar Hyperglycaemic State (HHS) – usually in older adults with type 2 diabetes

DKA and HHS will be discussed in more detail later in this module.

Effects of persistent hyperglycaemia

Persistent high blood glucose levels increase the risk of developing long-term diabetes-related health conditions including:

- microvascular (small blood vessel) health conditions
- macrovascular (large blood vessel) health conditions.

The adverse effects of hyperglycaemia are explored further in the National Diabetes Nursing Education Framework online learning modules, which can be accessed at **healthprofessionals.learnupon.com**

High blood glucose levels can also impact the immune system, increasing the risk of infections and compromising recovery.

Steroid-induced hyperglycaemia

Glucocorticoid (steroid) medications are widely used for their anti-inflammatory and immunosuppressive properties but have several side effects, hyperglycaemia being one of the most common[44.]

Several mechanisms by which glucocorticoids contribute to hyperglycaemia include[44]:

- increasing insulin resistance
- increasing glucose production
- inhibiting the production and secretion of insulin by the pancreatic beta-cells.

Glucocorticoids can impact blood glucose levels in people living with or without diabetes, inducing hyperglycaemia in those with previously normal glucose tolerance, and increasing blood glucose levels and medication needs in those with pre-existing diabetes. Studies of glucocorticoid use in hospital have shown that hyperglycaemia is common, occurring in 64-70% of individuals treated with these medications[45,46] dexamethasone 4. mg/day, hydrocortisone 100. mg/day, or more.

The majority of cases develop within 1-2 days of individuals commencing glucocorticoid treatment45. Risk factors for the development of hyperglycaemia include having diabetes, a higher prevalence of comorbidities, older age and a higher dose and/or prolonged treatment with steroids[44,47].

Considering the frequency of steroid-induced hyperglycaemia in individuals in hospital who are treated with glucocorticoids, it is important to consider the following before these medications are used:[47]

- undiagnosed diabetes should be excluded prior to administering glucocorticoid medications
- those with diagnosed diabetes will likely need to commence insulin, or adjust their insulin doses if already using insulin
- individuals without diabetes should have blood glucose levels checked in the afternoon following morning administration of steroids, to screen for the development of hyperglycaemia
- if hyperglycaemia develops, it usually requires management with insulin but in mild cases, oral glucose lowering medications may be used
- for those who require insulin, dose requirements need to be individualised and require daily review.

Workplace activity

Margaret is an 85yo woman living with type 2 diabetes, diagnosed when she was 62yo.

She lives alone in an independent unit in a retirement village.

Margaret manages her diabetes with glucose-lowering medication -Diabex 850mg bd. She does not self-monitor her blood glucose levels but sees her general practitioner regularly for management of her diabetes and other health conditions.

Margaret also has a history of cardiovascular disease, retinopathy, peripheral neuropathy, stage 3 chronic kidney disease and mild Chronic Obstructive Pulmonary Disease (COPD). Her medications include Diabex, Crestor, Ramipril and Aspirin. Margaret was admitted to hospital with exacerbation of her COPD over winter. The decision is made by her medical team to start Margaret on high dose glucocorticoids for treatment of her COPD.

Explain to your supervisor or mentor your plan for monitoring and managing Margaret's diabetes during her treatment with glucocorticoids.

Your notes:

Ask your supervisor or mentor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

Diabetic Ketoacidosis (DKA)

DKA occurs mainly in people with type 1 diabetes but can also develop in some individuals with type 2 diabetes.[48,49] It results from lack of insulin preventing glucose from being used as a fuel. When the body has insufficient insulin to use glucose as a fuel, it starts breaking down fat, resulting in the production of ketones. As ketone levels increase in the blood, ketoacidosis develops, resulting in metabolic decompensation.

Key facts about DKA:[48,49]

- Occurs most commonly in newly diagnosed type 1 diabetes.
- Can occur in those who have a known diagnosis, particularly during times of illness or infection (especially when dehydrated, during and post- surgery), if they accidentally or intentionally do not take insulin or in those using an insulin pump, if the pump fails to deliver insulin.
- While uncommon, it can also occur in some individuals with type 2 diabetes and individuals taking sodium-glucose co-transporter 2 inhibitors (SGLT2i) can develop DKA without elevated blood glucose levels (known as euglycaemic DKA).[50]

DKA is a medical emergency and requires hospitalisation. Treatment involves correcting fluid and electrolyte imbalances, reversal of the hyperglycaemia (usually with an insulin infusion) and treatment of the precipitating causes (e.g. antibiotics for an infection).[48,49]

Typical symptoms of DKA include:

- tiredness/drowsiness
- dry or flushed skin
- nausea, vomiting, or abdominal pain
- rapid deep breathing (Kussmaul's respiration)
- ketotic breath (a fruity, acetone-like odour)
- confusion/disorientation.

The risk of DKA can be reduced by ensuring that all individuals with type 1 diabetes, those with type 2 diabetes who are taking SGLT2 inhibitors, and their family/carers are provided with education on the risk of DKA and risk reduction strategies.

Individuals with type 1 diabetes (and/or their family/carers) should be encouraged to:

- always have access to a blood ketone meter, in-date blood or urine ketone test strips and an up-to-date sick day management plan
- monitor ketones whenever they are ill or have an infection, particularly if they are vomiting or unable to eat or drink
- monitor ketones when their blood glucose levels are consistently high (over 15mmol/L), particularly if they are feeling unwell
- monitor ketones if they have any symptoms of DKA.

Individuals with type 2 diabetes who are taking SGLT2 inhibitors (and/or their family/carers) should be advised to cease these medications and may be advised to perform ketone monitoring:

- if they are ill or have an infection, particularly if they are vomiting or unable to eat or drink
- if they are fasting for surgery or a medical procedure
- if they have any symptoms of DKA.

DKA and SGLT2 inhibitors

The Australian Diabetes Society recommends considering DKA in people taking Sodium-glucose co-transporter-2 inhibitors (SGLT2i) if they:[29,30]

- develop abdominal pain, nausea, vomiting, fatigue or unexplained acidosis, even with normal or only modestly elevated blood glucose levels
- have a finger prick capillary blood ketone (or blood beta-hydroxybutyrate) levels >1.0 mmol/L in the perioperative period or >1.5 mmol/L at any other time
- have a low pH (<7.3 on venous blood gas or <7.35 on arterial blood gas) and low bicarbonate (<15mmol/L) and a high anion gap (>12), indicating metabolic acidosis.

They also advise regular blood glucose and blood ketone measures in the perioperative period if the person is unwell or is fasting or has limited oral intake and has been on an SGLT2i prior to surgery.

Note: SGLT2i include dapagliflozin (Forxiga), empagliflozin (Jardiance), ertugliflozin (Steglatro) and combination medication (Xigduo, Jardiamet, Segluromet, Glyxambi, Qtern, Steglujan).

Workplace activity

David is a 28yo man living with type 1 diabetes, diagnosed when he was 8 years of age.

He lives with two housemates and works full time as an IT consultant.

David manages his diabetes with multiple daily injections using Novorapid and Optisulin and regular blood glucose monitoring. He has no other medical history and does not take any other medications.

David's girlfriend brought him into emergency due to drowsiness, fever, cough, abdominal pain and vomiting and he was found to have diabetic ketoacidosis (DKA).

In discussing with David the events leading up to his admission you find that his fever and cough had started two days prior to his admission and for around 24 hours before his girlfriend brought him to hospital, he was barely able to eat or drink. David did not have a sick day plan and had reduced his insulin doses due to concern about the risk of hypoglycaemia when he was unable to eat.

Your notes:

Discuss your answers to the following questions with your supervisor or mentor.

1. What are the likely precipitating factors leading to David's hospital admission?
2. What are the steps that need to be taken to manage his initial presentation with DKA?
3. How could David's development of DKA have been prevented?

Ask your supervisor or mentor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

You can learn more about David and the management of DKA in hospital in the online case study available at **healthprofessionals.learnupon.com**

Hyperosmolar Hyperglycaemic State (HHS)

HHS occurs in people with type 2 diabetes and is more common in older individuals.[48,49] It is characterised by extremely high blood glucose levels and dehydration in the absence of ketones. Individuals with type 2 diabetes usually have sufficient endogenous insulin production to prevent ketone production.

Key facts about HHS:[48,49]

More common in older individuals.

- Usually occurs as a result of severe physical stress or illness such as a heart attack or stroke, burns, infection, vomiting or diarrhoea.
- Risks can be increased with use of certain medications (e.g. corticosteroids and atypical antipsychotics), excess alcohol and recreational drugs.
- Can be the first presentation of diabetes.
- Blood glucose levels are often above 40mmol/L.

Like DKA, HHS is a medical emergency and requires hospitalisation. Treatment includes replacement of fluids and electrolytes, stabilisation of blood glucose levels and treatment of the precipitating cause.[48,49] HHS has a high mortality rate.

Typical symptoms of HHS include:

- thirst
- dry mouth
- polyuria
- dehydration (can be extreme)
- altered state of consciousness.

The risks of HHS can be reduced by ensuring that all individuals with type 2 diabetes, particularly the elderly and those caring for them, are educated on the risks of HHS, particularly when they are unwell.

People with type 2 diabetes and their carers should be educated to:

- monitor blood glucose levels regularly while unwell and seek medical assistance if blood glucose levels are persistently rising
- ensure an adequate fluid intake, particularly if taking diuretics, if suffering vomiting or diarrhoea or in hot weather
- seek prompt medical attention for illness and infections.

Emergency management of hyperglycaemia in primary care

If you work in primary care, the Royal Australian College of General Practitioners (RACGP) provide a guide to emergency management of hyperglycaemia in primary care.[51]

The full guide is available from their website: **racgp.org.au/clinical-resources/clinical-guidelines/key-racgp-guidelines/view-all-racgp-guidelines/emergency-management-of-hyperglycaemia** but the flowchart below summarises the management of people with known diabetes who present with hyperglycaemia.

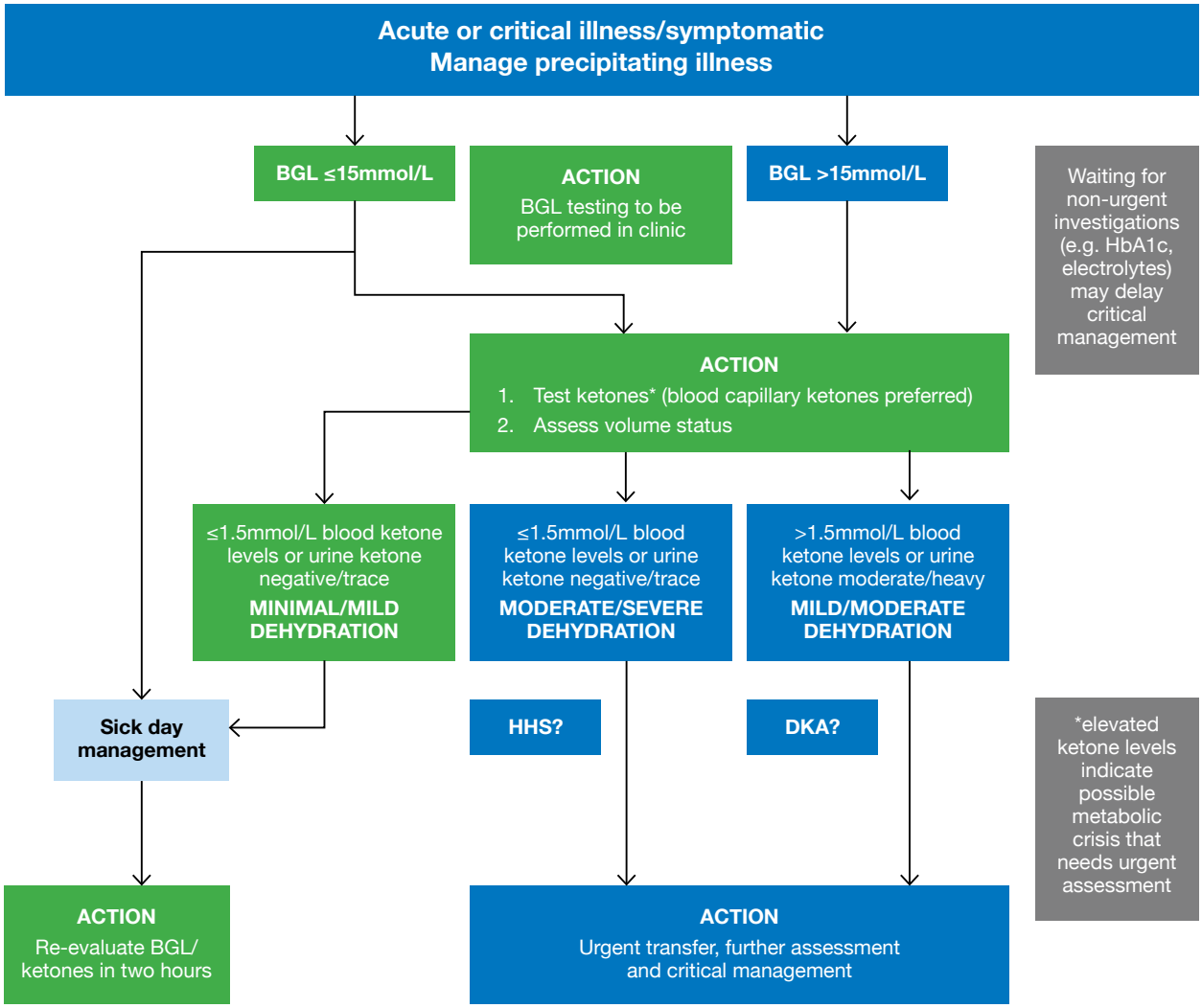


Figure 8: **Management of hyperglycaemia in primary care**

Workplace activity

Giovanni is a 62yo man living with type 2 diabetes. His current diabetes treatment includes metformin and Forxiga.

Giovanni presents with a three-day history of feeling unwell including fatigue, thirst, polyuria, nausea and loss of appetite.

Locate and review your workplace policies and procedures for the treatment of hyperglycaemia, including DKA and HHS. Record your findings below.

Explain to a work supervisor or mentor how you would recommend assessing and managing Giovanni.

Your notes:

Supervisor or mentor signature:

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes.

Download these resources related to sick day management and diabetes:

- **Managing sick days for type 1 diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/managing-sick-days-for-type-1-diabetes-fact-sheet
- **Managing sick days for type 2 diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/managing-sick-days-for-type-2-diabetes-fact-sheet
- **Steroid medications and diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/steroid-medications-and-diabetes-fact-sheet

Assessment questions

Question 1: **Choose all that apply. Symptoms of hyperglycaemia:**

- [ ] **a.** May initially go undetected.
- [ ] **b.** Only develop slowly.
- [ ] **c.** Include polydipsia, polyuria and fatigue.
- [ ] **d.** Include feeling weak, shaky and sweaty.
- [ ] **e.** Can lead to a hyperglycaemic emergency if not detected and treated.

Question 2: **Which of the following is not a common cause of hyperglycaemia?**

- [ ] **a.** Forgetting or missing medication.
- [ ] **b.** Being less active than usual.
- [ ] **c.** Illness or infection.
- [ ] **d.** Taking certain medications, such as cortisone.
- [ ] **e.** Eating less than usual without adjusting insulin/medication.

Question 3: **Which of the following statements are incorrect? Persistent hyperglycaemia:**

- [ ] **a.** Increases the risk of microvascular health conditions.
- [ ] **b.** Increases the risk of macrovascular health conditions.
- [ ] **c.** Improves immunity.
- [ ] **d.** Increases the risk of infection.
- [ ] **e.** Slows recovery from illness or infection.

Question 4: **Choose all that apply: Steroid-induced hyperglycaemia:**

- [ ] **a.** Only occurs in individuals with diagnosed diabetes.
- [ ] **b.** Is common in individuals in hospital who are treated with glucocorticoids.
- [ ] **c.** Is best managed with oral glucose lowering agents.
- [ ] **d.** Is best managed with insulin in the hospital setting.
- [ ] **e.** Can be screened for in those without diabetes by checking random blood glucose level in the afternoon following morning administration of glucocorticoids.

Question 5: **Which of the following about DKA is incorrect?**

- [ ] **a.** It is the abbreviation for diabetic ketoacidosis.
- [ ] **b.** It only occurs in people with type 1 diabetes.
- [ ] **c.** It is a medical emergency.
- [ ] **d.** It is caused by insulin deficiency and an inability to use glucose as fuel.
- [ ] **e.** It often develops when a person with diabetes is unwell.

Assessment answers

1. a, c and e
2. e
3. c
4. b, d and e
5. b
6. d
7. b
8. b, d and e
9. c
10. b and d

Question 6: **The treatment of DKA includes:**

- [ ] **a.** Hospitalisation.
- [ ] **b.** Replacement of fluids and electrolytes.
- [ ] **c.** Treatment of the precipitating cause.
- [ ] **d.** All of the above.
- [ ] **e.** None of the above.

Question 7: **Which of the following is not a common symptom of DKA?**

- [ ] **a.** Having dry or flushed skin.
- [ ] **b.** Excessive sweating.
- [ ] **c.** Nausea, vomiting and abdominal pain.
- [ ] **d.** Kussmaul's respiration.
- [ ] **e.** Confusion/disorientation.

Question 8: **Choose all that apply. HHS**

- [ ] **a.** Is the abbreviation for hyperosmolar hypoglycaemic state?
- [ ] **b.** Occurs in type 2 diabetes.
- [ ] **c.** Is characterised by extremely high blood glucose levels and ketones.
- [ ] **d.** Is more common in older individuals.
- [ ] **e.** Is a medical emergency.

Question 9: **Which of the following is incorrect? A Person with diabetes can reduce their risk of DKA or HHS by:**

- [ ] **a.** Monitoring blood glucose levels more regularly when unwell.
- [ ] **b.** Having a sick day management plan.
- [ ] **c.** Ceasing their insulin when unwell and unable to eat.
- [ ] **d.** Being aware of the symptoms of hyperglycaemia, DKA and HHS.
- [ ] **e.** Seeking medical advice promptly if they have an illness or infection which is not improving.

Question 10: **Which of the following individuals with diabetes should be provided with education on ketone monitoring?**

- [ ] **a.** All individuals with diabetes.
- [ ] **b.** All individuals with type 1 diabetes.
- [ ] **c.** Individuals with type 2 diabetes who are using oral glucose lowering agents.
- [ ] **d.** Individuals with type 2 diabetes who are taking SGLT2 inhibitors.
- [ ] **e.** All individuals who are taking insulin.

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Module 5: Diabetes medications

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 7: Medication monitoring – oral glucose lowering medication and aspect of care 9: Medication monitoring – injectable therapies.

Learning objectives

On completion of this module you will be able to:

- [ ] **1.** Outline the common types of oral glucose lowering medications and their mode of action.
- [ ] **2.** Explain indications for initiation of oral glucose lowering medications in people with pre-diabetes or type 2 diabetes.
- [ ] **3.** Describe contraindications/cautions for individual diabetes medications.
- [ ] **4.** Outline basic information about the timing of doses, especially in relation to meals
- [ ] **5.** Explain the effects of insulin on blood glucose level.
- [ ] **6.** Explain the effects of GLP-1 receptor agonists on blood glucose level
- [ ] **7.** Outline insulin therapy including action, profile, types, dosing and side effects (e.g. hypoglycaemia)
- [ ] **8.** Outline GLP-1 receptor agonists including type, action, dosing and side effects.
- [ ] **9.** Recognise devices used to deliver insulin and other injectable medications.
- [ ] **10.** Describe when the insulin dose may need to be altered and where to refer.
- [ ] **11.** Describe how to prepare and safely administer insulin and GLP-1 receptor agonists.
- [ ] **12.** Describe required storage and disposal of insulin syringes pen needles and lancets.
- [ ] **13.** Explain preferred insulin injection sites and explain the need for site rotation.
- [ ] **14.** Describe the presentation of lipohypertrophy.
- [ ] **15.** Explain the need to identify lipohypertrophy and avoid administration of insulin into affected areas.

- [ ] **16.** Explain to the person with diabetes the risks and benefits of taking or not taking a medication.

- [ ] **17.** Recognise the need for people with diabetes having surgery to be referred to either a Credentialled Diabetes Educator, doctor or nurse practitioner for pre-operative assessment, and perioperative advice and management of oral glucose lowering medications or insulin therapy.

- [ ] **18.** Identify local reporting systems for diabetes medication errors and needle stick injuries.

- [ ] **19.** Identify relevant legislation relating to diabetes medication including the relevant Poisons Act.

Oral glucose lowering agents

While many individuals with type 2 diabetes will initially manage their blood glucose levels with lifestyle modification, most will need medication over time. There are several different classes of oral glucose lowering agents available, all of which work in different ways to lower blood glucose levels. Many people with diabetes will need a combination of different oral glucose lowering agents to manage their blood glucose levels.

The six main classes of oral glucose lowering medications are:

- Biguanides
- Sulphonylureas
- Glitazones
- DPP-4 inhibitors
- Alpha-glucosidase inhibitors
- SGLT2 inhibitors.

The action, side effects, contraindications and precautions of each of these medications are discussed on the following pages, along with the drug and brand names within each class of medications.[52,53]

There are also several oral glucose lowering agents that combine two different drugs into a single tablet. These may be prescribed as an alternative to taking these medications separately. Side effects and precautions are similar to those of the single medications.

Further learning

To learn more about oral glucose lowering medications:

- The Australian Diabetes Society Australian Blood Glucose Treatment Algorithm for type 2 diabetes summarises the main glucose lowering agents (both injectable and oral) along with mechanisms of action, side effects, contraindications and administration.[52] You can download a copy by visiting: **t2d.diabetessociety.com.au/plan**
- You can also learn more about the use of oral glucose lowering agents for diabetes, by watching this short video: Treating type II diabetes – Pharmacology which can be viewed at: **khanacademy.org/science/health-and-medicine/endocrine-system-diseases/diabetes/v/treating-type-ii-diabetes-pharmacology**

Sulfonylureas (SU)

Sulphonylureas (SU) stimulate the production of insulin by the pancreas, independent of glucose.

Drug names	glibenclamide, gliclazide, gliclazide MR, glimepiride, glipizide
Brand names	include Diamicron®, Minidiab®, Glyade®, Amaryl®, Dimirel®, Daonil®, Glimel®
Side effects	weight gain
Contraindications	severe renal or hepatic impairment
Precautions	can cause hypoglycaemia
Timing of doses	take just before meals
Slow-release preparation available?	Yes

Biguanide/Metformin

Biguanides reduce hepatic (liver) glucose production, increase insulin sensitivity and lower fasting blood glucose levels.

Drug names	metformin, metformin XR
Brand names	include Diabex®, Diaformin®, Metex®, Formet®, Metformin®
Side effects	gastrointestinal (nausea, diarrhoea, bloating, indigestion, abdominal cramps), metallic taste in mouth
Contraindications	renal impairment (eGFR <30), severe hepatic impairment
Precautions	can cause lactic acidosis; can reduce absorption of vitamin B12; should be withheld 48 hours prior to procedures requiring intravenous contrast, surgery of if likely to become dehydrated
Timing of doses	take with or directly after food
Slow-release preparation available?	Yes

SGLT2 inhibitors

Sodium-glucose co-transporter-2 (SGLT2) inhibitors: lower the renal threshold for glucose and reduce glucose reabsorption, thereby increasing urinary glucose excretion.

Drug names	dapagliflozin, empagliflozin, ertugliflozin
Brand names	include Forxiga®, Jardiance®, Steglatro®
Side effects	genitourinary infections, genital candidiasis, dizziness, dehydration, hypotension
Contraindications	
Precautions	avoid use with loop diuretics; reduced efficacy with renal impairment; can cause euglycaemic DKA, particularly in association with fasting and surgery
Timing of doses	can be taken with or without food
Slow-release preparation available?	No

Glitazones/Thiazolidinedlones (TZD)

Thiazolidinediones (TZD) improve insulin sensitivity.

Drug names	pioglitazone, rosiglitazone
Brand names	include Actos®, Avandia®
Side effects	fluid retention, weight gain
Contraindications	symptomatic heart failure
Precautions	increased risk of bone fracture
Timing of doses	take with or without food but at a similar time each day
Slow-release preparation available?	No

DPP-4 inhibitors

Dipeptidyl peptidase-4 (DPP-4) inhibitors improve the body's ability to lower blood glucose levels when they are elevated by increasing the levels of hormones that stimulate the production and release of insulin from the pancreas and reduce the production of glucose by the liver.

Drug names	alogliptin, linagliptin, saxagliptin, sitagliptin, vildagliptin
Brand names	include Januvia®, Galvus®, Trajenta®, Onglyza®, Nesina®
Side effects	respiratory tract infections, common cold symptoms (runny nose, cough, sore throat), gastrointestinal symptoms, skin rash
Contraindications	pancreatitis
Precautions	dose adjustment needed in renal impairment (except linagliptin)
Timing of doses	can be taken with or without food
Slow-release preparation available?	No

Alpha-1 glucosidase inhibitors

Alpha-1 glucosidase inhibitors slow down the digestion and absorption of glucose from the gut, reducing postprandial glucose levels.

Drug names	Acarbose
Brand names	include Glucobay®
Side effects	flatulence, bloating, diarrhoea
Contraindications	severe renal impairment (eGFR <30)
Precautions	if taken with another medication that can cause hypoglycaemia, glucose should be used for treatment of hypos rather than other forms of carbohydrate
Timing of doses	take just before food
Slow-release preparation available?	No

Injectable diabetes medications

An increasing number of Australians are injecting diabetes medicines. This is due to:[54]

- an increasing prevalence of diabetes (both type 1 and type 2)
- the move to earlier insulin use in type 2 diabetes
- the newer classes of non-insulin injectable medicines for type 2 diabetes.

According to the National Diabetes Services Scheme (NDSS), in March 2021 there were 458,915 Australians with diabetes registered as requiring insulin, representing 32% of all people registered with diabetes.[55]

Of these:[55]

- 28% were identified as having type 1 diabetes
- 67% were identified as having type 2 diabetes
- 4% were identified as having gestational diabetes.

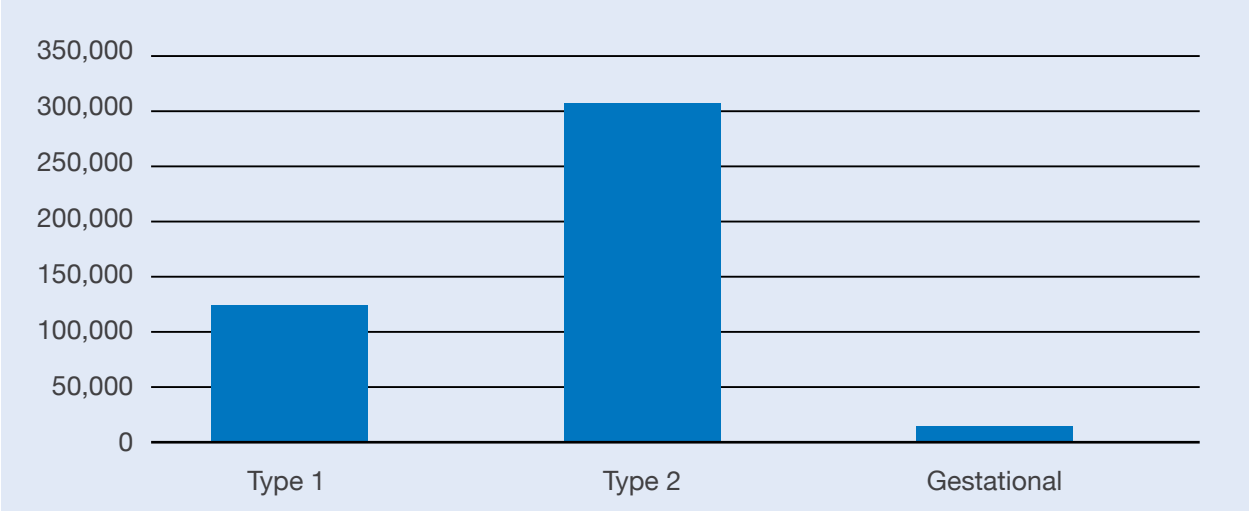

Figure 9: **People with diabetes requiring insulin by diabetes type**

Source: ndss.com.au/about-the-ndss/diabetes-facts-and-figures/diabetes-data-snapshots

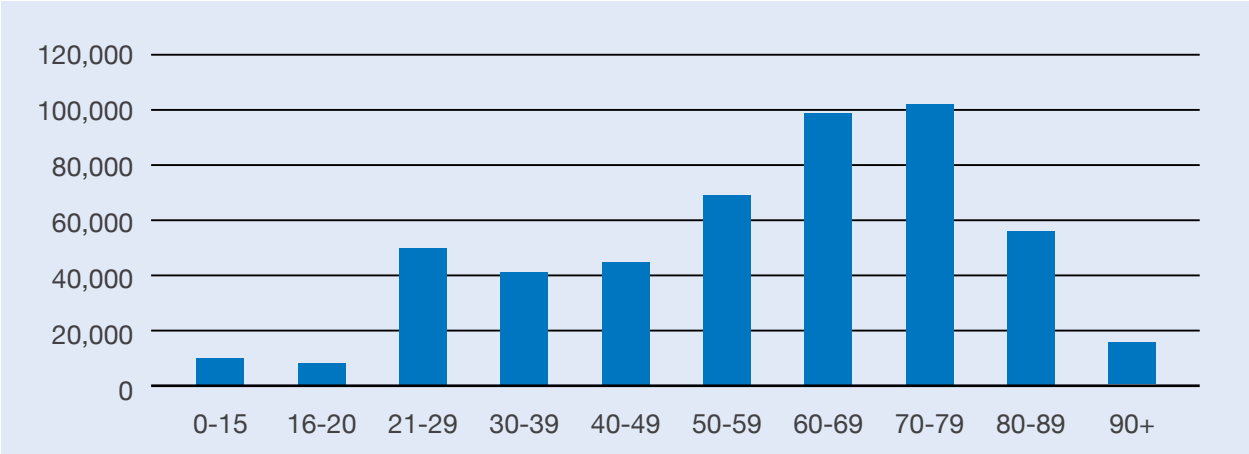

Figure 13: **People with diabetes requiring insulin by age group**

Source: ndss.com.au/about-the-ndss/diabetes-facts-and-figures/diabetes-data-snapshots

Types of injectable medications

There are two main types of injectable medications used for treating diabetes.

- Insulin is the only treatment for type 1 diabetes and is also used by many people with type 2 diabetes and some women with gestational diabetes.
- Non-insulin injectable medications, called incretin mimetics (GLP-1 receptor agonists), are used for treatment of type 2 diabetes.

Insulin lowers blood glucose levels by taking glucose from the bloodstream into the muscle cells to use for energy.

Insulin:

- is available in several different types (rapid-acting, short-acting, intermediate-acting, long-acting and mixed) and brands
- can only be given by injection (syringe or pen) or an insulin pump (or intravenously in a hospital setting)
- doses can vary widely between individuals and need to be carefully matched with food intake and activity levels to keep blood glucose levels within the target range and to reduce the risk of hypoglycaemia or hyperglycaemia.

Non-insulin injectable diabetes medications mimic the effect of the body's own 'incretin hormones'. Known as glucagon-like peptide-1 (GLP-1) agonists, they bind to GLP-1 receptors and stimulate glucose-dependent insulin release, helping with postprandial glycaemia. They also reduce the release of glucose from the liver and slow glucose absorption from the gut.

Non-insulin injectable diabetes medications:

- are currently available as several types and brands
- are given as a fixed dose, sometimes starting with a lower initiation dose before increasing to the maximum
- can help with weight loss by slowing down digestion inducing a feeling of fullness
- common side effects include nausea and vomiting; may also cause diarrhoea or constipation and reflux
- are contraindicated if the person has had pancreatitis or pancreatic cancer
- are taken using a pen device.

Insulin types and actions

Just as there are many different types and brands of tablets for diabetes, insulin comes in many different forms.

- Long and intermediate-acting insulins are usually taken once or twice a day and provide a 'background' dose of insulin (known as basal).
- Rapid and short-acting insulins are taken with meals to cover the rise in blood glucose level that occurs with eating (known as bolus).
- Mixed insulins combine a rapid or short-acting with a long or intermediate-acting insulin in one medication.

Type	Action	Medication names
Ultra rapid-acting	onset in 5–10 minutes, peak at 30 minutes, duration for 3.5–4 hours	Fiasp® (insulin aspart)
Rapid-acting	onset in 15–20 minutes, peak at 1 hour, duration for 3.5–4.5 hours	Novorapid® (insulin aspart) Humalog® (insulin lispro) Apidra® (insulin glulisine)
Short-acting	onset in ~1 hour, peak at 2-5 hours, duration for 6-8 hours	Actrapid® Humulin® R
Intermediate-acting	onset ~90 minutes, peak at 4-12 hours, duration for 16-24 hours	Protaphane® Humulin® NPH
Long-acting	Onset in 3-4 hours, peak at 3-8 hours, duration for 20–24 hours Onset in 1-2 hours, peakless duration for 18–24 hours Onset in 1-2 hours, peakless, duration for 24–36 hours	Levemir® (insulin determir) Optisulin® (insulin glargine) Semglee® (insulin glargine) Toujeo® (insulin glargine)
Pre-mixed	Onset in 15–20 minutes, peak at 1 hour, duration for 14–24 hours Onset in one to two hours, peak at 2-5 hours, duration for 12–18 hours Onset in 5–20 minutes, peak at one hour, duration for 36–48 hours	Humalog® Mix 25 Humalog® Mix 50 Novomix® 30 Mixtard® 30/70 Mixtard® 50/50 Humulin® 30/70 Ryzodeg® 70/30

Adapted from: Management of type 2 diabetes: A handbook for general practice (RACGP, 2020)[15]

Non-insulin injectable diabetes medications

There are several different injectable medications available in Australia. The drug and brand names, dosage options and timing are outlined in the table below.[52]

Drug name	Brand name	Dosage	Timing
Exenatide	Byetta	Twice daily 5mcg or 10mcg	Within 60 minutes before the morning and evening meals
Liraglutide	Victoza	Once daily 0.6mg 1.2mg or 1.8mg	Any time with or without meals
Dulaglutide	Trulicity	Once weekly 1.5mg	Any time with or without meals
Lixisenatide	Lyxumia	Once daily 10mcg or 20mcg	Within 60 minutes before the first meal of the day
Semaglutide	Ozempic	Once weekly 0.25mg, 0.5mg or 1.0mg	Any time with or without meals

To find out more about these medications, The Australian Diabetes Society Australian Blood Glucose Treatment Algorithm for type 2 diabetes summarises the main glucose lowering agents (both injectable and oral) along with mechanisms of action, side effects, contraindications and administration. You can download a copy by visiting: **t2d.diabetessociety.com.au/plan**

Each injectable medication comes with its own pre-filled pen device. Instructions for using each of the devices can be found by visiting the following links:

- Byetta
  byetta.com/taking-byetta/byetta-resource-center.html
- Victoza
  victoza.com/getting-started-on-victoza-/your-first-injection.html
- Trulicity
  trulicity.com/how-to-use
- Lyxumia
  ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/pdf?OpenAgent&id=CP-2013-CMI-01712-1
- Ozempic
  ozempic.com/how-to-use/the-ozempic-pen.html

Injection technique

Administering injectable medications requires consideration of several factors including:

- choosing the right injection site(s) for each individual
- detecting and avoiding areas of lipohypertrophy
- correctly preparing and using insulin pen devices and syringes
- deciding on whether a lifted skinfold is needed.

Injection sites

The most commonly recommended site for subcutaneous injections is the abdomen due to its convenience and tendency to more rapid and reproducible insulin uptake.[54] The buttocks thigh and upper arms may also be used however the risk of intramuscular injection is higher with the thighs and arms, particularly the arms. The difference in absorption between sites needs to be considered for some types of insulin e.g. Regular and Neutral Protamine Hagedorn (NPH).

- **Abdomen:** injections should be given at least 1cm above the symphysis pubis 1cm below the lowest rib and 1cm away from the umbilicus.
- **Thighs:** injections should be given in the upper third anterior lateral aspects of both thighs.
- **Buttocks:** injections should be given in the upper outer part of the buttocks.
- **In all cases**, areas of lipohypertrophy and scar tissue should be avoided.

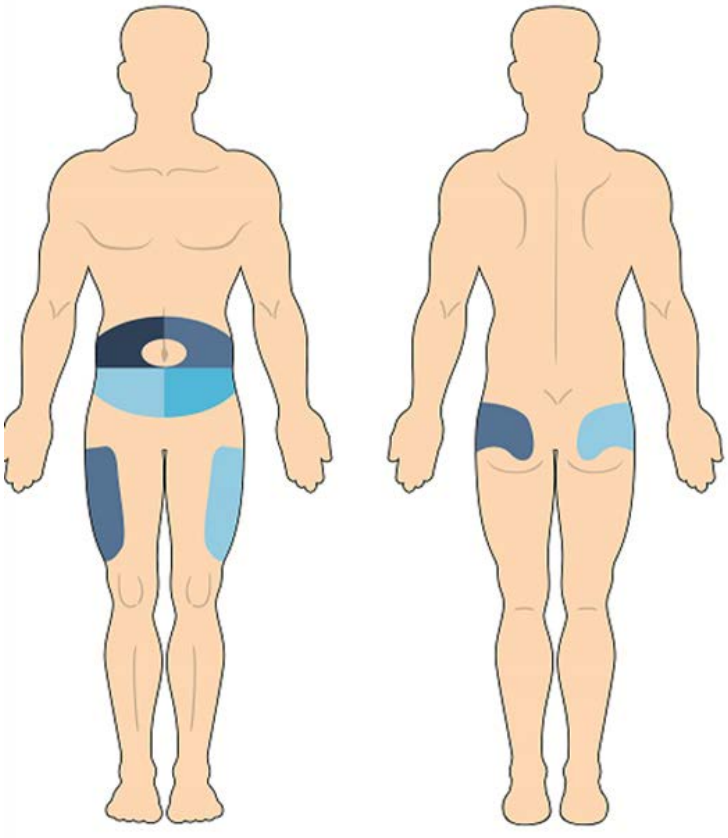

Figure 13: Injection sites

Image provided by BD Diabetes Care Australia.

The choice of injection site for each individual will depend on a number of factors including:[54]

- the preferences of the person with diabetes
- age
- body composition/amount of adipose tissue in different sites
- the length of the needle being used
- the type of insulin being administered.

Site rotation is important for reducing the risk of lipohypertrophy. In healthcare facilities documentation of injection site in the medication chart at time of administration will facilitate rotation of sites when injections are given by different staff.[54]

One effective method of rotation is to divide the injection site into quadrants (abdomen) or halves (buttock or thigh) using one quadrant per week and moving clockwise around this area. Injections within each area should be spaced at least 1cm apart.[54]

Lipohypertrophy (LH)

Lipohypertrophy (LH) is an area of thickened subcutaneous tissue at injection sites. Areas of LH may be hard or scar-like, or soft like a rubber ball.

LH is a common injection site problem in people with diabetes. Studies have shown that it may affect close to 40% of people with diabetes who inject insulin.[56]

Several factors can increase the risk of someone developing LH at injection sites. A person is more likely to develop LH if they:[57–62]

- have a longer duration of diabetes
- have a longer duration of insulin use
- give a higher number of injections each day
- do not rotate their injection sites i.e. repeatedly inject in the same areas
- reuse needles.

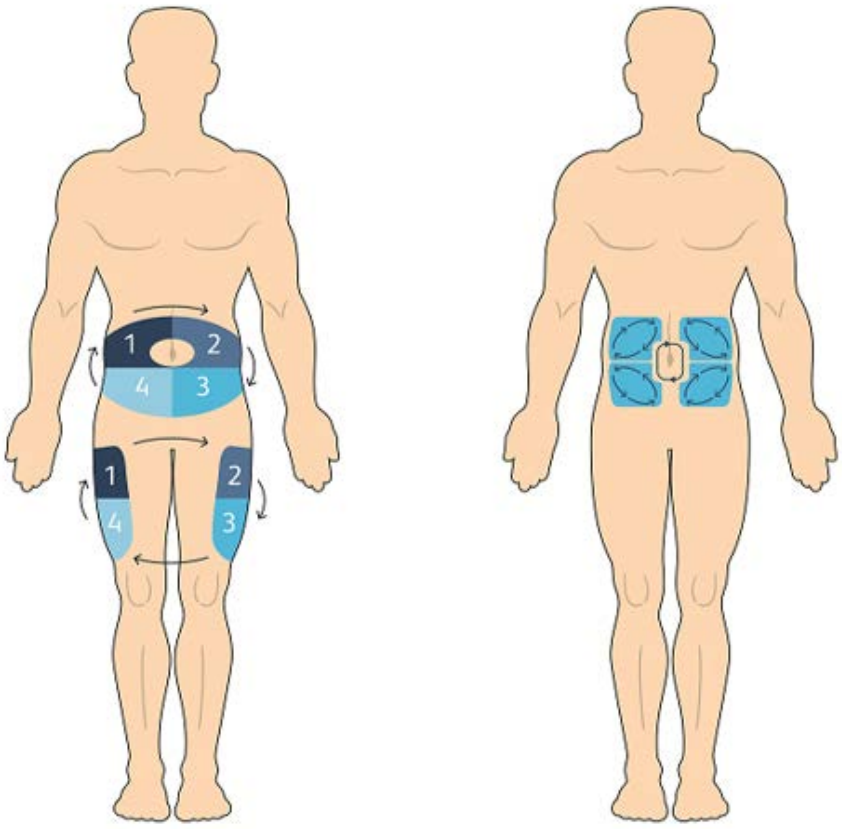

Figure 12: Injection rotation

Image provided by BD Diabetes Care Australia.

Figure 13: Lipohypertrophy (LH) on the stomach

Image provided by BD Diabetes Care Australia.

The presence of LH can impact blood glucose management, as injecting into LH-affected sites may lead to greater variability in blood glucose levels due to delayed or erratic insulin absorption.[63–65]

It is important to identify LH prior to administering injections to prevent injecting into affected areas.[54] Detection requires both visualisation and palpation of injection sites as some lesions can be more easily felt than seen.

- Look for multiple needle pricks from injections administered over a small area and signs of atrophied or hypertrophied skin.
- Gently palpate the desired injection area to identify any thickened rubbery lesions/nodules.
- Palpation is ideally performed with the person lying down and on bare skin.

If LH is detected the person with diabetes should be referred to a Credentialled Diabetes Educator (CDE) for further advice and education on injection technique.

Injecting with a pen device

Always follow the manufacturer's instructions to ensure the correct technique.[54]

1. Ensure the correct insulin and check use by date.
2. Fit a new needle to the top of the pen.
3. Resuspend cloudy insulin if applicable by gently rolling and tipping (avoid vigorous shaking). Confirm visually that the resuspended insulin is sufficiently mixed.
4. 'Prime' the pen to ensure the pen is working correctly there are no air bubbles and that pen needle is correctly secured.
5. Dial up the required dose of insulin.
6. Insert the needle into the injection site and push down the dose button to administer the dose.
7. Leave the pen in situ after injecting the medicine for 10 seconds (or as per manufacturer instructions) to allow the medicine to fully inject. Counting past 10 seconds may be needed for higher doses.
8. Remove the pen needle and discard safely. Replace cap on the pen.

Important information about pen devices: [54]

- Pen devices are for individual use only and should not be shared to avoid the risk of transmission of blood-borne illnesses.
- Durable (reusable) injection devices must be matched with their complimentary insulin cartridge to ensure the injection and dosing is accurate.
- The pen needle should be removed from the injection device immediately after administration of the medicine to prevent the entry of air or other contaminants into the cartridge and to prevent the leaking of medication which can affect subsequent dose accuracy. A new needle should be attached just prior to the subsequent injection.
- Pen devices for injectable medications require priming of the device before each injection.
- The requirements for priming may vary depending on the pen device.

- It is generally advised to prime the pen prior to each injection by dialling up 2 - 4 units inverting the pen so that the needle is facing upwards and pressing the dose button. This is repeated until a few drops of insulin are seen to check that the pen is working.
- During needle insertion the dose button should be touched only after the pen needle is inserted to reduce accidental leakage.
- Pressure should be maintained on the dose button until the needle is withdrawn from the skin to prevent aspiration of subcutaneous tissue into the cartridge.

Injecting with syringe

1. Prepare syringe - choose the correct size syringe and remove from packaging (e.g. 0.3ml if taking less than 30 units 0.5ml if taking less than 50 units and 1.0ml if taking less than 100 units).
2. If administering a dose greater than 100 units two separate injections are required. If two injections are required different injection sites should be used.
3. Confirm correct insulin and check use by date.
4. Resuspend cloudy insulin if applicable by gently rolling vial.

The next steps depend on if you are giving a single insulin dose or a mixed insulin dose.[54]

Single insulin dose

1. Inject air at a dose equal to or slightly greater than the desired dose of insulin into the vial (not required if using penfill cartridges).
2. Draw insulin dose into syringe.
3. Check for correct number of units and that there are no air bubbles.

Mixed insulin dose

1. Inject air at a dose equal to or slightly greater than dose of cloudy insulin into the vial not required if using penfill cartridges).
2. Inject air equal to the dose of clear insulin into the clear vial not required if using penfill cartridges).
3. Draw out clear insulin dose.
4. Check for correct amount and no air bubbles.
5. Insert needle into cloudy vial and withdraw correct dose.
6. Ensure total dose is correct.
7. If incorrect dose(s) are drawn up the syringe should be discarded and the procedure started again with a fresh syringe.

Important information about syringes:[54]

- Long-acting insulin analogues (insulin detemir and insulin glargine) should not be mixed with rapid-acting insulin due to the blunting of the onset of action of the rapid-acting insulin.
- Concentrated insulins such as Toujeo and Humalog U200 cannot be given by syringe and must only be administered using the manufacturers pen device to avoid overdosing.
- Short-acting and NPH insulins may be mixed. The mixture should be injected within 30 minutes before a meal.
- Rapid-acting insulin can be mixed with NPH. The mixture should be injected within 15 minutes before a meal.

Lifted skinfold

In some people (particularly young children and slim adults) a lifted skin fold may be needed to reduce the risk of intramuscular injection.[54] The decision to use a lifted skin fold should be assessed individually taking into account the likely composition of skin and subcutis relative to needle length injection site age size and body composition.

If using a lifted skinfold:[54]

1. Use thumb and index finger (or middle finger) to gently lift (not grab) the skin fold and avoid lifting accompanying muscle.
2. Inject into the raised tissue at 90 degrees.
3. Keep the skin folded raised as the medicine is administered.
4. Hold the needle in situ for 10 seconds or as per the manufacturer's instructions (for insulin pens).
5. Withdraw the needle.
6. Release the skin fold.

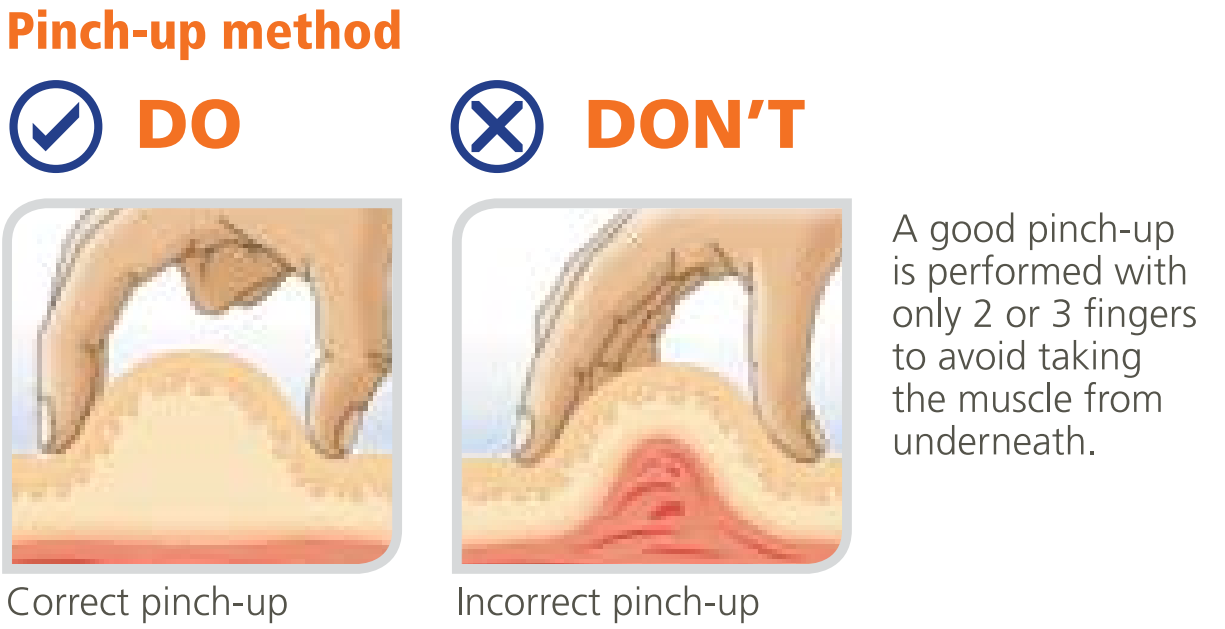

Image provided by BD Diabetes Care Australia.

Figure 14: **Lifted skin fold injection technique.**

Workplace activity

Demonstrate to a work colleagues or supervisor your ability to use an insulin pen and syringe. Consider each of the steps in the previous slides.

Your notes:

Ask your supervisor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

Storage of injectable medications

Injectable medications should be stored according to the manufacturer's instructions considering:[54]

- the required temperature for used and unused medicine
- length of time the medicine can be stored when open
- requirements for protection from light
- the expiry date of the medicine.

Injectable medications should be discarded if:[54]

- it is past the expiry date on the bottle or if the vial or cartridge/pen has been open for more than a month (8 weeks for Ozempic)
- the medication is discoloured lumps or flakes are seen or clear insulin has turned cloudy
- for cloudy insulins: uniform resuspension cannot be achieved
- the medication has been frozen or exposed to high temperatures.

Safe sharps disposal

Insulin syringe and injection device pen needles must be disposed of safely both in the healthcare setting and at home.

It is important that you are familiar with the policies and procedures for managing sharps and safe sharps disposal in your workplace. All individuals with diabetes who use injectable medications should also be provided with education on safe sharps disposal.

People with diabetes can purchase an Australian-standard approved plastic container from NDSS Access Points (usually a community pharmacy). Filled sharps containers can be disposed of at some public hospitals participating pharmacies community sharps disposal bins and some councils. Individuals can locate their local community sharps disposal facilities by visiting the Safe Sharps website (**safesharps.org.au**) calling the NDSS Helpline on **1800 637 700** or their local council.

Needlestick injury

Needlestick injuries are common among healthcare workers and carry the risk of acquiring blood-borne infections.

One study of Australian nurses found that insulin needles were the second most common causative device resulting in needle stick injuries[66]. A recent systematic review and meta-analysis of 18 studies including more than 10000 healthcare workers from 14 countries, including Australia, found a high prevalence of occupational exposure to needle stick injury.[67] While the findings varied across the populations studied (including many developing countries), the pooled prevalence of needle stick injuries among healthcare workers was 56% throughout their career and 32% in the past year.[67]

It is essential that your workplace has policies and procedures in place to reduce the risk of needlestick injuries and that all injuries and near-misses are reported.[68]

Further reading

Download and read the following article:

The serious and ongoing issue of needlestick in Australian healthcare settings (Murphy, 2013) **researchgate.net/publication/259157717_The_serious_and_ongoing_issue_of_needlestick_in_Australian_healthcare_settings**

The authors of this paper discuss improvements and current challenges in international needlestick injury reduction and recommend that Australia follows international recommendations and place focus on the following areas:

- improving sharps safety in surgical settings
- understanding and reducing exposure risks in nonhospital settings
- involving frontline healthcare workers in the selection of safety devices
- addressing gaps in safety devices through innovation
- enhancing education and training.

Workplace activity

Locate and read the policies and procedures for preventing, managing and reporting needlestick injuries in your workplace.

Explain to a supervisor or mentor what you would do if you or a colleague suffered a needlestick injury at work.

Your notes:

Ask your supervisor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

Medication safety

Medications in Australia, including oral and injectable diabetes medications, are regulated by legislation. Further information is available from the State/Territory medicines and poisons regulation units which can be found on the Therapeutic Goods Administration (TGA) website **tga.gov.au/medicines**).

You should also refer to your workplace policies and procedures on diabetes medication safety and error reporting.

It is recognised that medication errors occur frequently in the hospital setting and have the potential to cause serious harm. A review of Australian research, published in 2016, found that medication errors remain a significant problem and may occur at different stages of acute care, including at admission and discharge, and when medications are both prescribed and administered during a hospital admission[69].

Examples of common errors that occur include:[69]

- incorrect documentation of a person's medication history at the time of admission
- prescription of an incorrect dosage of a medicine
- omission of therapy when it should have been administered or administration of the wrong medicine
- continuation of medicines only intended during hospital stay at discharge
- administration of a medicine when there is a history of allergy or contraindication
- administration of a medicine that interacts with another medicine
- a lack of explanation to consumers and community health care providers of medication changes made during hospital stay that should be maintained after discharge.

People with diabetes may be at increased risk of medication errors as they often take multiple medications and are more likely to be taking high-risk medications. High risk medications are defined as those which have an increased risk of causing significant patient harm or death if they are misused or used in error[70]. Which medications are identified as high risk may vary between hospitals/health services but insulin is universally considered high risk[71]. Some oral hypoglycaemic agents may also present a high risk.

Eight rights of medication administration

The eight rights of safe medication administration are particularly important when administering diabetes medications[72]:

1. Right patient

» Check the name on the order and the patient.

» Use two identifiers.

» Ask the patient to identify himself/herself.

» When available, use technology (for example, bar-code system).

2. Right medication

» Check the medication label.

» Check the order.

3. Right dose

» Check the order.

» Confirm appropriateness of the dose using a current drug reference.

» If necessary, calculate the dose and have another nurse calculate the dose as well.

4. Right route

» Again, check the order and appropriateness of the route ordered.

» Confirm that the patient can take or receive the medication by the ordered route.

5. Right time

» Check the frequency of the ordered medication. Double-check that you are giving the ordered dose at the correct time. Confirm when the last dose was given.

6. Right documentation

» Confirm when the last dose was given.

» Chart the time, route, and any other specific information as necessary. For example, the site of an injection or any laboratory value or vital sign that needed to be checked before giving the drug.

7. Right reason

» Confirm the rationale for the ordered medication. What is the patient's history? Why is he/she taking this medication?

» Revisit the reasons for long-term medication use.

8. Right response

» Make sure that the drug led to the desired effect. For example, if an antihypertensive was given, has his/her blood pressure improved?

» Be sure to document your monitoring of the patient and any other nursing interventions that are applicable.

Workplace activity

Locate and read the policies and procedures for reporting of oral or injectable diabetes medication errors in your workplace.

Also review the relevant legislation covering injectable diabetes medication in your state or territory.

1. **Explain to a supervisor or mentor the relevant legislation covering diabetes medication in your state or territory.**
2. **Describe to a supervisor or mentor what you would do if you discovered a medication error in your workplace.**

Your notes:

Supervisor or mentor signature:

Insulin dose adjustment

A person using insulin may need adjustment of their insulin doses/regimen if:

- they are experiencing regular episodes of hypoglycaemia
- their blood glucose levels are regularly above their individual target range
- they have an intercurrent illness which is impacting their blood glucose levels
- they are unable to consume their usual diet (e.g. due to nausea vomiting loss of appetite)
- they require treatment with steroid medications.

If it is identified that someone requires adjustment of their insulin doses, they should be referred to either:

- the healthcare facility endocrine team (in a hospital setting)
- their general practitioner
- their endocrinologist
- their diabetes nurse practitioner
- their Credentialled Diabetes Educator (CDE): while CDE's cannot prescribe they can adjust and titrate insulin doses with the written support of a medical practitioner.

Surgery preparation

Prior to surgery or procedure that requires preparation, individuals with diabetes should be referred to a CDE or doctor (endocrinologist or GP) for review of their diabetes management, including:[73,74]

- Reviewing their blood glucose levels to ensure they are optimised prior to surgery, to minimise the risk of complications and improve recovery and wound healing.
- If taking oral or injectable medications for type 2 diabetes, discussing if these need to be temporarily ceased prior to or following surgery or a procedure, particularly when fasting is required.
- If taking insulin, how and when to adjust insulin doses prior to and following surgery and when fasting in preparation for surgery or a procedure.
- Speaking to the anaesthetist or physician of the admitting hospital for insulin orders if required.
- Reviewing education on sick day management and preparing a sick day management plan.

Supporting medication use

Research has shown that many people with diabetes do not regularly take their medications. A review of 15 studies found that between 7% and 67% of people with diabetes did not regularly take their diabetes medication.[75] Another review found that less than 60% of those prescribed oral diabetes medications took these at least 80% of the time.[76] 32% focused on hypertension, 27% on diabetes and 13% on dyslipidaemia. The remainder covered coronary heart disease and cardiovascular disease (CVD The most recent review, including 34 retrospective and 64 prospective studies evaluating the association between diabetes and medication adherence, found that 10% of people do not fill their first prescription for diabetes medications and 15% abandon treatment within the first six months.[77]

Not taking medication as prescribed is associated with adverse health outcomes. Those who do not take their medication as prescribed have been found to have higher blood glucose levels, higher rates of hospitalisation, higher rates of work absenteeism and higher medical care costs.[76,77]

There are many reasons why a person may not take their diabetes medications regularly. Barriers to taking medication as prescribed include:[76,77]

- having too many different medications to take
- difficulties remembering to take medications
- problems with the timing of medication
- medication costs
- side effects
- not understanding the reasons for taking them or being sceptical about their benefits
- depression
- health beliefs.

Asking about medication use and explaining the benefits of taking medication as prescribed is important.

- Ensure the person knows what each of their medicines is for, how and when they should take them, and how they should be stored. Either encourage the person to make a list of this information or provide them with one.
- Explain the importance of informing their doctor if they develop side effects, rather than ceasing their medicine. Discuss potential side effects and strategies to help in preventing or minimising side effects.
- For those taking multiple medicines, discuss strategies to help with remembering to take the correct medicines at the right time such as a Webster pack, dosette box, or use of alarms or phone reminders.
- Encourage the person to keep track of their scripts, repeats and expiry dates (or ask their pharmacist to help them with this) and to schedule an appointment with their doctor for a new script well before they run out of medication.
- Consider recommending a Home Medicines Review (HMR), MedsCheck or Diabetes MedsCheck for those who are eligible and would benefit.

Home Medicines Review

The Home Medicines Review (HMR) is designed to assist individuals living at home to maximise the benefits of their medication regimen and prevent medication related problems.[78] A GP can provide a referral for a HMR. A pharmacist then visits the person with diabetes in their home to conduct the review. The HMR report is sent to the GP and a 'Medication Management Plan' is agreed on by all parties.

To be eligible for a HMR, an individual must:[78]

- be a current Medicare/Department of Veterans' Affairs (DVA) cardholder
- live in a community setting
- be at risk of experiencing an adverse event related to medication
- have their GP confirm that there is an identifiable clinical need and they will benefit from a HMR Service.

MedsCheck

The MedsCheck is an in-pharmacy service which includes a review of an individual's medicines, focused on education and self-management with the aim of:[79]

- identifying problems they may be experiencing with their medicines
- helping them to learn more about their medicines including how medicines affect medical conditions
- improving the effective use of medicines
- educating them about how to best use and store their medicines.

To be eligible for a MedsCheck, an individual must:[79]

- be a current Medicare/Department of Veterans' Affairs (DVA) cardholder
- live in a community setting
- be taking five or more prescription medications
- have had a recent significant medical event
- have not received a MedsCheck, Diabetes MedsCheck, HMR or Residential Medication Management Review (RMMR) in the previous 12 months.

Diabetes MedsCheck

An in-pharmacy service which includes a review of an individual's medicines, focused on their type 2 diabetes education and self-management, with the aim of:[79]

- optimising their effective use of diabetes medications
- improving their effective use of blood glucose monitoring devices
- improving blood glucose management
- reducing their risk of diabetes-related complications.

To be eligible for a Diabetes MedsCheck, an individual must:[79]

- be a current Medicare/Department of Veterans' Affairs (DVA) cardholder
- live in a community setting
- have been diagnosed with type 2 diabetes within the past 12 months or their type 2 diabetes is less than ideally managed
- be unable to gain timely access to diabetes education/health services in their community
- have not received a MedsCheck, Diabetes MedsCheck, HMR or RMMR in the previous 12 months.

You can find out more about these programs by visiting the Pharmacy Programs Administrator website:

- Home Medicines Review **ppaonline.com.au/programs/medication-management-programs/home-medicines-review**
- MedsCheck **ppaonline.com.au/programs/medication-management-programs/medscheck-and-diabetes-medscheck**
- Diabetes MedsCheck **ppaonline.com.au/programs/medication-management-programs/medscheck-and-diabetes-medscheck**

You can also download posters, leaflets and brochures about these services, to provide to people with diabetes who are eligible, from the 6th Community Pharmacy Agreement website: **6cpa.com.au/resources/promotional-resources**

Workplace activity

Roberto is a 64-year-old man, recently diagnosed with type 2 diabetes.

Roberto has been taking blood pressure and cholesterol-lowering medications for many years. He also takes Panadol, Gaviscon and Osmolax as needed. He takes a vitamin D supplement, recommended by his GP, and his daughter has recently bought him an herbal supplement to help with blood glucose levels, although he has not started taking this as yet.

Roberto's GP has recently prescribed metformin to help in managing his diabetes.

Roberto is concerned about the new medication as he has been feeling unwell over the past few days since he started taking it. He is also confused about whether he should take it at the same time as his other medications and whether he can also take it along with the supplement his daughter has given him.

Discuss your answers to the following questions with your supervisor or mentor.

1. Do you feel that Roberto he would benefit from a Home Medicines Review (HMR)? Explain why or why not.
2. Let's assume you decide Roberto would benefit from an HMR.
   - » Explain how you would determine whether Roberto is eligible for an HMR.
   - » Describe how you would you explain to Roberto the benefits of having an HMR.
   - » Outline how you would go about organising an HMR for Roberto.

Your notes:

Ask your supervisor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes.

Download these resources related to diabetes medications:

- **Medications for type 2 diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/medications-for-type-2-diabetes-fact-sheet
- **Insulin**
  ndss.com.au/about-diabetes/resources/find-a-resource/insulin-fact-sheet
- **Starting insulin booklet (for type 2 diabetes)**
  ndss.com.au/about-diabetes/resources/find-a-resource/starting-insulin-booklet
- **Surgery and hospital stays**
  ndss.com.au/about-diabetes/resources/find-a-resource/surgery-and-hospital-stays-fact-sheet

Assessment questions

Question 1: **Which of the following statements about medication use in type 2 diabetes is incorrect?**

- [ ] **a.** Medications should be commenced when blood glucose targets are unable to be met with lifestyle changes.
- [ ] **b.** Medications should be offered as an alternative to lifestyle modification.
- [ ] **c.** Most people with diabetes will need medication over time.
- [ ] **d.** Many people with diabetes will need more than one oral glucose lowering agent to manage their blood glucose levels.
- [ ] **e.** Lifestyle measures should be reinforced with the introduction of medications.

Question 2: **Which of the following is most likely to cause hypoglycaemia?**

- [ ] **a.** Diaformin.
- [ ] **b.** Diabex.
- [ ] **c.** Diamicron.
- [ ] **d.** Januvia.
- [ ] **e.** Jardiance.

Question 3: **Which of the following statements about metformin is incorrect?**

- [ ] **a.** It is recommended as first-line therapy unless contraindicated or not tolerated.
- [ ] **b.** The most common side effects are gastrointestinal.
- [ ] **c.** It commonly causes hypoglycaemia.
- [ ] **d.** It reduces hepatic glucose production.
- [ ] **e.** It is contraindicated in those with severe renal impairment.

Question 4: **Choose all that apply – sulphonylureas:**

- [ ] **a.** Stimulate insulin production.
- [ ] **b.** Can cause hypoglycaemia.
- [ ] **c.** Help with weight loss.
- [ ] **d.** Should be taken with food.
- [ ] **e.** Are safe to use in those with severe renal or hepatic impairment.

Question 5: **Which of the following statements about DPP-4 inhibitors is incorrect?**

- [ ] **a.** They may increase the risk of pancreatitis.
- [ ] **b.** Weight gain is a common side effect.
- [ ] **c.** Their dose needs to be reduced in those with renal impairment.
- [ ] **d.** They do not cause hypoglycaemia.
- [ ] **e.** Side effects include runny nose, sore throat and gastrointestinal symptoms.

Question 6: **Which of the following statements about alpha-glucosidase inhibitors is correct? Choose all that apply:**

- [ ] **a.** They slow down the absorption of glucose from the gut.
- [ ] **b.** Common side effects include bloating and flatulence.
- [ ] **c.** They may contribute to weight gain.
- [ ] **d.** They mainly help to reduce postprandial blood glucose levels.
- [ ] **e.** They should be taken after a meal.

Question 7: **Which of the following statements about SGLT2-inhibtors is incorrect?**

- [ ] **a.** They reduce glucose reabsorption by the kidneys.
- [ ] **b.** Genitourinary infections are a common side effect.
- [ ] **c.** They need to be taken with food.
- [ ] **d.** They generally assist with weight loss.
- [ ] **e.** Their efficacy is reduced in those with renal impairment.

Question 8: **Choose all that apply. Which of the following statements about thiazolidinediones are correct?**

- [ ] **a.** They may cause hypoglycaemia.
- [ ] **b.** They improve the body's sensitivity to insulin.
- [ ] **c.** Fluid retention is a common side effect.
- [ ] **d.** They help with weight loss.
- [ ] **e.** They should be avoided in those with heart failure.

Question 9: **Choose all that apply. Which of the following statements about medication use are correct?**

- [ ] **a.** Most people with diabetes are taking their medication regularly.
- [ ] **b.** Many people with diabetes do not regularly take their medications.
- [ ] **c.** Not taking medication as prescribed is associated with adverse health outcomes.
- [ ] **d.** Common reasons for not taking medications as prescribed include side effects, costs and not understanding why they are taking the medication.
- [ ] **e.** Health professionals should not question people with diabetes about their medication use.

Question 10: **Which of the following is incorrect? A person with diabetes taking oral glucose lowering agents should see their doctor or diabetes educator before having surgery.**

- [ ] **a.** To review and optimise their diabetes management.
- [ ] **b.** To review their medications and determine whether some may need to be temporarily ceased before and/or after surgery.
- [ ] **c.** For advice on whether they should have the surgery.
- [ ] **d.** For review of their education on diabetes and sick day management.
- [ ] **e.** To develop a sick day management plan.

Question 11: Which of the following statements about injectable diabetes medications is incorrect?

- [ ] **a.** Insulin may be used in all types of diabetes.
- [ ] **b.** Insulin is only used in type 1 diabetes.
- [ ] **c.** People with type 2 diabetes may use insulin or non-insulin injectable medications.
- [ ] **d.** Non-insulin injectable medications are only used in type 2 diabetes.
- [ ] **e.** Women with gestational diabetes may require insulin.

Question 12: The main types of insulin are:

- [ ] **a.** Short-acting intermediate-acting long-acting and mixed.
- [ ] **b.** Short-acting long-acting and mixed.
- [ ] **c.** Rapid-acting short-acting intermediate-acting long-acting and mixed.
- [ ] **d.** Rapid-acting intermediate-acting long-acting and mixed.
- [ ] **e.** Rapid-acting short-acting extended and mixed.

Question 13: Choose all that are correct. Insulin and non-insulin injectable medications

- [ ] **a.** Can both be used in type 1 diabetes.
- [ ] **b.** Can both be used in type 2 diabetes.
- [ ] **c.** Work in different ways to lower blood glucose levels.
- [ ] **d.** Have similar side effects.
- [ ] **e.** Can both cause hypoglycaemia when used alone.

Question 14: Which of the following statements about non-insulin injectable diabetes medications is incorrect?

- [ ] **a.** They work by mimicking the effect of the body's own incretin hormones.
- [ ] **b.** They can cause hypoglycaemia.
- [ ] **c.** They help with postprandial glycaemia.
- [ ] **d.** They are administered as a fixed dose.
- [ ] **e.** They can help with weight loss.

Question 15: The main side effect of insulin is:

- [ ] **a.** Hypoglycaemia.
- [ ] **b.** Gastrointestinal symptoms.
- [ ] **c.** Weight loss.
- [ ] **d.** Skin rashes.
- [ ] **e.** Lactic acidosis.

Question 16: Choose all that are correct. Someone with diabetes may need to adjust their insulin dose if:

- [ ] **a.** They are experiencing regular episodes of hypoglycaemia.
- [ ] **b.** Their blood glucose levels are regularly above their individual target range.
- [ ] **c.** They experience a single high blood glucose level following a stressful event.
- [ ] **d.** They are unable to consume their usual diet due to nausea and vomiting.
- [ ] **e.** They require treatment with steroid medications.

Question 17: Which of the following statements about insulin pen devices is incorrect?

- [ ] **a.** They require priming before each injection.
- [ ] **b.** They must be matched with their corresponding insulin type.
- [ ] **c.** They can be shared between different people as long as a new needle is used each time.
- [ ] **d.** A new needle should be used with each injection.
- [ ] **e.** They may be reusable or disposable.

Question 18: Which of the following statements about lipohypertrophy are correct? Choose all that apply.

- [ ] **a.** It is a rare complication of injecting insulin.
- [ ] **b.** It is an area of thickened subcutaneous tissue at injection sites.
- [ ] **c.** May lead to greater variability in blood glucose levels if injections are given in affected sites.
- [ ] **d.** Is easy to visually identify.
- [ ] **e.** Identification is important prior to giving injections.

Question 19: Which of the following statements about injection sites is incorrect?

- [ ] **a.** The abdomen is the preferred injection site.
- [ ] **b.** Rotating injection sites is important to reduce the risk of LH.
- [ ] **c.** The risk of intramuscular injection is highest in the abdomen and buttocks.
- [ ] **d.** Absorption of some types of insulin can vary between injection sites.
- [ ] **e.** Injection sites should be documented in healthcare settings to facilitate site rotation.

Question 20: The main side effects of GLP-1 agonists are:

- [ ] **a.** Fluid retention and weight gain.
- [ ] **b.** Nausea and vomiting.
- [ ] **c.** Hypoglycaemia.
- [ ] **d.** Urinary tract infections.
- [ ] **e.** Dehydration and headaches.

Assessment answers

1. b
2. c
3. c
4. a, b and d
5. b
6. a, b and d
7. c
8. b, c and e
9. b, c and d
10. c
11. b
12. c
13. b and c
14. b
15. a
16. a, b, d and e
17. c
18. b, c and e
19. c
20. b

Module 6: Lifestyle

This course workbook is designed to support foundation level nurses develop the knowledge and skills listed in the National Diabetes Nursing Education Framework.

This module aligns with aspect of care 2: Lifestyle factors – nutrition, alcohol and other drugs, smoking, physical activity, weight, stress, and sleep.

Learning objectives

On completion of this module you will be able to:

- [ ] **1.** Explain how to conduct a general nursing assessment relating to lifestyle.
- [ ] **2.** Calculate and interpret Body Mass Index (BMI) waist circumference and waist-to-hip ratio.
- [ ] **3.** Describe the significance of BMI waist circumference and waist-to-hip ratio to diabetes and associated health issues.
- [ ] **4.** Explain the relationship between an unhealthy weight and diabetes and importance of attaining/maintaining a desired weight.
- [ ] **5.** Explain the effect of nutritional intake on glycaemic trends for people with diabetes.
- [ ] **6.** List the basic healthy eating principles for people with diabetes based on current reputable guidelines.
- [ ] **7.** Identify situations where regular healthy eating advice may not be appropriate.
- [ ] **8.** Explain when and how to refer to a dietitian.
- [ ] **9.** Discuss national guidelines and recommendations for physical activity.
- [ ] **10.** Describe the benefits of physical activity for people with diabetes including blood glucose and weight management.
- [ ] **11.** Explain when and how to refer to an exercise physiologist for physical assessment if necessary, prior to commencing exercise program.
- [ ] **12.** Describe the relationship between smoking and long-term health risks for the person with diabetes including cardiovascular disease and diabetes associated health issues.
- [ ] **13.** Outline precautions for people with diabetes in relation to alcohol consumption.

- [ ] **14.** Explain the effects of stress on diabetes management.
- [ ] **15.** Describe how to encourage the person with diabetes to share any stressors with the health care team.
- [ ] **16.** Recognise when to refer the person with diabetes to a Credentialled Diabetes Educator dietitian exercise physiologist counsellor and/or GP.

Lifestyle assessment

Reviewing lifestyle habits is an important part of an individual's diabetes annual cycle of care and includes a review of:

- eating habits
- physical activity levels
- weight and waist measurements
- smoking habits
- emotional health and stress management.

Annual cycle of care

The diabetes annual cycle of care is a checklist for reviewing a person's diabetes management which is completed with their GP and which incorporates a lifestyle assessment. The annual cycle of care is aimed at early identification of health concerns and reducing the risk of diabetes-related health conditions. You can find more information on the NDSS website: **ndss.com.au/about-diabetes/resources/find-a-resource/your-diabetes-annual-cycle-of-care-fact-sheet**

A Medicare item number (2517) is available for GPs to complete an annual cycle of care for a person with diabetes. More information can be found on the Department of Health website: **9.health.gov.au/mbs/fullDisplay.cfm?type=item&q=2517&qt=item**

SNAP guide

The other commonly used tool designed to help GPs and their practice team to support people with lifestyle modification is the smoking nutrition alcohol and physical activity (SNAP) guide. The guide is based on a five-step model the 5As (ask assess advise assist arrange) for detection and management of SNAP risk factors.

A copy of the guide can be found on the RACGP website: **racgp.org.au/clinical-resources/clinical-guidelines/key-racgp-guidelines/view-all-racgp-guidelines/snap/introduction**

Weight matters

Excess weight is a risk factor for type 2 diabetes and gestational diabetes. Carrying excess weight worsens insulin resistance and can make all types of diabetes more difficult to manage. In those who carry excess weight, weight loss plays an important role in management.

Anthropometric measures

Several measures can be used to determine whether someone is carrying excess weight and to monitor weight changes over time. Common easy to perform measurements include:[80]

Body mass index (BMI)

Body mass index (BMI) is one way to assess whether someone is a healthy weight. It is only used in adults.

- BMI is a calculation used to determine which weight category someone fits into and their associated health risks based on their current weight.
- BMI is calculated using following equation: body weight in kilograms divided by the square of height in meters.
- In Western populations a BMI less than 18.5 is considered underweight 18.5-24.9 is within the healthy weight range 25-29.9 is overweight and greater than 30 is obese.
- A lower healthy weight range may be considered for people of Asian and Aboriginal background.
- A higher healthy weight range may be considered for people of Pacific Island (including Torres Strait Island) background athletes with high muscle mass and older adults.

Waist circumference (WC)

Waist circumference is one way to measure whether someone is at risk of obesity related chronic disease.

- It is measured using a tape measure placed around the abdomen halfway between the bottom of the lowest rib and the top of the hip bones.
- For Caucasian men a WC above 94cm indicates increased risk and above 102cm substantially increased risk.
- For Caucasian women a WC above 80cm indicates increased risk and above 88cm substantially increased risk.
- Different WC cut-offs are recommended for people from certain ethnic backgrounds, but there is insufficient data to recommend cut-offs for some groups including Aboriginal and Torres Strait Islander Peoples.

Waist-to-hip ratio (WHR)

Waist-to-hip ratio is another way to measure a person's risk of obesity related chronic disease.

- It is calculated by dividing the waist measurement (measured as described above) and dividing by the hip measurement (measured at the widest diameter of the buttocks).
- A healthy WHR is 0.80 or lower in women and 0.95 or lower in men.
- A WHR of 0.86 or higher in women and 1.00 or higher in men is considered high risk.

Workplace activity

Brian is a 45yo Caucasian man recently diagnosed with impaired glucose tolerance.

Demonstrate to your supervisor or mentor your ability to measure, calculate and interpret Brian's anthropometric measures including his:

- BMI
- waist circumference (WC)
- waist-to-hip ratio (WHR).

1. You measure Brian's weight to be 86kgs and height 176cm. What is his BMI and which BMI category would he be in?
2. Demonstrate to your supervisor or mentor how you would measure Brian's waist circumference.
3. You measure Brian's waist circumference as 96cm and his hip circumference as 100cm. Which risk categories does he fall in for WC and WHR?

Your notes:

Ask your supervisor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

The role of nutrition

Healthy eating is an important part of the management of all types of diabetes. Food intake directly impacts blood glucose levels and needs to be balanced with physical activity levels and medication. The types and amounts of food eaten also impact weight insulin sensitivity and the risk of diabetes-related health conditions.

Goals of dietary management

The goals of dietary management in people with diabetes are:[81]

1. To promote and support healthy food choices which improve overall health and assist in:
   - » optimising blood glucose levels
   - » optimising blood fats and blood pressure
   - » preventing/reducing the progression of diabetes-related health conditions
   - » achieving and maintaining a healthy body weight.
2. To consider personal and cultural food preferences.
3. To maintain the enjoyment of eating.

Healthy eating guidelines

General healthy eating recommendations for people with diabetes are similar to those of the general population – people with diabetes do not need a 'special' diet.

These recommendations are consistent with the Australian Dietary Guidelines and the Australian Guide to Healthy Eating which can be found at **eatforhealth.gov.au**

However, the timing of meals and snacks amount eaten and type of carbohydrate foods chosen are more important for people with diabetes.

There are also some situations where these recommendations may not be appropriate – for example in those who are malnourished individuals with eating disorders or those with diabetes-related health conditions such as nephropathy or gastroparesis.

Figure 15: Australian guide to healthy eating.

Source: Australian Dietary Guidelines

Dietary recommendations for diabetes

While dietary recommendations need to be individualised for each person with diabetes, general recommendations are to:

- limit intake of saturated fat
- choose healthy unsaturated fats found in avocado nuts seeds oily fish and olive oil
- increase fibre from vegetables fruits legumes and wholegrains
- spread carbohydrate intake evenly across the day or match intake with insulin, other medications and activity
- choose carbohydrate foods with a lower glycaemic index (GI)
- choose water as the main drink and avoid or limit sugar-sweetened drinks and alcohol.

As discussed above, apart from being more specific around carbohydrate intake, these recommendations are consistent with the Australian government general healthy eating guidelines.

Dietitian referral

Nurses can provide general healthy eating advice however where possible all individuals with diabetes should be referred to an accredited practising dietitian (APD) for individualised dietary advice.

The following are specific to the role of an APD and outside the scope of practice of a nurse:

- providing medical nutrition therapy including any dietary modifications which are inconsistent with the Australian Dietary Guidelines
- advising on the use of nutritional supplements
- developing individualised eating plans.

APDs can be found by contacting Dietitians Australia 1800 812 942 or using the Find an APD search tool on their website **dietitiansaustralia.org.au/find-an-apd**.

Referral is particularly important for those:

- with type 1 diabetes
- with gestational diabetes
- with insulin-treated type 2 diabetes
- who are planning a pregnancy pregnant or breastfeeding
- with diabetes-related health conditions such as heart disease kidney disease or gastroparesis
- with other nutrition-related conditions such as coeliac disease, irritable bowel syndrome or food allergies
- who experience unwanted weight loss or are malnourished
- with an eating disorder or disordered eating.

Workplace activity

Debbie is a 55yo woman living with type 2 diabetes. She had gestational diabetes in her last pregnancy at age 39 years and was diagnosed with type 2 diabetes two years later. Debbie has taken several glucose lowering medications since her diagnosis but recently started insulin and is also taking metformin.

Debbie has read about the possible benefits of a low carbohydrate diet and asks for your advice about following a low carb diet to lose help her to lose weight and manage her diabetes.

Explain to a supervisor or mentor what advice you would provide to her?

Your notes:

Ask your supervisor to sign below to show that you have completed this activity.

Supervisor or mentor signature:

The role of exercise

Regular physical activity plays an important role in managing diabetes.[82] Exercise improves insulin sensitivity and can help with blood glucose management. It helps with weight management and reduces cardiovascular disease risk. Exercise also has benefits for mental health.

National physical activity guidelines

Australia's Physical Activity and Sedentary Behaviour Guidelines provide an evidence-based guide to physical activity recommendations for the general population.[83] They include separate guidelines for adults aged 18-64 years older, adults (65 years and over) and children. A copy of the guidelines along with associated consumer resources can be found on the Department of Health Website: **1.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines.** The 2017-2018 Australian National Health Survey found the majority of Australians are not meeting the recommended guidelines.[84]

Guidelines for adults 18-64 years:

- Be active on most preferably all days of the week. Doing any exercise is better than none.
- Accumulate 150-300 minutes of moderate intensity or 75-150 minutes of vigorous intensity physical activity or an equivalent combination of both each week.
- Do muscle strengthening activities on at least 2 days each week.
- Minimise the amount of time spent in prolonged sitting and break up long periods of sitting as often as possible.

Guidelines for older adults:

- Be active every day in as many ways as possible doing a range of physical activities that incorporate fitness strength balance and flexibility.
- Accumulate at least 30 minutes of moderate intensity physical activity on most preferably all days.
- Those who have stopped physical activity or who are starting a new physical activity should start at a level that is easily manageable and gradually build up to the recommendations.
- Those who have enjoyed a lifetime of vigorous physical activity should continue in a manner suited to their capability into later life while adhering to recommended safety procedures and guidelines.

Guidelines for children and young people 5-17 years:

- Accumulate 60 minutes or more of moderate-to-vigorous physical activity per day involving mainly aerobic activities.
- Include several hours of a variety of light physical activities.
- Include vigorous activities as well as those that strengthen muscle and bone at least three days per week.
- Break up long periods of sitting as often as possible and limit sedentary recreational screen time to no more than two hours per day.

While exercise recommendations for people with diabetes need to be individualised, the national guidelines will be appropriate for many people with diabetes.

Exercise recommendations for people living with diabetes

The American Diabetes Association also provides specific recommendations for exercise in people with diabetes which are similar to the national physical activity guidelines discussed on the previous page:[82]

- Most adults with diabetes should engage in 150 minutes or more of moderate-to-vigorous intensity activity weekly spread over at least 3 days per week with no more than two consecutive days without activity.
- Shorter durations (minimum 75 minutes per week) of vigorous intensity or interval training may be sufficient for younger and more physically fit individuals.
- Adults with diabetes should engage in 2–3 sessions per week of resistance exercise on non-consecutive days.
- Children and adolescents with type 1 or type 2 diabetes should engage in 60 minutes per day or more of moderate or vigorous intensity aerobic activity with vigorous muscle strengthening and bone strengthening activities included at least 3 days/week.
- Flexibility training and balance training are recommended 2–3 times per week for older adults with diabetes. Yoga and tai chi may be included based on individual preferences to increase flexibility muscular strength and balance.
- Individuals with diabetes or pre-diabetes are encouraged to increase their total daily incidental (non-exercise) physical activity to gain additional health benefits.
- To gain more health benefits from physical activity programs participation in supervised training is recommended over non-supervised programs.

Further reading

To learn more about exercise recommendations for people with diabetes, download and read this article:

Colberg, 2016. Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association." Diabetes Care 39 (11): 2065–79. Available at **doi.org/10.2337/dc16-1728**.

The authors of this paper discuss:

- benefits of exercise, physical activity and reducing sedentary time for people with diabetes
- physical activity recommendations for type 1 diabetes, type 2 diabetes and diabetes during pregnancy minimising exercise-related adverse events in people with diabetes
- managing exercise in people with diabetes-related health conditions
- promoting the adoption and maintenance of physical activity in people with diabetes.

When to refer to an exercise physiologist

While exercise is beneficial for most people with diabetes some individuals should be referred to an accredited exercise physiologist (AEP) for an assessment and individualised exercise program.

AEPs can be found by contacting the **Exercise & Sports Science Association** on **(07) 3171 3335** or visiting the website: **essa.org.au/find-aep**

Referral is particularly important for those:

- with or at high risk of cardiovascular disease
- with proliferative retinopathy (which may be a contraindication to certain types of exercise)
- with peripheral neuropathy and loss of sensation in their feet
- with autonomic neuropathy
- at risk of hypoglycaemia
- with osteoporosis and/or musculoskeletal issues such as arthritis or joint pain which impacts their ability to exercise
- with a physical disability or current injury.

Smoking and diabetes

Smoking is associated with an increased risk of developing type 2 diabetes.[85] Smoking also increases the risk of diabetes-related health conditions, particularly macrovascular health conditions.86,87 There is some evidence suggesting smoking may contribute to microvascular complications (including neuropathy and nephropathy), particularly in individuals with type 1 diabetes.[86,87] Quitting smoking gradually reduces the risk of developing diabetes or cardiovascular complications in those already diagnosed with these conditions.[86]

While quitting smoking is important for all current smokers, it is particularly important for people with or at risk of diabetes, who are at higher risk of the adverse effect of smoking.[86,87] Individuals with diabetes should be encouraged not to smoke and should be supported to quit smoking if they are a current smoker. Current smokers should be provided with information and advice on options to help with quitting smoking.

A variety of resources and tools are available to help Australian smokers to quit. These include:

- Quitline (13 7848 or 13 QUIT): a confidential, evidence-based telephone counselling service available in all states and territories.
- Quitcoach (**quitcoach.org.au**): an online tool that asks questions about an individual's smoking habits and lifestyle, and uses this information to create a quit plan tailored for them.
- QuitTxt (**quitcoach.org.au/QuitTextInformation.aspx**): sends several SMS messages each day which are designed to help someone prepare to quit, maintain their motivation and stay on track after they quit.
- My QuitBuddy (**health.gov.au/resources/apps-and-tools/my-quitbuddy-app**): a free mobile phone app designed to support and encourage users to quit smoking.
- Smoking and Diabetes brochure available for download from **quit.org.au/resources/fact-sheets/quitting-smoking-fact-sheets**

Workplace activity

John is a 58yo man living with type 2 diabetes. He was recently admitted to hospital after developing chest pain and has had a cardiac stent.

John reports smoking since his mid-twenties and currently smokes 20 cigarettes per day.

Considering what you know about the negative effects of smoking in someone with diabetes, explain to a supervisor or mentor how you would counsel John about his smoking

Your notes:

Supervisor or mentor signature:

Alcohol and diabetes

Alcohol particularly if consumed in excess can present a number of complications for a person with diabetes including:[88]

- increased triglycerides and risk of fatty liver disease
- high or low blood glucose levels
- an increased risk of hypoglycaemia for people taking insulin and some oral diabetes medications
- harmful interactions with some medications
- increased appetite and weight gain
- increased risk of some diabetes complications.

To reduce the risk of harm from alcohol-related disease or injury the **Australian Alcohol Guidelines** recommend that healthy men and women should drink:[89]

- no more than 10 standard drinks a week
- no more than 4 standard drinks on any one day.

They also say that the less a person drinks, the lower their risk of harm from alcohol.

Children and young people under 18 years and women who are pregnant or breastfeeding are advised not to drink alcohol.

These recommendations apply equally to people living with diabetes.

You can find out more about the guidelines by visiting the NHMRC website **nhmrc.gov.au/health-advice/alcohol**

Figure 16: Alcohol guidelines

Source: NHMRC

Stress, emotional health and diabetes

Living with diabetes from coming to terms with the diagnosis to the day-to-day management and coping with complications can cause stress for many people. Stress can also affect blood glucose levels both directly and indirectly by impacting an individual's ability to perform daily self-care activities such as healthy eating and regular exercise.

Diabetes-related distress is the emotional burden of living with and managing diabetes and if not addressed can lead to burnout where the person feels overwhelmed and stops taking care of their diabetes. It is important that all individuals with diabetes (and/or their family or carers) are encouraged to share their feelings about any aspects of their diabetes management with their healthcare team and are supported with their emotional health and wellbeing.

The NDSS ***Diabetes and Emotional Health Handbook*** describes the 7A's model for supporting people with diabetes with their emotional health:[90]

- Aware: be aware that people with diabetes may experience diabetes distress.
- Ask: about diabetes distress.
- Assess: for diabetes distress using a validated questionnaire.
- Advise: about diabetes distress.
- Assign: to another health professional.
- Assist: with developing an achievable plan.
- Arrange: follow-up.

The ***Diabetes and Emotional Health Handbook*** aims to support health professionals to identify address and communicate about emotional problems during consultations with adults with type 1 and type 2 diabetes.

You can download a free copy from the NDSS website: **ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-and-emotional-health**

The team approach

While nurses can perform a general lifestyle assessment and provide basic education around the lifestyle management of diabetes including stress management it is important that referral to other health professionals is arranged where needed.

This may include:

- referral to an APD for individualised dietary advice
- referral to an AEP for assessment and a tailored exercise program
- referral to a psychologist for help with dealing with diabetes-related distress anxiety or depression
- referral to the person's GP for help with smoking cessation managing emotional or mental health issues or to assess their safety to begin an exercise program.

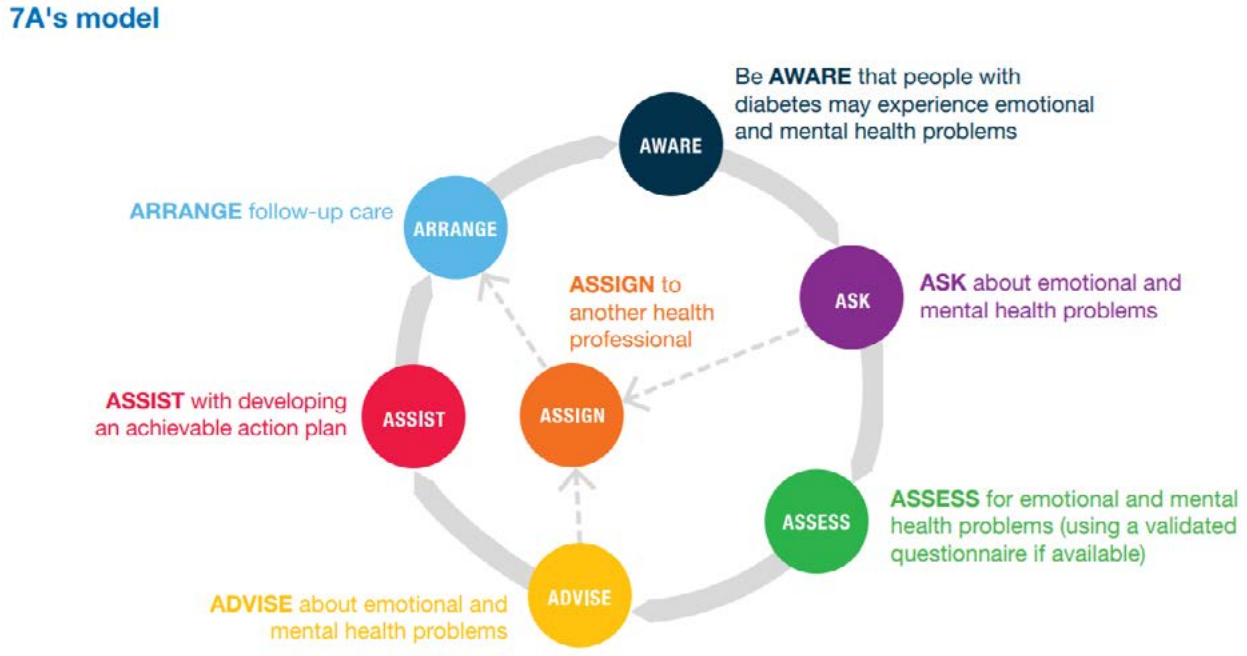

Figure 17: The 7a's model for supporting people with diabetes with their emotional health.

Source: NDSS Diabetes and Emotional Health Handbook.

Workplace activity

If you do not already have other health professionals to refer to within your workplace or local area search for and develop a referral list including a dietitian exercise physiologist and psychologist.

Make a list of referral sources, including their contact details, below:

Name	Profession	Contact details

Supervisor or mentor signature:

Workplace activity

Helen is 60yo woman with recently diagnosed type 2 diabetes. She is a regular patient at your practice and has been booked in for a review of her diabetes management.

Considering what you have learnt in this module explain to a colleague or mentor how you would conduct a lifestyle assessment for Helen and what information and advice you would give based on this assessment.

You might like to consider the diabetes annual cycle of care fact sheet as a guide (available from ndss.com.au/about-diabetes/resources/find-a-resource/your-diabetes-annual-cycle-of-care-fact-sheet)

Your notes:

Supervisor or mentor signature:

NDSS diabetes resources

The NDSS provides a range of fact sheets for people living with diabetes and pre-diabetes.

Download these resources related to nutrition, physical activity, alcohol and emotional health:

- **Healthy Food Choices**
  ndss.com.au/about-diabetes/resources/find-a-resource/making-healthy-food-choices-fact-sheet
- **Physical activity**
  ndss.com.au/about-diabetes/resources/find-a-resource/physical-activity-fact-sheet
- **Alcohol**
  ndss.com.au/about-diabetes/resources/find-a-resource/alcohol-fact-sheet
- **Alcohol and type 1 diabetes booklet (aimed at young people with type 1 diabetes)**
  ndss.com.au/about-diabetes/resources/find-a-resource/alcohol-type-1-diabetes-booklet
- **Diabetes distress**
  ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-distress-fact-sheet
- **Diabetes and depression**
  ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-and-depression-fact-sheet
- **Diabetes and anxiety**
  ndss.com.au/about-diabetes/resources/find-a-resource/diabetes-and-anxiety-fact-sheet
- **When and how psychologists can support people with diabetes**
  ndss.com.au/about-diabetes/resources/find-a-resource/accessing-diabetes-support-from-psychologists-fact-sheet

Assessment questions

Question 1: **Which of the following statements about dietary requirements for people with diabetes is incorrect?**

- [ ] **a.** Food choices should assist with attaining and maintaining a healthy weight.
- [ ] **b.** Personal and cultural food preferences should be considered.
- [ ] **c.** A special diabetes diet is needed.
- [ ] **d.** Food choices should aim to improve overall health.
- [ ] **e.** Food choices should assist in optimising blood glucose levels.

Question 2: **Choose all that are correct. General healthy eating recommendations for people with diabetes include:**

- [ ] **a.** Reducing saturated fat intake.
- [ ] **b.** Choosing foods with a high glycaemic index (GI).
- [ ] **c.** Reducing total fat intake.
- [ ] **d.** Increasing dietary fibre intake.
- [ ] **e.** Avoiding or limiting intake of sugar-sweetened beverages.

Question 3: **David is a 52-year-old with type 2 diabetes treated with metformin and diamicron. His BMI is 29. He has read that a low carbohydrate diet might help him to lose weight and reduce his need for medication and asks your advice about the diet. Would you:**

- [ ] **a.** Encourage him to try the diet but monitor his blood glucose levels regularly.
- [ ] **b.** Tell him that the diet is not suitable for him due to his medications.
- [ ] **c.** Refer him to an Accredited Practising Dietitian (APD) for advice.
- [ ] **d.** Help him to develop a low carbohydrate eating plan.
- [ ] **e.** Provide him with a book on low carbohydrate diets for diabetes.

Question 4: **Choose all that are correct: Ben is a 21-year-old man with newly diagnosed type 1 diabetes who currently smokes a pack a day. Would you:**

- [ ] **a.** Suggest to him that smoking may have caused his diabetes.
- [ ] **b.** Explain the increased risk of diabetes-related health conditions associated with smoking.
- [ ] **c.** Tell him that he has no choice but to stop smoking.
- [ ] **d.** Encourage him to consider quitting.
- [ ] **e.** Offer him support and resources to help with quitting smoking.

Question 5: **Which of the following is not one of the physical activity recommendations for Australian adults 18 - 64 years?**

- [ ] **a.** Be active on most days of the week.
- [ ] **b.** Accumulate 150-300 mins of moderate intensity physical activity each week.
- [ ] **c.** Include muscle strengthening exercises at least twice per week.
- [ ] **d.** Accumulate 75-150 mins of moderate intensity physical activity each week.
- [ ] **e.** Minimise the amount of time spent in prolonged sitting.

Assessment answers

1. c
2. a, d and e
3. c
4. b, d and e
5. d
6. a, c and d
7. a and c
8. c
9. c
10. c

Question 6: **Choose all that are correct. The American Diabetes Association physical activity recommendations for adults include:**

- ☐ **a.** 150 minutes or more of moderate-to-vigorous intensity activity per week.
- ☐ **b.** No more than three consecutive days without exercise.
- ☐ **c.** 2-3 sessions per week of resistance training on non-consecutive days.
- ☐ **d.** Increasing daily incidental exercise.
- ☐ **e.** Exercising on your own which is as effective as supervised programs.

Question 7: **Mary is a sedentary 55-year-old woman with insulin-treated type 2 diabetes and cardiovascular disease. Her husband has recently started exercising at their local gym and she would like to join him but has asked for your advice. Would you (choose all that apply)**

- ☐ **a.** Explain the general benefits of exercise for diabetes and heart health.
- ☐ **b.** Encourage her to join her husband but reduce her insulin doses before her gym sessions.
- ☐ **c.** Refer her to an exercise physiologist for assessment and advice.
- ☐ **d.** Suggest that she speak with a personal trainer at the gym for advice.
- ☐ **e.** Discourage her from joining the gym due to her cardiovascular disease.

Question 8: **Jane is a 45-year-old Caucasian woman. You measure her weight and height which are 75kgs and 158cm and calculate her BMI. She is considered:**

- ☐ **a.** Underweight.
- ☐ **b.** Within the healthy weight range.
- ☐ **c.** Overweight.
- ☐ **d.** Obese.
- ☐ **e.** To have abdominal obesity.

Question 9: **Bill and Mary are a Caucasian husband and wife who both have type 2 diabetes. You measure Bill's waist circumference as 105cm and Mary's at 85cm. Which of the following is correct about their risk of obesity related chronic disease?**

- ☐ **a.** They are both at low risk.
- ☐ **b.** They are both at increased risk.
- ☐ **c.** Mary is at increased risk and Bill is at substantially increased risk.
- ☐ **d.** Bill is at increased risk and Mary is at substantially increased risk.
- ☐ **e.** Mary is at low risk and Bill is at increased risk.

Question 10: **Which of the following statements about emotional health in people with diabetes is incorrect?**

- ☐ **a.** Stress can impact a person's diabetes management.
- ☐ **b.** Diabetes-related distress is common and can lead to burnout if not addressed.
- ☐ **c.** A psychologist is the only health professional who should talk to people with diabetes about their emotional health.
- ☐ **d.** All health professionals should ask people with diabetes about their emotional health.
- ☐ **e.** Assessing emotional health should be part of the diabetes annual cycle of care.

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