
Diabetes and insulin

Summary

- People with type 1 diabetes must inject insulin every day, often up to four or five times per day.
 - There are different insulin delivery devices available ranging from a syringe and needle to an insulin delivery pen to an insulin pump.
 - Your doctor or diabetes nurse educator will teach you about how, where and when to inject insulin, and how to store it safely.
 - Even with the help of your doctor and diabetes nurse educator, it may take a while to find the right insulin dose to reduce your blood glucose to your target levels.
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Diabetes mellitus (diabetes) is a chronic and potentially life-threatening condition where the body loses its ability to produce insulin, or begins to produce or use insulin less efficiently, resulting in blood glucose levels that are too high (hyperglycaemia).

Over time, blood glucose levels above the normal range can damage your eyes, kidneys and nerves, and can also cause heart disease and stroke. An estimated 280 Australians develop diabetes every day.

Diabetes is Australia's fastest-growing chronic disease. The main types of diabetes are type 1, type 2, and gestational diabetes.

Type 1 diabetes

Type 1 diabetes develops when the cells of the pancreas stop producing insulin. Without insulin, glucose cannot enter the cells of the muscles for energy. Instead the glucose rises in the blood causing a person to become extremely unwell. Type 1 diabetes is life threatening if insulin is not replaced. People with type 1 diabetes need to inject insulin for the rest of their lives.

Type 1 diabetes often occurs in children and people under 30 years of age, but it can occur at any age. This condition is not caused by lifestyle factors. Its exact cause is not known but research shows that something in the environment can trigger it in a person that has a genetic risk.

The body's immune system attacks and destroys the beta cells of the pancreas after the person gets a virus because it sees the cells as foreign. Most people diagnosed with type 1 diabetes do not have family members with this condition. For more information about symptoms, visit the [Diabetes type 1 fact sheet](#).

Type 2 diabetes

Type 2 diabetes develops when the pancreas does not make enough insulin and the insulin that is made does not work as well as it should (also known as insulin resistance). As a result, the glucose begins to rise above normal levels in the blood. Half the people with type 2 diabetes do not know they have the condition because they have no symptoms.

Type 2 diabetes (once known as adult-onset diabetes) affects 85 to 90 per cent of all people with diabetes. People who develop type 2 diabetes are very likely to also have someone in their family with the condition. It is considered a lifestyle condition because being overweight and not doing enough physical activity increases the risk of developing type 2 diabetes.

People from certain ethnic backgrounds, such as Aboriginal or Torres Strait Islander, Polynesian, Asian or Indian are more likely to develop type 2 diabetes.

When first diagnosed, many people with type 2 diabetes can manage their condition with healthy diet and increased physical activity.

Over time, most people with type 2 diabetes will need diabetes tablets to help keep their blood glucose levels in the target range. (Regular blood glucose monitoring may be necessary in order to keep track of the effectiveness of the treatment.) The starting time for diabetes tablets varies according to individual need. About 50 per cent of people with type 2 diabetes need insulin injections within 6 to 10 years of diagnosis.

Read more about [type 2 diabetes](#) on the Better Health Channel. The National Diabetes Services Scheme (NDSS) has fact sheets on [Type 2 diabetes](#) and [Understanding type 2 diabetes](#).

Gestational diabetes

Gestational diabetes occurs in about 5 to 10 per cent of pregnant women, and usually goes away after the birth of the baby. Women who have had gestational diabetes have an increased risk of developing type 2 diabetes later on.

Gestational diabetes is commonly managed by monitoring blood glucose levels, seeing a dietitian for help with a healthy eating plan and, where possible, taking part in regular physical activity. Some women may need to inject insulin during their pregnancy to help manage their blood glucose levels until their baby is born.

Read more about [gestational diabetes](#).

Insulin for diabetes

Insulin is a hormone our body makes to keep our blood glucose levels within the normal range. It is made by beta cells in the pancreas. Insulin's main job is to move glucose from our bloodstream into the body's cells to make energy. If you don't have enough insulin, the glucose builds up in your bloodstream instead of providing energy for your body.

With type 1 diabetes, the body does not make any insulin and therefore insulin has to be injected regularly every day to stay alive. With type 2 diabetes, the body does not make enough insulin, or the insulin that is made does not work well. Insulin injections are sometimes needed to manage blood glucose levels.

Starting on insulin

People with type 1 diabetes must inject insulin every day, often up to four or five times per day. They may use a pump to deliver insulin which means they insert a new cannula (very fine plastic tube) under the skin every two to three days. Sometimes, people with type 2 diabetes also need to begin using insulin when diet, physical activity and tablets no longer effectively control their blood glucose levels.

Having to start injecting insulin can be frightening. However, injecting insulin is much easier than most people imagine. There are different devices that can be used to make insulin delivery easy. Pen needles are very fine and so are cannulas. Often people needing insulin feel much better once they start having insulin.

If you need to start using insulin, your doctor or diabetes nurse educator can help with education and support. They will teach you about:

- the type and action of your insulin
- how, where and when to inject insulin
- how to rotate injection sites
- where to get your insulin and how to store it safely
- how to manage low blood glucose
- how to keep a record of your blood glucose levels and insulin doses
- who will help you to adjust insulin doses.

Insulin doses usually don't stay the same as your starting dose. Your doctor or diabetes nurse educator will help you to adjust your insulin. An important part of insulin adjustment is regular blood glucose monitoring and recording.

It may take some time to safely reach the right dose of insulin for you. And because your insulin needs won't necessarily remain constant throughout your life, you will need to see your diabetes health care team regularly for review.

When you start using insulin it is important to have a review by an accredited practising dietitian to understand how carbohydrates and insulin work together.

If you have type 1 diabetes, learning how to count carbohydrates and matching your insulin to the food you eat is the ideal way to manage it. Depending on what you eat, your mealtime insulin doses may therefore vary from meal to meal and day to day.

Types of insulin

Rapid- and short-acting insulin helps reduce blood glucose levels at mealtimes and intermediate or long-acting insulin helps with managing the body's general needs. Both help manage blood glucose levels.

Insulin is grouped according to how long it works in the body. The five different types of insulin range from rapid- to long-acting. Some types of insulin look clear, while others are cloudy. Check with your pharmacist whether the insulin you are taking should be clear or cloudy.

Before injecting a cloudy insulin, the pen or vial needs to be gently rolled between your hands to make sure the insulin is evenly mixed (until it looks milky). Don't use clear insulin if it appears cloudy.

Often, people need both rapid- and longer-acting insulin. Everyone is different and needs different combinations.

The five types of insulin are:

- rapid-acting insulin
- short-acting insulin
- intermediate-acting insulin
- mixed insulin
- long-acting insulin.

Rapid-acting insulin

Rapid-acting insulin starts working somewhere between 2.5 to 20 minutes after injection. Its action is at its greatest between one and three hours after injection and can last up to five hours. This type of insulin acts more quickly after a meal, similar to the body's natural insulin, reducing the risk of a low blood glucose (blood glucose below 4 mmol/L). When you use this type of insulin, you must eat immediately after you inject.

The three rapid-acting insulin types currently available in Australia are:

- Fiasp and NovoRapid® (insulin aspart)
- Humalog® (insulin lispro)
- Apidra® (insulin glulisine).

Fiasp – released in Australia June 2019 – is a new, rapid acting insulin with faster onset of action. It is designed to improve blood glucose levels after a meal.

Short-acting insulin

Short-acting insulin takes longer to start working than the rapid-acting insulins.

Short-acting insulin begins to lower blood glucose levels within 30 minutes, so you need to have your injection 30 minutes before eating. It has its maximum effect two to five hours after injection and lasts for six to eight hours.

Short-acting insulins currently available in Australia are:

- Actrapid®
- Humulin® R.

Intermediate-acting insulin

Intermediate-acting and long-acting insulins are often termed background or basal insulins.

The intermediate-acting insulins are cloudy in nature and need to be mixed well.

These insulins begin to work about 60 to 90 minutes after injection, peak between 4 to 12 hours and last for between 16 to 24 hours.

Intermediate-acting insulins currently available in Australia are:

- Humulin® NPH (a human isophane insulin)
- Protaphane® (a human isophane insulin).

Long-acting insulin

The long-acting insulins currently available in Australia are:

- Lantus® (glargine insulin) – slow, steady release of insulin with no apparent peak action. One injection can last up to 24 hours. It is usually injected once a day but can be taken twice daily.
- Toujeo (glargine insulin) – this insulin has a strength of 300 units per ml so is three times the concentration of other insulin in Australia. It is given once a day and lasts for at least 24 hours. It should not be confused with regular Lantus which has a strength of 100 units per ml. Toujeo is given for safety by a disposable pen only. Toujeo gives a slower, steadier glucose profile especially during the night.
- Levemir® (detemir insulin) –slow, steady release of insulin with no apparent peak action and can last up to 18 hours. It is usually injected twice daily.

Although these insulins are long-acting, they are clear and do not need mixing before injecting.

Mixed insulin

Mixed insulin contains a pre-mixed combination of either very rapid-acting or short-acting insulin, together with intermediate-acting insulin.

The mixed insulins currently available in Australia are:

- rapid-acting and intermediate-acting insulin
 - Ryzodeg 70:30 (70% long acting Degludec, 30% rapid Aspart)
 - NovoMix® 30 (30% rapid, 70% intermediate Protaphane)
 - Humalog® Mix 25 (25% rapid, 75% intermediate Humulin NPH)
 - Humalog® Mix 50 (50% rapid, 50% intermediate Humulin NPH)
- short-acting and intermediate-acting insulin
 - Mixtard® 30/70 (30% short, 70% intermediate Protaphane)
 - Mixtard® 50/50 (50% short, 50% intermediate Protaphane)
 - Humulin® 30/70 (30% short, 70% intermediate Humulin NPH).

Note

In Australia, the strength of the above insulins is 100 units per ml. Some countries have different strengths.

The exception to this is the once-daily long-acting insulin Toujeo which was released in 2015 and has a strength of 300 units per ml. Do not change between Lantus and Toujeo without consulting a health professional.

Insulin injection devices

Different insulin delivery devices are available. The main choices are syringes, insulin pens and insulin pumps.

Insulin syringes

Syringes are manufactured in 30-unit (0.3 ml), 50-unit (0.5 ml) and 100-unit (1.0 ml) measures. The size of the syringe needed will depend on the insulin dose. For example, it is easier to measure a 10 unit dose in a 30 unit syringe and 55 units in a 100 unit syringe.

The needles on the syringes are available in lengths ranging from 6–8 mm Your doctor or diabetes nurse educator will help you decide which syringe and needle size is right for you.

Insulin syringes are single-use only, and are free for people in Australia registered with the National Diabetes Service Scheme (NDSS). Most Australian adults no longer use syringes to inject insulin. They now use insulin pens for greater convenience.

Insulin pens

Insulin companies have designed insulin pens (disposable or reusable) to be used with their own brand of insulin.

Disposable insulin pens already have the insulin cartridge in the pen. They are discarded when they are empty, when they have been out of the fridge for one month, or when the use-by date is reached.

Reusable insulin pens require insertion of an insulin cartridge or 'penfill' (3 ml, containing 300 units of insulin). When finished, a new cartridge or penfill is inserted.

Pen cartridges also need to be discarded one month after commencing if insulin still remains in the cartridge.

Your doctor or diabetes nurse educator will advise you about the right type of pen for your needs.

Pen needles are disposable needles that screw on to an insulin pen device to allow insulin to be injected. They are available in different lengths, ranging from 4 – 12.7 mm. However research recommends that size 4 – 5mm pen needles are used. The thickness of the needle (gauge) also varies – the higher the gauge, the finer the needle. It is important that a new pen needle is used with each injection. Your diabetes nurse educator can advise you on the appropriate needle length and show you correct injection technique.

Insulin pumps

An insulin pump is a small programmable device that holds a reservoir of insulin and is worn outside the body. The insulin pump is programmed to deliver insulin into the fatty tissue of the body (usually the abdomen) through thin plastic tubing known as an infusion set or giving set. Only rapid-acting insulin is used in the pump.

The infusion set has a fine needle or flexible cannula that is inserted just below the skin. This is changed every two to three days.

The pump is pre-programmed to automatically deliver small continual amounts of insulin to keep blood glucose levels stable between meals. Individuals can instruct the pump to deliver a burst of insulin each time food is eaten, similar to the way the pancreas does in people without diabetes.

The insulin pump isn't suitable for everyone. If you're considering using one, you must discuss it first with your diabetes healthcare team.

The cost of an insulin pump is generally covered by private health insurance for people with type 1 diabetes (a waiting period applies). Disposable extras required for use (such as cannulas, lines and reservoirs) are subsidised by the National Diabetes Service Scheme.

Insulin injection sites

Insulin is injected through the skin into the fatty tissue known as the subcutaneous layer. It shouldn't go into muscle or directly into the blood, as this changes how quickly the insulin is absorbed and works.

Absorption of insulin varies depending on where in the body it is injected. The abdomen absorbs insulin the fastest and is used by most people. The upper arms, buttocks and thighs have a slower absorption rate and can also be used.

Factors that speed insulin absorption

Variation in insulin absorption can cause changes in blood glucose levels. Insulin absorption is increased by:

- injecting into an exercised area such as the thighs or arms
- high temperatures due to a hot shower, bath, hot water bottle, spa or sauna
- massaging the area around the injection site

- injecting into muscle – this causes the insulin to be absorbed more quickly and could cause blood glucose levels to drop too low.

Factors that delay insulin absorption

Insulin absorption can be delayed by:

- over-use of the same injection site, which causes the area under the skin to become lumpy or scarred (known as lipohypertrophy)
- insulin that is cold (for example, if insulin is injected immediately after taking it from the fridge)
- cigarette smoking.

Disposal of used insulin syringes

Used syringes, pen needles, cannulas and lancets must be disposed of in an Australian Standards-approved sharps container, which is puncture-proof and has a secure lid. These containers are usually yellow and are available through pharmacies, local municipal councils and state or territory diabetes organisations such as Diabetes Victoria.

Procedures to dispose of sharps containers vary from state to state.

For sharps disposal information and help, you can contact:

- state or territory diabetes organisations, such as Diabetes Victoria
- state department of health
- your local municipal council.

Insulin storage

Insulin needs to be stored correctly. This includes:

- storing unopened insulin on its side in a fridge
- keeping the fridge temperature between 2 and 8°C
- making sure that insulin does not freeze
- once opened, keeping it at room temperature (less than 25 °C) for not more than one month and then disposing of it safely
- avoiding keeping insulin in direct sunlight.

Extreme (hot or cold) temperatures can damage insulin so it doesn't work properly. It must not be left where temperatures are over 30 °C. In summer your car can get this hot (above 30°C) so don't leave your insulin there.

There are various insulated insulin carry bags (such as FRIO) available for transporting insulin.

Insulin safety

Don't use insulin if:

- clear insulin has turned cloudy
- cloudy insulin has lumps or flakes in it, or deposits of insulin are visible on the inside of the vial, penfill or cartridge and cannot be dissolved by gentle rotation
- expiry date has been reached
- it has been frozen or exposed to high temperatures
- a vial, penfill or cartridge has been used or has been out of the fridge for longer than one month.

Record your blood glucose levels and insulin doses

Keeping a written record of your blood glucose levels helps you and your healthcare professional to know when your insulin dosage needs adjustment.

Where to get help

- Your **GP (doctor)**
- Diabetes nurse educator
- Local community health service
- **National Diabetes Services Scheme** helpline Tel. **1300 136 588**
- **Baker Heart and Diabetes Institute** Tel. **(03) 8532 111**

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