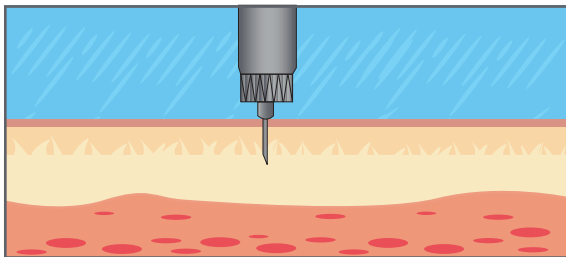


INSULIN

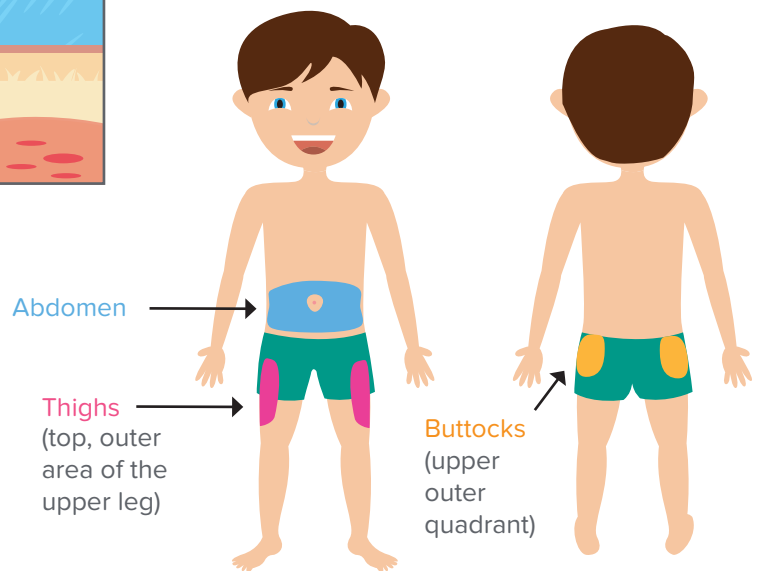
When a person has type 1 diabetes, insulin needs to be administered via injections, or an insulin pump, to replace the insulin that is not being produced by the pancreas. Unfortunately, due to the structure of insulin, it cannot be made into any other forms, such as a tablet or oral liquid. Insulin is essential for normal growth and development. The insulin we administer replaces what our body normally produces.

3.1 INSULIN INJECTIONS

- **Insulin is injected under the skin,** into the fat (known as the subcutaneous layer), where it is absorbed into the bloodstream.



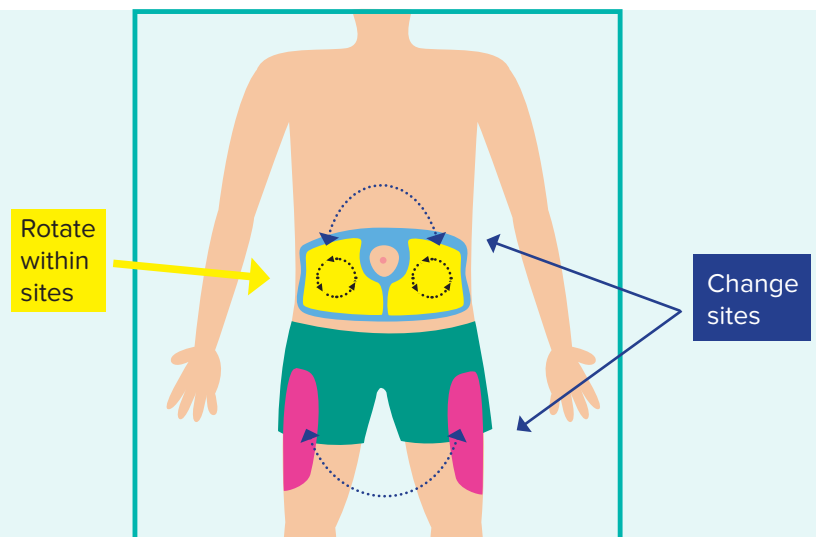
The 3 main sites for injection used in children are:



It is very important to rotate between injection sites and within previous injection sites.

Fatty lumps (called **lipohypertrophy**) can occur when insulin is repeatedly injected into the same area. This will affect insulin absorption.

If **lipohypertrophy** occurs, **stop injecting into these areas immediately.** The lumps should go away over a period of a few months.



3.2 PENS

Insulin pens are either:

Disposable:

- Are prefilled with insulin.
- They can be disposed of into the household rubbish (with needle detached) when either the insulin has run out or if it has been out of the fridge longer than a month, whichever occurs first.

OR

Non-disposable:

- Require you to load a penfill cartridge into the pen before use.
- The pen should not be thrown out.
- The penfill needs to be removed and thrown into a sharps container once empty or if it has been out of the fridge longer than a month. A new cartridge then needs to be loaded.

Your diabetes educator can provide you with non-disposable pens.

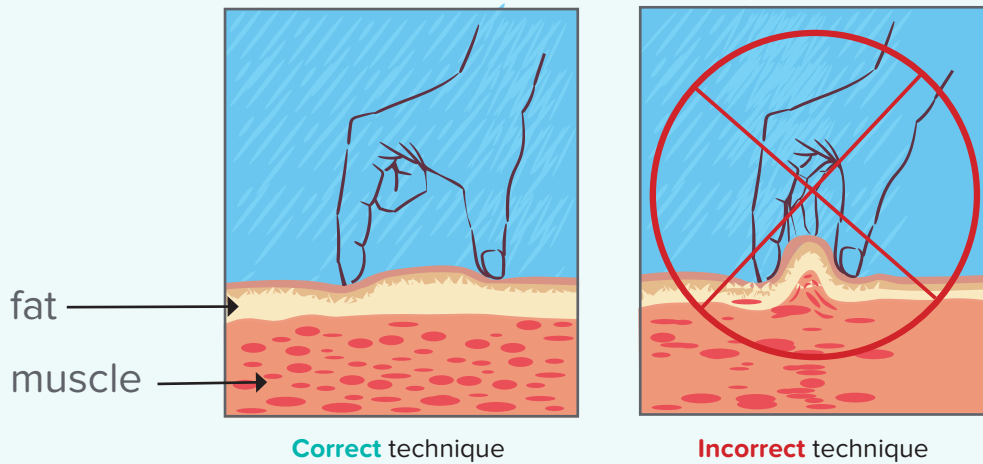
Whether you use a disposable or non-disposable pen is a personal choice and your team can help you decide which option is better for you. Some non-disposable pens can deliver in 0.5 unit increments which may be more suitable for younger children, or those in 'honeymoon phase'.

Insulin is measured in units. One millilitre (mL) of insulin contains 100 units. The penfill cartridges and disposable pens hold 3mL of insulin (300 units). Insulin is also available in larger vials which hold 10mL (1000 units) – some people on insulin pumps may prefer to purchase larger vials.

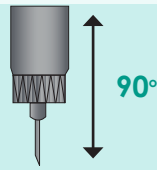
How to do an insulin injection:

- 1 Wash and dry hands.
- 2 Collect **equipment**
(■ **insulin pen** ■ **alcohol swab** ■ **needle** ■ **sharps container** ■ **penfill cartridge for non-disposable pen if required**).
- 3 Check the **expiry date** and ensure there is **enough insulin left** in the pen for the injection.
- 4 **Wipe end of pen** with alcohol swab to disinfect rubber tip.
- 5 Attach needle and pull off outer and inner caps. **Ensure a new needle is used with each injection.**
- 6 Prime the pen by dialling up 2 units of insulin and press the injection button fully. Continue to repeat this procedure until you see drops of insulin at the tip of the pen needle. **Ensure a successful prime has occurred before proceeding with the injection.**
- 7 Use the dose selector to **dial up the number of units you need to inject**. If a larger dose is accidentally dialled up, do not inject the dose. The pen can be dialled backwards.
- 8 Place pen in **preferred hand and curl fingers around pen barrel**, with your thumb near injection button and needle pointing towards the injection site.

- 9 Hold the skin using your index finger and thumb at the chosen site.



- 10 Insert needle through the skin at a **90-degree angle**, firmly but gently.



- 11 Fully depress the injection button, and hold.

- 12 **Count to 10 to allow the insulin to be absorbed.**

- 13 Relax the skin and withdraw needle. Detach needle by placing the outer cap over the needle and unscrew. **Never store an insulin pen with a pen needle attached.**

- 14 Dispose of pen needle into sharps container and store pen in case.



You can view an instructional video here:

<https://www.youtube.com/watch?v=VVKnBOQyHLE>



Please refer to **pictorial guides for specific pen manufacturer instructions**. This will be given to you by your diabetes educator.

3.3 TIPS

- Occasionally an area will bleed slightly or bruise, and this is not harmful. A tense area will bruise more readily, so it is best to relax the area.
- Insulin sometimes leaks out when the needle is withdrawn from the skin. If this happens, ensure you are counting to 10 before withdrawing the needle, or try injecting more slowly.
- Insulin is best injected at room temperature for comfort.
- If your child is experiencing any difficulties with the injections, for example refusal or pain, speak to your diabetes team so they can help address the issue as soon as possible.

3.4 STORAGE

Insulin that is in use can be kept out of the refrigerator in a cool, dark place. Ensure you note the date you open each pen/cartridge because it is only valid for one month once opened. It is important that the insulin is not exposed to extreme conditions (too hot or too cold), as this can affect its effectiveness.

Insulin that is not in use, or is spare, will last until the expiry date when stored in the refrigerator (2-8 degrees Celsius).

Unopened insulin must not be used past its expiry date.

Insulin should never be:

frozen



shaken vigorously



exposed to direct heat or sunlight



Do not use insulin if:

⊗ the clear insulin has turned cloudy

⊗ it is discoloured

⊗ it contains lumps or flakes

⊗ it is past its expiry date

3.5 INSULIN ACTION

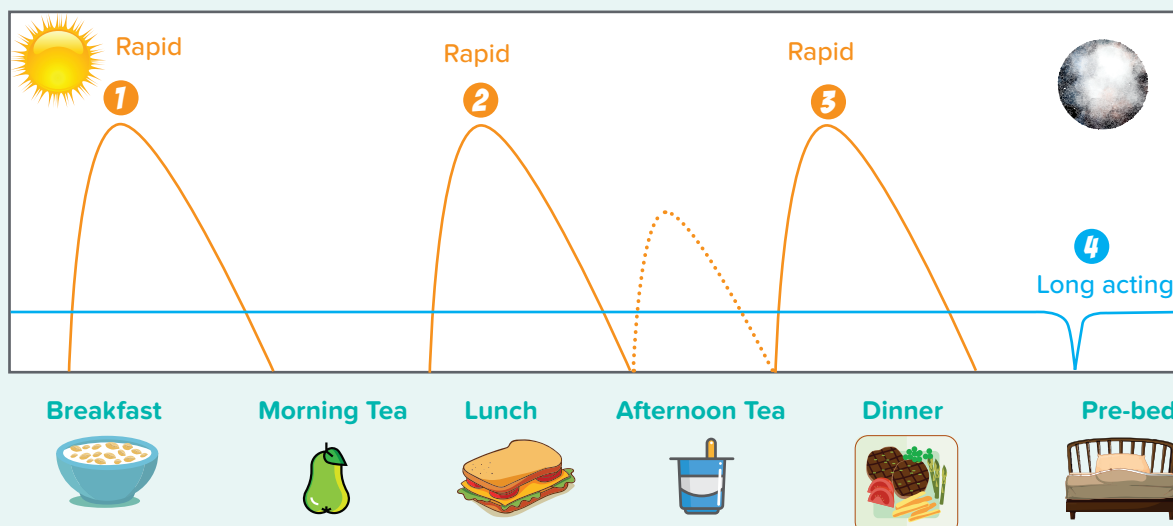
There are various brands and types of insulin available. They are all identical in structure to human insulin despite being made synthetically. Below is a table of commonly used insulin at Perth Children's Hospital.

Insulin Type		Onset of action	Peak of action	Duration of action
Rapid acting (clear)	Humalog NovoRapid	0-15 mins	1-1½ hrs	3-5 hrs
	Fiasp	0-5mins	60 mins	3-5 hrs
Long acting (clear)	Optisulin	2-4 hrs	No peak	24 hrs
	Detemir Levemir	1 hour	3-14 hrs	Up to 24hrs

➤ The **type of insulin used** depends on the **insulin regimen prescribed**.

Multiple Daily Injections (MDI)

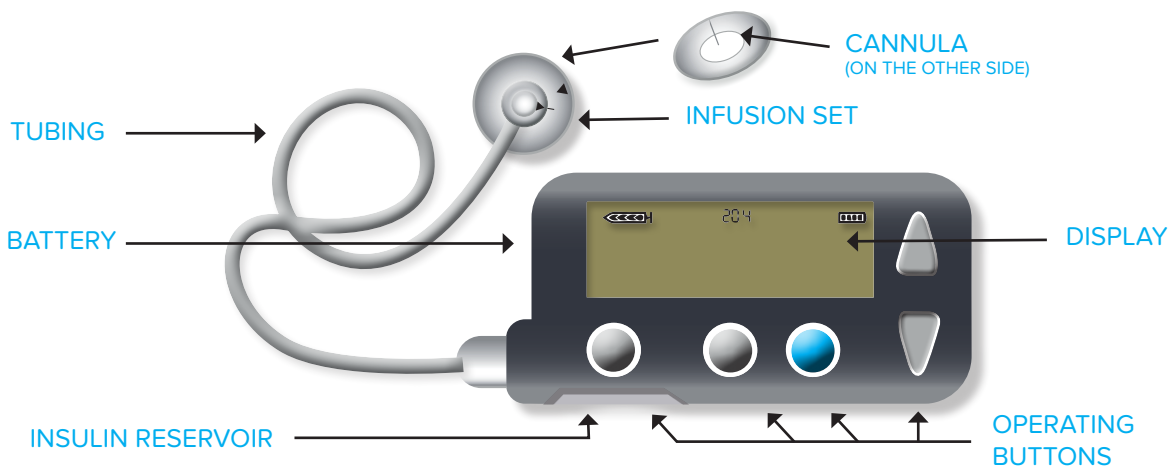
- **1** A **rapid-acting insulin** prior to all main meals
- **2** A **long-acting insulin** at the same time each day usually before bed
- **3** The preferred insulin injection regimen to achieve GL targets but does require a lunchtime insulin injection to be facilitated. It allows for greater flexibility. There is also scope for an afternoon tea injection.



3.6 INSULIN PUMP THERAPY

Insulin pump therapy is a treatment choice for patients with diabetes. Instead of multiple daily injections, insulin is delivered to the patient via a small, electronic device – small enough to fit into the palm of your hand. **The pump is made up of:**

- 1** The pump itself, which is individually programmed to deliver insulin.
- 2** An insulin reservoir which is housed inside the pump. It can hold anywhere between 100-300 units of rapid-acting insulin.
- 3** Most pumps have tubing which connect the pump to the infusion site. The tubing is available in varying lengths.
- 4** An infusion site that is placed on the skin with a waterproof dressing. Underneath the dressing, a cannula sits in the fat layer under the skin where insulin is delivered and absorbed. This infusion site requires changing every two to three days.



*** Please note:** Pump technology is always changing so please check with your clinic team as to what pumps are currently available.

At this point in time, the pump is **not** a fully automated system. It still requires the user to enter information such as:

- **The amount of carbohydrates about to be eaten** - therefore carbohydrate counting is an essential skill.
- **The current blood or sensor glucose level** – meaning blood glucose monitoring and finger pricks still may be required.

Some pump brands can pair with a separate technology called Continuous Glucose Monitoring (CGM) (please refer to **Section 3** for more information).

Regular review is required to ensure the programmed pump settings are adequate for the user – this is especially the case when a person is **under 18 years of age** and may still be undergoing periods of growth and development. Insulin pump settings may need to be reviewed and adjusted as often as every **2-4 weeks** in some cases to fit the person's changing insulin requirements.

The pump is able to fine-tune insulin delivery and can deliver insulin amounts as small as 0.01 units. Because of this ability, it can very closely mimic the pancreas, resulting in the ability to achieve finer blood glucose control. The pump is completely programmable and delivers insulin in two ways:

- **Basal insulin:** The pump delivers a small amount of insulin (as would the pancreas) according to the programmed settings based on the person's insulin requirements without food. Different basal rates can be programmed for different times of the day as needed. Automated basal delivery systems can alter the amount of insulin delivered in response to sensor glucose levels.
- **Bolus insulin:** To give a dose (or "bolus") of insulin to cover carbohydrate intake or to bring a person's high GL back to target. The pump can calculate how much insulin is required as a bolus when provided with a blood or sensor glucose level and amount of carbohydrate being consumed.

3.7 Why choose insulin pump therapy?

- Ability to achieve **better blood glucose control** and reduce the risk of long-term complications.
- Reduced rate of **acute hypoglycaemia**.
- Increased ability for **flexible lifestyle**.
- **Removes the need for multiple daily injections** that can help with improved quality of life and burden of disease.
- **Can help with:**
 - managing exercise
 - bolusing for low GI foods or foods containing fat and / or protein
 - hypo unawareness
 - gastroparesis

3.8 Things to consider

- Insulin pump therapy can be challenging with the need to carbohydrate count and regularly review insulin pump settings.
- The person with diabetes should want to be on insulin pump therapy. It is important to have this conversation with your child if they are old enough.
- It does not remove the requirement of blood glucose monitoring at this time but can reduce it when used with an approved CGM system.
- The cost of consumables is about \$30-\$40 / month.
- The pump ideally needs to be attached at all times. However, it can be detached for exercise, baths, showers and swimming. It should not be detached for more than 2 hours.
- The insulin pump only delivers rapid-acting insulin. If the pump is disconnected or if the **flow of insulin is interrupted for more than 3-4 hours, diabetic ketoacidosis (ketones) can develop quickly**.
- Computer and internet access is required so that you can upload your insulin pump data for review of settings.

3.9 Interested in pump therapy? Here's what to do:



Think about which pump brand you would like to use.

This is your decision made with the support of the clinic team.

The main pumps seen in our clinics include:

1

MEDTRONIC

Website • www.medtronic-diabetes.com.au

2

Tandem t:slim - Australasian Medical and Scientific Ltd

Website • <https://amsldiabetes.com.au/>

3

YpsoPump - Ypsomed Delivery Systems

Website • www.ypsomed.com/en-AU/

4

Omnipod DASH - Insulet

Website • <https://www.omnipod.com/en-au>

Do your own research. It is advised to complete the online learning packages so that you have a full understanding of the pump's capabilities. You can also speak to your health care team if you have any further questions.



Speak to your private health insurance company

Once you have decided on the type of pump you would like to use, it is important to speak to your private health insurer to see if your child's current level of cover will purchase the insulin pump.

If your child's health insurance is yet to reach its maturation date or if you have just applied for health insurance, you may be eligible for a loan pump until your health insurance matures. You will need proof of health insurance commencement, and level of cover.

Please speak to your **diabetes team** if you are unable to afford private health insurance.

Interested in pump therapy? Here's what to do (continued):



Speak to your diabetes educator

The transition to insulin pump therapy can be overwhelming. Your diabetes educator will be able to provide you with advice to ensure this transition process is as smooth and stress-free as possible.

Once you and your team feel like you are ready for [insulin pump therapy](#), you will need to complete [insulin pump application paperwork](#). This includes:



Insulin pump choice and checklist form



Insulin pump order form



Health insurance form (if applicable)



Your completed **application is then submitted.**



Then you will be **placed on the pump waitlist.** Pump waitlist times can vary.



You will be **contacted by the pump administration team** once you have **reached the top of the waitlist** to organise education dates and pump start.