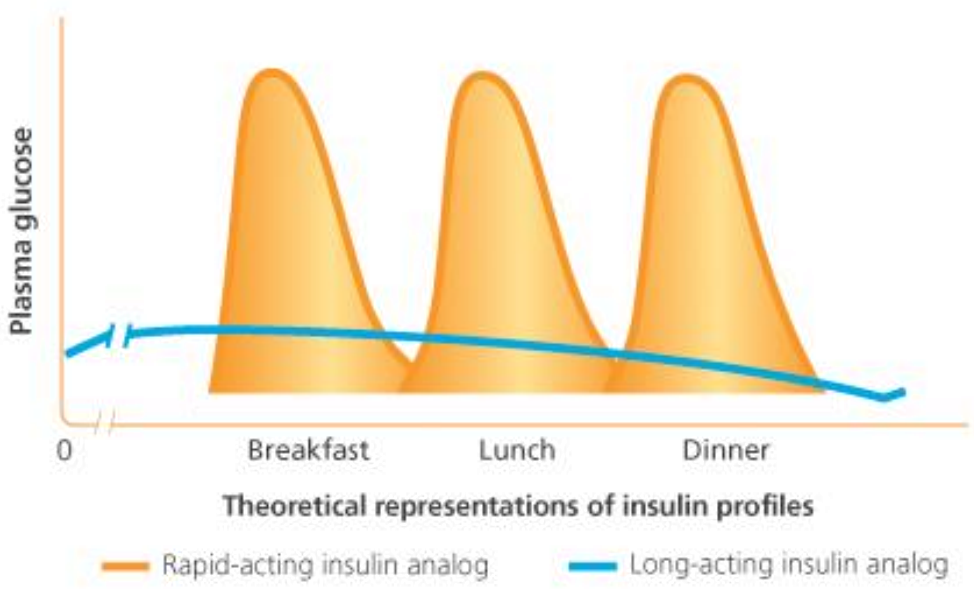
Flexible Dosing of Insulin

Flexible Dosing, sometimes called Flexible Bolusing or MDI (Multiple Daily Injections), is designed to mimic the body's normal production of insulin. It requires you to inject a background amount of insulin daily and an extra dose of rapid acting insulin (known as an insulin *bolus*) with each meal. This means people on MDI will have a minimum of 4 injections each day.

Basal insulin (e.g. Lantus or Levemir) is background insulin that helps to keep blood glucose levels (BGLs) in target when food isn't being eaten.

Bolus insulin (e.g. NovoRapid or Humalog) is rapid acting insulin given before each meal that allows you to use the carbohydrate you eat for energy. This dose should be matched to the amount of carbohydrate you eat.



"Flexible" means you can inject different amounts of insulin depending on:

1. how much you are planning to eat, and
2. what your pre-meal blood glucose level (BGL) is.

Adjusting your insulin doses to match your food intake, and correct any BGLs that are above target, will help you keep your BGLs in target more often.

It also means you can be flexible with the timing of your meals. Unlike twice-daily insulin regimens, if you are using flexible dosing your meals do not have to be eaten at strictly the same time each day/night.

Flexible dosing can also help you manage sport, illness and stress more easily.

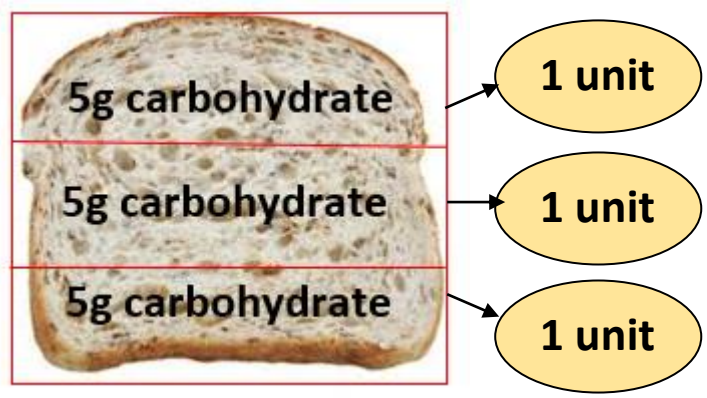
For success with flexible dosing it is important to have a good understanding of carbohydrate counting. See your dietitian if you need help with carb counting.

Carbohydrate ratio

The Insulin to Carbohydrate Ratio (ICR) is the number of grams of carbohydrates that is covered by 1 unit of insulin. For people who prefer to count carbs in serves (instead of grams) the carb ratio can also be written as units of insulin per serve of carbohydrate.

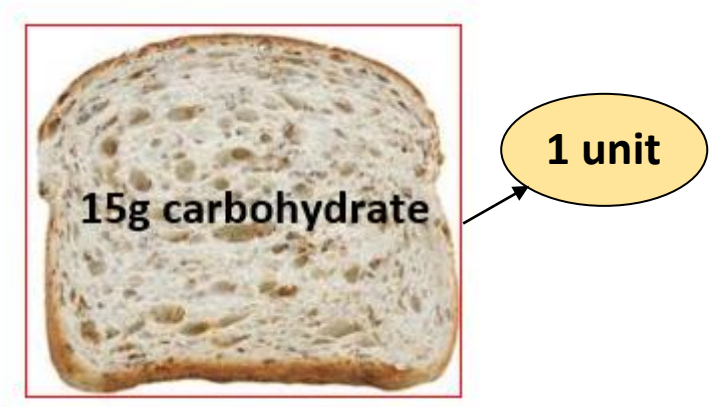
Carb ratios vary amongst people and can be affected by the time of the day, and other factors like changes in weight, age, or exercise.

Below is an example of two different ICR's applied to the same food.



This person needs an ICR of 1 : 5g.
This can also be written as 3 : 15g or 3 units per serve of carbs.

Each unit of insulin covers 5 g of carbohydrate
OR each serve of carbs (15g) needs 3 units of insulin.



This person needs an ICR of 1 : 15g, or 1 unit per serve of carbs.

Each unit of insulin covers 15g, or 1 serve, of carbohydrate

To calculate the ICR the 500 rule is sometimes used. You take the number 500 and divide it by the current total daily dose (TDD) of insulin. For example, if you usually have 20 units of Lantus and 10 units of Novorapid with each of your three meals then your TDD is 50.

- 500 divided by 50 = 10, thus your ICR would be 1:10g.
- This could also be written as 1.5 units per 15g serve of carbs.

Often children under 5 years of age need to use the 300 rule for more accuracy. The 300 rule may also be helpful for older children and teenagers, especially if their TDD is low (e.g. less than 1 unit of insulin per kilogram of body weight).

To check if your ICR is correct you need to check your BGL 2-3 hours after eating. If the BGL is more than 3mmol higher than what it was before the meal, you need to consider making your carb ratio stronger.

Provides the largest dose of insulin ↕ Provides the smallest dose of insulin	**Insulin : Carb ratio (g)**	**Which can also be written as**	
	1	15	units per 15g serve carbs
	1.5	10	units per 15g serve carbs
	2	7.5	units per 15g serve carbs
	3	5	units per 15g serve carbs
	4	3.75	units per 15g serve carbs
	5	3	units per 15g serve carbs
	6	2.5	units per 15g serve carbs
	7.5	2	units per 15g serve carbs
	8	1.875	units per 15g serve carbs
	10	1.5	units per 15g serve carbs
	12	1.25	units per 15g serve carbs
	15	1	units per 15g serve carbs
	20	0.75	units per 15g serve carbs
	25	0.6	units per 15g serve carbs
	30	0.5	units per 15g serve carbs

Correction factor

A correction factor is sometimes called the Insulin Sensitivity Factor (ISF). This is a measure of how powerful one unit of insulin is in your body. The correction factor is used to work out how much extra insulin you need to give when your BGL is above target.

For example, a correction factor of 2 means that 1 unit of insulin should lower your BGL by 2mmol/L. So if your BGL is 9mmol/L and you give 1 unit of insulin, your BGL should come down to about 7mmol/L in the next 2-3 hours.

To work out what your correction factor is, take the number 100 and divide it by your TDD. Like the previous example, if your TDD is 50 units, your correction factor is 2.

To check if your correction factor is right, check your BGL logbook. Look at times when you have added a correction dose of insulin to your meal dose, and see what the BGL was 2-3 hours later. If the BGL is not coming back to target (i.e. you are having high or low BGLs 2-3 hours after that meal) then you know your correction factor might need to change.

Working out the insulin dose
When you are using flexible dosing your pre meal insulin dose will change all the time. To help work out the dose you can use tools like dosing cards, or a meter or app with a bolus calculator feature built in.
There are several glucose meters and phone apps available which allow you to program different ICRs and ISFs at different times of the day to help you calculate your insulin dose.

Remember that ICRs and ISFs will change over time, especially in children and young people who are still growing. This is why its important to regularly review your settings in whichever tool you are using.

NOTE - the pre meal target blood glucose level is 4 – 7mmol/L.

What about snacking?
Snacks are not compulsory on MDI. If you want to snack in between your meals then aim to keep it less than 15 grams of carbohydrate, unless you are planning to give extra rapid acting insulin.

If you are consistently feeling hungry in between your meals then consider increasing the size of your main meal or including more low GI carbohydrates such as wholegrain breads, grains, dairy foods, legumes, vegetables and some fruits to improve your feeling of fullness.

Getting the most out of Flexible Dosing

- ✓ Check your BGLs before each meal and at bedtime as a daily minimum.

- ✓ Check your BGLs 2-3 hours after your main meal (without snacking in between) to assess if your insulin dose and food are well matched. If your BGL is more than 3mmol/L higher or lower than your pre-meal reading on 3 occasions (at that same meal) then your insulin dose may need to be adjusted.

- ✓ Check if your background insulin (e.g. Lantus or Levemir) dose is correct by comparing your pre bed BGL with your fasting BGL first thing in the morning. If the morning BGL is often more than 4mmol higher or lower than the night before you need to change the dose by 1-2 units. If you change the background insulin, always give it at least 3 days to see the new pattern before making any further changes.

- ✓ Stay in touch with your diabetes team, especially during the first few weeks of changing over to MDI.

RCH Diabetes Team: Monday-Friday 8am-4pm (03) 9345 6661
or diabetes@rch.org.au

RCH acknowledges the Children's Diabetes Centre, at Perth Children's Hospital, WA for their permission to adapt their resource "Guide to Flexible Insulin Therapy for Families"