



Managing Type 1 Diabetes with Multiple Daily Injections (MDI)



Diabetes Care and Research Program

Important telephone numbers

Diabetes Clinic:	
Diabetes Specialist:	
Nurse Practitioner/Nurse:	
Registered Dietitian:	
Pharmacist:	
Family Doctor:	

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How will this class help me?

You will be able to:

1. Find patterns in your blood sugar results.
2. Identify reasons for blood sugars that are out of target such as:
 - Not taking the right insulin dose.
 - Under or overestimating carbohydrates in meals.
 - Exercise, stress, illness or other factors.
3. Describe steps to take to correct blood sugars that are out of target.
4. Describe actions to prevent and treat low blood sugar.
5. Describe actions to prevent and treat high blood sugar. Know how to use a correction factor.
6. State actions to take during sick days, including blood ketone monitoring.
7. Describe baseline doses (basal and bolus doses) which include personalized blood sugar targets, insulin to carbohydrate ratio with meal carbohydrate goals and correction factor.
8. Think about problems or issues you may have with your current insulin plan.
9. Develop an action plan for pattern management of your insulin doses.
10. Commit to collecting information you need to evaluate your doses.

What is a Basal-Bolus system?

A basal-bolus system includes basal (background) insulin and bolus (carbohydrate or correction dose) insulin.

When you have Type 1 diabetes, you take insulin by multiple daily injections or through an insulin pump because your pancreas is unable to make enough insulin.

Both ways mimic how a healthy pancreas works by matching insulin to the food you eat and activity you do.

For the system to be successful, you must:

- test your blood sugar
- count your carbohydrates, and
- adjust your insulin doses as needed

Basal insulin

- Basal insulin is the slow long acting insulin that provides a foundation of insulin over 24 hours.
- Keeps your blood sugar constant throughout the day and night.
- Usually makes up about ½ of the insulin that your body needs.

Bolus insulin (carbohydrate or correction dose)

- Bolus insulin is the fast acting insulin to work with the carbohydrate at meal and snack time.
- Keeps your blood sugar from rising too high after you eat carbohydrates. Rapid acting insulins do not have their full effect as quickly as many think. They start to work almost right away, but the full effect to lower blood sugar takes longer.

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- Usually makes up about ½ of the insulin that your body needs.

Take this insulin 5 to 15 minutes before you eat.

You may need a “correction dose” of rapid acting insulin if your blood sugars are out of your target range. An example of this is if you did not take enough insulin the last time you ate or you are sick.

Basal Insulin	Onset	Peak	Duration
NPH or N	1 to 3 hours	5 to 8 hours	12 to 18 hours
Lantus	90 minutes	Peakless	24 hours
Levemir	90 minutes	Peakless	16 to 24 hours

Bolus Insulin	Onset	Peak	Duration
Novorapid Humalog Apidra	10 to 15 minutes	1 to 2 hours	3 to 5 hours
Novolin (R) Humulin (R)	30 minutes	2 to 3 hours	6.5 hours

Circle or highlight which basal and bolus insulin(s) you are taking.

Find your BEST Baseline Insulin Doses on MDI

Baseline doses are set doses of basal and bolus insulins which keep your blood sugars in target under normal conditions.

It may take time and practice to find the best baseline doses for you. It is important to know these doses. All of your adjustment guidelines should be based on correct baseline doses.

Refer to your copy of “My Diabetes Plan” (Baseline Doses), which includes your:

- carbohydrate goals at each meal
- insulin to carbohydrate ratio
- blood sugar targets
- correction factor
- basal insulin dose(s)

What are blood sugar targets?

The Canadian Diabetes Association recommends these following blood sugar targets for most adults:





- Before meals:
 - 4.0 to 7.0 mmol/L
- Up to 2 hours after meals:
 - Between 5.0 to 10.0 mmol/L. Between 5.0 to 8.0 mmol/L is even better if you can safely get there without many low blood sugars.

Work with your diabetes educator to set blood sugar targets that work best for you.

**What causes blood sugars to fluctuate
(go too high or too low)?**

Hypoglycemia (Low blood sugar – less than 4.0 mmol/L)	Causes	Hyperglycemia (High blood sugar – more than 9.0 mmol/L)

Exercise and physical activity

Exercise and physical activity can:	Why?	What do I need to consider?
Raise blood sugars 	<ul style="list-style-type: none"> • During intense activities, your body release hormones that can raise your blood sugars. 	<ul style="list-style-type: none"> • You may need to adjust your insulin doses.
Lower blood sugars 	<ul style="list-style-type: none"> • Your body uses up extra carbohydrate when exercising. • You are more sensitive to your insulin. 	<ul style="list-style-type: none"> • Take less insulin (bolus or basal). • Eat more carbohydrate. • Combination of both.

These are guidelines. Work with your diabetes educator to determine the food and insulin adjustments that are right for you.

Exercise and physical activity guidelines to help you prevent low blood sugars

Aerobic activities: For activities such as cleaning, chores and shopping as well as brisk walking, jogging, swimming and skiing.

- Take less insulin (bolus OR basal) that is peaking during the activity, OR
- Eat more food, OR
- Do a combination of both

If you know your activity will take place within 2 hours of having taken a meal or correction bolus, you may choose to take less bolus insulin.

The amount to reduce your bolus insulin depends on how hard your activity is, how fit you are, the time spent (duration) and the type of activity.

If the activity is happening 3 or more hours after a meal or correction bolus, you may not need to make any changes.

How much carbohydrate will I need during activity?

Mild-Moderate Activity (walking)	Take 15 grams of carbohydrate for every 30 minutes.
Strenuous Activity (such as tennis, swimming, cycling, jogging, biking, hockey, or soccer)	Take 20 grams of carbohydrate for every 30 minutes.

A **'try and test'** approach will help you learn what will work for you!

Test your blood sugar before, during and after your activity to determine your blood sugar trends.

Call your diabetes educator if you need help managing your blood sugar for your activity.

Let's put this into practice - exercise

1. Jeff is taking his dog for a walk right after supper for 30 minutes.
How much carbohydrate will Jeff need for his walk and to prevent a low blood sugar?



75 grams	Carbohydrate eaten at supper (meal carbohydrate)
—	minus
___ grams	Carbohydrate needed for a 30 minute walk (exercise carbohydrate)
=	equals
___ grams	Carbohydrate to be covered by insulin

You do not need to take insulin for the carbohydrates your body uses during exercise.

2. Jane is planning to go cycling at 11 am for 1 hour. Her blood sugar before breakfast is 5.9 mmol/L. At breakfast (7:00 am), she is planning to eat 50 grams of carbohydrate. She is trying to decide what she should do at breakfast to prevent a low blood sugar during her planned activity.

Place a check beside what Jane should do at breakfast time:

- Take less insulin at breakfast.
- Take her usual dose of insulin at breakfast for her 50 grams carbohydrate.
- Eat more carbohydrate at breakfast.

Jane's blood sugar right before cycling is 6.6 mmol/L. She is planning to cycle for 1 hour.

Place checks beside what Jane should do:

- Have fun cycling.
- Eat protein only.
- Eat 15 grams of carbohydrate.
- Eat 40 grams of carbohydrate without taking extra insulin.
- Eat 40 grams of carbohydrate and take insulin to cover it.
- Other ideas _____

A website for persons with type 1 diabetes who are interested in sports and activity is run by the Diabetes Exercise and Sports Association (DESA) at www.insulindependence.org

Alcohol

If you wish to drink alcohol when you have diabetes, you will need to ask your doctor these questions:

- Can I drink alcohol?
- How much should I drink?
- What can I drink?



Do not drink alcohol without talking to your doctor. He or she knows your medical history, and how well your diabetes is controlled. Your doctor will let you know if you can have alcohol.

Once you know you can drink alcohol, it is important to learn about:

- the effect of alcohol on the control of your diabetes.
- how to avoid running the risk of having a low blood sugar.

You must be 19 years of age or older to legally drink in Ontario.

How does alcohol affect my diabetes?

The alcohol moves from your stomach into your blood.



The liver starts to break it down.



If you drink alcohol faster than the liver is able to break it down, the alcohol builds up in your blood. When your blood alcohol level is high, your liver will work very hard to lower it.



If in addition to drinking alcohol, your blood sugar goes low from lack of food or from extra activity like dancing, the pancreas will make a hormone called glucagon.



Glucagon causes the liver to make more sugar. If the liver is too busy breaking down the alcohol, it will not react to the glucagon to make more sugar.



The symptoms of low blood sugar can look like the signs of being drunk. You and people around you may not even realize that your blood sugar is low.



If your blood sugar goes too low, you can become unconscious. Glucagon by injection may not work if you have been drinking a lot of alcohol.

How do I help to prevent the risks?

Here is a list of tips to help you drink alcohol safely:



- Follow your normal diabetes routine such as testing, taking insulin or other medications and regular meals. This will help you keep your blood sugars stable.
- Wear a bracelet showing you have diabetes and tell the people in your life that you have diabetes. Let them know the symptoms of a low blood sugar and what to do if it happens.
- Always carry:
 - your glucometer and test your sugar, especially if you start to feel the symptoms of low blood sugar.
 - a source of simple carbohydrate with you (such as hard candies, juice box, dextrose tablets) and tell people where it is.
- If you are going to drink alcohol, have it with food. Be sure to eat more if you are active, such as dancing.
- **Never take extra insulin for the alcohol you will be drinking.**
- Drink slowly - this will prevent alcohol build-up in your blood.
- Stretch drinks with mixers that do not contain carbohydrates such as diet pop, water and soda water.
- Alternate alcoholic and non-alcoholic drinks.
- Limit your drinks to 1 or 2 at one time. Take no more than 14 drinks/week for a man and 9 drinks/week for a woman.
- Before going to bed, test your blood sugar. If it is low, eat a snack with carbohydrate before you go to bed.
- When you wake up, follow your normal diabetes routine such as testing, taking insulin or other medications and regular meals. Carry a source of simple carbohydrate with you even after breakfast, because there is still a risk of low blood sugar.

Carbohydrate and alcohol content of selected drinks

Drink	Carbohydrate Content	Alcohol Content	Calorie Content
12 oz Regular Beer (5 to 6% alcohol)	10 to 13 g	15 g	135 to 150 kcal
12 oz Light Beer (3-4% alcohol)	5 to 9 g	10 to 11 g	90 to 120 kcal
12 oz Low Carb Beer, eg. Sleeman Clear (4% alcohol)	2.5 g	11 g	90 kcal
1 ½ oz Whiskey, Rye, Scotch, Gin, Rum, Vodka	0 g	15 g	105 kcal
1 ½ oz Brandy or Cognac	0 g	15 g	105 kcal
5 oz Dry Red or White Wine (0)	0 g	13 g	100 kcal
3 oz Dry Sherry	0 g	15 g	105 kcal
12 oz Wine Cooler	30 to 43 g (flavours vary)	13 g	200 to 280 kcal

Never take extra insulin for alcohol.

Stress

Stress can	Why? During stressful times:	What do I need to consider?
Raise blood sugars 	<ul style="list-style-type: none">• Your body releases hormones that can raise your blood sugars.	<ul style="list-style-type: none">• You may need to take a correction dose.• For ongoing stress, you may need to adjust your insulin doses (basal and/or bolus).
Lower blood sugars 	<ul style="list-style-type: none">• You may be eating less carbohydrate than usual or miss meals.• You may be more busy (active) than usual trying to deal with stressful event.	<ul style="list-style-type: none">• Take less insulin (bolus or basal).

Call your diabetes educator if you need help managing your blood sugars for stress.

What is a low blood sugar?

Low blood sugar is when your blood sugar is less than 4.0 mmol/L.

It is also called **hypoglycemia**.

How do you know you have low blood sugar?

You may feel one or more of these symptoms:

- nervous or irritable
- sweaty
- very hungry
- unsteady on your feet
- a headache
- blurred vision
- shaky, faint or light headed
- weak
- difficulty thinking
- abdominal pain or upset stomach
- slurred speech
- numb or tingling lips, tongue, fingers, feet

If you have one or more of these symptoms, test your blood sugar to see if it is less than 4.0 mmol/L.

If your blood sugar is less than 4.0 mmol/L, you need to treat it right away. If left untreated, your symptoms could get worse and you could pass out.

If you are not able to test your blood sugar, treat your symptoms right away.

Treating low blood sugar

Step 1

Stop what you are doing

Blood sugar 2.9 to 4.0 mmol/L	Blood sugar 2.8 mmol/L or less
<p>Eat or drink 15 grams of fast-acting carbohydrate. Choose one of these:</p> <ul style="list-style-type: none">• 4 glucose tablets (depending on brand)• 3 teaspoons, cubes or packages of table sugar (may be dissolved in water)• $\frac{3}{4}$ cup regular pop (not sugar free or diet)• $\frac{3}{4}$ cup fruit juice• 3 candies (depending on brand)	<p>Eat or drink 20 grams of fast-acting carbohydrate. Choose one of these:</p> <ul style="list-style-type: none">• 7 glucose tablets (depending on brand)• 4 teaspoons, cubes or packages of table sugar (may be dissolved in water)• 1 cup regular pop (not sugar free or diet)• 1 cup fruit juice• 6 candies (depending on brand)

Step 2

- Wait for 15 minutes. Check your blood sugar level again.
- If your blood sugar is still less than 4.0 mmol/L or if the symptoms of low blood sugar do not go away, repeat Step 1.



If you have a low blood sugar just before a meal or snack, treat it as described in Steps 1 and 2 and then have your regularly planned meal or snack and medication.

If your next meal is more than one hour away, have a snack with a starch and protein such as:

- $\frac{1}{2}$ cup of milk plus 2 plain cookies
- $\frac{1}{2}$ cup of milk with $\frac{1}{2}$ cup cereal
- 6 crackers with 1 oz cheese
- 1 slice of bread with 1 tablespoon peanut butter or 1 oz meat or cheese

This will help maintain your blood sugar level until your next meal.

Always carry a fast acting source of carbohydrate with you.

Let's put this into practice – “Low Blood Sugar”

What would you do if you had a low blood sugar of 2.3 mmol/L first thing in the morning before breakfast?

- Eat breakfast and not take breakfast bolus insulin
- Eat breakfast and take less bolus insulin
- Drink $\frac{3}{4}$ cup juice and then eat my breakfast and take my usual dose of insulin
- Drink 2 cups of juice and skip breakfast and insulin
- Drink 1 cup of juice, and then I eat my breakfast and take my usual dose of insulin
- Think about what may have caused my low blood sugar

Hypoglycemia unawareness

This means you do not feel the symptoms of a low sugar. The most common cause of hypoglycemia unawareness is frequent low blood sugar.

This is dangerous! It puts you at risk of passing out (being unconscious). You will need help from someone else when this happens.

Talk to your diabetes educator if you do not have symptoms of low blood sugars. Sometimes avoiding low blood sugars for a period of time, will help you regain the symptoms in the future if you have them.

Your diabetes educator will work with you to adjust your current insulin doses and set blood sugar targets that will reduce the frequency of low blood sugars.

What is glucagon?

- Glucagon is a hormone that quickly raises the blood sugar level in an emergency, such as a severe insulin reaction.
- You will require glucagon when your blood sugar is low and you are unable to swallow safely. Without glucagon, low blood sugar is dangerous and may cause a seizure and/or brain damage.
- Glucagon is not sugar. It works by making the body use glycogen, the sugar stored in the liver, for energy.

Speak to your diabetes educator if you would like more information about glucagon.

Driving guidelines

When you take insulin, you are at risk of having a **low blood sugar while driving**.

If you have a low blood sugar while driving, you are a danger to yourself and others. A low blood sugar is also called hypoglycemia.

Your blood sugar should be over 5.0 mmol/L to drive.

Remember “Over 5 to Drive”.

If you drive a commercial vehicle, there are different guidelines for your blood sugar level. Please discuss with your health care provider and ask for a copy of “Diabetes and Commercial Driving”.



What do I need to do before I drive?

Always test your blood sugar just before driving.

- If your blood sugar **is over 5.0 mmol/L**, you can drive. Test your blood sugar after every 4 hours of driving.
- If your blood sugar **is less than 5.0 mmol/L** or you have one or more of the symptoms of a low blood sugar, you need to raise your blood sugar quickly by doing **Steps 1 and 2** below.



Testing your blood sugar before you drive is critical when you have hypoglycemia unawareness.

Step 1

Stop what you are doing

Blood sugar 2.9 to 5.0 mmol/L	Blood sugar 2.8 mmol/L or less
<p>Eat or drink 15 grams of fast-acting carbohydrate. Choose one of these:</p> <ul style="list-style-type: none"> • 4 glucose tablets (depending on brand) • 3 teaspoons, cubes or packages of table sugar (may be dissolved in water) • ¾ cup regular pop (not sugar free or diet) • ¾ cup fruit juice • 3 candies (depending on brand) 	<p>Eat or drink 20 grams of fast-acting carbohydrate. Choose one of these:</p> <ul style="list-style-type: none"> • 7 glucose tablets (depending on brand) • 4 teaspoons, cubes or packages of table sugar (may be dissolved in water) • 1 cup regular pop (not sugar free or diet) • 1 cup fruit juice • 6 candies (depending on brand)

Step 2

Wait 15 minutes. Do not drive. Check your blood sugar again:

- If your blood sugar is still **5.0 mmol/L or less** or your symptoms have not gone away, repeat Step 1.
- If your blood sugar is **over 5.0 mmol/L**, have a snack such as a granola bar, cheese and crackers or ½ sandwich to keep your blood sugar above 5.0 mmol/L.



When you treat a low blood sugar, always wait 45 to 60 minutes before you drive.

You need this time to fully recover and be able to drive safely.

What do I do if I feel a low blood sugar while I am driving?

If you feel that your blood sugar is low:

- pull to the side of the road and stop driving
- remove your keys from the ignition
- test your blood sugar
- treat a low blood sugar by doing Step 1 and Step 2 above
- wait 45 to 60 minutes before driving



Drive safely

Always wear your medical alert identification.

Keep an “emergency kit” in your vehicle to prevent or treat low blood sugars. This kit should contain:

- glucose tablets
- drinks with sugar such as juice or regular pop
- granola bars
- 2 or 3 plain cookies



Always travel with your blood glucose monitor and testing supplies.

Do not keep your monitor and supplies in the vehicle as they can be affected by hot or cold temperatures.

When is it unsafe to drive?

A person who is likely to have a low blood sugar (hypoglycemia) may not be fit to drive. You may need to test your blood sugar more often if you:

- were recently diagnosed with diabetes and are learning how to use insulin
- are unable to recognize early signs of hypoglycemia called hypoglycemia unawareness
- are not testing your blood sugar regularly or keeping your blood sugar well controlled
- have moderate hypoglycemia (needing others' help) or severe hypoglycemia (needing emergency medical care)



By law, doctors must report anyone they consider to be unfit to drive. It is important to follow up with your health care provider to review your blood sugar patterns.

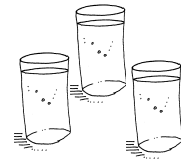
What is high blood sugar?

A high blood sugar level is when the amount of sugar in your blood is higher than your target level. High blood sugar is also called hyperglycemia.

What are the signs of high blood sugar?

When your blood sugar level is high, you may:

- be thirsty, have a dry mouth and skin
- urinate more often
- feel tired or weak
- feel hunger or nausea
- have stomach pains or cramps



Let's have a closer look at correction doses...

A correction dose is a dose of rapid acting insulin that you take when your blood sugar is high to bring your blood sugar back down to target.

Once you know your Correction Factor, you can bring most high blood sugars back into target safely. It may take more time than you realize to bring a high blood sugar down to target. If your Correction Factor is set right, your blood sugars should return to close to target within 4 hours.

Your Correction Factor tells you how much your blood sugar will drop when you take 1 unit of rapid acting insulin.

Let's review how your bolus insulin works ...

Bolus Insulin	Onset	Peak	Duration
Novorapid Humalog Apidra	10 to 15 minutes	1 to 2 hours	3 to 5 hours
Novolin (R) Humulin (R)	30 minutes	2 to 3 hours	6.5 hours

How often should I take correction doses?

Generally, it is recommended that you only take a correction dose every 4 hours. This will help to prevent stacking of insulin, and a possible low blood sugar.

If you need to use correction doses often, you and your diabetes educator will need to review your blood sugar/food/insulin log and may need to make adjustments to your baseline insulin doses.

If you find your correction dose of rapid acting insulin does not lower your blood sugar to target within 4 hours after taking it, or you have frequent low blood sugars when taking your correction doses, your Correction Factor may need to be changed. Discuss this with your diabetes educator.

What is stacking insulin?

Stacking insulin means that you have two doses of rapid acting insulin working at the same time.

Let's put this into practice – "Correction Dose"

John's Diabetes Plan

Insulin Action Time:	4 hours
Correction Factor (CF):	1 unit of bolus insulin will lower blood sugar by 2.0 mmol/L (1 unit : 2.0 mmol/L)
Insulin to Carbohydrate Ratio:	1 unit of bolus insulin for every 10 grams of carbohydrate (1 unit : 10 grams)
Blood Sugar Targets:	5 to 7 before meals
Total Daily Dose (TDD):	50 units (25 units of Basal insulin at bedtime) (25 units of Bolus insulin at meals and snacks)

John eats 42 grams of carbohydrate at lunch. His blood sugar is 13.0 mmol/L. How much insulin should he take before he eats?

Meal Insulin:	$\frac{42 \text{ grams of carbohydrate}}{1 \text{ unit of insulin for each } 10 \text{ g of carbohydrate}}$ $= \frac{42}{10} = 4 \text{ units}$ <p>= 4 units</p>
Insulin for his high blood sugar (correction dose):	<p>Current blood sugar, minus target blood sugar divided by CF:</p> $\frac{13 \text{ mmol/L} - 7 \text{ mmol/L}}{1 \text{ unit} : 2 \text{ mmol/L}} = \frac{6}{2} = 3 \text{ units}$ <p>= 3 units of rapid acting insulin</p>

Total meal insulin: = Meal insulin + Correction Dose
 = 4 units + 3 units
 = 7 units

Important point!

Before taking this full dose, John needs to consider whether or not he will be doing any exercise after eating.

Let's put this into practice – “High Blood Sugar”

What would you do if your blood sugar is 13.0 mmol/L?

- Nothing – it will come down on its own.
- Go for a walk.
- Have a glass of juice.
- Take a correction dose of insulin.
- Take a correction dose of insulin and think about what might have caused this high blood sugar.
- Ask yourself: When was my last bolus? Is this insulin still working? Recheck my blood sugar in another hour.

Sick days

Refer to “My Sick Day Plan for Type 1 Diabetes”.



Let's put this into practice – "Sick Days"

Jako is a 62-year old man with type 1 diabetes for 25 years. He has been using multiple daily injections (MDI) for 8 years with an A1C result usually about 8.0%. He takes 15 units of Lantus at night and 5 units of Humalog with each of his 3 meals.



He is sick with the flu. He has a fever, sore throat and has felt sick to his stomach for the last 8 hours. He vomited only once and is now able to drink fluids.

Questions (Hint: Use the chart on page 27 to help you answer these questions):

1. Jako's blood sugar is 22 and his blood ketone level is 2.0 mmol/L. What should he do with his insulin dose? _____
2. What would you suggest Jako eat or drink? _____
3. Jako continues to vomit two more times in the next four hours. What would you recommend? _____

Step 1	Add up the number of units of all the insulin Jako takes in a day (both basal and bolus) which is called Total Daily Dose (TDD) _____.						
Step 2	Calculate: <table style="margin-left: 20px; border: none;"> <tr> <td>10% of Jako's TDD</td> <td>_____</td> </tr> <tr> <td>15% of Jako's TDD</td> <td>_____</td> </tr> <tr> <td>20% of Jako's TDD</td> <td>_____</td> </tr> </table>	10% of Jako's TDD	_____	15% of Jako's TDD	_____	20% of Jako's TDD	_____
10% of Jako's TDD	_____						
15% of Jako's TDD	_____						
20% of Jako's TDD	_____						
Step 3	Use the chart on page 27 to decide how much bolus (rapid acting) insulin Jako would take every 4 hours in addition to his usual insulin dose for carbohydrates.						

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How much insulin will Jako need to take if he is sick on MDI?

Use the chart below to determine how much extra insulin Jako should take.

Blood sugar (mmo/L)	Blood ketones (mmol/L)	Action needed (Bolus Insulin)	Extra dose would be:
Less than 3.9	None	No extra insulin. Treat low blood sugar with 15 grams of fast acting carbohydrate. Do not stop taking insulin.	
Under 7	Less than 0.6	Take usual* insulin dose.	
Under 7	0.6 or more	Take usual* insulin dose. If unable to eat or drink any carbohydrate containing food or fluids, go directly to the emergency department. You CANNOT safely treat this at home!	
7 to 14	Less than 0.6	Take usual* insulin dose.	
7 to 14	0.6 or more	Take insulin dose for carbohydrates eaten, PLUS 10% (of TDD) extra rapid acting insulin	
Between 14 and 22	Less than 0.6	Take insulin dose for carbohydrates eaten, PLUS 10% (of TDD) extra rapid acting insulin	
Between 14 and 22	Between 0.6 and less than 1.5	Take insulin dose for carbohydrates eaten, PLUS 15% (of TDD) extra rapid acting insulin	
Between 14 and 22	Between 1.5 and 3.0	Take insulin dose for carbohydrates eaten, PLUS 15% (of TDD) extra rapid acting insulin	
More than 22	More than 3.0	Take insulin dose for carbohydrates eaten, PLUS 20% (of TDD) extra rapid acting insulin This is a medical emergency. Recheck blood sugars and ketones. If they have not decreased, go to the emergency department right away!	

* Your usual insulin dose includes the insulin for carbohydrates eaten, plus correction dose if needed for high blood sugars.

Now consider ... yourself

You have a chest cold. You have been up coughing all night and you feel feverish. You do not have much of an appetite, but you drink 1 cup of apple juice and eat 1 slice of dry toast.

Your blood sugar this morning is 14.3 mmol/L.

You check your blood ketone level and it is 0.7 mmol/L.

Your insulin to carbohydrate ratio is 1 unit for every _____ grams of carbohydrate.

How much insulin would you need to take?

Food and drink	_____ g of carbohydrate / 1 unit for every _____ of carbohydrate = _____ units
Correction dose for blood sugar and ketone levels	$\frac{\text{current BS} - \text{target BS}}{\text{correction factor}} = \left(\frac{\quad}{\quad} \right)$ = _____ units
Total bolus insulin dose	meal (_____ units) + correction (_____ units) = _____ units

What is pattern management?

Pattern management is a way of identifying trends in your blood sugars. This may help you to determine adjustments you may need to make to your insulin doses.

Before looking at patterns, it is important to:

1. Count your carbohydrates accurately and use your insulin to carbohydrate ratio.
2. Check your blood sugars regularly (at least 4 times a day).
3. Take a correction dose using your Correction Factor if needed.
4. Make adjustments for exercise, stress and sickness if needed.

General dose adjustment guidelines:

My TDD = _____

- Adjust 1 dose (either basal or bolus) of insulin at a time.
- **Basal Insulin:** Consider increasing or decreasing your basal insulin if your fasting blood sugar is out of target. Use approximately 10% of your TDD _____ units, to either increase or decrease your fasting blood sugar.
- **Bolus Insulin:** If your blood sugar before meals or at bedtime is too high or too low, consider adjusting your insulin to carbohydrate ratio or your correction dose.

Use the 1-2-3 system to make adjustments in your insulin dose.

1. Correct your lows first.
2. Look at your overnight blood sugar levels.
3. Test your daytime blood sugar level and adjust meal doses if needed.

Let's put this into practice – "Adjusting Your Insulin Dose"

Mary's Total Daily Dose (TDD) is 65 units.

Basal insulin taken at bedtime provides 28 units.

Bolus insulin provides about 37 units of insulin with meals and snacks.

Insulin to Carb Ratio:

1 unit for every 6 grams of carbohydrate

Correction Factor:

1 unit will lower blood sugar by 2 mmol/L

Target Blood Sugars:

Before meals 5 to 7 mmol/L
2 hours after meals 5 to 9 mmol/L

Day	Breakfast	After Breakfast	Lunch	After Lunch	Dinner	After Dinner	Bed	Night (3 am)
1	10.3		4.1		9.8		6.9	5.9
2	11.8		6.0		10.9	8.4	5.0	5.2
3	9.7		5.5	9.8	10.7		7.0	6.4
4	12.1		4.8		9.5			

Highlight the blood sugars that are under 4.0 mmol/L in pink and over 9.0 mmol/L in yellow.

In a group of two, answer these questions.

1. What pattern do you see?

2. What insulin (basal or bolus) is working at this time?

3. Which dose adjustment should Mary make first?

4. What are the possible problems with her overnight basal insulin?

5. What changes could Mary make to her insulin dose?

Either now or when you go home, look at your own food and blood sugar log book and think about what or how you would change things.

Highlight or circle blood sugars that are under 4.0 mmol/L in pink or over 9.0 mmol/L in yellow.

1. Are most of the results in your target range? YES or NO
2. If Yes, Congratulations and keep up the great work!
If No, what is the pattern that you see? _____
3. If you see a pattern, which pattern should you fix first? _____
4. What do you think **you could** do?
Change the basal dose? _____
Change your insulin to carbohydrate ratio? _____
Change your correction factor? _____
5. If you do not have a pattern and you have both low and high blood sugars, what can you do?

Check all that apply:

- Count your carbohydrates accurately and use your insulin to carbohydrate ratio.
- Check your blood sugars regularly (at least 4 times a day).
- Take a correction dose using your Correction Factor if needed.
- Make adjustments for exercise, stress and sickness if needed.

Keep detailed food, blood sugar and insulin records and call your diabetes educator if you need help.

Financial assistance programs

Monitoring for Health Program (MFHP)

1-800-361-0796

- If you use insulin and have no other coverage, you can apply for a 75% reimbursement of the cost of your strips and lancets, up to a maximum of \$820 a year.
- You can also get a 75% reimbursement of the cost of a meter, up to a maximum of \$75. (The MFHP can also help with the cost of a 'talking meter' if you are visually impaired).

Ontario Drug Benefit (ODB)

1-888-405-0405

- Your prescription medications, insulin and strips are covered under ODB if you belong to any one of the following categories: receiving social assistance, Senior 65+, resident of a long-term care facility or Trillium Drug Program recipient.
- A small deductible and dispensing fee may apply to seniors over a certain income; all others pay up to \$2 each time they fill a prescription.

Trillium Drug Program (TDP)

1-800-575-5386

- If you are not on social assistance and you do not have private health insurance (or your private health insurance does not cover 100% of your drug costs), you can apply to the Trillium Drug Program to help pay for the cost of prescription medications, insulin and strips.
- You will have to pay a deductible based on your household income.

Insulin Pump & Supplies Program

1-800-268-6021

- If you have type 1 diabetes and you're not having success managing with multiple daily injections, this program may be able to help you purchase an insulin pump and help pay for the supplies. Program covers 100% of the cost of a pump and provides a \$2400 yearly grant for insulin pump supplies.
- Your Diabetes Team will do the initial assessment and help you fill out the application form.

Syringes for Seniors

1-800-268-6021

- If you are over 65 years of age and use insulin on a daily basis, you can apply for a yearly grant of \$170 to help pay for your needles and syringes.
- Note: If you use insulin, you can also get back 75% of the cost of your lancets through the Monitoring for Health program (page 32).

Social Assistance (OW or ODSP):

Please speak to your Caseworker directly.

- If you are receiving social assistance (OW or ODSP), your prescription medications and strips are covered through your Ontario Drug Benefit card.
- You should also be receiving a monthly amount to help pay for the cost of other supplies like needles and syringes.
- If you are using insulin, you will need to apply to the Monitoring for Health program to get back 75% of the cost of your lancets; the other 25% will be covered by social assistance.

Lilly Canada Cares Insulin & Glucagon Program

1-888-545-5972

- If you are using insulin, have a low income and your insulin is not covered by any private health plan OR government program, you may be eligible to get a 3-month supply of insulin (Eli Lilly products only) through Lilly Canada Cares. Program can also help provide Glucagon and an insulin pen, if needed.
- Ask your doctor or Diabetes Educator for more information; they will have to apply for you.

Diabetes Hope Foundation

905-670-0557

- Assists the families of children and youth with type 1; scholarship opportunities and financial assistance programs available.

Non-Insured Health Benefits (NIHB) – for First Nations and Inuit only

Look in the Blue Pages of your local phone book for local NIHB office.

- Can help cover the cost of those prescription drugs and medical services that are not covered by any other provincial or federal government programs.

Veterans Health Benefits Program – Veterans Affairs Canada

1-866-522-2122

- Can help cover the cost of prescription drugs and a variety of medical services for Veterans, released/still-serving CF members, RCMP members and certain civilians, as well as their dependants and survivors.

Tax Credits & Deductions

1-800-959-8281

- To find out more about tax credits and deductions, including the Medical Expense Tax Credit, the Disability Tax Credit and the Child Disability Benefit, please visit www.cra-arc.gc.ca/disability or contact Revenue Canada directly.

(Information on pages 32 to 35 used with permission from Canadian Diabetes Association, 2009)

10 steps to success

1. Check your blood sugar levels at least 4 times a day (before each meal and at bedtime).
2. You may want to occasionally check your blood sugar 2 hours after a meal to see if your insulin to carbohydrate ratio is set correctly.
3. Look for blood sugar patterns every 2 to 4 weeks. The more you test, the easier it is for you to see blood sugar patterns!
4. For low blood sugars, ask yourself:
 - Am I having frequent low blood sugars (daily or more than 4 times per week)?
 - Am I having low blood sugars at the same time of each day?
If you answered YES, adjust the insulin that is causing lows.
5. Next, look at your fasting blood sugars. Are they usually between 4.0 to 7.0 mmol/L? If they are usually over 7.0 mmol/L, ask yourself:
 - Did I miss my evening basal insulin?
 - Did I eat a snack after supper and not take insulin for it?
 - Could my blood sugar levels be dropping low at night without me knowing resulting in a rebound high blood sugar in the morning? Check your blood sugars at 3 am to see if you are going low. If you are, you will need to lower your evening basal insulin dose by up to 10% of your Total Daily Dose every 3 days, until your fasting blood sugars are between 4.0 to 7.0 mmol/L.
 - Do I need more basal insulin in the evening? If you are not having lows at 3 am, increase your evening basal insulin dose by up to 10% of your Total Daily Dose every 3 days, until your fasting blood sugars are between 4.0 to 7.0 mmol/L.

6. If there is no blood sugar pattern and you are having both low and high blood sugars, ask yourself the questions below.

Am I:

- testing my blood sugar before meals?
 - taking my bolus insulin before eating?
 - counting my carbohydrates accurately?
 - using my insulin to carbohydrate ratio?
 - taking a correction dose if my blood sugar level is high?
 - making adjustments for activity, stress and sickness if needed?
 - rotating my injection sites?
 - using proper insulin injection technique (priming insulin pen, counting to 10 when injecting, not leaving pen tip on, using new pen tip with each injection)?
 - storing my insulin properly?
 - using insulin that has been at room temperature for more than 28 days?
7. If your blood sugar levels are high, correction doses of insulin can help to bring your blood sugar back down close to target. However, if you are needing to take correction doses every day, your baseline doses (basal insulin dose, insulin to carbohydrate ratio and correction factor) may need to be re-evaluated.
8. You know yourself and your diabetes best! If you feel comfortable, we encourage you to make insulin adjustments as needed.

Managing Type 1 Diabetes
with Multiple Daily Injections (MDI)

9. See your diabetes team regularly.
10. Despite your best efforts, you may find that your blood sugar levels may occasionally still fluctuate. Try not to get discouraged. Use your A1C to measure progress!

Remember, call your diabetes educator for help with insulin adjustments.

Take home messages
