

Sick Day Management

Children whose diabetes is well controlled should not experience more illness or infections than children without diabetes. However those with poor diabetes control will be more at risk of a variety of different infections. Any illness may upset the control of your/your child's diabetes and it is important to know how to manage 'Sick Days':

- Most illnesses will cause high blood glucose levels. Fever tends to raise blood glucose levels. Some illnesses, especially vomiting illnesses, can cause low blood glucose levels.
- If high blood glucose levels are not treated, ketones will develop due to a shortage of insulin, and you/your child could become very unwell with diabetic ketoacidosis (DKA).
- **Never omit the basal (background) insulin.** Generally extra very fast acting insulin is required.

What do I do if I am/my child is unwell?

- Check BG before meals, before bed and every 3-4 hours overnight.
- Check blood ketone levels every 4-6 hours.



Insulin is always required to switch off ketone production.

How do I work out the insulin dose to give if I am/my child is unwell?

Refer to Table 1 (page 2) for management of blood glucose and blood ketone levels when unwell.

- Find the ketone value on the left hand side of the chart, then read along to the right until you reach the blood glucose value recorded on the meter. Follow the advice in the identified box.
- Calculate total daily dose (TDD) of insulin by adding all the expected insulin doses over the day (see Table 2).
- If extra insulin (sick day dose) is advised use Novorapid or Humalog via an insulin pen device.
- However if you use a correction factor, calculate this dose and compare it to the dose advised according to table 1: give whichever dose is higher.
- Remember the 'Sick Day dose' is given **in addition** to the insulin required to cover carbohydrate intake.
- Expect the blood ketone levels to fall within two hours after the sick day dose. This sick day dose can be repeated four hourly as required.



Table 1

Calculation of ADDITIONAL fast acting insulin required for Sick Day management

Use Novorapid / Humalog 4 hourly via an insulin pen device

TDD=total daily dose of insulin. See Table 2

Blood ketones (mmol/L) Check 4 hourly	Urine ketones (if no blood ketone test available)	Blood Glucose Less than 4mmol/L	Blood Glucose 4-9.9mmol/L	Blood Glucose 10-15mmol/L	Blood Glucose More than 15mmol/L
Less than 1.0	Negative or trace	<ul style="list-style-type: none"> Treat hypo No extra insulin; consider a 20% reduction in insulin dose Starvation ketones. Give CHO containing food/drink to replenish energy stores. See example 2	<ul style="list-style-type: none"> No extra insulin Starvation ketones. Give CHO containing food/drink to replenish energy stores.	<ul style="list-style-type: none"> No extra insulin Correct at next mealtime using usual correction factor.	<ul style="list-style-type: none"> No extra insulin Correct at next mealtime using usual correction factor.
1.0 - 1.4	Small	<ul style="list-style-type: none"> Treat hypo No extra insulin Starvation ketones. Give CHO containing food/drink to replenish energy stores. See table 3	<ul style="list-style-type: none"> No extra insulin Starvation ketones. Give CHO containing food/drink to replenish energy stores	<ul style="list-style-type: none"> Extra insulin Give 10% of the TDD.	<ul style="list-style-type: none"> Extra insulin Give 10% of the TDD - but remember to calculate correction dose first, as this may be higher.
1.5 - 2.9	Moderate - large	Recheck blood glucose + ketones. Extra CHO + fluid required. May require admission to hospital for a glucose drip.	<ul style="list-style-type: none"> Extra insulin Give 10% of the TDD. Extra CHO + fluids are required - give 10g CHO 'free'	<ul style="list-style-type: none"> Extra insulin Give 10% of the TDD. Extra CHO + fluids are needed.	Extra insulin Give 20% of the TDD.
3.0 and higher <i>There is an immediate risk of diabetic ketoacidosis (DKA) if the blood ketone level is > 3mmol/L</i>	Large	Recheck blood glucose + ketones. Extra CHO + fluid required. Will require admission to hospital for a glucose drip.	<ul style="list-style-type: none"> Extra insulin Give 10% of the TDD. Extra CHO + fluids are required - give 20g CHO 'free'.	<ul style="list-style-type: none"> Extra insulin Give 20% of the TDD. Extra CHO + fluids are needed. Consider urgent admission if vomiting.	Extra insulin Give 20% of the TDD. Consider urgent admission if vomiting.



Table 2

This table gives a guide to 10% or 20% of the TDD (total daily dose).
The exact value can be calculated using the formula shown (see examples 1 and 2)

Total daily dose (TDD) of insulin (Basal + usual bolus)	10% TDD = TDD x 0.1	20% TDD = TDD x 0.2
Up to 10 units	0.5 – 1 unit	1 - 2 units
11 - 20 units	1 – 2 units	2 – 4 units
21 - 30 units	2 – 3 units	4 – 6 units
31 - 40 units	3 – 4 units	6 – 8 units
41 – 50 units	4 – 5 units	8 – 10 units
50 – 60 units	5 – 6 units	10 – 12 units
60 – 70 units	6 – 7 units	12 – 14 units
70 – 80 units	7 – 8 units	14 – 16 units



Give 10% or 20% of the TDD as Novorapid or Humalog.

What should I/my child eat and/or drink when unwell?

High blood glucose readings lead to dehydration so it is important to drink more fluids.

If you are/your child is not managing to eat, aim to replace the mealtime carbohydrate with fluid containing carbohydrate (see Table 3). Cover this CHO with bolus insulin (Novorapid/ Humalog).

There may be occasions where additional carbohydrate-containing fluids are required to maintain BG levels (and therefore energy supplies) without covering with bolus insulin – (see Table 1 for 'free CHO'). These fluids can be sipped/drunk over a few hours.

Table 3

Fluids containing 10g carbohydrate

Carbohydrate containing fluids	10g equivalents
Glucose powders	2 teaspoons in 20mls water/sugar-free juice
Original lucozade	50 - 55mls
Original coca-cola	90mls
Milk	200mls
Apple juice	100mls



When to contact the 24 hour diabetes emergency helpline (0131 536 0701 or 0704)

- Continued vomiting and/or unable to tolerate CHO-containing drinks.
- Unable to keep BG level above 4mmol/L.
- BG is more than 15mmol/L and/or blood ketones are more than 1mmol/L after 3 sick day doses.
- You are worried or exhausted or don't know what to do next.

Examples of Sick Day Management

1. High BG + High blood ketones

9 year old girl
Unwell and miserable
Still able to drink - wants 200ml apple juice (20g CHO)
Pre-lunch: BG 21 mmol/L, blood ketones 2.1 mmol/L
Lunch insulin: CHO ratio 1:10g

Calculate total daily dose (TDD) insulin

Basal Lantus: 12 units
Bolus Novorapid: 4 units (average breakfast)
3 units (average lunch)
+ 5 units (average tea)

24 units

Refer to Table 1

Action: 'Extra insulin'
Give 20% of the TDD
= $0.2 \times 24 = 4.8$
(round up or down to nearest 0.5 units)
= 5 units

Calculate lunchtime dose

Sick day dose = 5 units
+ Novorapid to cover apple juice = + 2 units

7 units



2. Hypoglycaemia (vomiting and diarrhoea)

6 year old boy

Vomited three times during the night

Now able to drink but has diarrhoea

Pre-breakfast: BG 3.2 mmol/L, blood ketones 0.4 mmol/L

Breakfast insulin: CHO ratio 1 unit:12g

Morning Levemir: 4 units



Refer to Table 1

- Action:
- 1) Treat hypo
 - 2) No extra insulin: consider 20% reduction in insulin dose
 - Reduce basal insulin by 20% ($0.2 \times \text{dose} = \text{amount to reduce by}$)
 $= 0.2 \times 4 = 0.8$
Therefore, Levimer dose $= 4 - 0.8$
 $= 3.2$
(round up or down to nearest 0.5 units) $= 3$ units
 - Reduce bolus insulin dose by changing the ratio to 1 unit:15g

What are ketones?

Ketones are produced when fat is broken down in the body.

Ketones are acid chemicals. If these ketones are **allowed** to build up in the body, they can make you/your child very unwell.

The normal reading on the blood ketone meter is '**less than 0.5 mmol/L**'. Additional insulin will be required if an individual's blood ketone reading is $\geq 1.0\text{mmol/L}$ (see table 1).

Why do ketones appear in the blood?

A lack of insulin in the body causes a high level of glucose in the blood. However the body is not able to use this glucose for energy. Instead the body uses fat as an alternative energy source: fat is broken down producing ketones.

This can occur:

- At diagnosis of type 1 diabetes.
- If a person with type 1 diabetes forgets to take insulin.
- During 'Sick Days' - when the body has an increased requirement for insulin.

How are ketones cleared?

Additional insulin will be required if the blood ketone level is $\geq 1\text{mmol/L}$ (see Table 1).

The normal blood ketone level is less than 0.5mmol/L – this would be common in people without type 1 diabetes.



Diabetic Ketoacidosis (DKA)

This is an unwanted complication of poor diabetes control, and/or inadequate sick day management. Management of DKA is in the high dependency unit (HDU).

What is DKA and what are the symptoms?

- DKA is a serious and potentially life-threatening condition.
- Ketones build up in the body due to a lack of insulin and there is a great loss of fluids and salts from the body. DKA requires urgent treatment.
- The build up of the ketone acids in the blood stream affects the breathing pattern making it faster as the body tries to get rid of the acid.
- General abdominal/tummy pain and tenderness are also caused by the ketoacidosis.

What is the urgent treatment?

- Replacement of fluids and salts at a carefully calculated rate and administered via a 'drip' (infusion) directly into a vein.
- Insulin administered via an infusion directly into the vein. This will allow the body to use glucose appropriately and importantly will 'switch off' the production of ketones, which will clear from the body.
- Drinks and food are not allowed until the ketones clear from the blood. This is because the high blood ketones and the high blood glucose levels stop the stomach and gut from 'moving'/contracting as usual. Therefore any fluids or food entering the stomach will pool in the stomach and make the person vomit: vomiting can worsen the DKA and it can take longer to recover. A very fine tube called a nasogastric tube may be passed from the nose into the stomach to help empty the stomach and prevent any vomiting.

What to expect in HDU

- Very close attention from the nursing and medical staff.
- Hourly finger prick blood testing to monitor the blood glucose levels and the blood ketone levels.
- 2 - 4 hourly blood samples from a vein to measure the ketone acids in the blood and the salts and fluids in the blood.
- Monitors will be attached to you/your child to check heart rate, blood pressure and the amount of oxygen circulating in the blood.
- Fluids and insulin will be administered into a vein until the ketones clear. Thereafter you/your child will return to your normal insulin regimen.

