

Insulin Dose Adjustment REAL-Time CGMS Guidelines for Subjects on Pump Therapy

In addition to using the blood sugar logs to adjust your insulin doses every week, you should also use your continuous glucose sensor and home glucose meter to make changes to your insulin doses in "real time," that is, whenever you are about to take a pre-meal dose of insulin, or whenever the sensor is alerting you for a high or low blood sugar.

Your target glucose values are:

Pre-meal: 3.9-7.0mmol/L

Peak post-meal: <10.0mmol/L

Bedtime/overnight: 5.5-8.0mmol/L

For the meal bolus you will use your current insulin-to-carbohydrate ratio (ICR).

For the correction dose you will correct to these target blood glucose levels:

Day: mmol/L (1 unit per _____over _____mmol/L)

Night: mmol/L (1 unit per _____over _____mmol/L)

Meal Bolus Calculation

Look at the RT-CGM and home glucose meter to determine what your blood glucose level is.

If your blood sugar is 3.9mmol/L or lower: take 15g of simple carbohydrate, and once your glucose is above 3.9mmol/L, then begin to eat your meal, and take your usual insulin bolus to cover all of the carbohydrates in the meal.

If your blood sugar is above 3.9mmol/L: do your usual calculation of the amount of rapid-acting insulin needed to cover the carbohydrates in the meal and the correction for high blood sugar if present

Now look at the receiver screen on your RT-CGM. See if there are any up or down arrows adjacent to your glucose reading. Make the following adjustment to the amount of rapid acting insulin that you just calculated for your meal:

Glucose rising >2.2mmol/L
(↑↑) two up arrows

Increase meal dose by 20%

Glucose rising by 1.1-2.2mmol/L
(↑) one up arrow

Increase meal dose by 10%

Glucose rising or falling by
<1.1mmol/L, no arrows

No change in meal dose of rapid acting insulin

Glucose falling by 1.1-2.2mmol/L
(↓) one down arrow

Decrease meal dose by 10%

Glucose falling by >2.2mmol/L
(↓↓) two down arrows

Decrease meal dose by 20%

Use your ICR ratio for every meal and a correction factor to "correct" for the high and bring it down into range.

If you don't use ICR or correction factors, then you will need to instead increase or decrease the bolus (short-acting) insulin doses by small steps (1-2 units). Example:

Your ICR = 1 unit for 10 g of carbohydrate

Your target blood glucose = 5.5mmol/L

Your high glucose correction is 1 unit per 2.75mmol/L over your target.

Your current blood glucose is 11.0mmol/L, and you are about to eat 60g of carbohydrate.

The sensor indicates (↑↑) two up arrows.

Calculate: 6 units of insulin (for the 60 g of carbohydrate) + 2 units (for the high glucose correction of 1 unit for each 2.75mmol/L over target) + 1.6 units trend arrow correction (20% of 8 units) for a total of 9.6 units. Infuse 9.6 units.

Correction Bolus Calculation at Times Other Than Meals

Do your usual calculation of the amount of rapid-acting insulin needed to correct for the high blood sugar.

Look at the RT-CGM arrow and make the following adjustments to the amount of rapid-acting insulin that you just calculated to cover the high blood sugar.

Glucose rising >2.2mmol/L (↑↑) two up arrows	Increase meal dose by 20%
Glucose rising by 1.1-2.2mmol/L (↑) one up arrow	Increase meal dose by 10%
Glucose rising or falling by <1.1mmol/L, no arrows	No change in meal dose of rapid acting insulin
Glucose falling by 1.1-2.2mmol/L (↓) one down arrow	Decrease meal dose by 10%
Glucose falling by >2.2mmol/L	Decrease meal dose by 20%

Example for time other than meal:

Using the example above (without the meal), you would correct for a high blood sugar of 11.0mmol/L with (↑) one up arrow.

Calculate: 2 units for the high glucose correction (1 unit for each 2.75mmol/L over target) + 0.2 units trend arrow correction (10% of 2 units = 0.2) for a total of 2.2 units. Infuse 2.2 units.

If you are doing a correction for high blood sugar outside of a meal, you should wait at least 2-3 h before taking any more insulin.

When to check your blood sugar with the blood glucose meter:

1. Whenever the RT-CGM calls for a calibration to be entered.
2. When you are going to make an insulin management decision.
3. You have symptoms that are not consistent with the RT-CGM values (for example, you feel low, but the RT-CGM do not show that you are low).
4. Anytime a high or low alarm/event goes off (high or low event is considered first alarm in a 1-h period).

High alert _____mmol/L

Did you take your premeal insulin dose?

NO - Take the amount of insulin, that you should have, as shown above, using your pre-meal blood sugar.

YES—Wait at least 2 h after the last dose before taking a correction dose, since there may be a lot of insulin left over from your last injection.

Make sure you correct to the targets shown at the beginning of these instructions (_____during the day and during the night)

Low alert _____mmol/L

Treat with 15 g of carbohydrate

Using the RT-CGM downloads and blood sugar logs to adjust your doses for subjects on pump therapy

If you have access to a home computer, the GMS team can give you software to download your RT-CGM and look at the data on your computer. You can use this to make adjustments to your insulin in a different way from examining blood glucose logs:

- Download your RT-CGM.
- In your software program, examine the report that shows several days of sensor tracings all overlapping on top of each other. It may be called "glucose modal day," "sensor daily overlay," or "modal day." Choose 3 days to examine at one time.
- Look for patterns that occur 2 out of 3 days. If there are no patterns, don't make any changes.

If you don't have a computer to download your CGM, you can still use your blood sugar logs to make changes. Collect 3-4 days' worth of blood sugar records from your log.

- Draw a CIRCLE around all the glucose levels OVER your target.
- Draw a BOX around all the glucose levels UNDER your target.
- Look down the columns (corresponding to meals or times of the day) and look for consistent patterns over 2-3 days.



- If there are no patterns, don't make any changes.

SUGGESTED INSULIN DOSE ADJUSTMENT

Glucose pattern (2-3 days)

Blood glucose in morning

High

Suggested changes

Look at your bedtime blood glucose, and if that is out of range work on correcting that before trying to change the overnight insulin.

Increase the basal insulin rate by 0.05-0.1 units/h starting 3 h before your morning sugar check

Check blood glucose at 3:00 a.m. If high at that time, increase the basal rate by 0.05-0.1 units/h from midnight to 2 a.m.

Consider eating fewer carbs in your bedtime snack or increase bedtime snack ICR (example: if 1:15, change to 1:10)

Low

Look at your bedtime blood glucose, and if that is out of range work on correcting that before trying to change the overnight insulin.

Decrease basal insulin rate by 0.05-0.1 units/h starting 3 h before your morning sugar check.

Check blood glucose at 3:00 a.m. If low at that time, decrease the basal rate by 0.05-0.1 units/h from midnight to 2 a.m.

Consider eating more carbs in your bedtime snack or decrease bedtime snack ICR (example: if 1:15, change to 1:20).

Consider adding protein or fat to your bedtime snack.

SUGGESTED INSULIN DOSE ADJUSTMENT

Glucose pattern (2-3 days)

BG pre-lunch

High

Suggested changes

Breakfast ICR: increase ratio by 5g (example: if 1:15, change to 1:10).

Cut out or decrease mid-morning snack.

Increase basal rate by 0.05-0.1 units/h from 8 to 10 a.m.

Low

Breakfast ICR: decrease ratio by 5g (example: if 1:15, change to 1:20).

Consider adding or increasing a morning snack.

Decrease basal rate by 0.05-0.1 units/h from 8 to 10 a.m.

BG pre-dinner

High

Lunch ICR: increase ratio by 5g (example: if 1:15, change to 1:10).

Consider cutting down or reducing the afternoon snack.

Increase the basal rate by 0.05-0.1 units/h between lunch and 3 p.m.

Low

Lunch I/C ratio: decrease ratio by 5g (example: if 1:15, change to 1:20).

Consider adding or increasing the afternoon snack.

Decrease the basal rate by 0.05-0.1 units/h between lunch and 3 p.m.

SUGGESTED INSULIN DOSE ADJUSTMENT

Glucose pattern (2-3 days)

Suggested changes

Bedtime

High

Dinner ICR: increase ratio by 5g (example: if 1:15, change to 1:10).

Increase the basal rate by 0.05-0.1 units/h between dinner and 8 p.m.

Low

Dinner ICR: decrease ratio by 5g (example: if 1:15, change to 1:20).

Decrease the basal rate by 0.05-0.1 units/h between dinner and 8 p.m.