FreeStyle Libre Monitoring System
Real-Time Flash Glucose Scanning (FGS)

Training for Healthcare Professionals and Patients
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**Note:**

- **STEP 2** and **STEP 3** are likely detailed steps for using flash glucose monitoring system (FGS) effectively in diabetes management.
- **STEP 4** may include additional tools and practices to monitor and manage glucose levels.
STEP 1

- You must attend the first 4 training sessions to ensure you know how to use the FreeStyle Libre
- There are 4 leaflets to remind you of the 4 step training
- You will be asked to write down your reasons for using the FreeStyle Libre and what your targets are?
- Further training will be arranged following completion of these first 4 steps
- As you get older the way you look after your diabetes will need changing
- Ongoing education is an essential part of your diabetes care to make sure you reach your targets
Aims for STEP 1:
• Getting started with flash glucose monitoring system (FGS)
• Understanding the basic knowledge of your FreeStyle Libre
• Learn to identify trends and patterns

Aims for STEP 2:
• Learn to actively use target glucose range
• Further understanding of trend arrows

Aims for STEP 3:
• Recap the target glucose range
• Optimise the effect of FGS using trend arrows
• How to use the total dose percentage adjustment tool
• How to use the insulin sensitivity factor tool (ISF)

Aims for STEP 4:
• Recap the target glucose range
• How to use the Ambulatory Glucose Profile (AGP)
• Diasend and FreeStyle Libre software
FreeStyle Libre - **STEP 1** - Patient information

**Reader display**
- Time
- Battery life
- Notes
- Trend arrow
- Target glucose range and profile
- One button to access screen
- Access to use blood glucose and ketone strips
- Sensor
- Glucose level
- Change sensor
- Change sensor

**Starter pack**
- 1 Reader
- 2 Sensors
- 1 Charging cable
**Getting started with your FreeStyle Libre**

What are your reasons for using the FreeStyle Libre? Tick the statement/s below that you agree with.

<table>
<thead>
<tr>
<th>Suggestions for using the FGS</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevent hypos (low blood glucose levels)</td>
<td></td>
</tr>
<tr>
<td>Prevent high blood glucose levels</td>
<td></td>
</tr>
<tr>
<td>Manage blood glucose better when playing sport</td>
<td></td>
</tr>
<tr>
<td>Less blood testing from the fingers</td>
<td></td>
</tr>
<tr>
<td>Would like more information about blood glucose levels</td>
<td></td>
</tr>
</tbody>
</table>

**Any other reasons? Write below**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Aims for using FreeStyle Libre**

What are your aims for using the FGS? Discuss these with your educator and make a note below:

<table>
<thead>
<tr>
<th>Aims for using the FGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Remember!**

Look out for this symbol to remind you of the main messages in each step.
Getting started with your FreeStyle Libre system

You will be shown how to apply your sensor and what the information on the meter screen means.

For the first 2 weeks you will be asked to simply watch the display to see how the reader records your glucose and the use of the arrows.

You must keep using your blood glucose meter until you attend the second training session (STEP 2). Keep a record of:

- Glucose level before and 2 hours after a meal
- Glucose during illness or stress
- The effect of physical activity on your glucose reading
- What your overnight trend is
- The effect of meal insulin doses
- The timing of your meal time insulin in relation to the time of your meal or snack
- Scan within 10mins if the trend arrow is pointing straight up or down

During your first 2 weeks you must also:

Download your data at least once a week to bring to the STEP 2 training session and to start to think about how to assess your glucose control.

Check a blood glucose to confirm a low (4.0 mmol/L) or high (14.0 mmol/L) sensor glucose reading or if the glucose levels are falling rapidly or rising rapidly.

If FGS readings do not match your clinical symptoms – a blood glucose value should be obtained before making a treatment decision.

Record the start date and expiry date of your sensor:

<table>
<thead>
<tr>
<th>Start date</th>
<th>Change date</th>
</tr>
</thead>
</table>

Your sensor will last up to 2 weeks
It does not need calibrating
Ignore glucose levels for the first hour
**Why is checking the glucose levels important?**

Researchers in America have proven that keeping glucose levels in single figures most of the time reduces the chance, for some people, of getting problems with the eyes, kidneys, nerves and blood vessels.

This is why there are many different devices available to help children, young people and adults monitor their glucose levels.

However simply recording glucose levels is not enough. Any obvious patterns showing a need to change insulin treatment or revision of carbohydrate counting needs to be acted upon.

**Continuous education is essential**

There are 2 types of meter that read glucose levels but in a different way:

1. Blood glucose meter
2. Interstitial glucose meter or continuous glucose monitoring system (CGMS) or flash glucose system (FGS)

**What is the difference between blood glucose monitoring and interstitial glucose readings CGMS/FGS?**

- Blood glucose (BG) monitoring is taken using a finger pricker and meter. This gives the true glucose value at the moment it is taken
- Interstitial glucose (CGM/FGS) monitoring. This measures the glucose between the tissues via an indwelling sensor
- The FGS gives a reading every minute when scanned
- There is a time delay between the true blood glucose level and the glucose level in the tissues using CGM/FGS
- This is called the lag time. (See page 9). It means the glucose level in the tissues will always be just under 5 minutes behind the true glucose level
- There are different symbols called trend arrows on the FGS to help you to decide how to interpret the results (see page 17)

**Remember!**

Choosing to use the FGS means a new way of glucose monitoring. Trend arrows help in the decision making (after completing step 2). Training is essential to interpret the increased number of glucose readings.

FGS does not completely replace blood glucose monitoring. It is to be used along side the blood glucose result.
The **lag time** is the difference in measurement between the actual blood sugar level and the interstitial glucose level. The time difference is just under 5 mins.

- If your values are falling rapidly, your blood glucose value might initially be lower than the sensor reading (see diagram).
- If the values are rising rapidly, the blood glucose value might be higher than the sensor reading **but** then the sensor reading will go higher than your blood glucose value (see diagram below).
FreeStyle Libre - **STEP 1** - Patient information

**General information**

- Sensor needs to be changed every 14 days
- Sensor worn on upper outer area of the arm
- Change position of sensor to prevent problems with the sensor site
- No calibration needed. It is factory calibrated
- The first reading may be taken 1 hour after changing the sensor
- The meter will show glucose levels from the last 8 hours
- Scan 1-4 cm away from sensor
- May be scanned through clothing
- Set personal target glucose range
- Scan frequently - at least before meals and 2 hours afterwards

**Reminder!**

The FreeStyle Libre (FGS) does not have alarm settings. It only gives a reading when scanned.

Evidence from CGM suggests sensors should be worn 70% of the time.

Download data once a week to review glucose control.
**What to practise for next session - STEP 2**

For the first 2 weeks watch the display to see how the FGS reader records your glucose and the use of the arrows.

You must keep using your blood glucose meter until you attend the second training session (**STEP 2**). Keep a record of:

- Glucose level before and 2 hours after a meal
- Glucose during illness or stress
- The effect of physical activity on your glucose reading
- What your trend arrow is doing overnight
- The effect of meal insulin doses on your glucose level
- Note what time you take your insulin and what time you eat your meal or snack

**You must also:**

- Scan within 10mins if the trend arrow is pointing straight up or down
- Download your data at least once a week and bring to the **STEP 2** training session
- Think about how you will use the FGS glucose readings
- Check a **blood glucose** to confirm a low (4.0 mmol/L) or high (14.0 mmol/L) sensor glucose reading or if glucose levels are falling \( \downarrow \) rapidly \( \uparrow \) or rising rapidly

**Date for STEP 2 training:**

_____________________________________________________
_____________________________________________________

**Notes:**

**Remember!**

**Do not** use your FreeStyle Libre for changes to your insulin doses **until** you have completed **STEP 2**.

At your next session your blood glucose results and FGS results will be discussed.

After **STEP 2** training you will start to use your FGS readings for treatment changes.
FreeStyle Libre Flash Glucose Monitoring System by Abbott

Patient leaflet

**STEP 2**

- You must attend the first 4 training sessions to ensure you know how to use the FreeStyle Libre
- There are 4 leaflets to remind you of the 4 step training
- You will be asked to write down your reasons for using the FreeStyle Libre and what your targets are?
- Further training will be arranged following completion of these first 4 steps
- As you get older the way you look after your diabetes will need changing
- Ongoing education is an essential part of your diabetes care to make sure you reach your targets
Aims for STEP 1:
• Getting started with flash glucose monitoring system (FGS)
• Understanding the basic knowledge of your FreeStyle Libre
• Learn to identify trends and patterns

Aims for STEP 2:
• Learn to actively use target glucose range
• Further understanding of trend arrows
• Android LibreLink

Aims for STEP 3:
• Recap the target glucose range
• Optimise the effect of FGS using trend arrows
• How to use the total dose percentage adjustment tool
• How to use the insulin sensitivity factor tool (ISF)

Aims for STEP 4:
• Recap the target glucose range
• How to use the Ambulatory Glucose Profile (AGP)
• Diasend and FreeStyle Libre software
**HbA1c and setting target glucose range**

- The HbA1c is taken in clinic every 3 months
- The result is the average blood glucose level over 10-12 weeks
- The Flash readings give an average glucose reading continually
- This can be used to help set glucose targets

**HbA1c target**

The target for the HbA1c is 48 mmol/mol or 6.5%.

The chart gives you an idea about what an average glucose reading would be translated as an HbA1c value.

For example, an average glucose of 7.7 mmol/L would indicate a likely HbA1c of 48 mmol/mol (6.5%).

<table>
<thead>
<tr>
<th>Estimated average glucose</th>
<th>3.8 mmol/L</th>
<th>7.7 mmol/L</th>
<th>9.3 mmol/L</th>
<th>11.7 mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too low risk of hyp</td>
<td>Ideal target range</td>
<td>Good control but not in target</td>
<td>Glucose and HbA1c too high</td>
<td>Glucose extremely high</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HbA1c</th>
<th>Estimated average glucose</th>
<th>Suggest glucose target range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7.0%</td>
<td>8.5 mmol/L</td>
<td>4-8 mmol/L</td>
</tr>
<tr>
<td>7 - 8%</td>
<td>8.5 - 10.1 mmol/L</td>
<td>4-9 mmol/L</td>
</tr>
<tr>
<td>&gt; 8%</td>
<td>&gt; 10.1 mmol/L</td>
<td>4-10 mmol/L</td>
</tr>
</tbody>
</table>

**Write down your current HbA1c target:**

__________________________

Look at your glucose results over the past 2 weeks.
What has been your average glucose level?

Look at this chart below for a suggested glucose target range starting point. You may make this higher or lower than the suggestion.

<table>
<thead>
<tr>
<th>HbA1c</th>
<th>Estimated average glucose</th>
<th>Suggest glucose target range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7.0%</td>
<td>8.5 mmol/L</td>
<td>4-8 mmol/L</td>
</tr>
<tr>
<td>7 - 8%</td>
<td>8.5 - 10.1 mmol/L</td>
<td>4-9 mmol/L</td>
</tr>
<tr>
<td>&gt; 8%</td>
<td>&gt; 10.1 mmol/L</td>
<td>4-10 mmol/L</td>
</tr>
</tbody>
</table>

**Write down your glucose target:**

__________________________

FreeStyle Libre - **STEP 2** - Target glucose range - Patient information

- Too low
- Ideal target range
- Good control but not in target
- Glucose and HbA1c too high
- Glucose extremely high

Write down your glucose target:

_____________________________________________  ____________________________________________
### Setting target glucose range

Look back at your aims for using the FreeStyle Libre? Discuss these with your educator and make any new notes below:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

### Setting lower target glucose range

Looking back at your results over the past 2 weeks focus on your lower glucose results on the FGS and compare with your blood glucose levels taken at the same time and any notes you made about your signs and symptoms.

<table>
<thead>
<tr>
<th>TIME:</th>
<th>TIME:</th>
<th>TIME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discuss the difference between the readings and any action you took.

Discuss with your educator if your glucose target range is set correctly? Write down what the lower target range is set at.

What is your lower target level set at now?

There is a delay (see [STEP 1 leaflet](#)) between your symptoms and what is shown on your reader so it is important to understand at what point you should think about treating a low sugar level.

Write down how you will treat a low glucose level
Setting higher target glucose range

Look at your the higher glucose results on the reader and compare with your blood glucose levels taken at the same time and any changes you made to your insulin dose.

<table>
<thead>
<tr>
<th>TIME:</th>
<th>TIME:</th>
<th>TIME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discuss the difference between the readings and any action you took.

💡 Think about:
1. How often were you out of target range?
2. Is there a pattern to the time and day?
3. Did you count your carbohydrate correctly?
4. Were you unwell?
5. What time had you last taken your insulin?
6. Did you need a correction dose?
7. Did the correction dose bring you back down into your target range?

Make a note of the higher target level set on your FGS

_____________________________________________________

Write down how you will respond to a high glucose level

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________
**Understanding trend arrows**

The trend arrows to the right of the glucose level (see diagram below) shows if the glucose level is stable, rising or falling and how fast.

<table>
<thead>
<tr>
<th>Trend arrow</th>
<th>Description</th>
<th>10-15min timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>➡️</td>
<td>Glucose is rising quickly (more than 0.1 mmol/L per minute)</td>
<td>1-1.5 mmol/L in 10-15 mins</td>
</tr>
<tr>
<td>➡️</td>
<td>Glucose is rising (between 0.06 - 0.1 mmol/L per minute)</td>
<td>0.6-0.9 mmol/L in 10-15 mins</td>
</tr>
<tr>
<td>➩</td>
<td>Glucose is changing slowly (less than 0.06/L per minute)</td>
<td>Stable</td>
</tr>
<tr>
<td>➩</td>
<td>Glucose is falling (between 0.06 - 0.1 mmol/L per minute)</td>
<td>0.6-0.9 mmol/L in 10-15 mins</td>
</tr>
<tr>
<td>➩</td>
<td>Glucose is falling quickly (more than 0.1 mmol/L per minute)</td>
<td>1-1.5 mmol/L in 10-15 mins</td>
</tr>
</tbody>
</table>

This example shows the glucose level rising steadily (0.6 mmol/L in 10 mins)

It is important to understand the different arrow symbols as it is a guide as to whether any intervention is needed and how soon.

Because the Freestyle Libre does not have alarms frequent scanning is necessary.

You need to agree your target glucose range with your educator.

The trend arrows are based on the setting of the target glucose range.

**Trend arrows**

The table below explains what the arrows mean. Don’t use these alone to make a decision. Think about:

- When did you last take insulin?
- When did you last take a meal or drink containing carbohydrate?
- When did you last do any exercise or are you about to do some?
- Are there any other factors affecting your glucose levels i.e. exams, illness, stress
- Is a blood glucose reading needed? The red arrow box below shows when a blood glucose test must be taken

Example: The glucose level rising steadily (0.6 mmol/L in 10 mins)
FreeStyle Libre - **STEP 2** - Android LibreLink

**LibreLink**
Your glucose readings may be read by using your Android phone if it has:
- OS 4.0 or higher
- Screen resolution 480 x 800 to 1080 x 1920
- Screen size 8.9 cm to 14.5 cm (3.5” to 5.7”)
- Near-field communication (NFC) capability

How to use it:
- Download the App onto your phone
- Scan a new sensor with the back of the phone and wait for 2 beeps
- The phone will show a screen of information (see picture below)

**LibreLinkUp**
For families and carers glucose readings will be sent to their android phone. This allows them to see:
1. Current glucose
   The colour band indicates whether glucose is high, low, in target, or out of target
2. Trend arrow
   Shows whether glucose is going up, down or how fast it is changing
3. Scan history
   Shows up to the last 100 scans
4. Share readings
   Email reports to your child's diabetes educator

![Glucose level](image1)

Glucose level

- Trend arrow
- 8 hour profile

![Scan history](image2)

- Colour band
- Trend arrow
- Scan history

For families and carers glucose readings will be sent to their android phone. This allows them to see:
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   The colour band indicates whether glucose is high, low, in target, or out of target
2. Trend arrow
   Shows whether glucose is going up, down or how fast it is changing
3. Scan history
   Shows up to the last 100 scans
4. Share readings
   Email reports to your child's diabetes educator

![Glucose level](image1)

Glucose level

- Trend arrow
- 8 hour profile

![Scan history](image2)

- Colour band
- Trend arrow
- Scan history
What to practise for next session - STEP 3

Date for STEP 3 training:

Remember!

- Choosing to use the FGS means a new way of glucose monitoring
- FGS does not completely replace blood glucose monitoring
- Training is essential to interpret the increased number of glucose readings
- Trend arrows help to give extra information about which direction the glucose is travelling in and how fast
- The target range may be altered gradually as you reach your personal target for glucose control
- The FGS DOES NOT have alerts so scan frequently is essential, when you feel unwell or before an activity which may affect your glucose level
- Check blood glucose when trend arrow straight up or straight down

Notes:

Diabetes team contact details:
FreeStyle Libre Flash Glucose Monitoring System by Abbott

Patient leaflet

**STEP 3**

- You must attend the first 4 training sessions to ensure you know how to use the FreeStyle Libre
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Aims for STEP 4:
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- Diasend and FreeStyle Libre software

Getting started with your FreeStyle Libre
**Recap on setting target glucose range**

Do you have any new aims for using the FreeStyle Libre? Discuss these with your educator and make a note below:

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Look at your glucose profiles you have recorded since your last session.

Discuss with your educator if your glucose target range is set correctly.

What is your lower target level set at now?  

What is your upper level set at now?

---

**Recap on trend arrows and what they mean?**

Trend arrows on the reader give you an idea as to how fast or slow your glucose is rising or falling.

💡 If the arrow is straight up or down check a blood glucose (Highlighted in red)

<table>
<thead>
<tr>
<th>Arrow trend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose is rising quickly</td>
<td>Check a blood glucose</td>
</tr>
<tr>
<td>Glucose is rising steadily</td>
<td></td>
</tr>
<tr>
<td>Glucose is changing slowly</td>
<td></td>
</tr>
<tr>
<td>Glucose is falling steadily</td>
<td></td>
</tr>
<tr>
<td>Glucose is falling quickly</td>
<td>Check a blood glucose</td>
</tr>
</tbody>
</table>
**Insulin adjustment tools?**

There are 2 methods for adjusting insulin which use the trend arrows to help you to make decisions to your insulin dose.

Each method gives a different insulin dose adjustment, Your educator will discuss the best method for you.

There are 2 occasions when the arrows may be used:

1. At meal times
2. In between meals and snacks (when you are NOT eating a meal)

**The 2 methods you can use are:**

**Method 1 (page 24)**

Total insulin dose percentage adjustment tool

**Method 2 (page 28)**

Insulin sensitivity factor tool (ISF)

This how much 1 unit of insulin drops the blood glucose by i.e. 1:3 means 1 unit of quick acting insulin brings the blood glucose down by 3 mmol/l

Write down your ISF __________________________

**Method 1**

**A) With meals**

Work out the carbohydrate value of your meal

Look at the trend arrow and work out whether you need to increase or decrease the total insulin dose by 10 or 20% BUT if a correction dose is needed the increase or decrease of insulin (depending on the direction of the arrow will be worked out with the correction dose.

**NOTE:** If using the bolus advisor handset you will have to work out the 10-20% dose and add it on yourself because the handset will not do it for you

**B) In between meals or snacks**

If extra insulin is needed in between meals (at least 2 hours after last insulin dose) the adjustment tool will be worked out on your usual correction dose ratio i.e. increase correction dose by 10-20% and recheck in 2 hours and repeat if needed.

---

These tools are only a guide. There may be other things that you need to think about before making the correct decision about your insulin dose for example:

- Are you unwell?
- When did you last exercise?
- Are you doing exams so feeling worried or stressed?
- When did you last take an insulin dose?
### Method 1 - Total insulin dose percentage adjustment

This table helps you to decide how much insulin to give by using the glucose level and the direction of the trend arrow before a meal and when a blood glucose must also be taken before deciding on your dose.

<table>
<thead>
<tr>
<th>Arrow trend before meal time bolus</th>
<th>Description</th>
<th>10-15min timing</th>
<th>Action needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚅 Glucose is rising quickly (more than 0.1 mmol/L per minute)</td>
<td>1-1.5 mmol/L in 10-15 mins</td>
<td>Add 20% of meal time dose as extra</td>
<td></td>
</tr>
<tr>
<td>➡️ Glucose is rising (between 0.06 - 0.1 mmol/L per minute)</td>
<td>0.6-0.9 mmol/L in 10-15 mins</td>
<td>Add 10% of meal time dose as extra</td>
<td></td>
</tr>
<tr>
<td>➤ Glucose is changing slowly (less than 0.06/L per minute)</td>
<td>Stable</td>
<td>Give usual meal time dose</td>
<td></td>
</tr>
<tr>
<td>⬇️ Glucose is falling (between 0.06 - 0.1 mmol/L per minute)</td>
<td>0.6-0.9 mmol/L in 10-15 mins</td>
<td>Take 10% off meal time dose</td>
<td></td>
</tr>
<tr>
<td>⏳ Glucose is falling quickly (more than 0.1 mmol/L per minute)</td>
<td>1-1.5 mmol/L in 10-15 mins</td>
<td>Take 20% off meal time dose</td>
<td></td>
</tr>
</tbody>
</table>

#### How to work out 10% of your meal time dose:

10% of meal time insulin = meal time insulin ÷ 10

This amount will either be added to your meal time dose or take off your meal time dose

#### How to work out 20% of your meal time dose:

20% of meal time insulin = meal time insulin ÷ 5

This amount will either be added to your meal time dose or taken off your meal time dose
### Total insulin dose percentage adjustment example 1

1. Count how much carbohydrate you are going to eat.
2. Write down your meal time dose.
3. What is your glucose level?
4. Do you need a correction dose? (Example below uses 1:3)
5. Write down your meal time dose + correction dose if needed.
6. Look at the direction of the arrows on your meter and find the arrow below. Use this line to work out what insulin to have.

**NOTE:** Is your trend arrow straight up or down? YES check your blood glucose level before deciding on your insulin dose and record glucose.

7. Do you need to increase total insulin or decrease your total insulin dose?
8. Insulin dose to be given?

**NOTE:** You may need to round up or down your insulin dose.

9. Glucose reading after 2 hours should be no more the 2 mmol/L higher than pre meal value (if within target glucose range).

<table>
<thead>
<tr>
<th>1 Meal carbs</th>
<th>2 Meal insulin units (ratio 1:10)</th>
<th>3 Glucose reading before food</th>
<th>4 Correction dose (if needed)</th>
<th>5 Meal time dose + correction dose units</th>
<th>6 Which trend arrow do you have?</th>
<th>7 Insulin dose increased or decreased by 10% or by 20%</th>
<th>8 Insulin dose to be given</th>
<th>9 Glucose reading after 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10</td>
<td>6.0 mmol/L</td>
<td>none</td>
<td>10 + 0</td>
<td>↑</td>
<td>20% increase 10 + 5 = 2 units</td>
<td>10 + 2 = 12 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>6.0 mmol/L</td>
<td>none</td>
<td>10 + 0</td>
<td>↑</td>
<td>10% increase 10 + 10 = 1 unit</td>
<td>10 + 1 = 11 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>6.0 mmol/L</td>
<td>none</td>
<td>10 + 0</td>
<td>➔</td>
<td>no extra needed glucose stable</td>
<td>10 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>6.0 mmol/L</td>
<td>none</td>
<td>10 + 0</td>
<td>➔</td>
<td>10% decrease 10 + 10 = 1 unit</td>
<td>10 - 1 = 9 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>6.0 mmol/L</td>
<td>none</td>
<td>10 + 0</td>
<td>➔</td>
<td>20% decrease 10 + 5 = 2 units</td>
<td>10 - 2 = 8 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
</tbody>
</table>
**FreeStyle Libre - STEP 3 - Using trend arrows and percentage tool - Patient information**

**Total insulin dose percentage adjustment example 2**

1. Count how much carbohydrate you are going to eat
2. Write down your meal time dose

Is the trend arrow straight up or down? **YES** check your blood glucose level before deciding on your insulin dose and record glucose.

3. What is your glucose level?
4. Do you need a correction dose? (Example below uses 1:3)
5. Write down your meal time dose + correction dose if needed.

**NOTE:** When the trend arrow is pointing down, be aware that the glucose is falling therefore you may want to delay any correction dose until blood glucose is stable. i.e. 12mmol BG could drop to 9.5 or 11.1 in 15 mins. This may affect how much correction you need. (See page 30)

<table>
<thead>
<tr>
<th>Meal carbs</th>
<th>Meal insulin units (ratio 1:10)</th>
<th>Glucose reading before food</th>
<th>Correction dose (if needed)</th>
<th>Meal time dose + correction dose units</th>
<th>Which trend arrow do you have?</th>
<th>Insulin dose increased or decreased by 10% or by 20%</th>
<th>Insulin dose to be given (See note above)</th>
<th>Glucose reading after 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10</td>
<td>14.0 mmol/L</td>
<td>3 units</td>
<td>10 + 3</td>
<td>▲</td>
<td>20% increase 13 ÷ 5 = 2.6 units</td>
<td>13 + 2.6 = 15.6 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>14.0 mmol/L</td>
<td>3 units</td>
<td>10 + 3</td>
<td>▲</td>
<td>10% increase 13 ÷ 10 = 1.3 unit</td>
<td>13 + 1.3 = 14.3 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>14.0 mmol/L</td>
<td>3 units</td>
<td>10 + 3</td>
<td>▶</td>
<td>no extra needed glucose stable</td>
<td>13 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>14.0 mmol/L</td>
<td>3 units</td>
<td>10 + 3</td>
<td>▾</td>
<td>10% decrease 13 ÷ 10 = 1.3 unit</td>
<td>13 - 1.3 = 11.7 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>14.0 mmol/L</td>
<td>3 units</td>
<td>10 + 3</td>
<td>▼</td>
<td>20% decrease 13 ÷ 5 = 2.6 units</td>
<td>13 - 2.6 = 10.4 units</td>
<td>6.0 - 8.0 mmol/L</td>
</tr>
</tbody>
</table>
### FreeStyle Libre - **STEP 3** - Using trend arrows and percentage tool - Patient information

**Total insulin dose percentage adjustment tool at mealtime**

Now fill in this chart with your educator to practise using the percentage adjustment tool.

<table>
<thead>
<tr>
<th>1 Meal Carbs</th>
<th>2 Meal time insulin units</th>
<th>3 Glucose reading before food</th>
<th>4 Correction dose if needed</th>
<th>5 Total Meal time dose (includes correction dose) units</th>
<th>6 Which trend arrow do you have?</th>
<th>7 Insulin dose increased or decreased by 10% or by 20%</th>
<th>8 Insulin dose to be given</th>
<th>9 Glucose reading after 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**How to work out 10% of your total meal time dose:**

10% of total meal time insulin = total meal time insulin ÷ 10

This amount will either be added to your meal time dose or taken off your meal time dose

**How to work out 20% of your total meal time dose:**

20% of meal time insulin = total meal time insulin ÷ 5

This amount will either be added to your meal time dose or taken off your meal time dose

---

Before giving your insulin dose THINK are there any other reasons to make further changes to your bolus dose?

—if the trend arrow is straight up or down check a BG. Use the BG result to calculate the insulin dose.
**FreeStyle Libre - **STEP 3 - Using trend arrows and ISF tool - Patient information

**Method 2 - Insulin sensitivity factor tool (ISF)**

The Insulin sensitivity factor tool helps you decide how much insulin to add or take away from your total insulin dose without having to it work out.

<table>
<thead>
<tr>
<th>Insulin sensitivity factor</th>
<th>Direction of trend arrows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Go down to your insulin sensitivity factor</td>
<td>The glucose is rising moderately, <strong>ADD</strong> the amount of units below to the total bolus amount</td>
</tr>
<tr>
<td>2. Go across to the arrow displayed on your reader.</td>
<td>The glucose is falling moderately, <strong>TAKE OFF</strong> the amount of units below from the total bolus amount</td>
</tr>
<tr>
<td>3. This is the amount of insulin to add or take off your total insulin dose</td>
<td>The glucose is rising quickly, <strong>ADD</strong> the amount of units below to the total bolus amount</td>
</tr>
<tr>
<td>The glucose is falling quickly, <strong>TAKE OFF</strong> the amount of units below to the total bolus amount</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insulin sensitivity factor</th>
<th>1.5</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>0.75</td>
<td>1.5</td>
</tr>
<tr>
<td>2.5</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>3.0</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>3.5 - 4.0</td>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>4.5 - 5.0</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>5.5 - 6.0</td>
<td>0.25</td>
<td>0.5</td>
</tr>
<tr>
<td>7.0 - 8.0</td>
<td>0.2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Before giving your insulin dose THINK are there any other reasons to make further changes to your bolus dose?**

**If the trend arrow is straight up or down check a blood glucose**
### Insulin sensitivity factor tool (ISF)

Now fill in this chart with your educator to practice using the ISF tool page x using your own readings as examples.

1. Count how much carbohydrate you are going to eat  
2. Write down your meal time dose  
3. What is your glucose level?  
4. Do you need a correction dose?  
5. Write down your meal time dose + correction dose if needed.  
6. Look at the direction of the arrows on your meter and find the arrow below. Use this line to work out what insulin to have.

**NOTE:** Is your trend arrow straight up or down? **YES** check your blood glucose level before deciding on your insulin dose and record glucose.

7. Look at the ISF dose to be added or taken away from the total dose.  
8. Insulin dose to be given?  
**NOTE:** You may need to round up or down your insulin dose.  
9. Glucose reading after 2 hours should be no more the 2 mmol/L higher than pre meal value (if within target glucose range).

<table>
<thead>
<tr>
<th>1 Meal Carbs</th>
<th>2 Meal time insulin units</th>
<th>3 Glucose reading before food</th>
<th>4 Correction dose if needed</th>
<th>5 Total Meal time dose (includes correction dose) units</th>
<th>6 Which trend arrow do you have?</th>
<th>7 Look at ISF and write down +/- insulin dose</th>
<th>8 Insulin dose to be given</th>
<th>9 Glucose reading after 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
**Correction dose adjustment using the trend arrows**

If the trend arrow is straight up or down check a blood glucose:

<table>
<thead>
<tr>
<th>Trend arrow</th>
<th>Description</th>
<th>Glucose in 15mins</th>
<th>Action needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔺</td>
<td>Glucose is rising quickly (more than 0.1 mmol/L per min)</td>
<td>13.5 mmol/L</td>
<td>Add 20% to correction dose</td>
</tr>
<tr>
<td>🔺</td>
<td>Glucose is rising (between 0.06 - 0.1 mmol/L per min)</td>
<td>12.9 mmol/L</td>
<td>Add 10% to correction dose</td>
</tr>
<tr>
<td>🔺</td>
<td>Glucose is changing slowly (less than 0.06/L per min)</td>
<td>Stable 12.6 or 11.4 mmol/L</td>
<td>Give usual correction dose</td>
</tr>
<tr>
<td>⬇</td>
<td>Glucose is falling (between 0.06 - 0.1 mmol/L per min)</td>
<td>11.1 mmol/L</td>
<td>Take 10% off correction dose</td>
</tr>
<tr>
<td>⬇</td>
<td>Glucose is falling quickly (more than 0.1 mmol/L per min)</td>
<td>10.5 mmol/L</td>
<td>Take 20% off correction dose</td>
</tr>
</tbody>
</table>

---

**Write down your correction dose ratio:**

<table>
<thead>
<tr>
<th>Trend arrow</th>
<th>Glucose</th>
<th>Glucose in 15mins</th>
<th>Action needed</th>
<th>Correction dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔺</td>
<td></td>
<td></td>
<td>Add 20% to correction dose</td>
<td></td>
</tr>
<tr>
<td>🔺</td>
<td></td>
<td></td>
<td>Add 10% to correction dose</td>
<td></td>
</tr>
<tr>
<td>🔺</td>
<td></td>
<td></td>
<td>Give usual correction dose</td>
<td></td>
</tr>
<tr>
<td>⬇</td>
<td></td>
<td></td>
<td>Take 10% off correction dose</td>
<td></td>
</tr>
<tr>
<td>⬇</td>
<td></td>
<td></td>
<td>Take 20% off correction dose</td>
<td></td>
</tr>
</tbody>
</table>
**What to practise for next session - STEP 3**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring glucose 2 hrs after meal?</td>
<td>Are you still within target range?</td>
</tr>
<tr>
<td>Glucose level should not rise more than 2 mmol/L after a meal.</td>
<td></td>
</tr>
<tr>
<td>Is trend arrow ‹ or ‡ YES - check blood glucose.</td>
<td></td>
</tr>
<tr>
<td>If above target range add a correction dose.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

**Diabetes team contact details:**

---

**Date for next FGS review:**

---

**Remember!**

- Choosing to use the FGS means a new way of glucose monitoring
- FGS does not completely replace blood glucose monitoring
- Training is essential to interpret the increased number of glucose readings
- Trend arrows help to give you extra information about which direction your glucose is travelling in and how fast
- Insulin dose adjustment tools can help you decide how much total insulin to give
- The FGS does not have alerts so you must scan frequently, when you feel unwell or before an activity which may affect your glucose level
FreeStyle Libre Flash Glucose Monitoring System by Abbott

Patient leaflet

STEP 4

• You must attend the first 4 training sessions to ensure you know how to use the FreeStyle Libre
• There are 4 leaflets to remind you of the 4 step training
• You will be asked to write down your reasons for using the FreeStyle Libre and what your targets are?
• Further training will be arranged following completion of these first 4 steps
• As you get older the way you look after your diabetes will need changing
• Ongoing education is an essential part of your diabetes care to make sure you reach your targets
Aims for STEP 1:
- Getting started with flash glucose monitoring system (FGS)
- Understanding the basic knowledge of your FreeStyle Libre
- Learn to identify trends and patterns

Aims for STEP 2:
- Learn to actively use target glucose range
- Further understanding of trend arrows

Aims for STEP 3:
- Recap the target glucose range
- Optimise the effect of FGS using trend arrows
- How to use the total dose percentage adjustment tool
- How to use the insulin sensitivity factor tool (ISF)

Aims for STEP 4:
- Recap the target glucose range
- Using AGP profile and trend data
- Diasend and FreeStyle Libre software
Recap on setting target glucose range

Do you have any new aims for using the FreeStyle Libre? Discuss these with your educator and make a note below:

_____________________________________________________
_____________________________________________________  
_____________________________________________________  
_____________________________________________________  
_____________________________________________________  

Look at your glucose profiles you have recorded since your last session.

Discuss with your educator if your glucose target range is set correctly.

What is your lower target level set at now?  

What is your upper level set at now?  

Recap on trend arrows and what they mean?

Trend arrows on the reader give you an idea as to how fast or slow your glucose is rising or falling.

💡 If the arrow is straight up or down check a blood glucose (Highlighted in red)

<table>
<thead>
<tr>
<th>Arrow trend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>Glucose is rising quickly</td>
</tr>
<tr>
<td></td>
<td>Check a blood glucose</td>
</tr>
<tr>
<td>→</td>
<td>Glucose is rising steadily</td>
</tr>
<tr>
<td>↓</td>
<td>Glucose is falling steadily</td>
</tr>
<tr>
<td></td>
<td>Check a blood glucose</td>
</tr>
</tbody>
</table>
**Introduction to ambulatory glucose profile (AGP)**

Your FGS device and the software with it and or the Diasend software (if used in your clinic) will give you lots of information which may be confusing. This session is to help you to understand the different graphs and how to use them to improve your glucose control.

There are 3 ways of presenting your glucose data:

1. **Daily trend graph**

   ![Daily trend graph](image)

   - **mmol/L**
   - **00:00** to **24:00**
   - **Black**: CGM
   - **Red**: Carbs

2. **Modal day data**
   - 14 days of glucose results over 1 day time frame

   ![Modal day data](image)

3. **Ambulatory glucose profile (AGP)**

   ![Ambulatory glucose profile](image)

   - **mmol/L**
   - **00:00** to **22:00**
   - **Legend**:
     - Median (50%)
     - 25th percentile
     - 75th percentile
     - Max
     - Min

**You can use all these to manage your diabetes**
Daily trend graph examples

In this example the glucose levels are going high over night. With extra bolus insulin the glucose comes down during the day. What needs to be done?

Basal has been increased from 4am

By increasing the basal the glucose has started to come down to nearer the glucose target.
**Example of Modal day graph**

Looking at hundreds of glucose results dotted onto a graph can be confusing. The Modal day graph includes all the glucose results over a 2 week period and displayed in one 24 hour time frame.

**Example of AGP Diasend profile**

- This shows the glucose values over 14 days
- The orange line shows the median of all the results
- The pale blue areas is the 10-90% percentile range
- The dark blue area is the 25-75% range
- The wider these areas the bigger the variation in glucose levels
- The average glucose level for this period is 10.2 mmol/L

There is a single curved line giving the average (median) of all glucose results. On either side of this line are shaded areas which identify how close to the average you are.

The further away you are from the curved line (median) the more erratic your glucose results are.
Ambulatory glucose profile (AGP)

How to use the AGP:
1. Look at the median glucose line over a 2 week period.
2. How close are you to target?
3. What is the variability like i.e. how wide are the glucose levels?
4. How often have you had a hypo or hyper or been close?

The profile will show a rise and fall of glucose levels at certain times of the day and whether you are consistently high, low or within target range.

Start by looking at the risk of a hypo.
- The FreeStyle Libre software will be highlighted as red in a traffic light system
- Diasend software will show results in the 10% percentile range

If hypos are a problem look at the common time they occur or are likely to occur.

Think about:
- When did you last have insulin?
- Are you counting carbohydrate correctly?
- Are you within your target range overnight?

Are your glucose levels high most of the time?

Think about:
- Has insulin been omitted?
- Have you given insulin after a meal?
- Are you counting carbohydrates correctly? Are you over treating a hypo?
- Is your basal insulin too low?
- Have you been unwell?
- Does it occur at certain times of the week?

NOTE:
It may be difficult to find a pattern because the range of glucose levels are too wide. Therefore you may need to reduce variability first.

Look at a 2 week profile and focus on overnight glucose level being in or nearer target range.

Then review the profile and see if you can identify any times of the day you are too high or too low thinking about the points earlier.
Ambulatory glucose profile (AGP) provides an average of glucose levels over past 14 days

Statistics
Number of values: 2037
Values per day: 70.2
Period average (mmol/L): 10.2

Values above goal (10 mmol/L): 900
Values within goal (4-10 mmol/L): 893
Values below goal (4 mmol/L): 244

Highest value (mmol/L): Hi (10/05/2016 11:53)
Lowest value (mmol/L): Lo (19/05/2016 15:24)
Standard deviation: 5.7

This value of 10.2 mmol/L shows the average of all blood glucose results over past 14 days linked to HbA1c
Ambulatory glucose profile (AGP) provides an average of glucose levels over past 14 days

During the day the glucose is stable

What information can we get from this graph?
- The glucose level (highlighted in red) is stable during the day and within or close to the target range of 4-10 mmol/L
- The day time glucose from 08.00 - 16:00 can vary a lot from the median although the average is within target
Ambulatory glucose profile (AGP) provides an average of glucose levels over past 14 days

What possible problems can we get from this graph due to the rising glucose at 9pm-midnight?

POSSIBLE PROBLEM: Not enough basal insulin from 21:00 (9pm) - midnight
SOLUTION: Increase basal rate 9pm-midnight to prevent a rise in glucose but reduce the background from midnight to 6am to avoid going too low in early hours of morning

POSSIBLE PROBLEM: Possibly eating supper with no insulin causing glucose to rise until midnight then basal insulin brings it down.
SOLUTION: Give insulin with supper but reduce the background rate at midnight - 6am to avoid a hypo later.
Ambulatory glucose profile (AGP) provides an average of glucose levels over past 14 days

What possible problems can we get from this graph due to the consistently low glucose at 3am - 8am?

**PROBLEM:** Lower limit set at 4.0 mmol/L, profile shows glucose <4 mmol/L more than 10% of the time (light blue area extends below lower threshold of 4 mmol). Therefore increased risk of hypoglycaemia

**SOLUTION:** Decrease basal rate from 3am - 8am to prevent a hypo
**Traffic lights to identify risk of hypos**

To help you identify which time of the day you need to look more closely at a traffic light system has been added with the FreeStyle Libre software i.e.

- **Red**: There is a very high risk of hypo or hyperglycaemic episode (a lot of glucose results away from the goal)
- **Amber**: Moderate or high chance of hypo or hyper (many glucose results further away from target)
- **Green**: Low chance of hypo or hyper (Most glucose results closer to target)

<table>
<thead>
<tr>
<th>Glucose control measure</th>
<th>Assessment</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>How likely you are to have a low glucose</td>
<td>Less than 10% chance</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Orange" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Median glucose (compared to your goal)</td>
<td>Less than goal</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Orange" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Variability below median (median to 10th percentile)</td>
<td>less than 1.9 mmol/L</td>
<td>Between low and high</td>
<td>Not close to median but far enough away not to cause low glucose</td>
<td></td>
</tr>
</tbody>
</table>

Estimated HbA1c is 7.0% OR 53 mmol/mol

- This graph is over 92 days
- Median is 8.6 mmol/L (thick blue line)
- The shaded areas are showing how close to the median the glucose is. The closer to the solid curved line means less variation in glucose levels
- Red dots show the times of the day hypos are more likely to occur. On this chart it is over night that hypos are more likely to happen
- The basal insulin may need adjusting to prevent a hypo
FreeStyle Libre - **STEP 4** - - Patient summary

**Summary of glucose target aims**

Aim for an average glucose of 8 mmol/L, most of the time, you should then be close to the target HbA1c result of 6.5%.

Aim for a glucose level not rising more than 2 mmol/L after a meal.

Aim for very few hypos with improving control.

Continue to download your data with an educator to review your targets.

**Remember!**

- Choosing to use the FGS means a new way of glucose monitoring
- FGS does not completely replace blood glucose monitoring
- Ongoing training and reviews are essential to interpret the increased number of glucose readings
- Trend arrows help to give you extra information about which direction your glucose is travelling in and how fast
- Insulin dose adjustment tools can help you decide how much total insulin to give
- The FGS **DOES NOT** have alerts so you must scan frequently, when you feel unwell or before an activity which may affect your glucose level

**Date for next FGS review:**

____________________________________________________

____________________________________________________

**Diabetes team contact details:**

____________________________________________________

____________________________________________________

**Diabetes control changes as you get older.**

*Ongoing education is the key to better glucose control*
Authors
ACDC Guideline Development Group Dr Neil Wright, Dr May Ng, Dr Chizo Agwu, Dr Peter Adolfsson, Dr Josephine Drew, Mr John Pemberton, Dr Melanie Kershaw, Ms Sammie Bissell, Dr Christopher Moudiotis, Dr Fiona Regan, Ms Anne Astle, Dr Paul Manning, Dr Alison Timmis, Dr Astha Soni, Dr Eleri Williams

ACDC commissioned compilation of the patient leaflets to Julie Knowles of Healthcare Professionals and Educators (HCP&E)

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