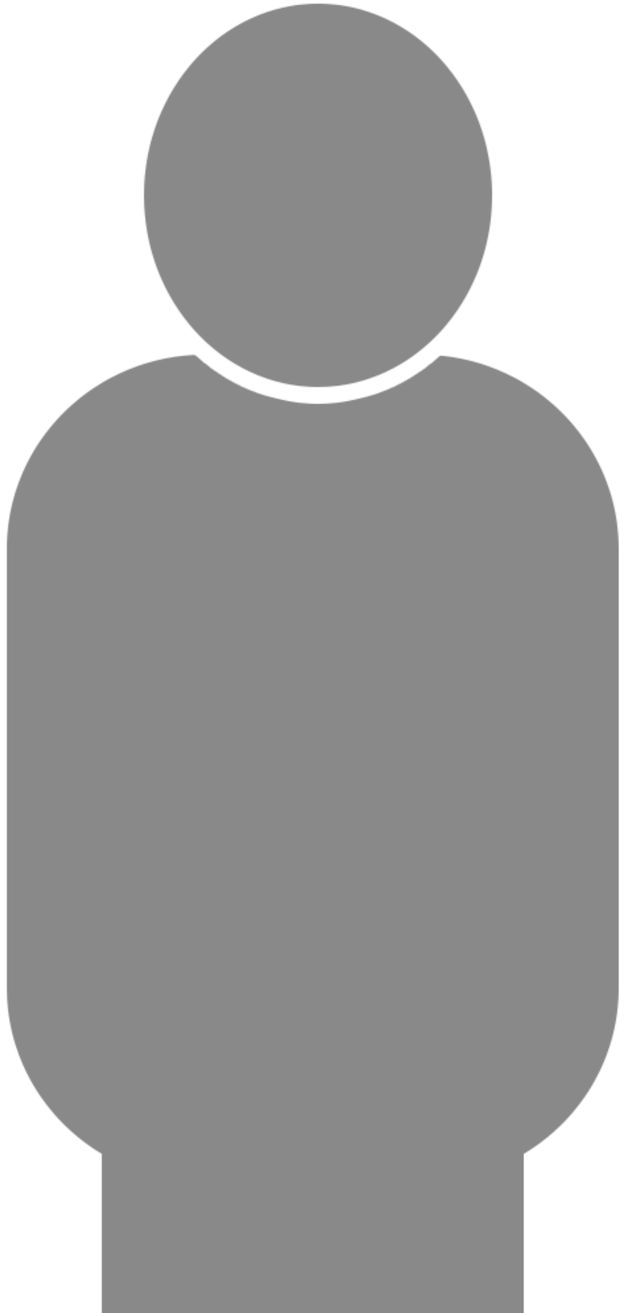


Hypoglycaemia

Dr Pratik Choudhary

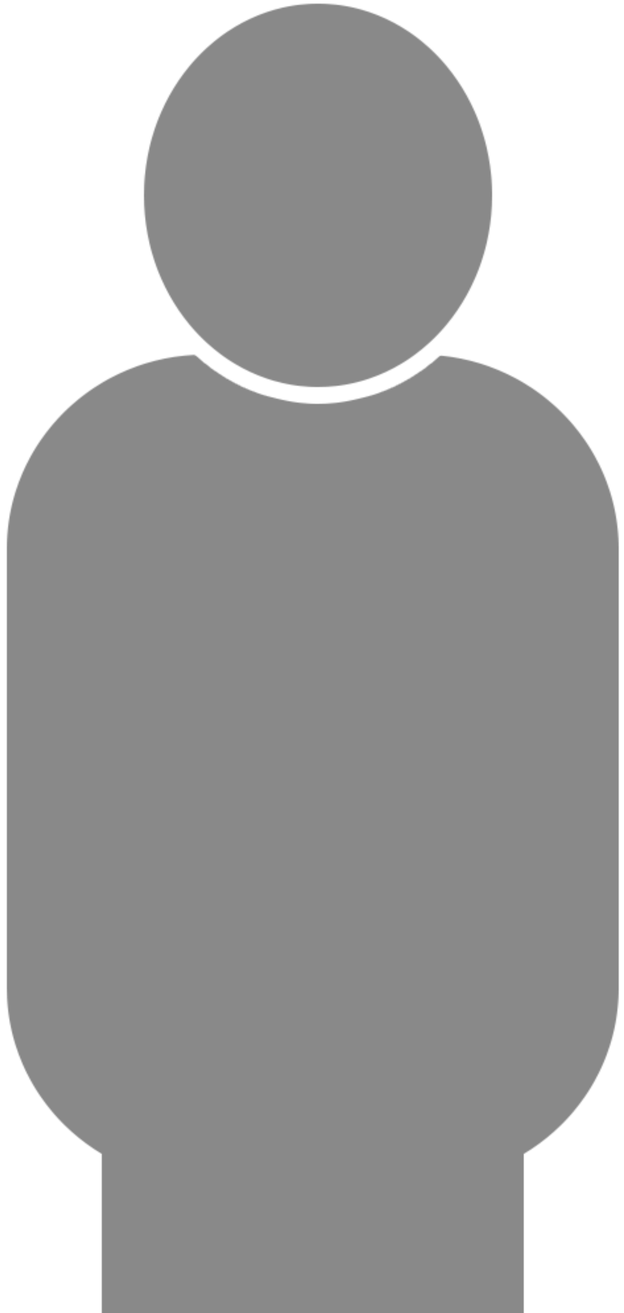
King’s College, London

Supported by a restricted educational grant from Abbott

Association of British Clinical Diabetologists

DTN UK

collaborate · evolve · support



Dr Pratik Choudhary

- Senior Lecturer and Consultant in Diabetes, King’s College London
- DTN Chair Elect
- DAFNE Doctor

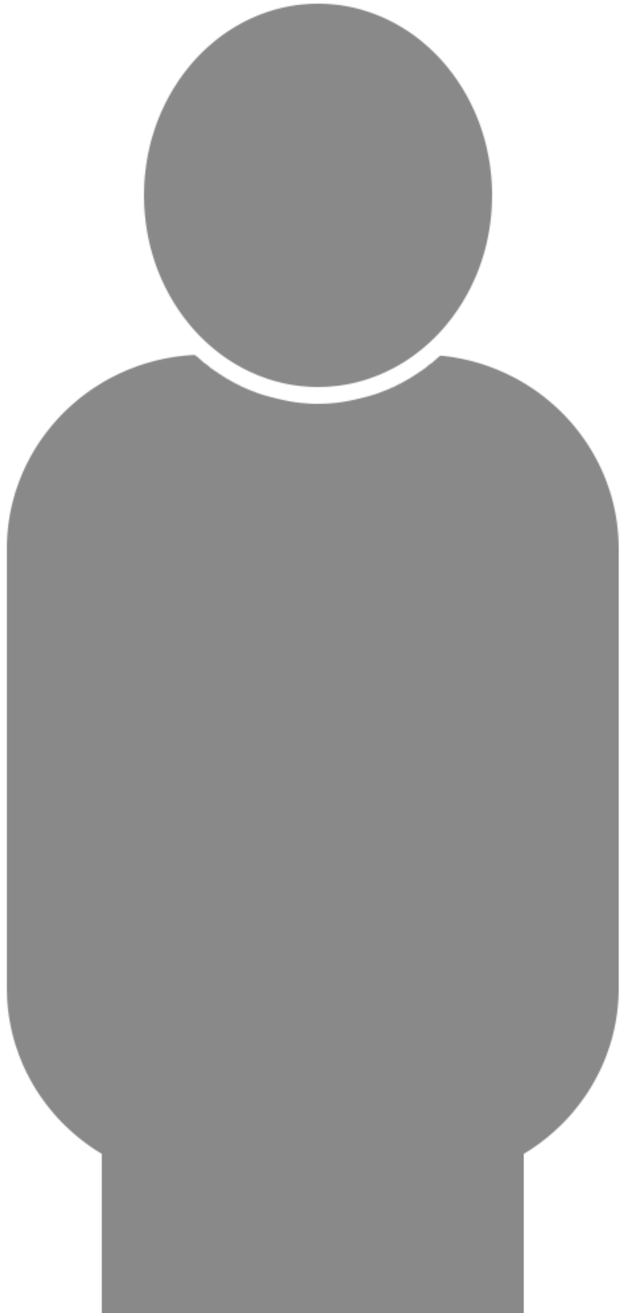
Disclosures:

Speaker fees and advisory boards for Medtronic, Abbott, Dexcom and Roche

Supported by a restricted educational grant from Abbott

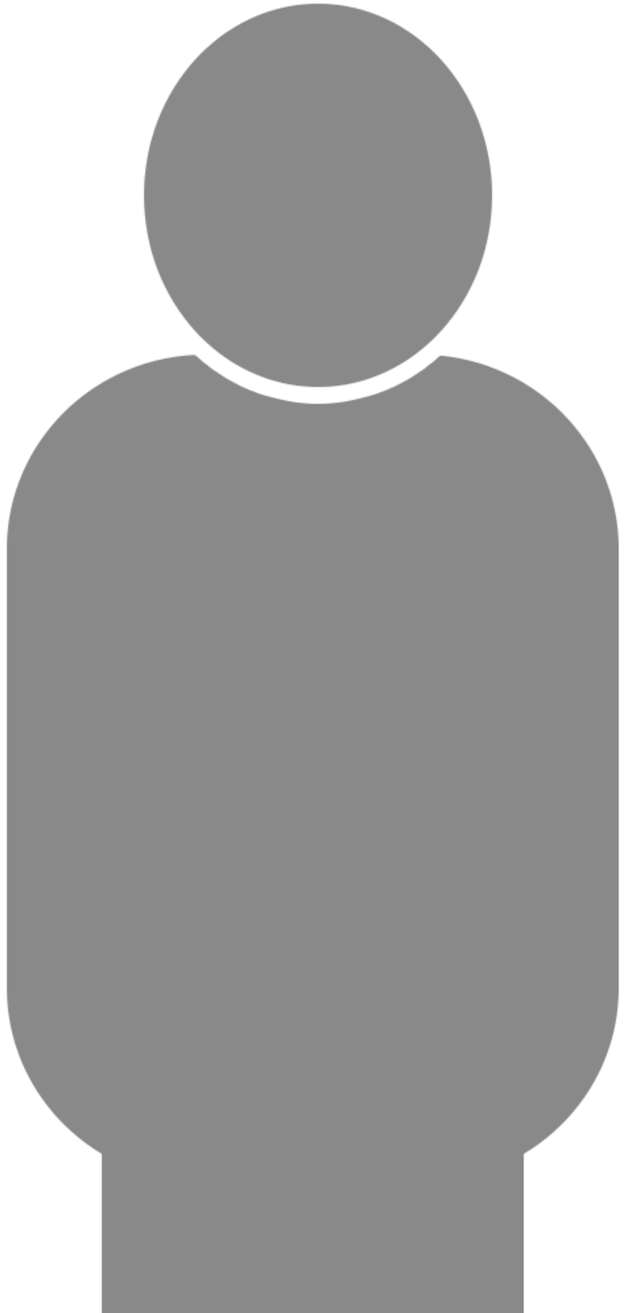
ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

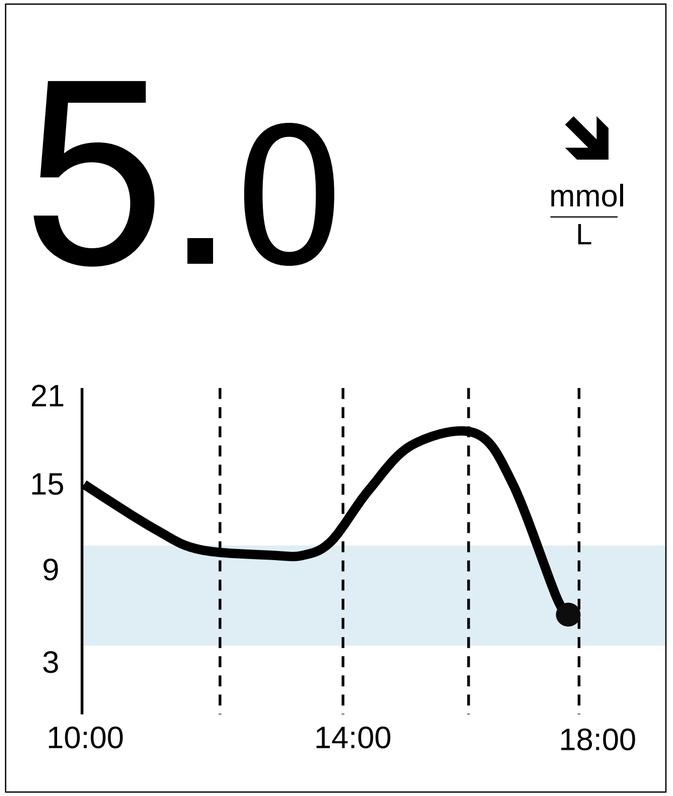


Learning objectives

- By the end of this session the reader will be able to
  - Understand definitions of hypoglycaemia
  - Define impaired awareness of hypoglycaemia
  - Know where to look to find hypoglycaemia on reports
  - Recognise common patterns that cause hypoglycaemia
  - Be aware of the pathway for management of problematic or recurrent hypoglycaemia



Defining hypoglycaemia



Although some people can feel their glucose falling or get hypo symptoms at high glucose levels, this isn't true hypoglycaemia

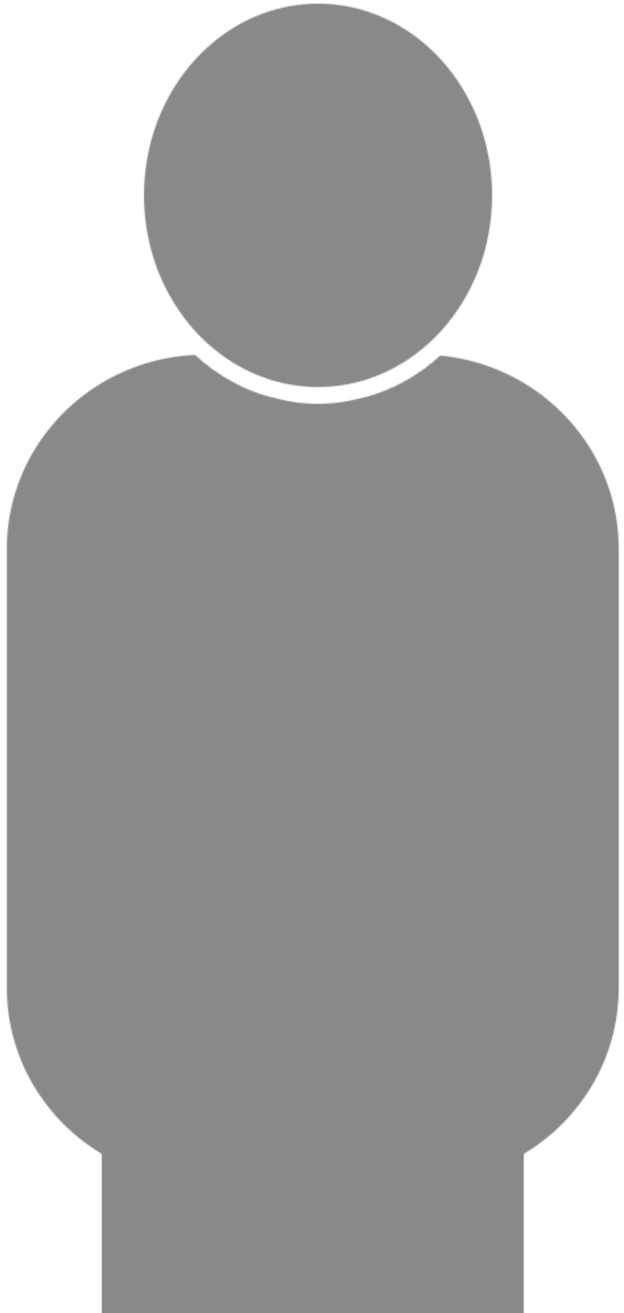
However, because sensors are reading glucose in the skin not the blood, sometimes your blood glucose may be low even though the sensor glucose is not showing a hypo [is above 4 mmol/l]

IF YOU FEEL LOW, AND THE SENSOR SHOWS A FALLING GLUCOSE, DOUBLE CHECK WITH A FINGERSTICK READING

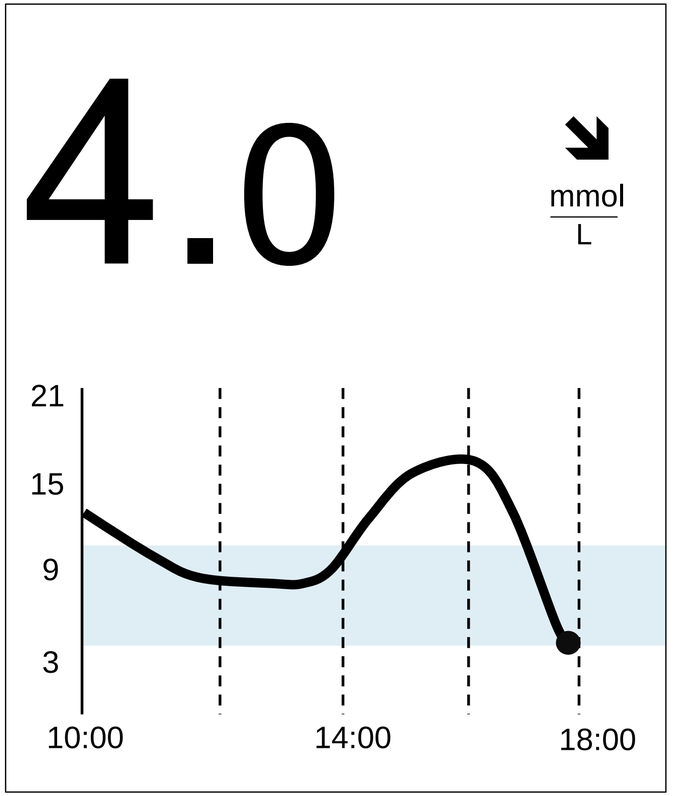
If you are not yet low, but glucose is falling consider taking 5-10 grams of carbs (1-2 jelly babies or dextrose tablets)

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Defining hypoglycaemia



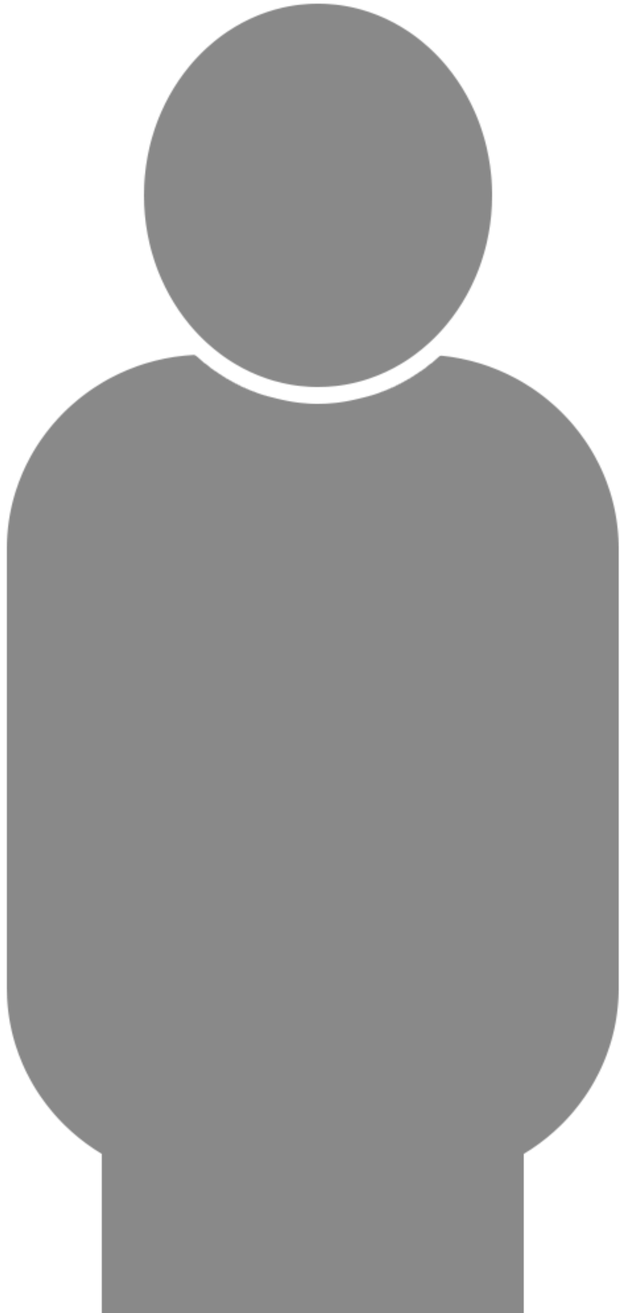
A blood glucose of less than 3.9mmol/l has been defined as a hypo ALERT value

You should take action here to avoid further drop and be aware that your blood glucose value may be lower. Check a fingerstick glucose.

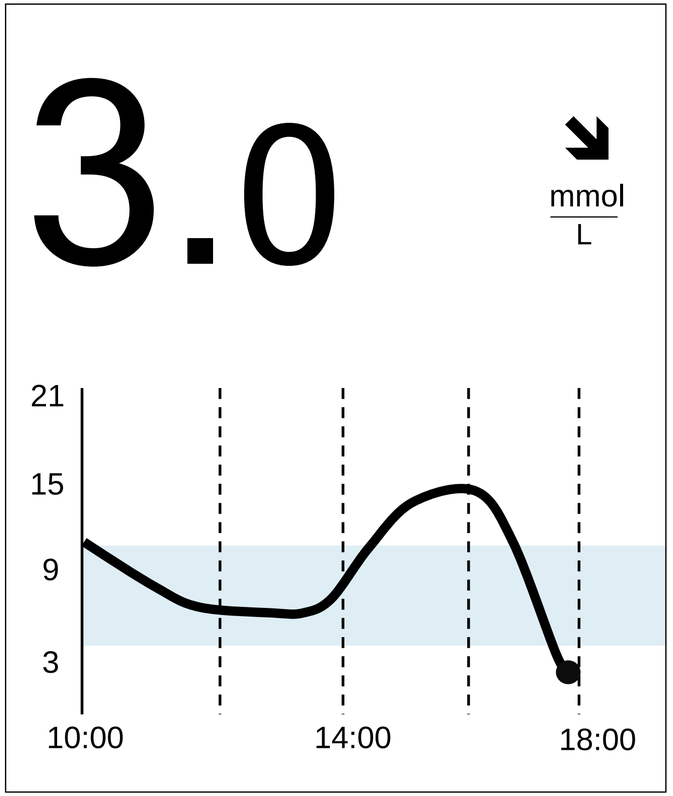
DAFNE hypo treatment:
Below 3.5mmol/l: 15-20g rapid acting carbohydrate (lucozade or orange juice or 3-4 dextrose tablets)
Below target but above 3.5mmol/l: eat 10g of carbs
IF YOU FEEL LOW, AND THE SENSOR DOES NOT SHOW THIS, DOUBLE CHECK WITH A FINGERSTICK READING

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Defining hypoglycaemia



3 mmol/l and below is defined as SERIOUS hypoglycaemia.

Below this level, there is usually some slowing of brain function, and people can experience confusion and drowsiness.

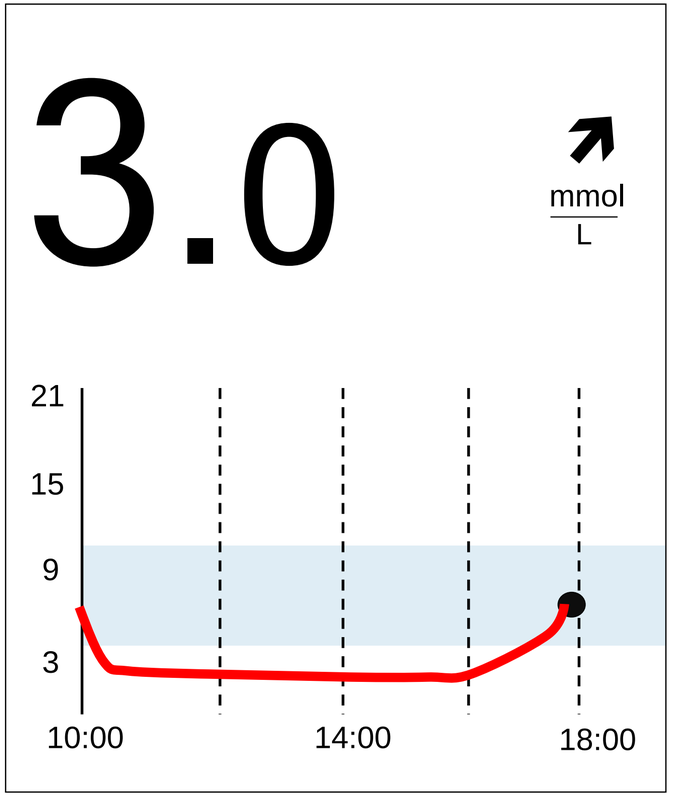
Repeated episodes below this level increase the risk of severe hypoglycaemia

TREAT URGENTLY
15-20g of rapid acting carbohydrate [150 mls of lucozade or orange juice or 3-4 dextrose tablets] and recheck in 15 mins

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

Defining hypoglycaemia

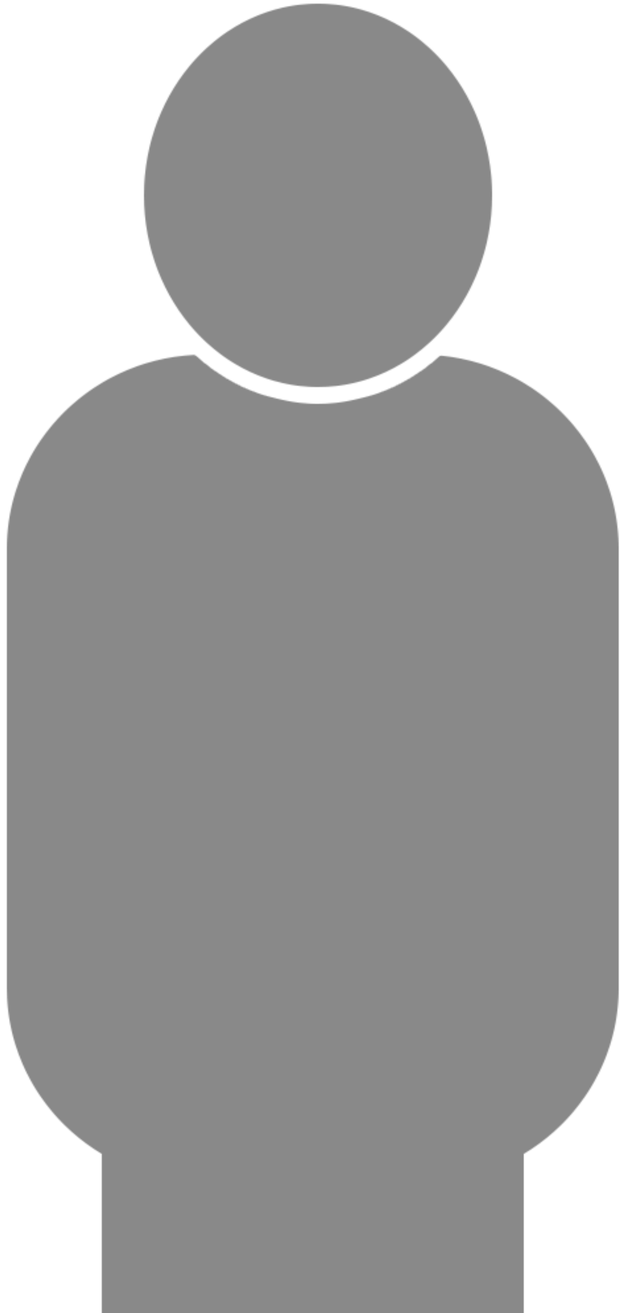


PROLONGED HYPOGLYCAEMIA

OVER 2 HOURS BELOW 3 mmol/l is defined as prolonged hypoglycaemia

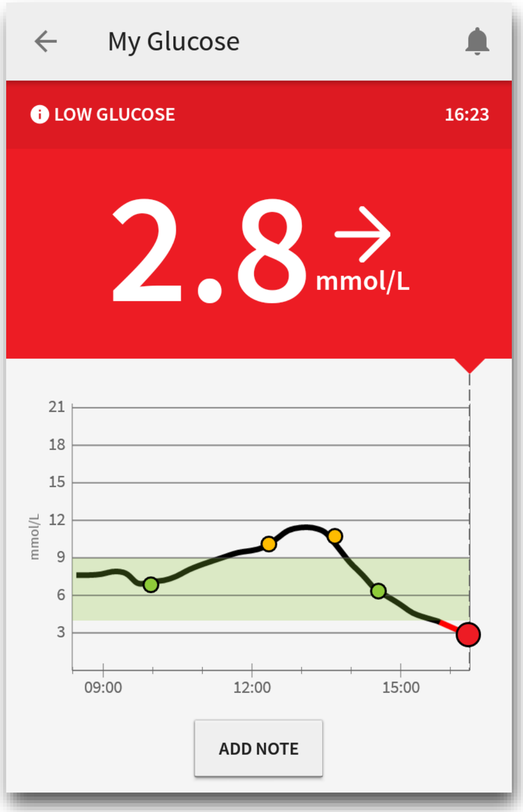
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Hypoglycaemia on the Libre

- Remember there is a 5-15 minute lag between blood glucose and FreeStyle Libre glucose
- Always double check with a fingerprick glucose if the FreeStyle Libre suggests you are hypo or are becoming hypo



Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

Hypoglycaemia defintions

Alert value

Plasma glucose < 3.9 mmol/L (70 mg/dL) with no symptoms (Note: 3.5 mmol/L is the lower limit of the alert range)

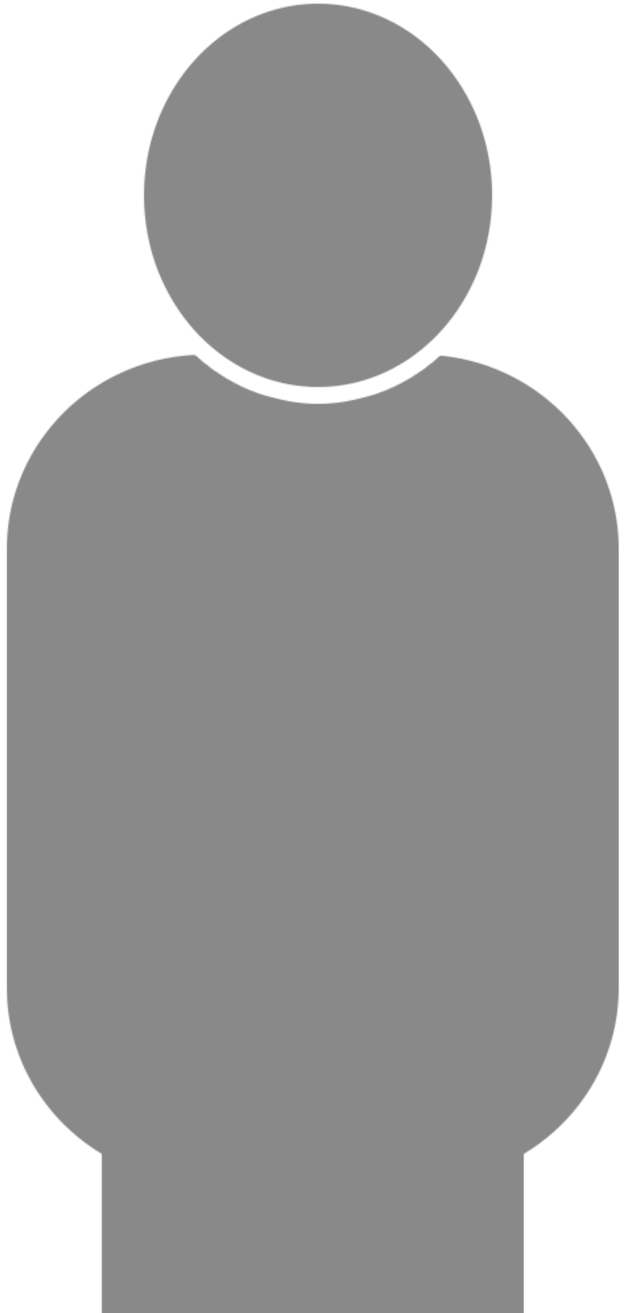
Non-severe symptomatic

Patient has symptoms but can self-treat and cognitive function is intact

Severe symptomatic

Symptoms include cognitive impairment that requires the help of another person or coma/seizure

http://ihsgonline.com/understanding-hypoglycaemia/definition/

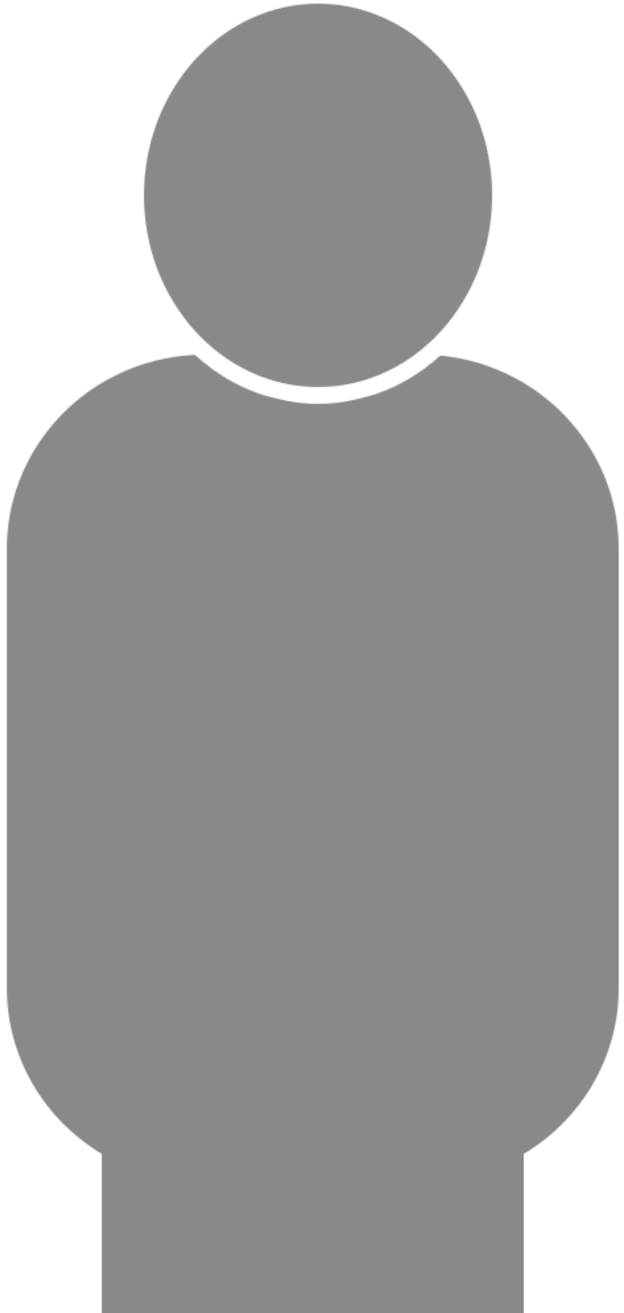


Incidence of CGM hypos

- Low sensor glucose occurs in between 10-20% of nights with CGM. You may only pick these up when you scan.
- 2-5% of nights will have prolonged hypoglycemia [> 2 hours] on CGM[2]
- This is within normal limits – even non-diabetic people have nights when glucose is between 2 – 3 mmol/l
- In a recent Danish study, patients classified as having good awareness of hypoglycemia were unaware of almost two thirds of hypoglycaemic episodes captured on blinded CGM

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

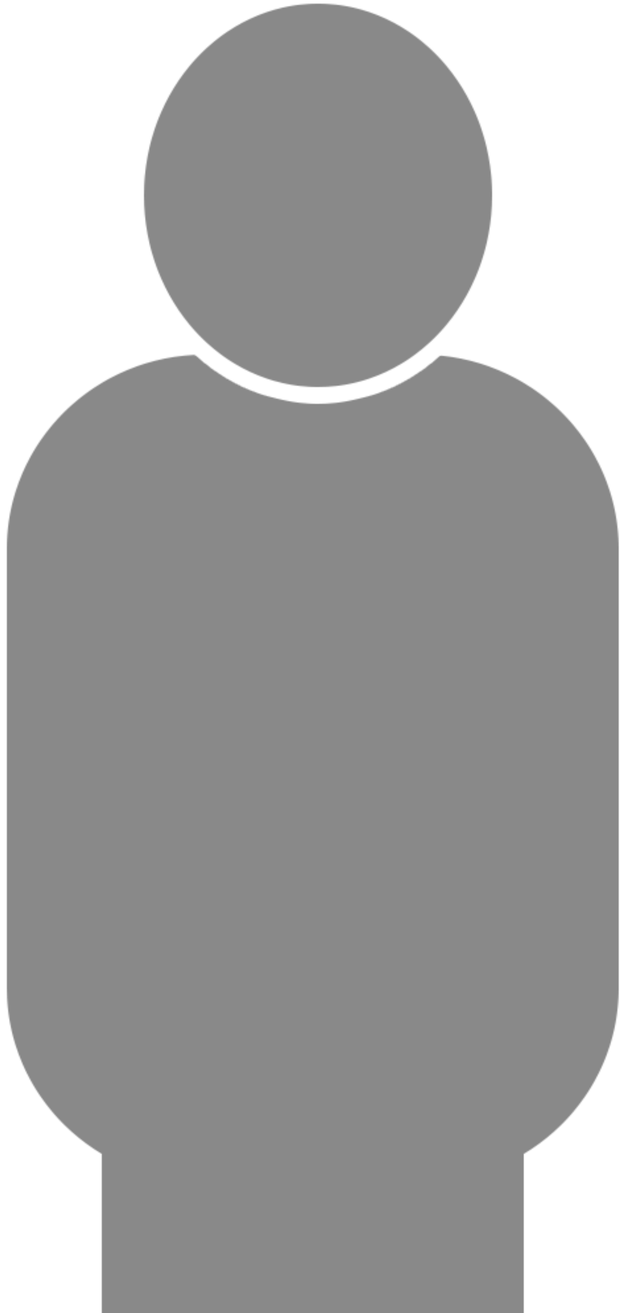


When is Hypoglycaemia too much

- Any hypoglycaemia of course can cause problems for the person with diabetes
- Up to 10% readings below 3.9 are seen in those with HbA1c around 7% [53mmol/l] and does not lead to harm
- More than 10% below 3.9mmol/l is usually considered to be a high amount of hypoglycaemia.
- In someone with impaired awareness of hypoglycemia the same % of hypoglycaemia may put them at greater risk

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



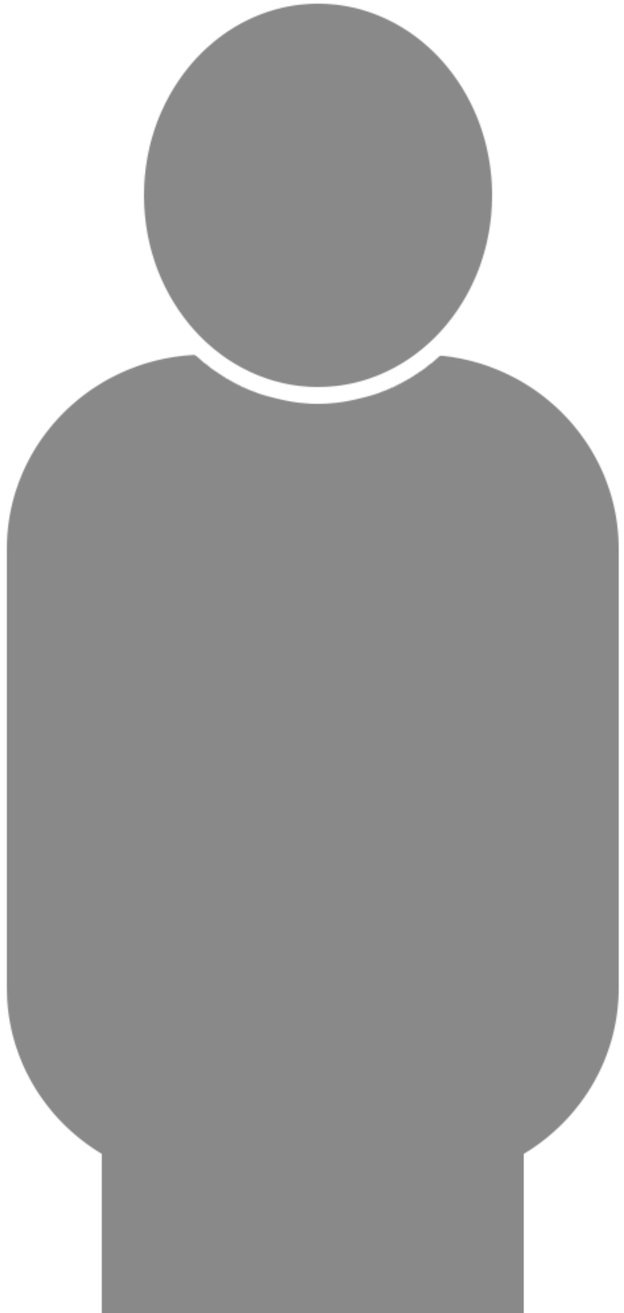
Step 1→ finding the hypos

- Hypoglycaemia is highlighted on a number of Libre reports as seen in the next few slides

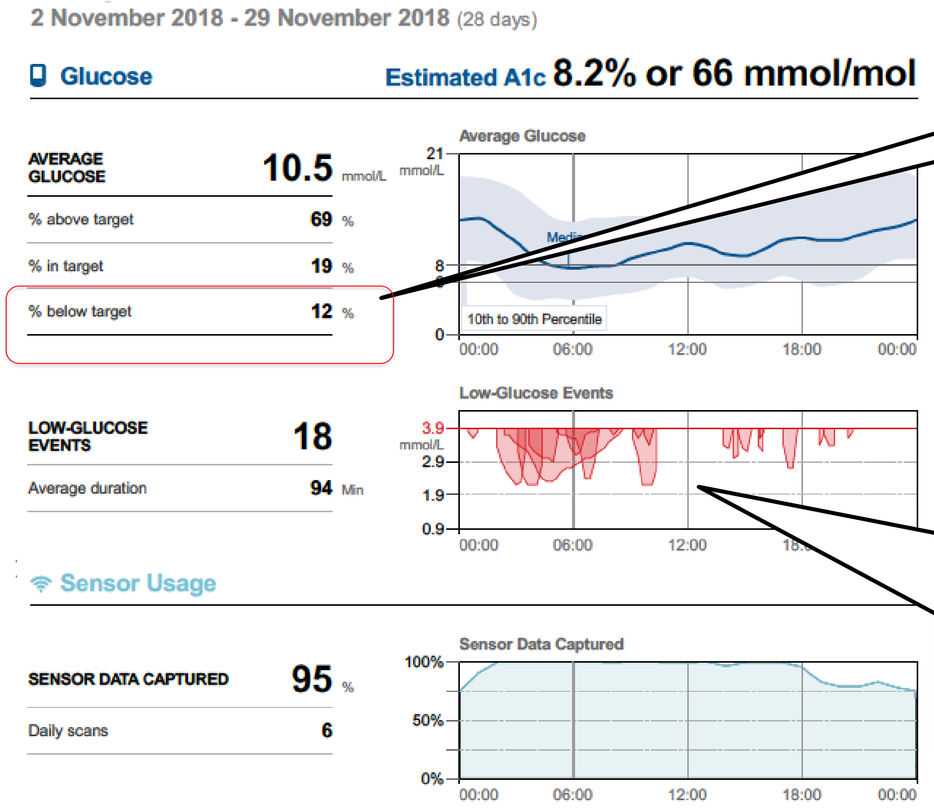
- Different views will appeal to different people

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Step 1→ finding the hypos



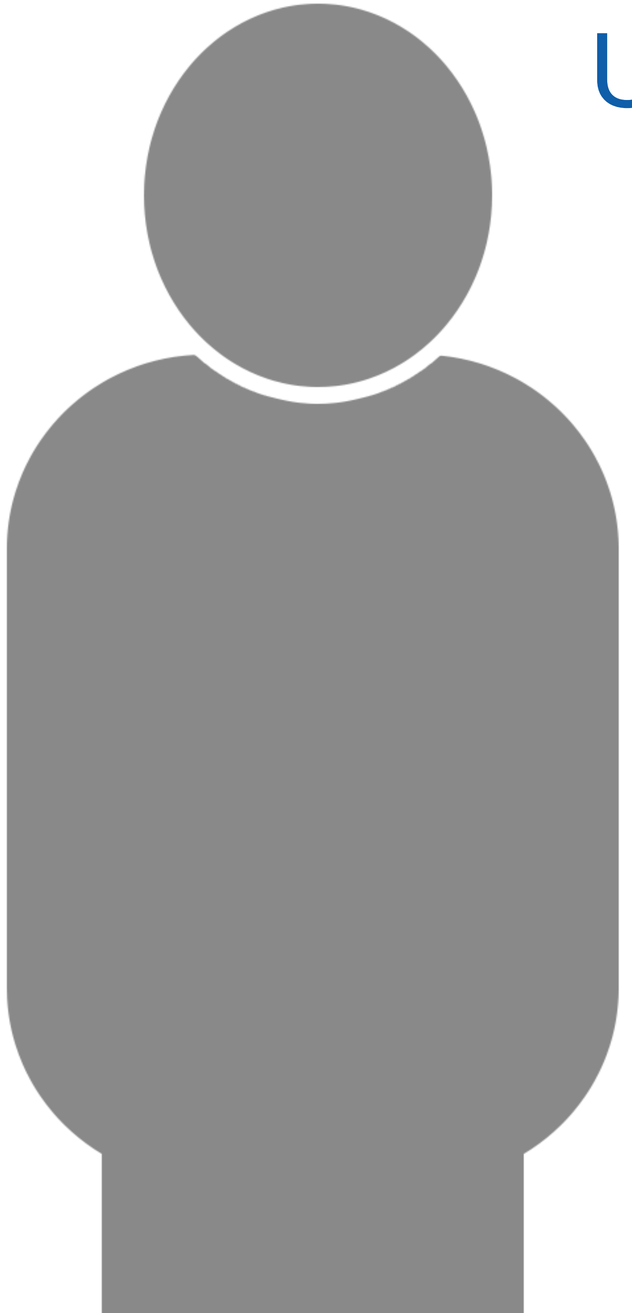
12% below target [3.9 mmol/l] suggests a high amount of hypoglycaemia

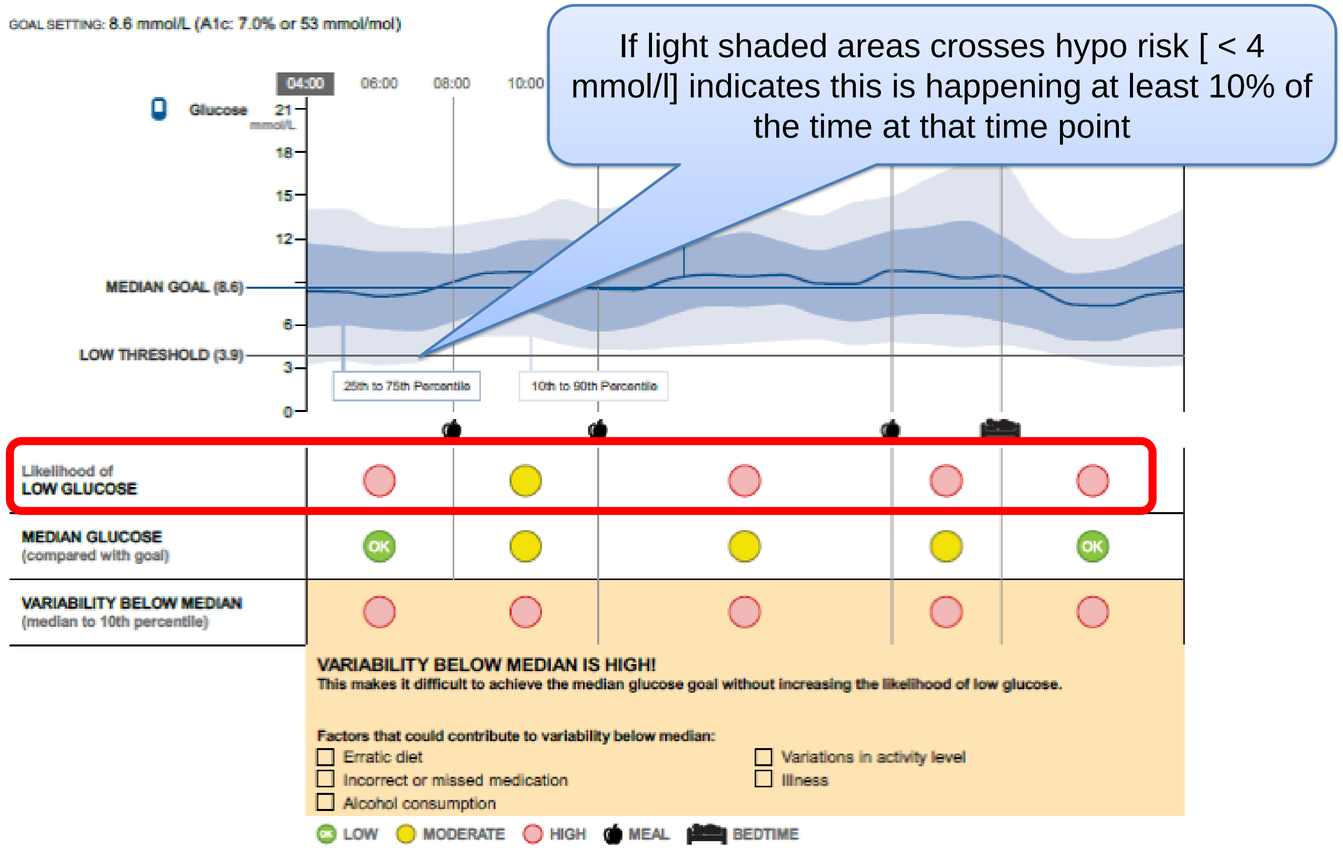
On the very first summary page, you get a readout of low glucose events showing the profile of these events – For eg here we can see the night events are a little longer and lower, while the day time ones are shorter

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

Using AGP to highlight times at risk

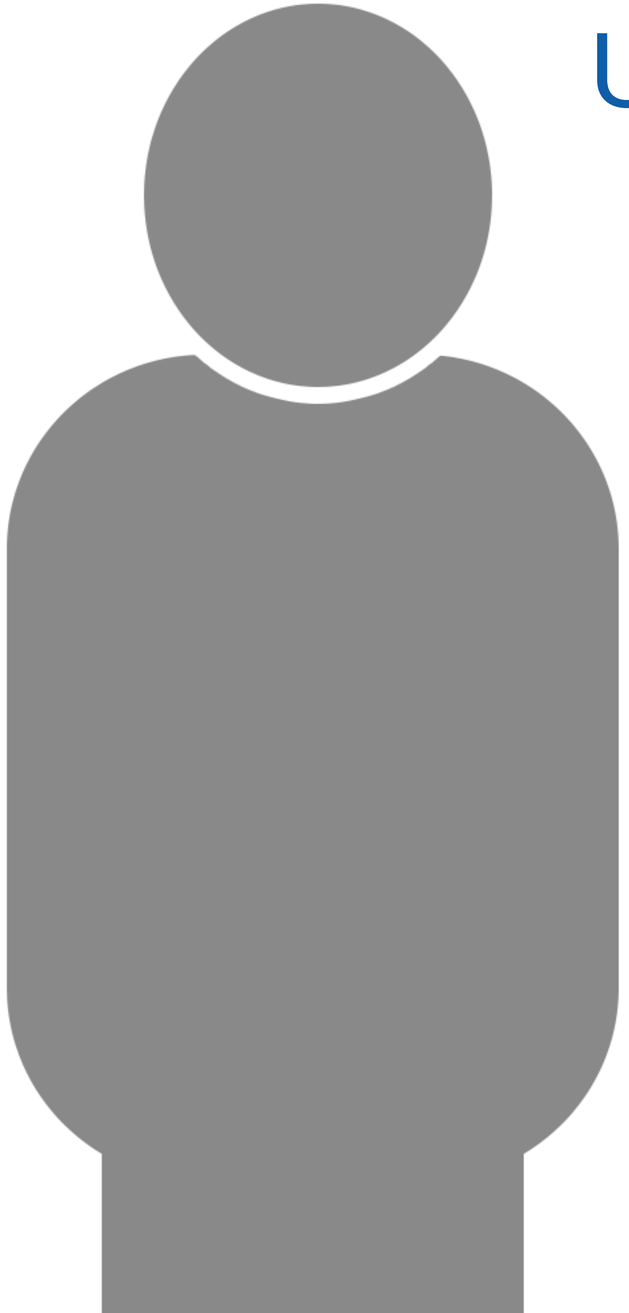


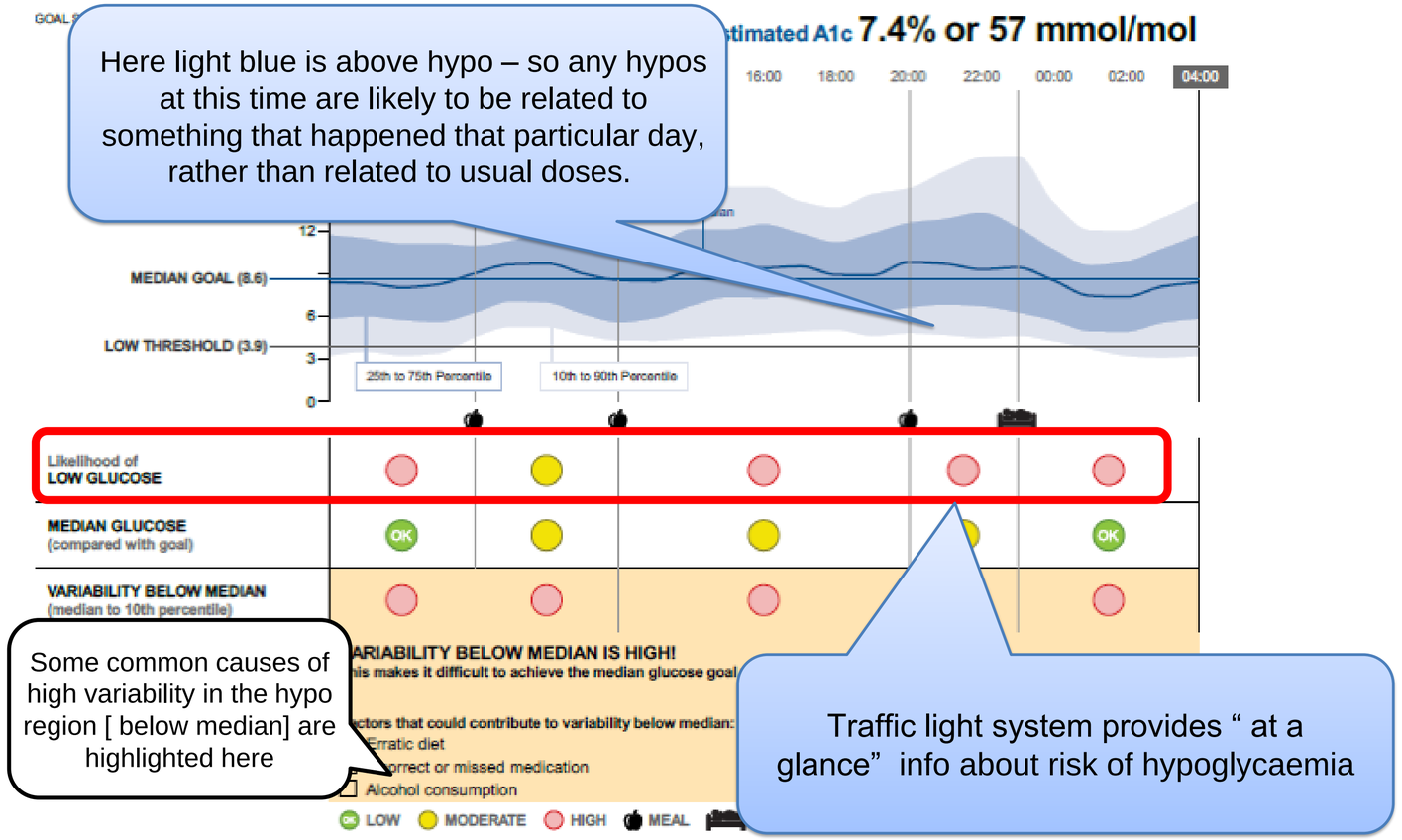


Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

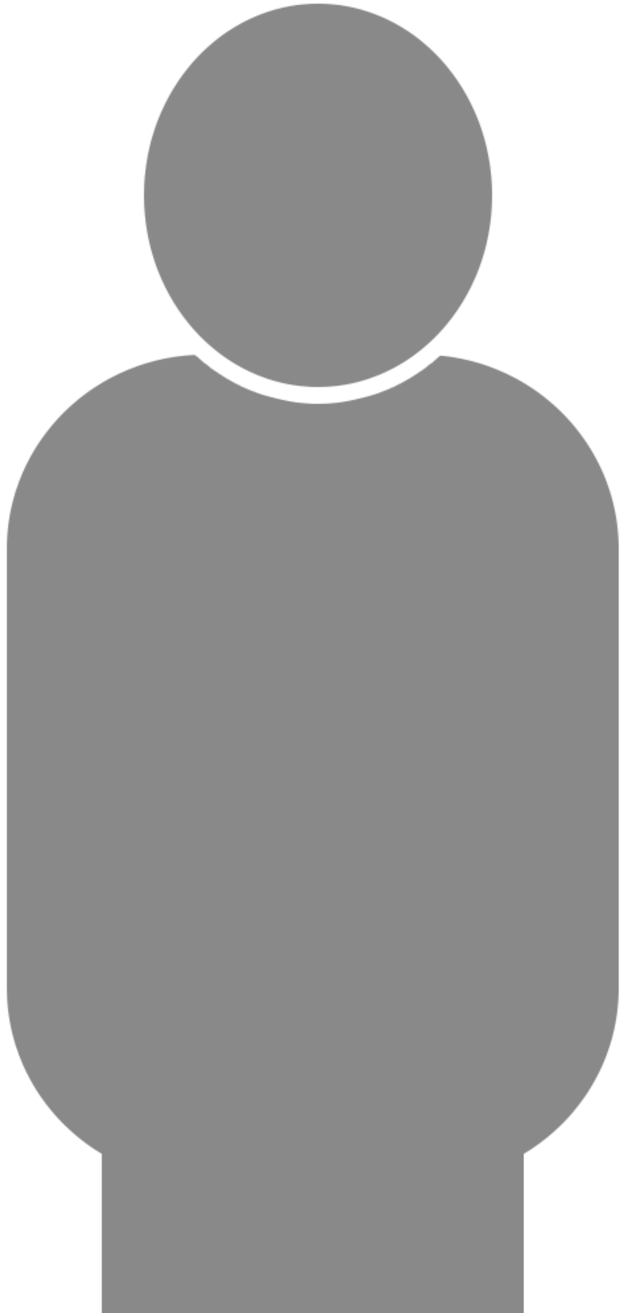
Using AGP to highlight times at risk





Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Glucose Pattern Insights (with glucose readings)

2 November 2018 - 29 November 2018 (28 days)

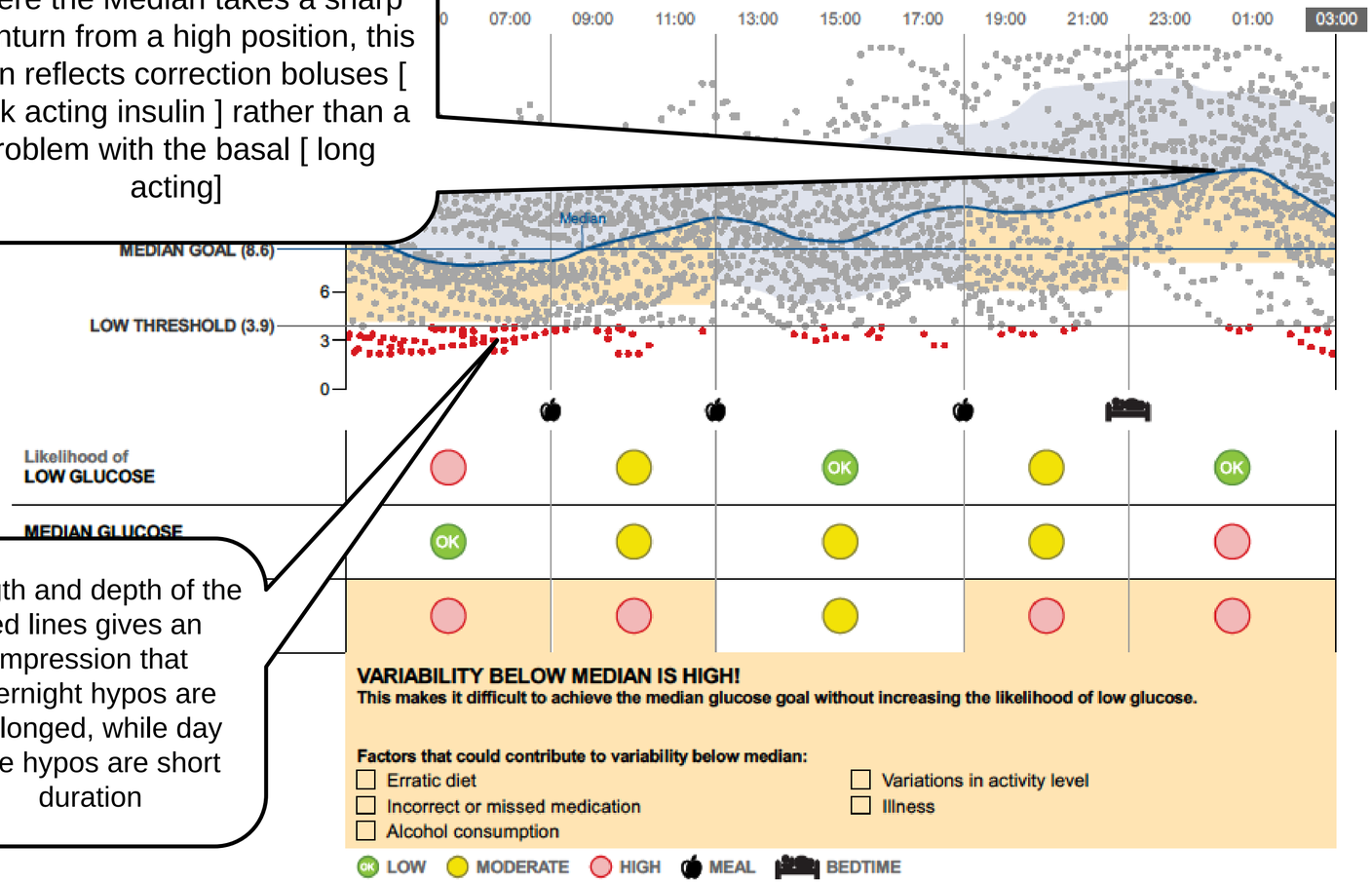
LOW-GLUCOSE ALLOWANCE SETTING: **Medium**

FreeStyle Libre

Estimated A1c 8.2% or 66 mmol/mol

Where the Median takes a sharp downturn from a high position, this often reflects correction boluses [quick acting insulin] rather than a problem with the basal [long acting]

Length and depth of the red lines gives an impression that overnight hypos are prolonged, while day time hypos are short duration



VARIABILITY BELOW MEDIAN IS HIGH!

This makes it difficult to achieve the median glucose goal without increasing the likelihood of low glucose.

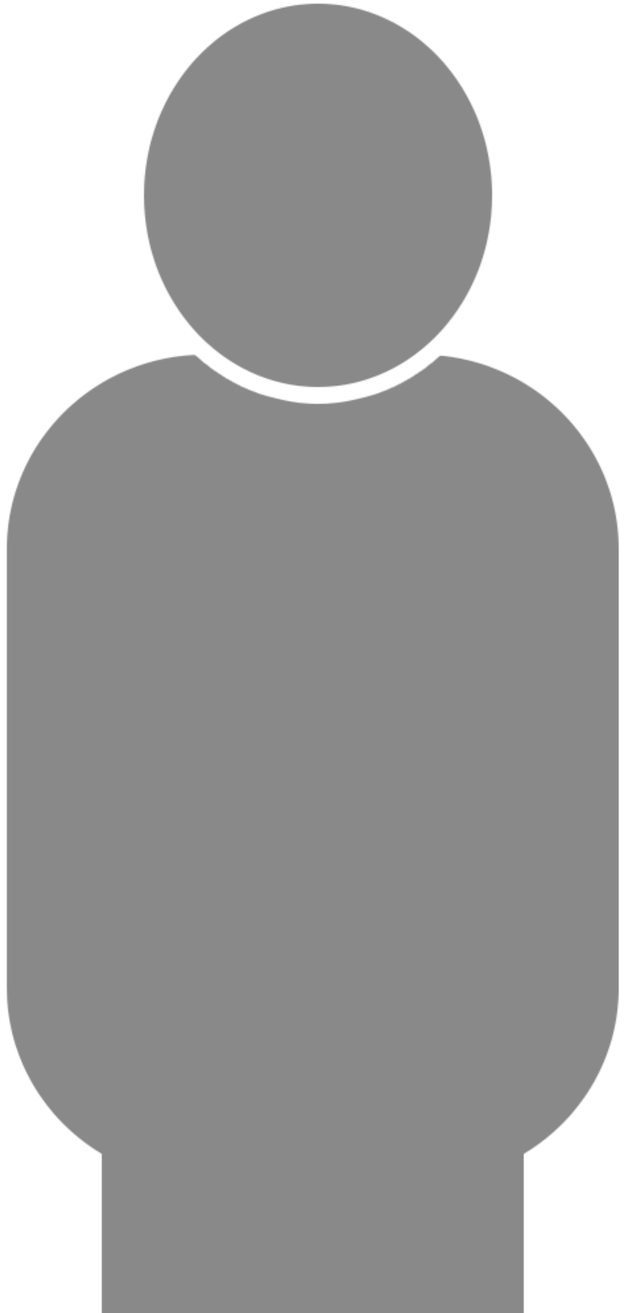
Factors that could contribute to variability below median:

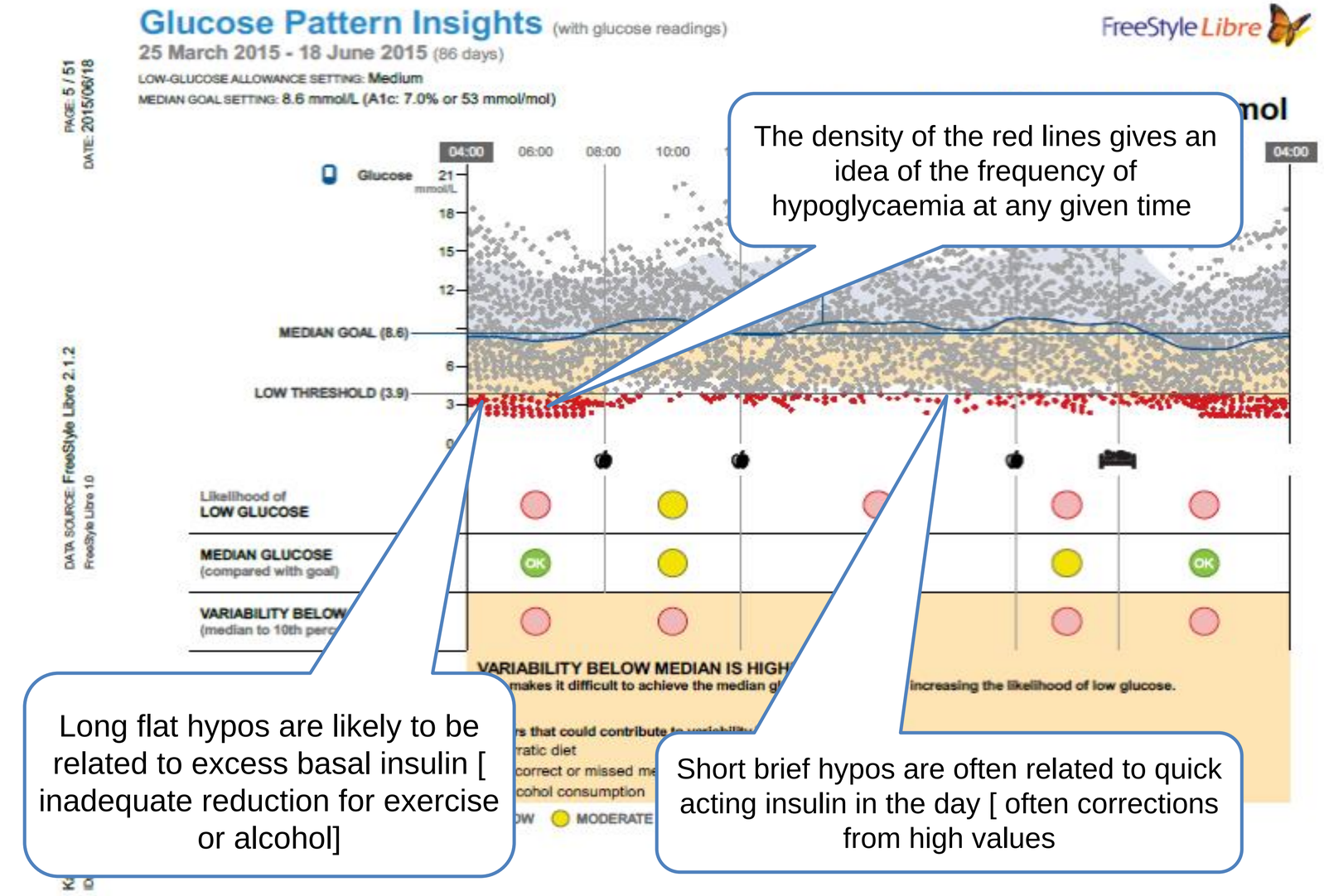
- ☐ Erratic diet
- ☐ Incorrect or missed medication
- ☐ Alcohol consumption
- ☐ Variations in activity level
- ☐ Illness

OK LOW · MODERATE · HIGH · MEAL · BEDTIME

ABCD Association of British Clinical Diabetologists

DTN UK collaborate · evolve · support





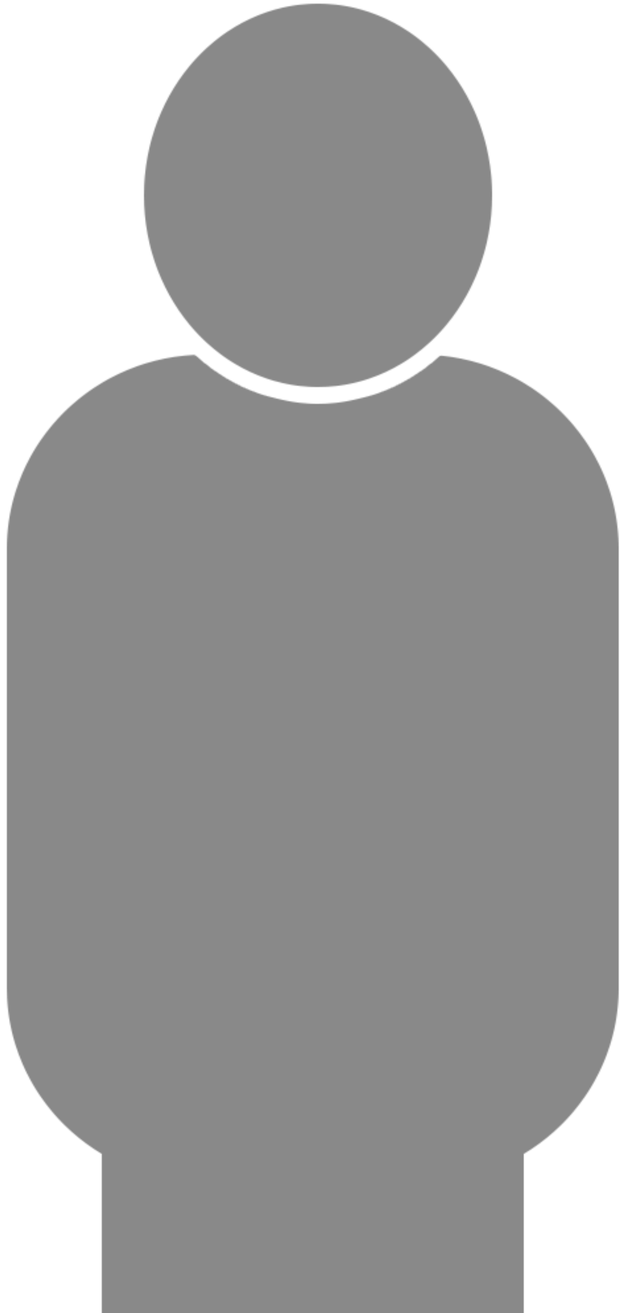
The density of the red lines gives an idea of the frequency of hypoglycaemia at any given time

Long flat hypos are likely to be related to excess basal insulin [inadequate reduction for exercise or alcohol]

Short brief hypos are often related to quick acting insulin in the day [often corrections from high values

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Monthly Summary

November 2018

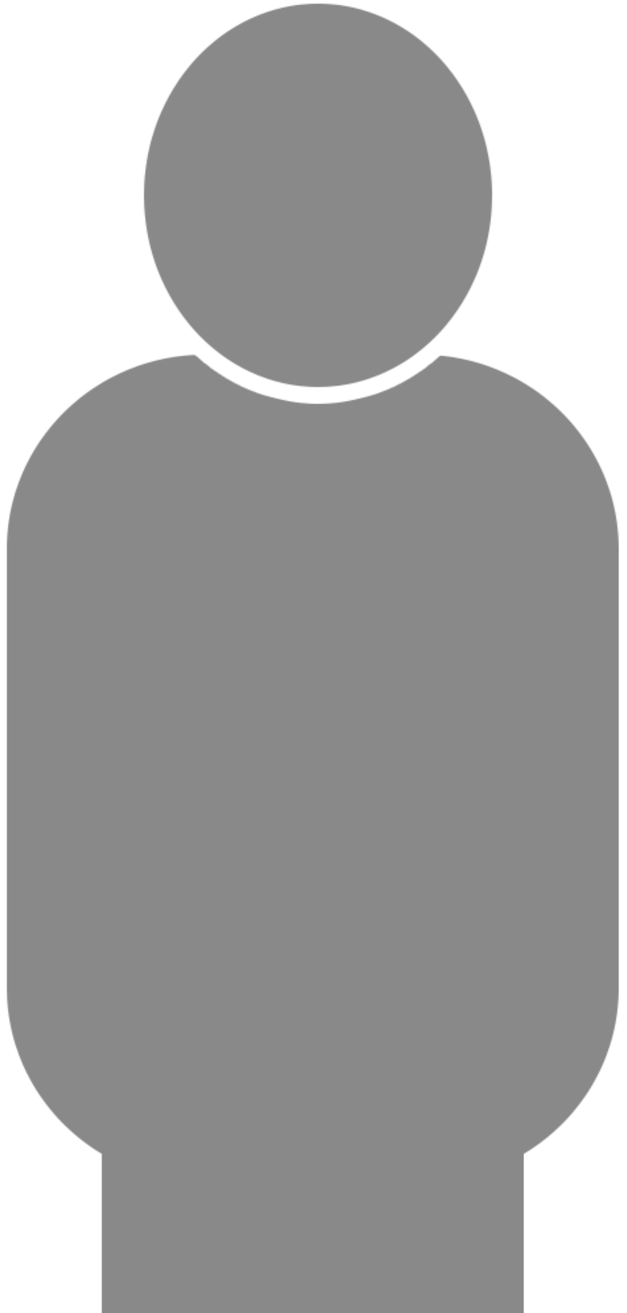
FreeStyle Libre

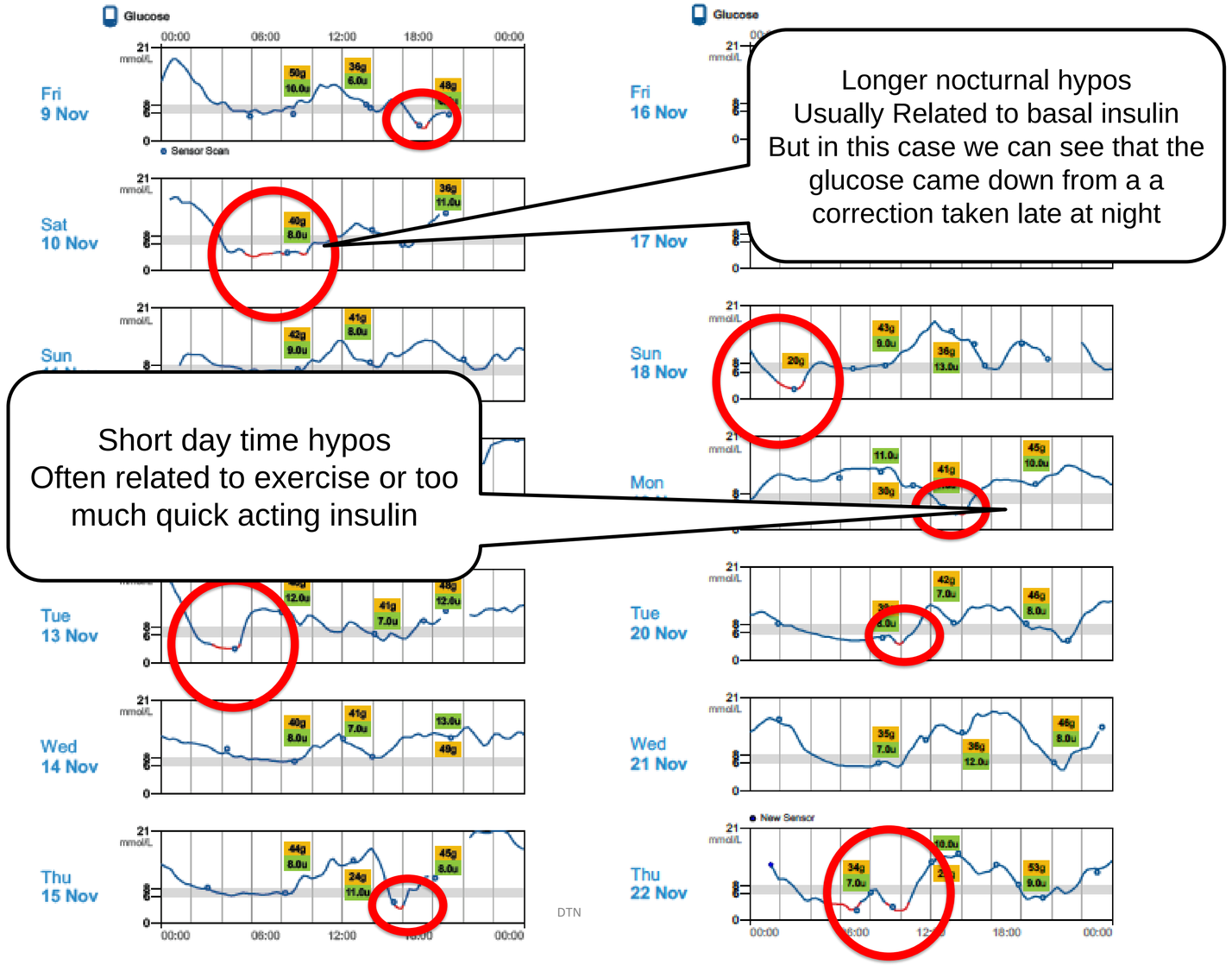
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose / Scans/Day / Low-Glucose Events				1 10.8 mmol/L 5 ↓	2 12.7 mmol/L 7	3 12.9 mmol/L 6	4 High 13.5 mmol/L 5
	5 9.3 mmol/L 8 ↓	6 12.9 mmol/L 6 ↓	7 7.5 mmol/L 5 ↓↓	8 9.8 mmol/L 9 ↓	9 9.0 mmol/L 6 ↓	10 7.9 mmol/L 4 ↓	11 9.5 mmol/L 3
	12 11.1 mmol/L 7	13 9.0 mmol/L 6 ↓	14 10.8 mmol/L 5	15 11.2 mmol/L 5 ↓	16 11.7 mmol/L 8	17 11.3 mmol/L 8 ↓	18 9.3 mmol/L 9 ↓
	19 10.8 mmol/L 6 ↓	20 8.1 mmol/L 5 ↓	21 10.8 mmol/L 6	22 8.1 mmol/L 9 ↓↓	23 12.2 mmol/L 7	24 12.4 mmol/L 5	25 10.2 mmol/L 6 ↓
	26 9.4 mmol/L 5 ↓	27 12.3 mmol/L 7 ↓	28 9.9 mmol/L 4	29 9.6 mmol/L 5	30		

We can use this view to evaluate the frequency of low glucose events – e.g. here they are happening 17/29 = > 50% of days

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support





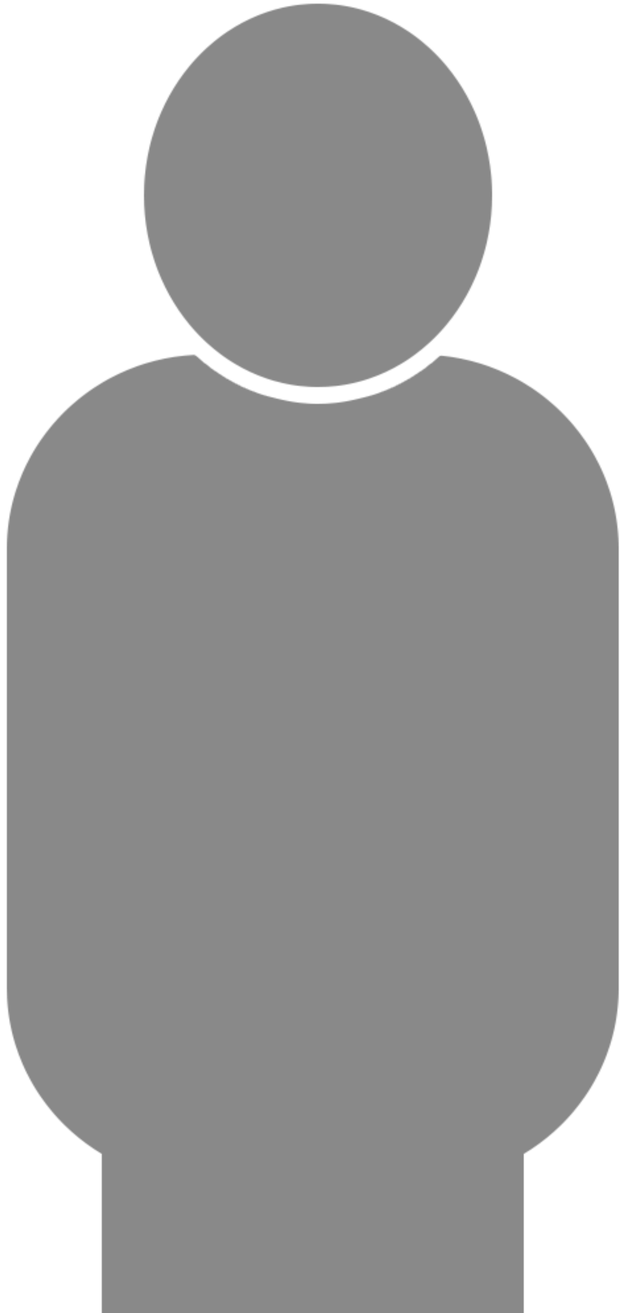
Longer nocturnal hypos
Usually Related to basal insulin
But in this case we can see that the glucose came down from a a correction taken late at night

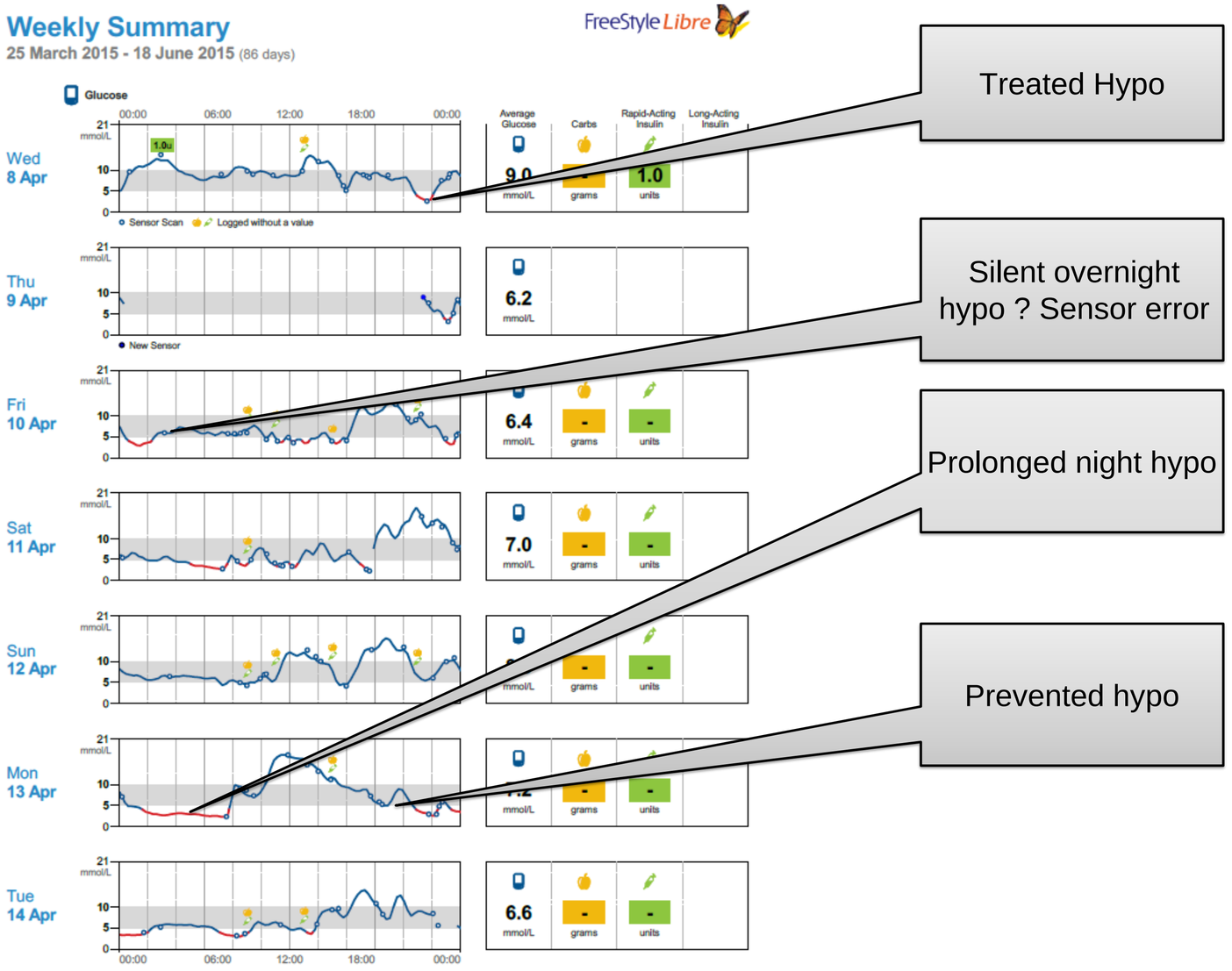
Short day time hypos
Often related to exercise or too much quick acting insulin

DTN

Association of British Clinical Diabetologists

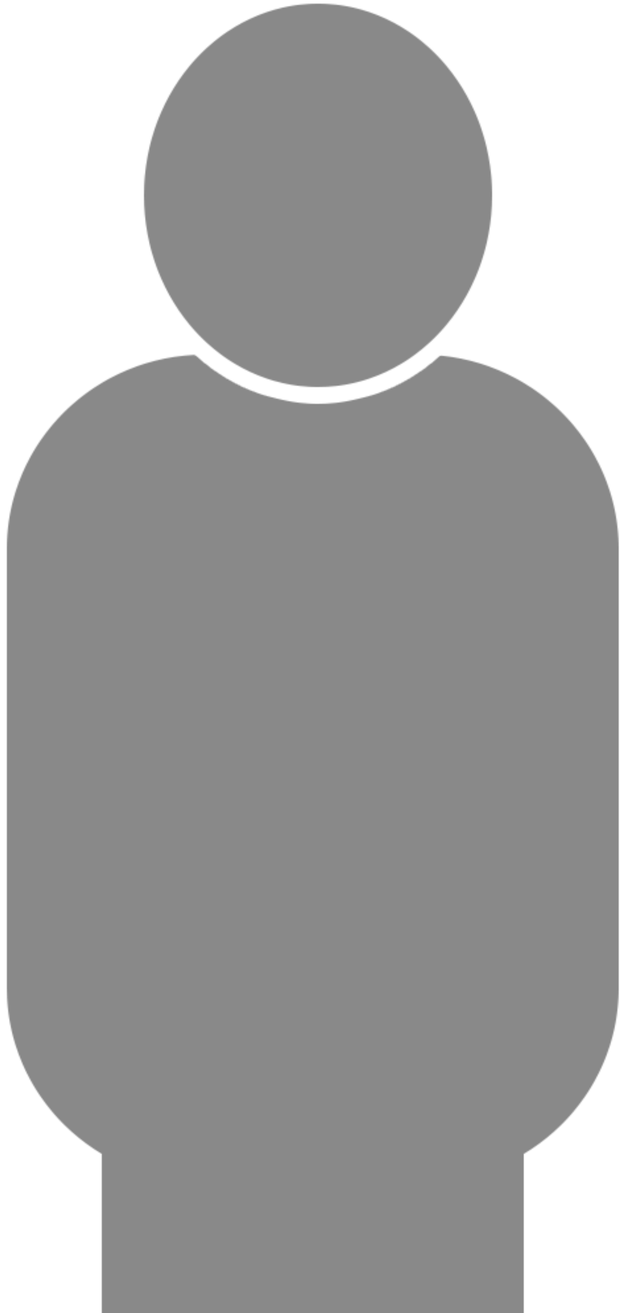
DTN UK
collaborate · evolve · support





Association of British Clinical Diabetologists

DTN UK
collaborate • evolve • support

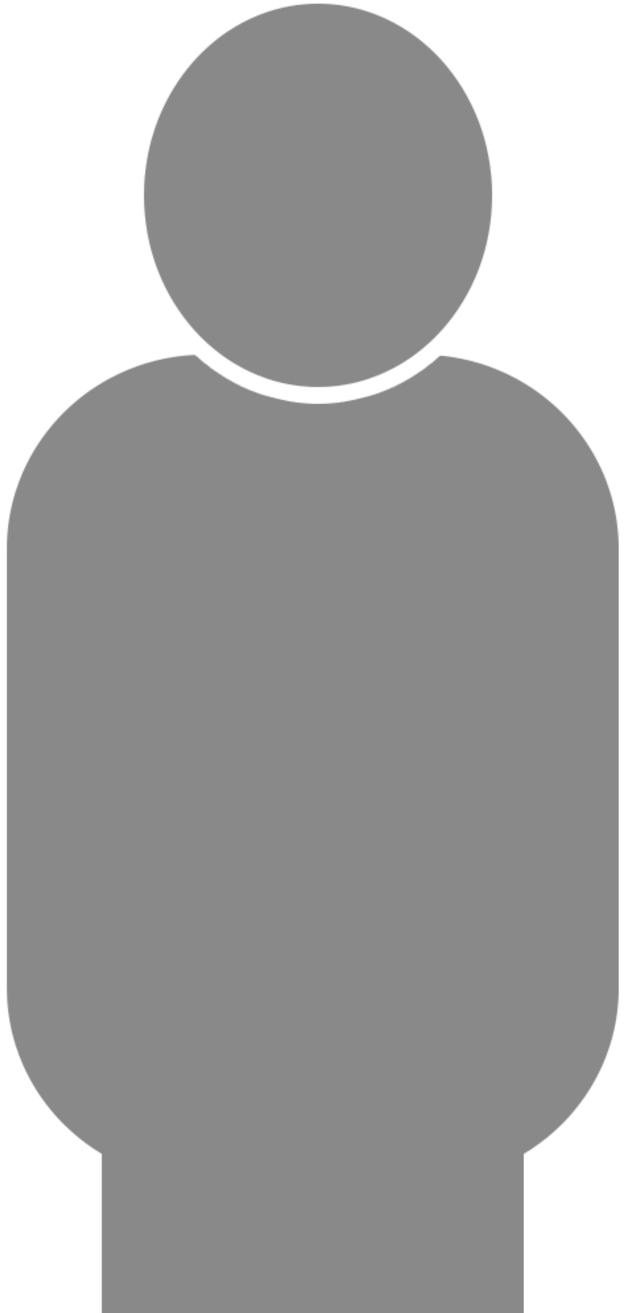


Common causes of hypoglycaemia

- Inadequate basal reduction for exercise / alcohol
- Over correction of a high glucose
- Insulin “stacking” → when you give some rapid acting insulin while a previous dose of rapid acting insulin is still working [stacking]
- Overestimated carbohydrate

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



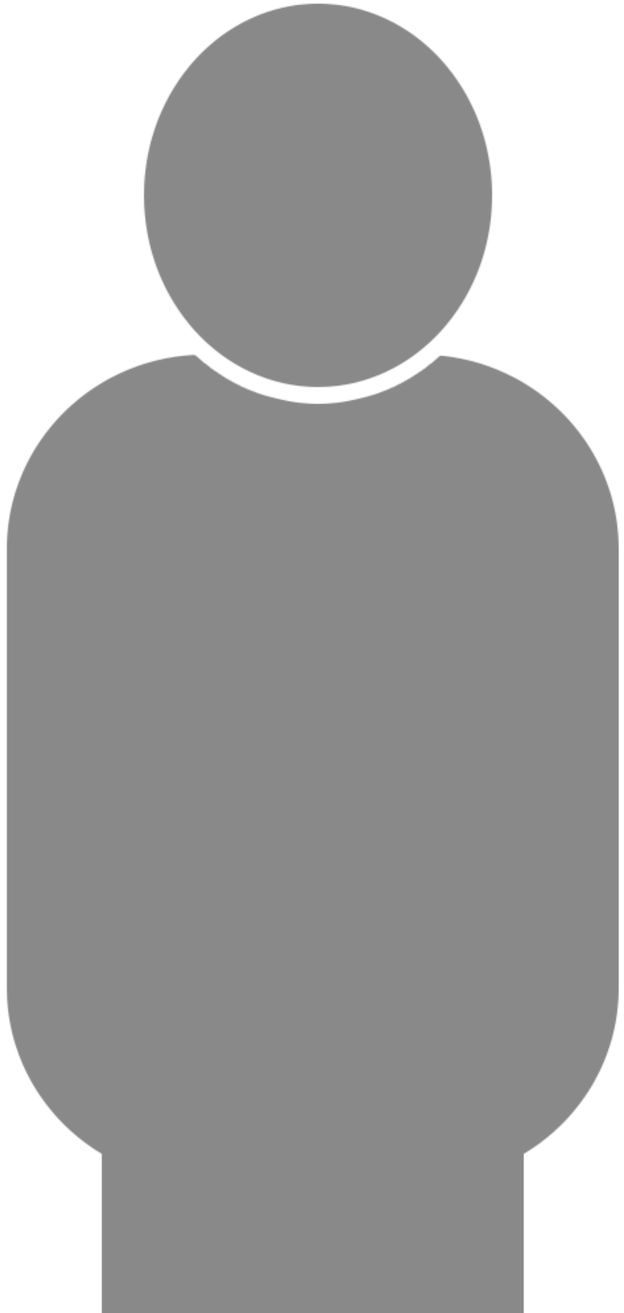
Impaired awareness of hypoglycaemia

- Repeated hypoglycaemia can blunt the usual symptoms and the stress hormone response that helps raise glucose

- This can lead to impaired or reduced awareness of hypoglycaemia and increase the risk of severe hypoglycemia which requires third party help

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Hypoglycaemia aware

Blood glucose

4.0

symptoms

3.5

REACTION TIME

3.0

2.5

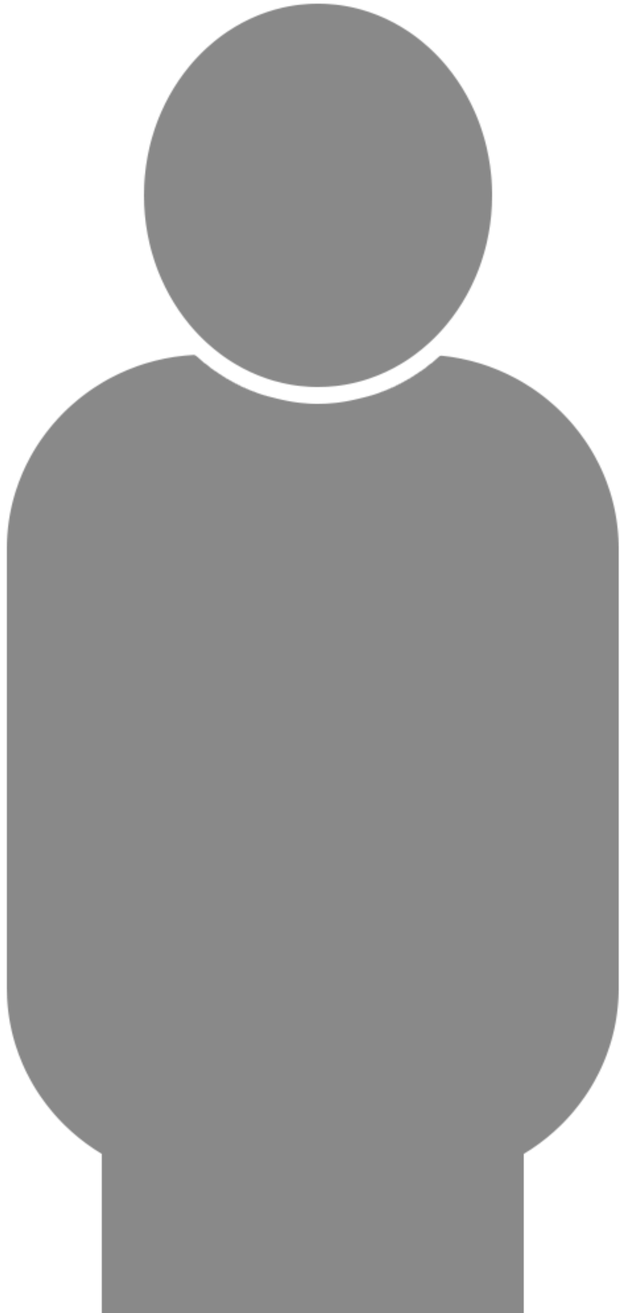
Confusion or reduced conscious level

2.0

Association of British Clinical Diabetologists

DTN UK

collaborate · evolve · support



Hypoglycaemia unaware

Blood glucose

4.0

3.5

3.0

2.5

2.0

symptoms

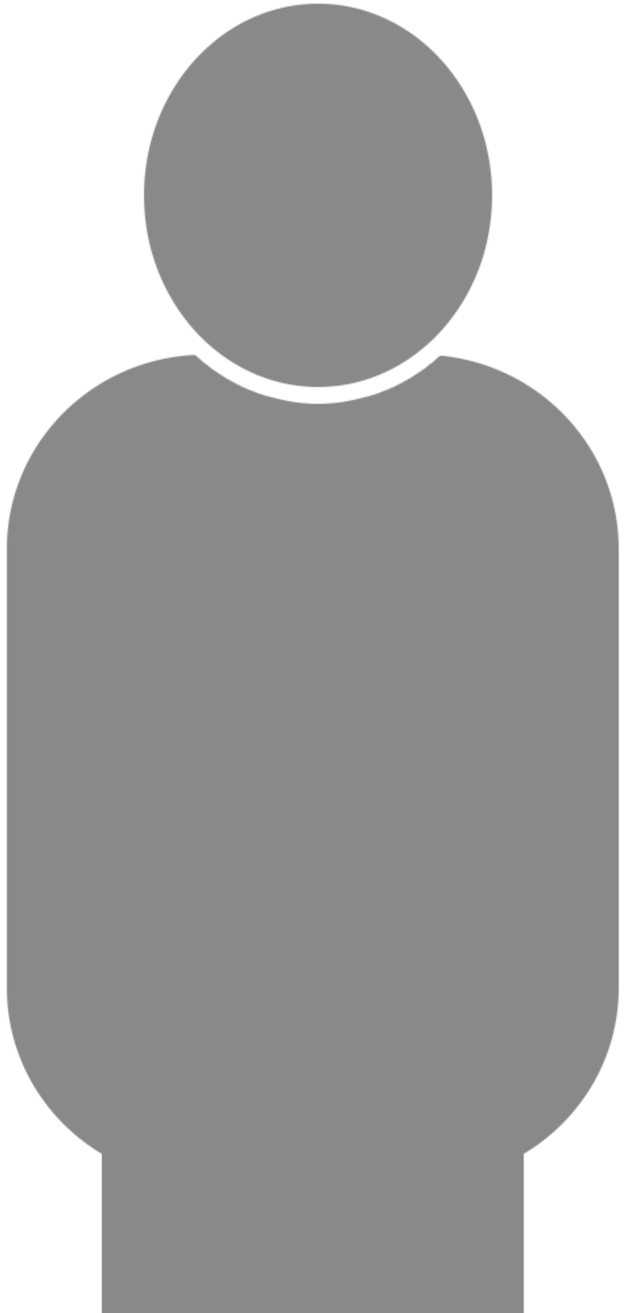
REACTION TIME

neuroglycopaenia

Association of British Clinical Diabetologists

DTN UK

collaborate · evolve · support



Can we use CGM to diagnose hypoglycemia unawareness?

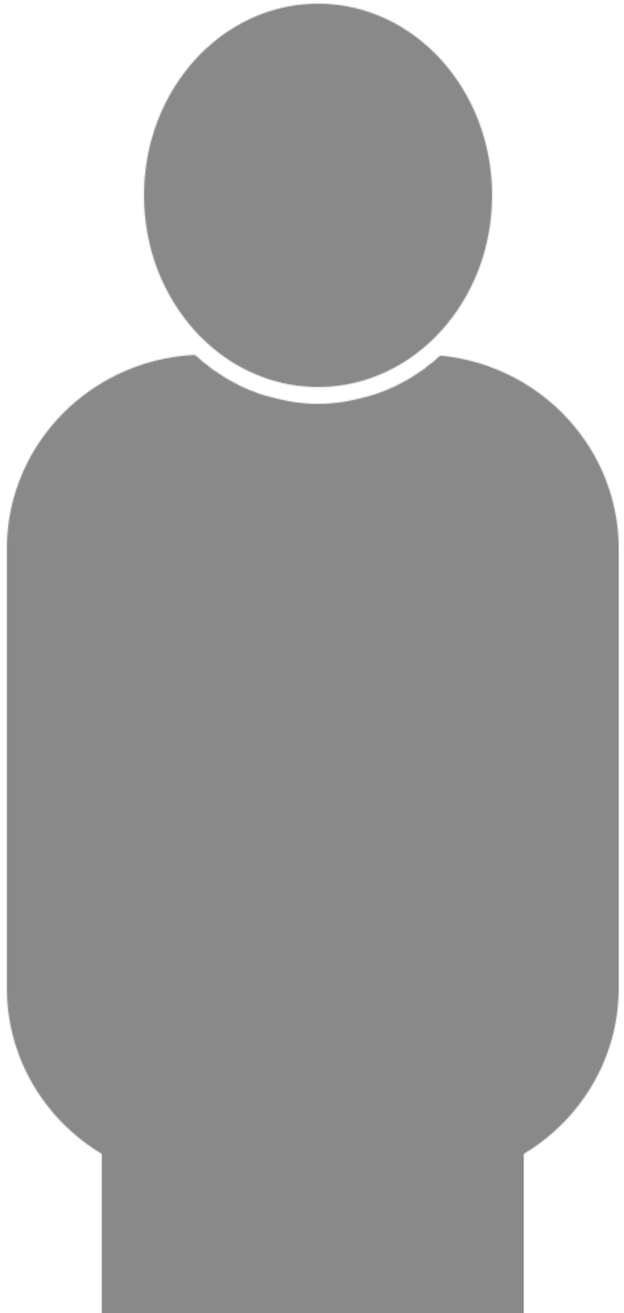
The short answer is …..NO

The rate of hypos seen on CGM, is similar between those with normal awareness and those with impaired awareness of hypoglycaemia by clinical scores.

So – while CGM is useful to find hypos, we can't use it to define hypoglycemia unawareness

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Assessing hypoglycaemia awareness

There are two easy validated methods

[Gold score]

How well can you detect onset of hypoglycaemia

Always 1 2 3 4 5 6 7 Never

DAFNE question
When do you usually detect your hypos

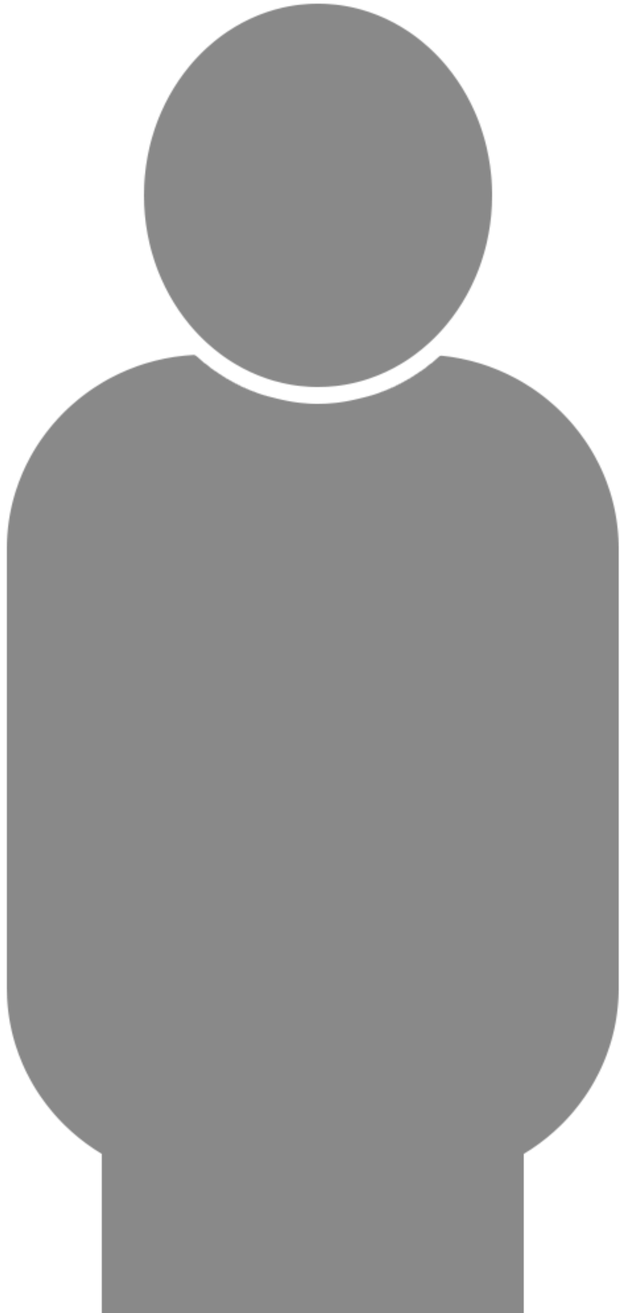
Above 3.0 mmol/l
Below 3.0 mmol.l
Never

= Impaired awareness of hypoglycaemia

= Normal awareness of hypoglycaemia

ABCD
Association of British Clinical Diabetologists

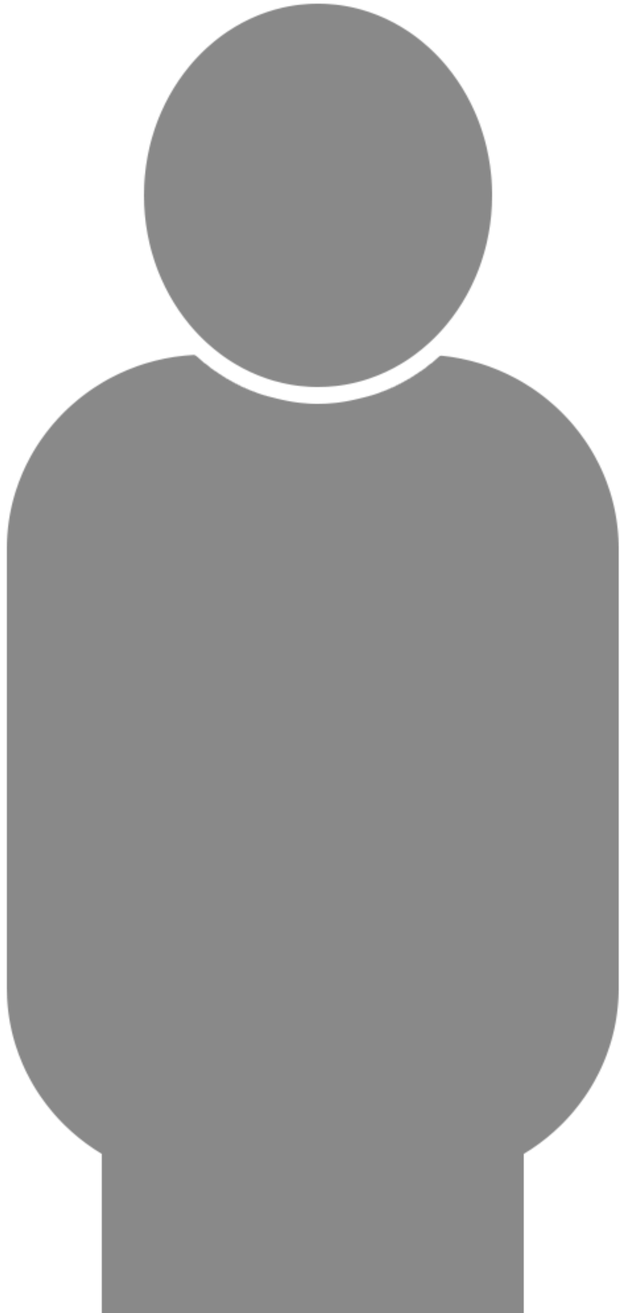
DTN UK
collaborate · evolve · support



MANAGEMENT OF PROBLEMATIC HYPOGLYCAEMIA

Association of British Clinical Diabetologists

DTN UK
collaborate • evolve • support

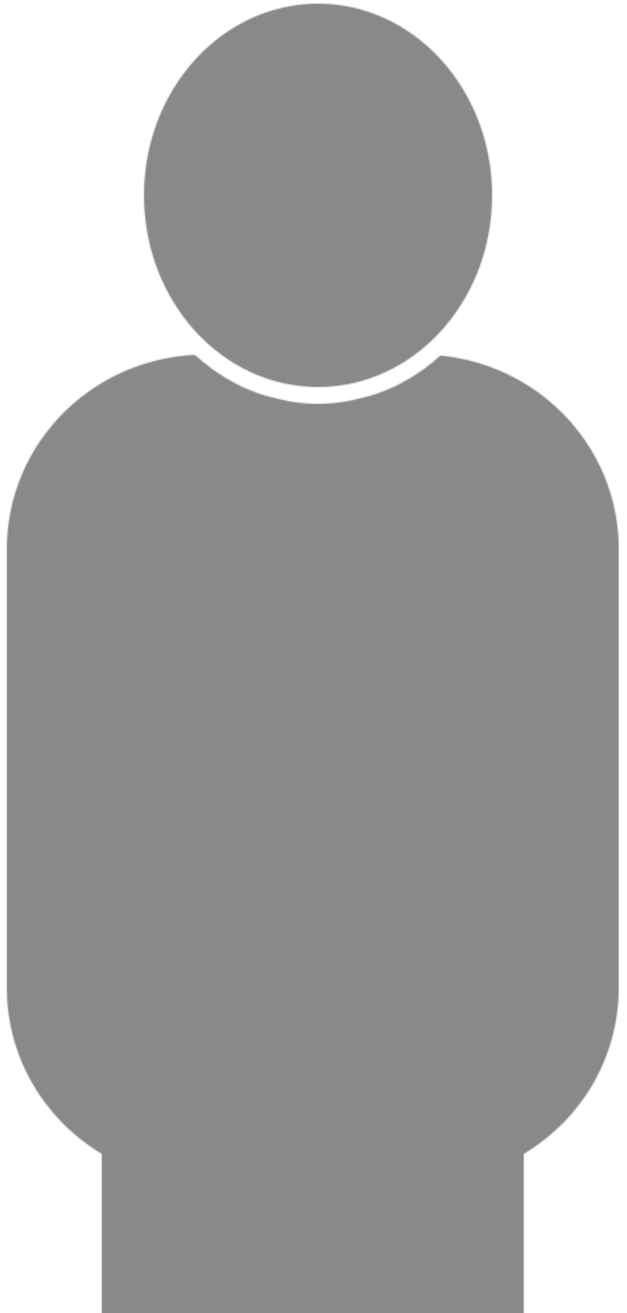


Problematic Hypoglycamia

- Loss of awareness of hypoglycaemia (no or limited symptoms, most of the time, when glucose <3mmol/l)
- Severe hypoglycaemia (needing someone else to help treat the hypo/seizure/coma)
- Repeated and unpredictable hypoglycaemia that results in persistent anxiety/adverse effect on quality of life

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



What can help with problematic hypoglycaemia?

DAFNE structured education

Insulin pump therapy

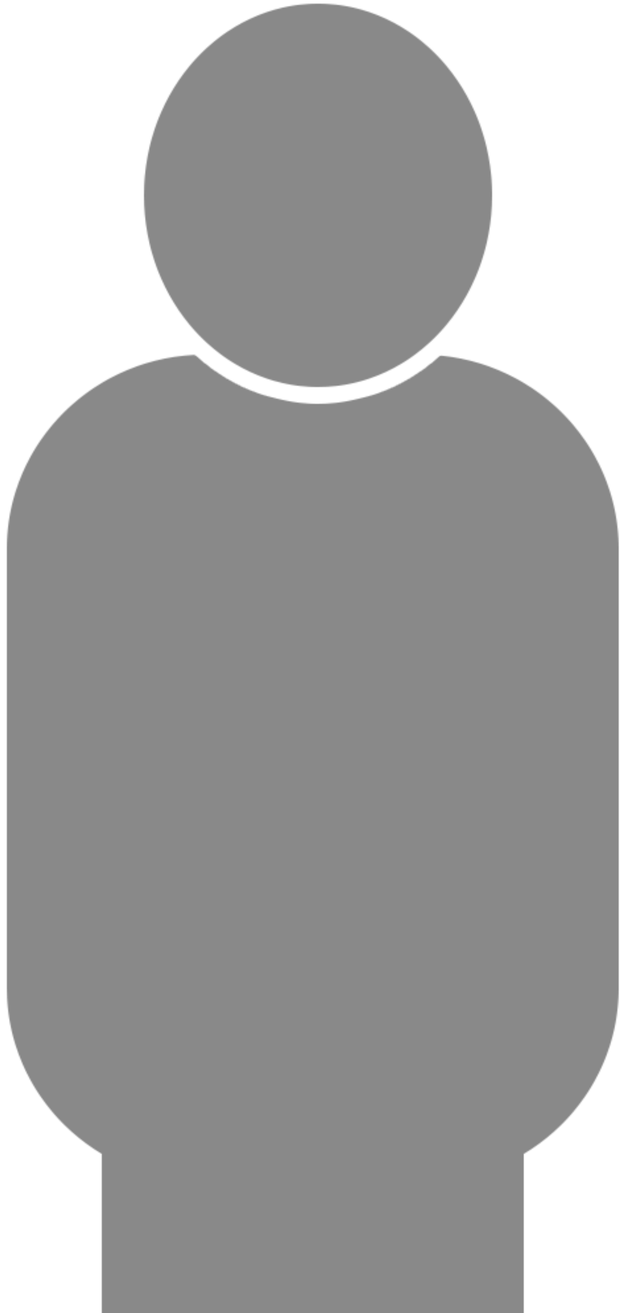
Continuous Glucose Monitoring (CGM) with alarms

Sensor augmented insulin pump therapy

NICE NG17, NICE TA151, NICE DG21

Association of British Clinical Diabetologists

collaborate · evolve · support



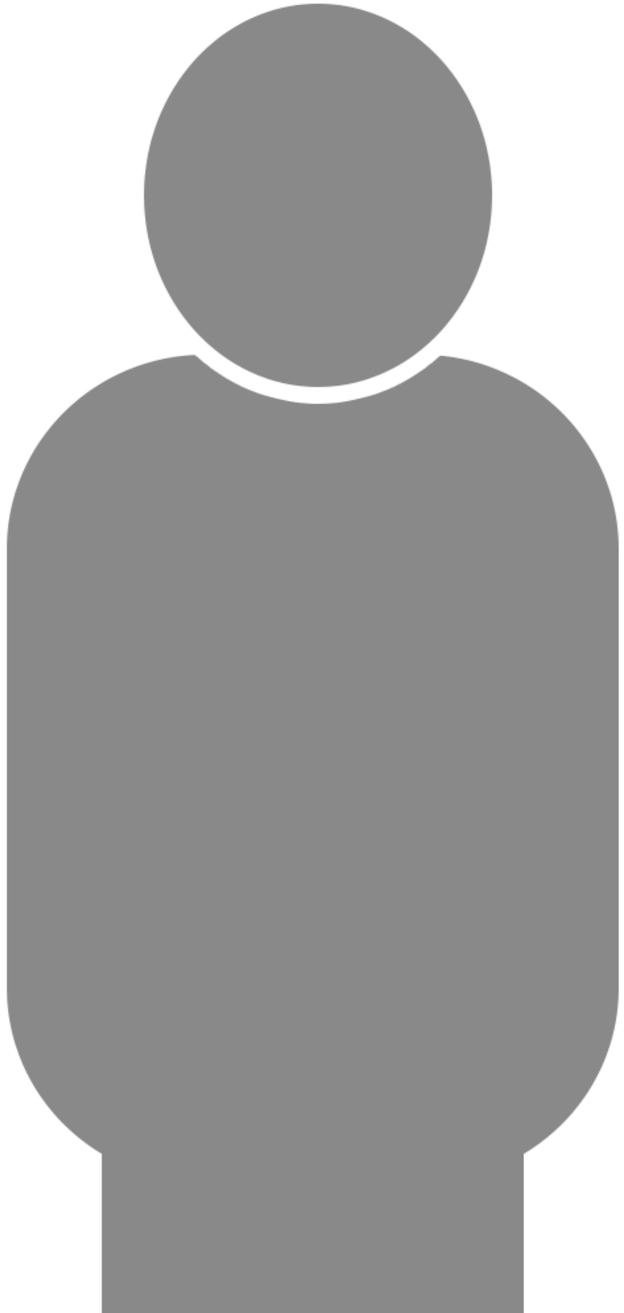
Loss of awareness of hypoglycaemia

- If impaired awareness of hypoglycaemia or recurrent severe hypoglycemia, CGM with alarms or sensor augmented pump therapy may be more suitable
  - NICE NG17, DG21

- If you are having problems with hypos please discuss with your diabetes team to discuss other options

Association of British Clinical Diabetologists

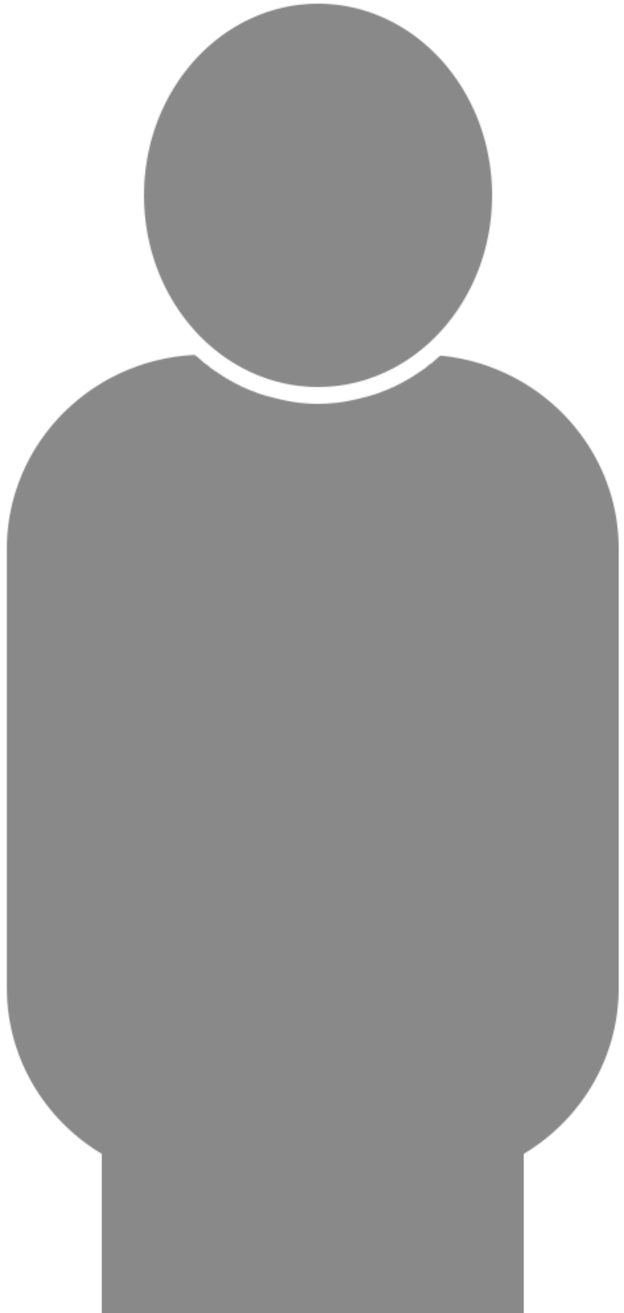
DTN UK
collaborate · evolve · support



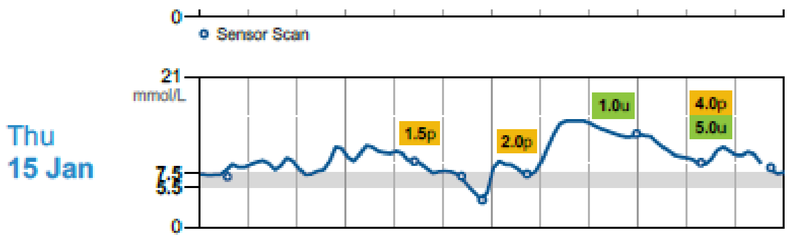
PRACTICAL EXAMPLES

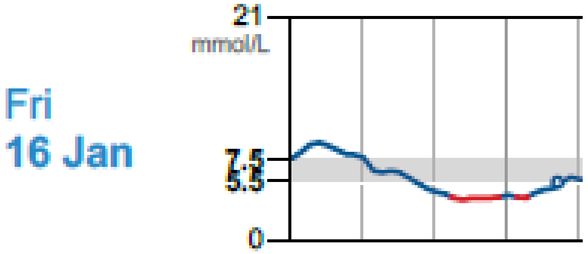
Association of British Clinical Diabetologists

DTN UK
collaborate • evolve • support



Scenario 1 Nocturnal Hypoglycaemia

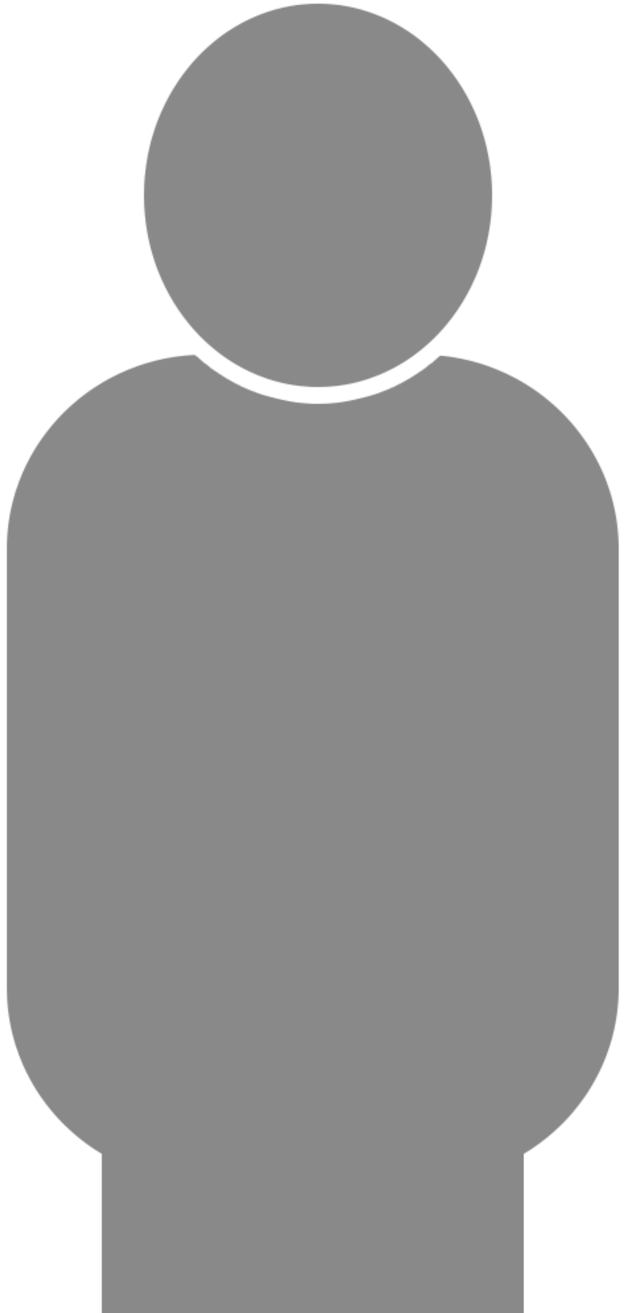




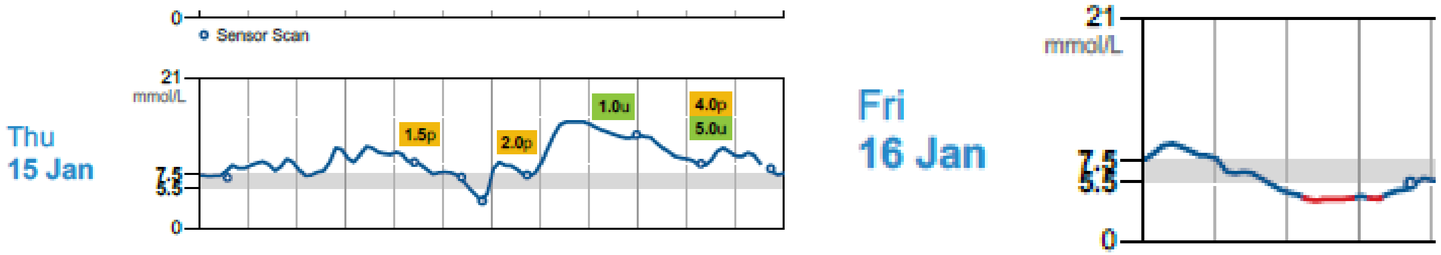
- Wakes up on Friday am with a glucose of 5.6 mmol/l and a flat arrow but was low overnight.
- What could have caused this?

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



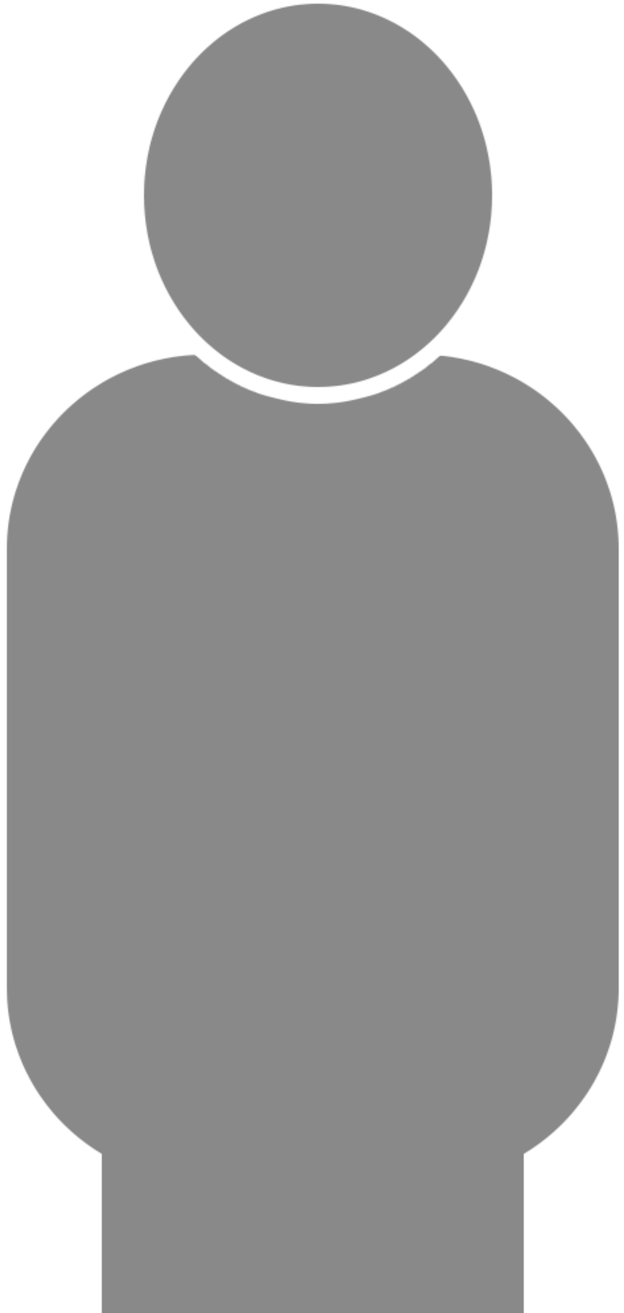
Scenario 1 Nocturnal Hypoglycaemia

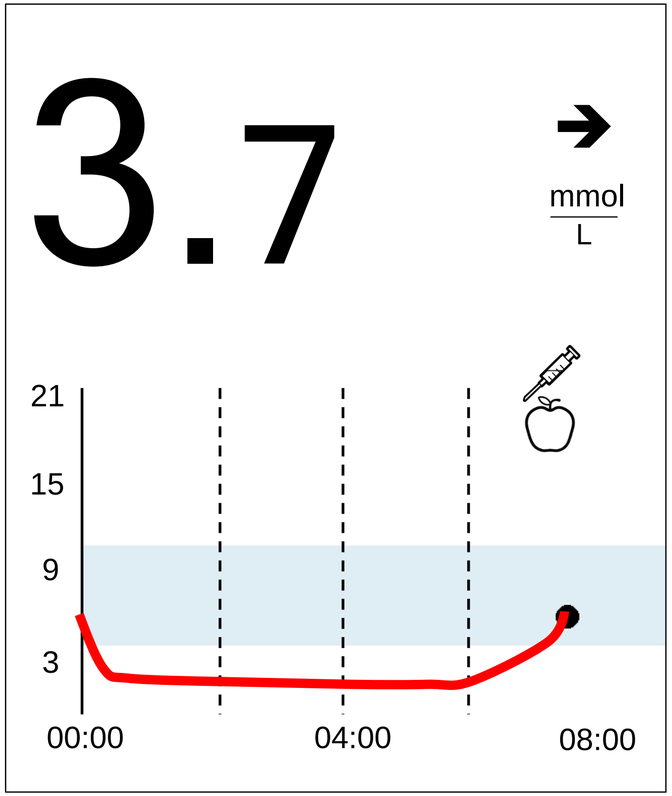


- Had 2 glasses of wine that evening with meal.
- Other possibilities
  - If was happening regularly – it may have been due to too much overnight basal
  - If they had done some exercise the previous evening, that could have contributed.

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support





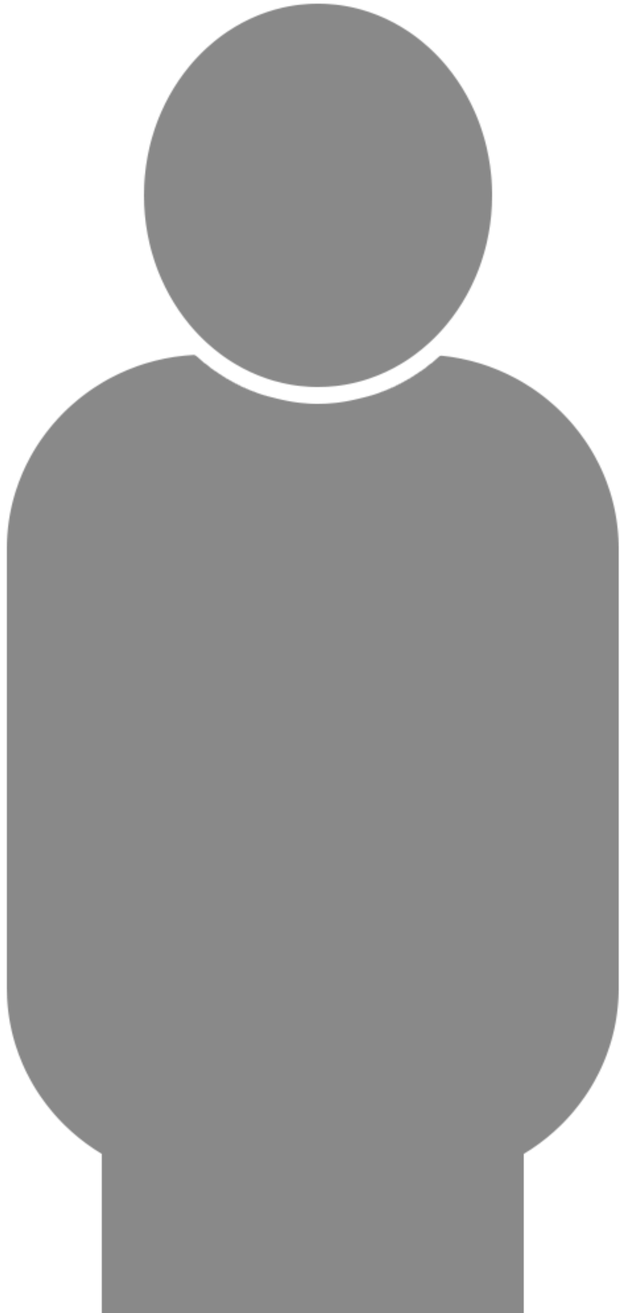
This glucose has been low overnight

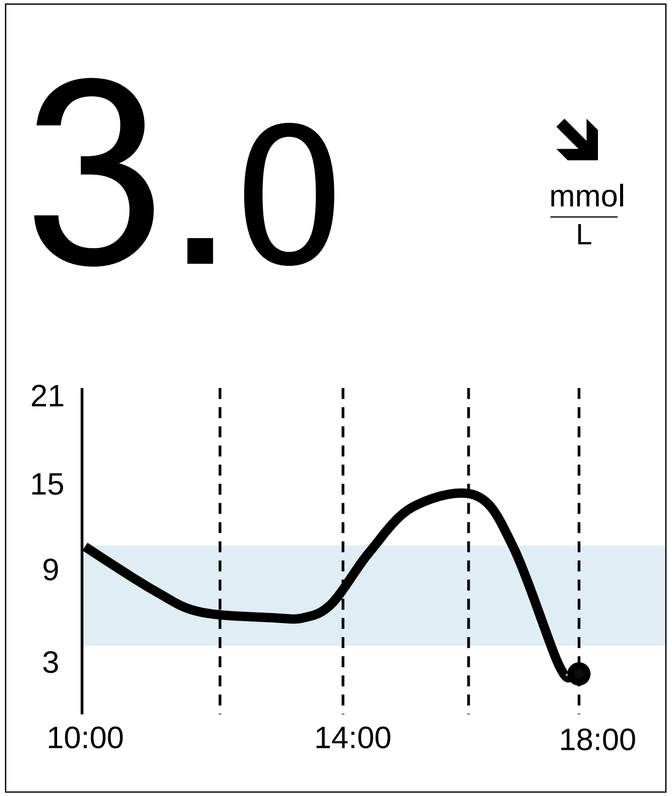
? Basal hypo

? alcohol, exercise or hypoglycaemia the previous day

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



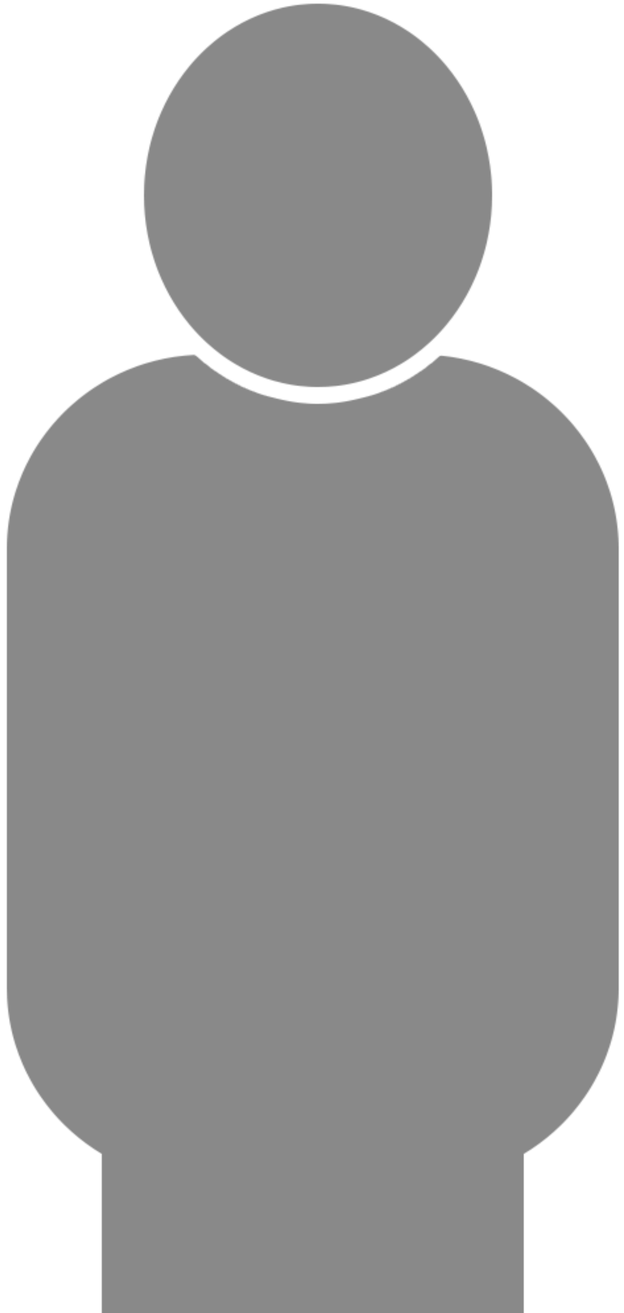


3 hours post meal glucose was 16 mmol/l and so a 3 unit correction dose was taken
This can lead to “ stacking” where insulin –on-board is not taken into consideration
This can lead to hypos

If we need to take a correction within 3 hours of a previous bolus
use insulin on board [through an app or a pump]
OR
Just take ½ the correction you would usually take

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Preventing hypos

If glucose is below 6 mmol/l and dropping – consider

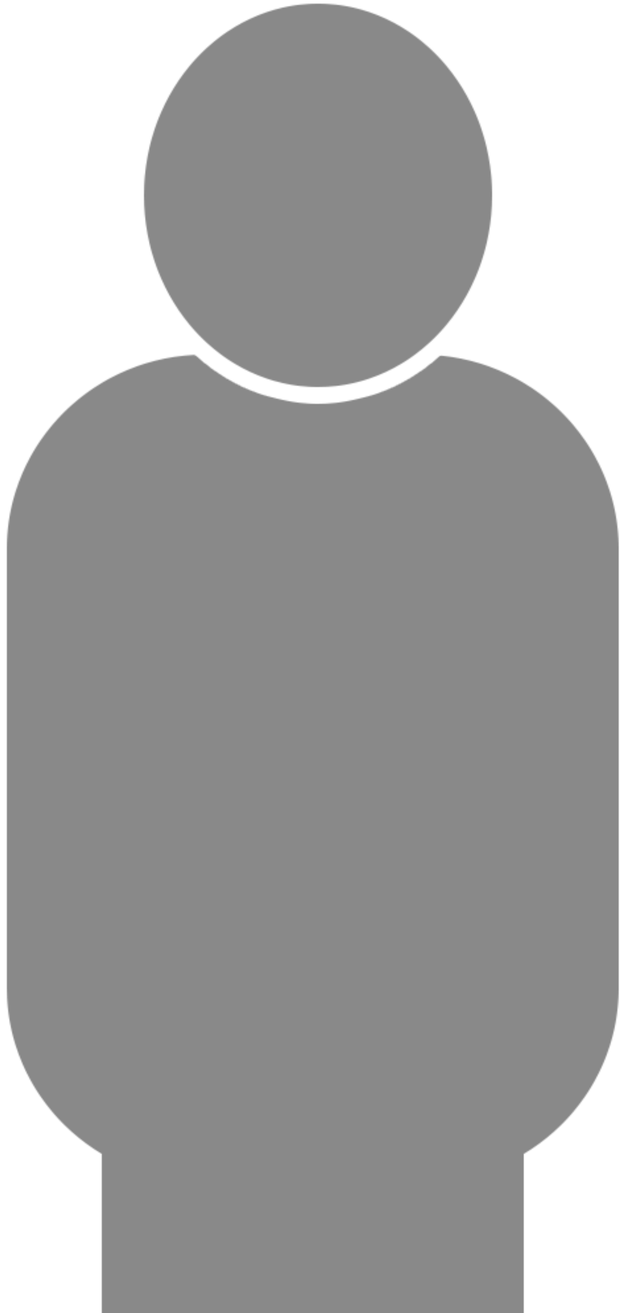
- why is the glucose dropping?
- Is there any insulin on board?
- Have I done any recent exercise?

Consider:

- 5 gms of carbohydrate if ↘ Eg 1 jelly baby
- 10 gms of carbohydrate if ↓ Eg 2 jelly babies

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

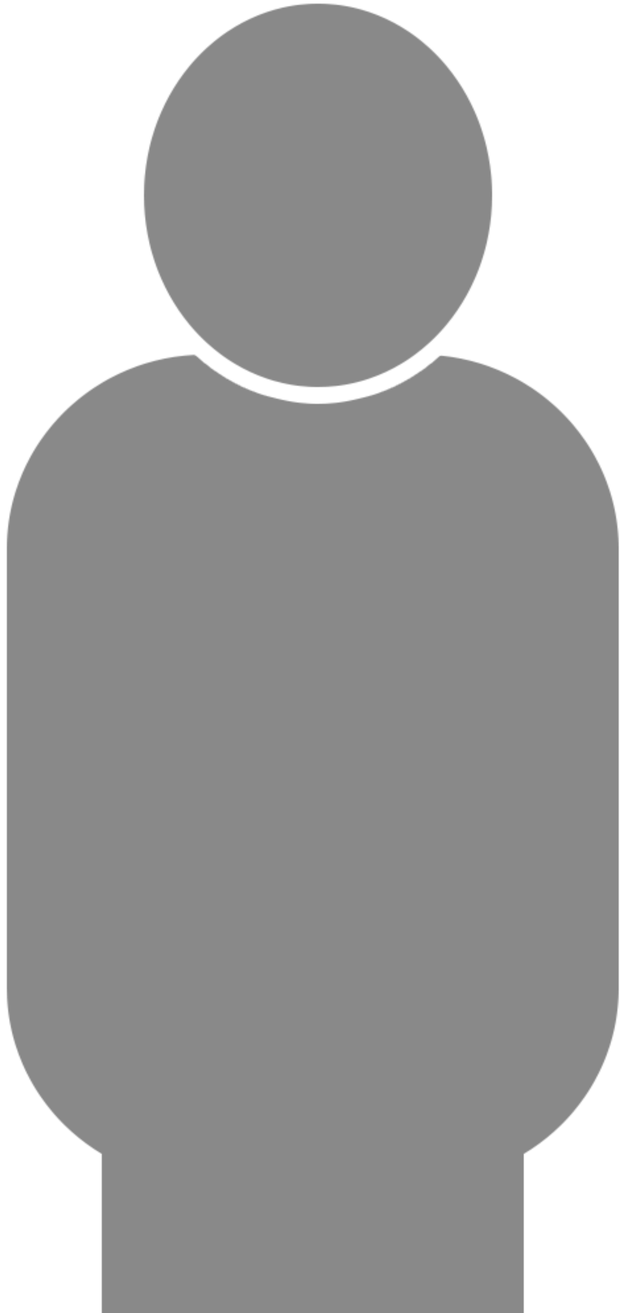


Identifying the cause of hypoglycaemia

- Check the basal: bolus ratio:
- If basal > 60%, hypos may be more likely to be due to excess basal insulin at that time, even if they come at the “tail” of a bolus
- If Bolus > 60%, hypos are likely to be related to correction boluses.
- Overnight hypos
- Early night hypos are often related to corrections done late in the evening / bedtime
- Late night hypos are often related to inadequate reduction of basal insulin for exercise or alcohol

ABCD
Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support

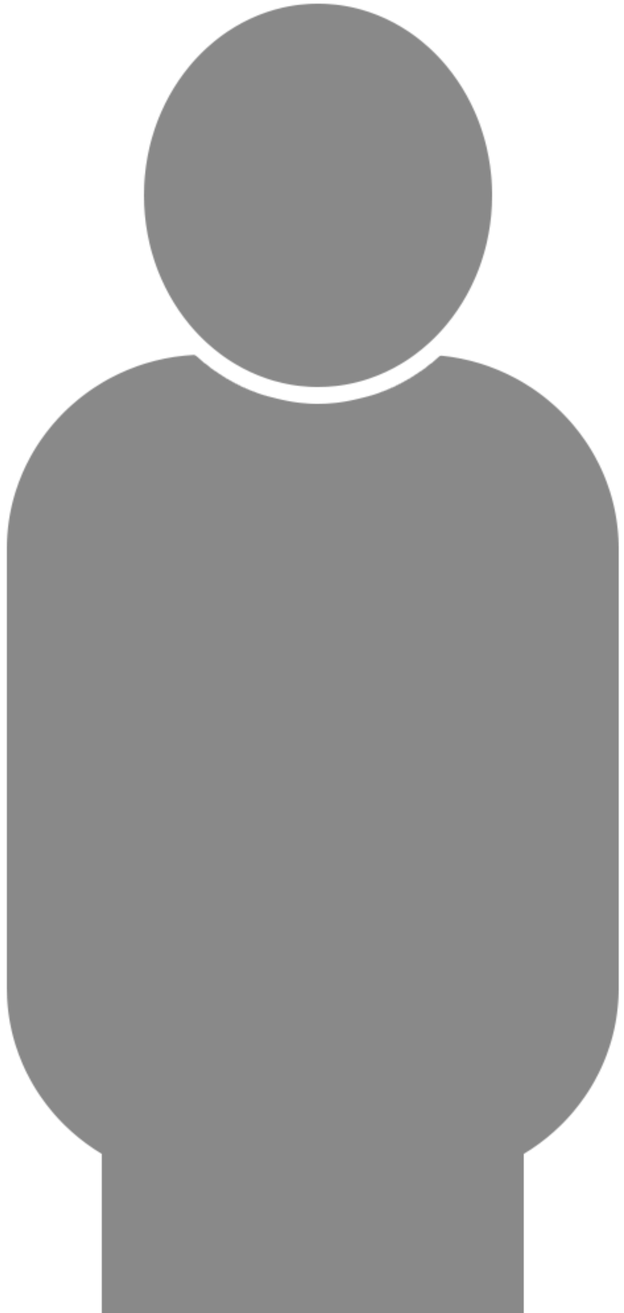


Key messages

- Look at time in hypo
- We are aiming for
- < 5% time less than 3.9 mmol/l
- Minimal time below 3.0 mmol/l
- in particular avoid prolonged hypoglycemia - less than 3.0 mmol/l for more than 2 hours

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support



Summary

- Even people with good hypoglycemia awareness can have a significant number of “silent” hypos
- However, where frequent hypos – consider reasons and adjust therapy
- Those with hypoglycemia unawareness or severe hypos may do better with a CGM system with alarms

Association of British Clinical Diabetologists

DTN UK
collaborate · evolve · support