

# WORKSHOP B

## Hybrid Closed Loops

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&

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## Learning Outcomes:

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To understand referral criteria for HCL

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To be familiar with the available HCL systems in the UK

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To learn what features can be adjusted in clinic

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To become confident with interpreting HCL data and to be able to spot common patterns

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To understand how to support people using HCL

## Who should we consider for HCL?:

“Hybrid closed loop (HCL) systems are recommended as an option for managing blood glucose levels in type 1 diabetes for adults who have an HbA1c of 58 mmol/mol (7.5%) or more, or have disabling hypoglycaemia, despite best possible management with at least 1 of the following:

- continuous subcutaneous insulin infusion (CSII)
- real-time continuous glucose monitoring
- intermittently scanned continuous glucose monitoring”

“HCL systems are recommended as an option for managing blood glucose levels in type 1 diabetes for women, trans men and non-binary people who are pregnant or planning to become pregnant.”

**NICE: Hybrid closed loop systems for managing blood glucose levels in type 1 diabetes**  
TA943 December 2023

## Who should we consider for HCL?:

“Only use HCL systems with the support of a trained multidisciplinary team experienced in CSII and continuous glucose monitoring in type 1 diabetes.”

“Only use HCL systems if the person or their carer:

- is able to use them, and
- is offered approved face-to-face or digital structured education programmes, or
- is competent in insulin dosing and adjustments.”

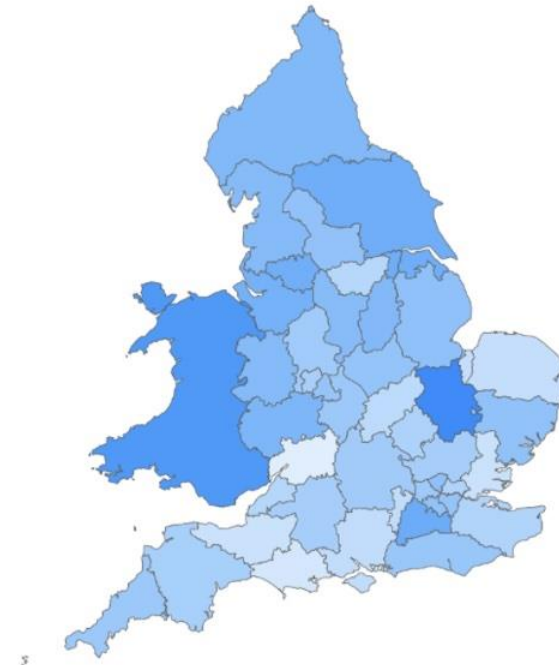
**NICE: Hybrid closed loop systems for managing blood glucose levels in type 1 diabetes**  
TA943 December 2023

# Numbers

## NDA type 1 diabetes audit

- 227 435 adults with type1 diabetes in England and Wales
- 34% overall achieving HbA1c 7.5% or below
- **Just over 150 000 adults** eligible for HCL under HbA1c criteria
- An estimated 26 000 current insulin pump users
- An additional 58 000 eligible under HbA1c criteria from NICE TA 151

6.4 Minimum (%)  18.4 Maximum (%)



# HCL systems:

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Medtronic  
SmartGuard

Tandem  
Control IQ

CamAPS FX

Omnipod 5  
SmartAdjust

Medtrum  
Touchcare  
Nano

# Different types of algorithm

## Model predictive control

predict future glucose to bring current glucose into the target range

Control IQ, CamAPS FX, Omnipod 5

## Proportional integral derivative

analyses deviation of measured glucose from target glucose to calculate the amount of insulin to deliver

Medtronic 780G

## Fuzzy logic

calculate insulin doses based on how a clinical expert would make real-time adjustments based on CGM data

Medtronic 780G



# Medtronic 780G

## Components:

- Medtronic 780G pump with SmartGuard algorithm integrated
- Guardian 4 or Simplera sensors (note that Medtronic have signed an agreement with Abbott for the future)

Can only adjust 2 settings that will influence the algorithm:

- Glucose target (5.5, 6.1 or 6.7 mmol/l)
- Active insulin time (influences aggressiveness of algorithm)

SmartGuard algorithm does not use pre-set basal rates (except at the start of use) **so adjusting these has no impact on Auto mode**

Meal Detection feature: gives more insulin if system detects a meal time bolus was missed



# Medtronic 780G

Algorithm adjusts basal insulin delivery every 5 minutes based on sensor glucose values

Where glucose is above target, basal is increased

Where glucose is below target, basal is decreased

Autocorrection to get at target (do not adjust this)

reached

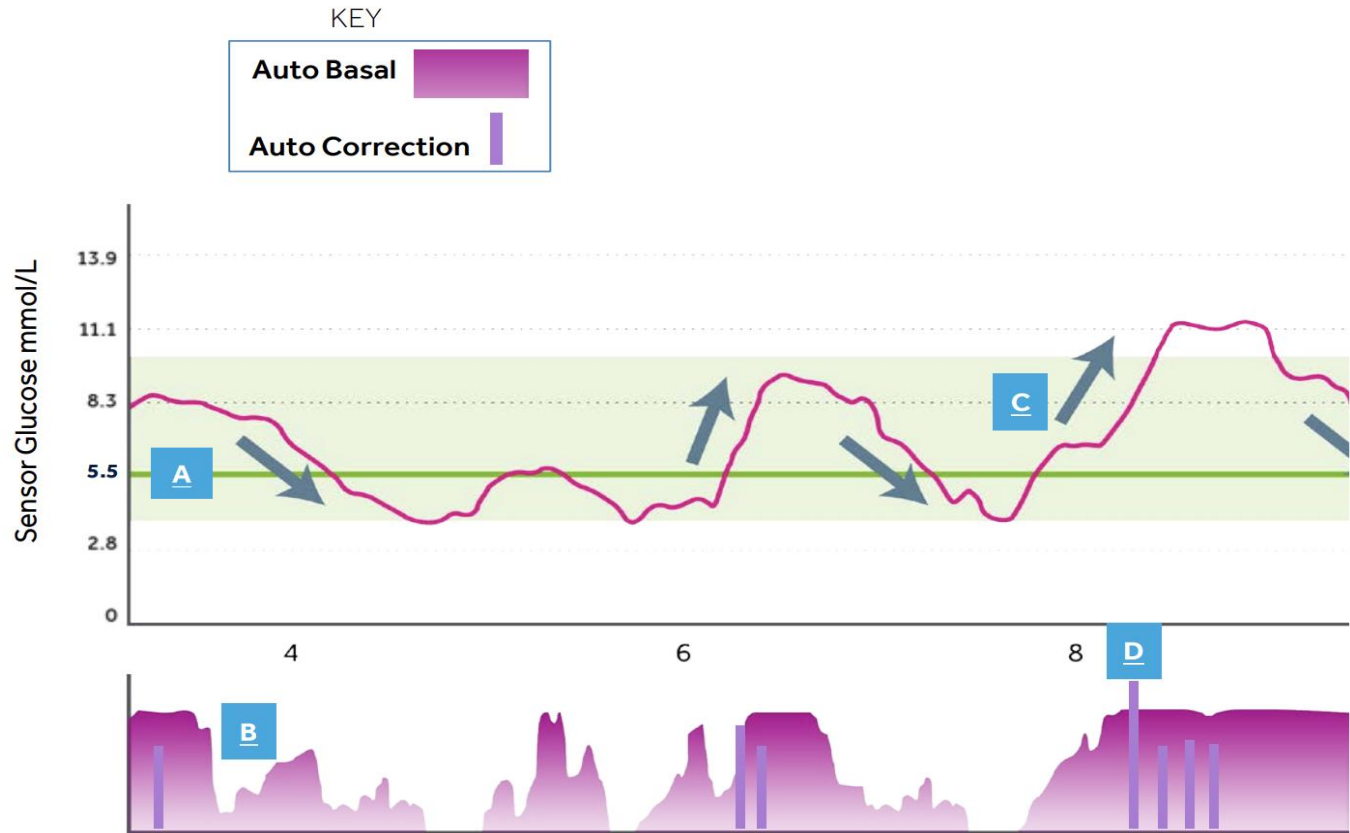
**Algorithm uses real-time information to adjust basal every 5 mins aiming for target:**

Current SG, How far SG is from the set target, How long SG has been away from target, How rapidly SG has been changing  
Estimated total insulin (Basal and Bolus)

**Algorithm uses TDD to**

- calculate
- ISF (updated every midnight)
- Max and Min autobasal (updated every 6-12 days)

# Medtronic 780G



## SUMMARY

- A** Selection between the default setting of 5.5 mmol/L, and 6.1 mmol/L or 6.7 mmol/L.
- B** Basal insulin adjusts every 5 mins based on SG values
- C** The auto correction target is set at 6.7 mmol/L
- D** Auto corrections delivered every 5 minutes if max basal reached and SG is above 6.7 mmol/L, as determined by the algorithm. NO automatic corrections if Temp Target is set.

# Tandem Control-IQ



## Components:

- Tandem t:slim pump with integrated Control-IQ algorithm
- Dexcom G6 or G7 sensors

Adjusts basal insulin delivery based on pre-set basal rates (so adjusting these impacts the way the algorithm works)

- eg can set a profile with reduced settings if experiencing hypoglycaemia during exercise in “Exercise Activity” mode

Insulin adjusted based on predicted glucose value in 30 mins

Active insulin time fixed at 5 hours, glucose target for boluses at 6.1 mmol/l

Control IQ Algorithm uses weight, ISF from personal profile (influences aggressiveness of algorithm) alongside the current glucose level, trend and IOB

# Control IQ insulin adjustments

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**$\geq 10.0$  mmol/l**

- Delivers auto-correction bolus (60% expected  $-IOB$  per hour) if SG is predicted to be  $>10$  mmol/l

**$\geq 8.9$  mmol/l**

- $\uparrow$  basal insulin if SG is predicted to be  $> 8.9$  mmol/l

**6.25-8.9 mmol/l**

- Maintains personal profile settings

**$\leq 6.25$  mmol/l**










- $\downarrow$  basal insulin if SG is predicted to be  $< 6.3$  mmol/l

**$\leq 3.9$  mmol/l**

- Stops insulin delivery if SG is predicted to drop  $< 3.9$  mmol/l

# Control IQ insulin adjustments

(all adjustments based on 30 min predicted BG)

		 Control-IQ	 Sleep Activity	 Exercise Activity
  <b>Delivers</b>	Delivers an automatic correction bolus if sensor glucose is predicted to be above <u>10.0</u> mmol/L	<b>10.0</b>	--	<b>10.0</b>
 <b>B</b> <b>Increases</b>	Increases basal insulin delivery if sensor glucose is predicted to be above <u>8.9</u> mmol/L	<b>8.9</b>	<b>6.7</b>	<b>8.9</b>
 <b>B</b> <b>Maintains</b>	Maintains active Personal Profile settings when sensor glucose is between <u>6.25</u> - <u>8.9</u> mmol/L	<b>6.25 - 8.9</b>	<b>6.25 - 6.7</b>	<b>7.8 - 8.9</b>
 <b>B</b> <b>Decreases</b>	Decreases basal insulin delivery if sensor glucose is predicted to be below <u>6.25</u> mmol/L	<b>6.25</b>	<b>6.25</b>	<b>7.8</b>
 <b>0</b> <b>Stops</b>	Stops basal insulin delivery if sensor glucose is predicted to be below <u>3.9</u> mmol/L	<b>3.9</b>	<b>3.9</b>	<b>4.4</b>

mmol/L

# CamAPS FX

## Components:

- Dana or Ypsomed pumps
- Freestyle Libre 3 or Dexcom G6 sensors
- CamAPS algorithm resides in an app on an Android phone

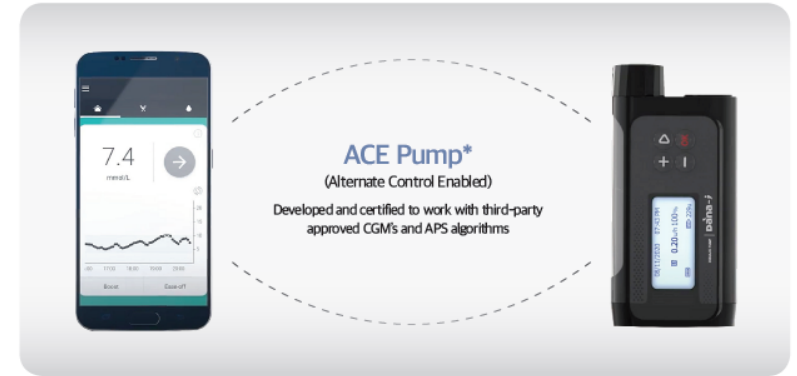
## Only algorithm with a specific indication in pregnancy

Personal glucose target can be adjusted from 4.4 to 11.0 mmol/l

Also need to set weight and TDD

Does not use basal rates from personal profile **so adjusting these will not impact algorithm**

Offers both “Boost” and “Ease off” modes



# CamAPS FX

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Adjusts insulin delivery based on predicted glucose in 2.5-4 hours

Models a variety of scenarios and selects that which best matches the desired glucose trajectory

Adjusts according to TDD from last 5 days, learned insulin needs from previous days (including mealtime responses), current glucose level/trend as well as weight and CHO ratios

Insulin delivered as extended boluses every 10-12 minutes

Algorithm takes time of day into account when considering previous insulin and glucose data (so if walking the dog at the same time each day this will be reflected in calculations)

Most effective at “learning” the individual

# Omnipod 5

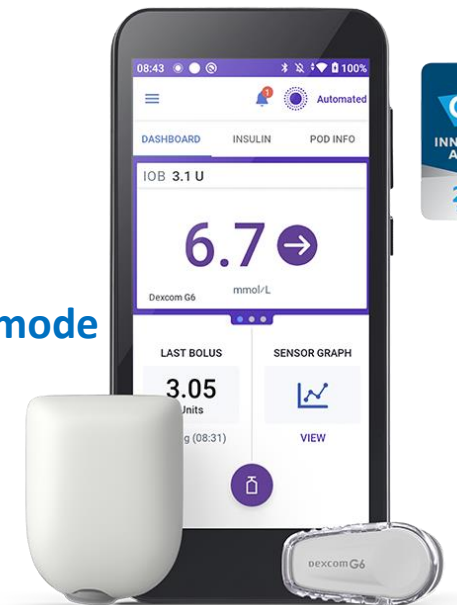
## Components:

- Omnipod 5 pod (SmartAdjust algorithm in pod itself)
- Omnipod 5 controller
- Dexcom G6/*Dexcom G7- coming soon!* (needs Dexcom G6/G7 App) or Freestyle Libre 2 PLUS (does not need LibreLink App)

## Only target glucose will influence the algorithm:

- 5 glucose targets 6.1, 6.7, 7.2, 7.8 or 8.3 mmol/L
- Activity target 8.3mmol/L and 'relaxed' algorithm

Algorithm does not use pre-set basal rates **so adjusting these has no impact on Automated mode**





# Omnipod 5

Aggressiveness of algorithm is learnt from TDD history of previous 4 to 5 pods

Adaptive basal rate given as micro boluses every 5 minutes

Automatic correction boluses delivered as part of adaptive basal rate (not based on ISF)

SmartBolus feature- takes account of current glucose levels and TREND

# Medtrum Touchcare Nano System

## Components:

- Nano patch pump
- Nano CGM
- Personal Diabetes Manager (PDM) or EasySense App (Android and iPhone)

**Auto Basal:** adjusts every 2 minutes using micro boluses based on sensor glucose, trends and recent insulin delivery.

**Auto Correction Bolus:** when auto basal increases are not enough, again given as micro boluses every 2 minutes as required.

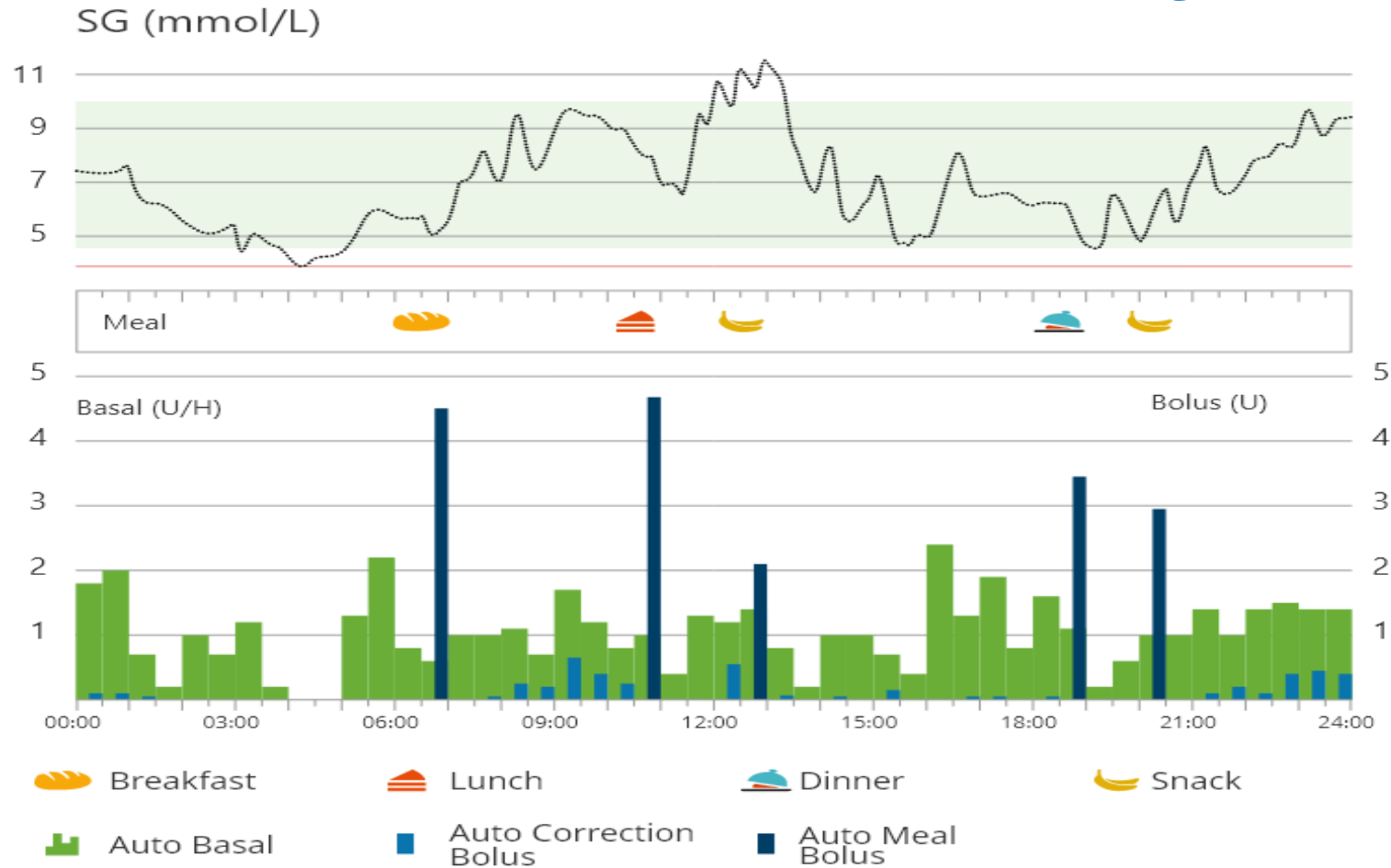
**Auto Meal Bolus:** delivered in response to glucose fluctuations after meal announcement.



3 glucose targets:

- 5.6mmol/L
- 6.1mmol/L
- 6.7mmol/L

# Medtrum Touchcare Nano System



# DTN statement regarding the use of Medtrum HCL systems:

The DTN committee 4 key concerns:

1. We have requested published evidence of the safety and efficacy of the Medtrum HCL system from the company, who are currently unable to provide this. The safety of people with type 1 diabetes is clearly of paramount concern.
2. There were a small number of users of the Medtrum system included in the NHS England Pilot of these systems. Some of these users experienced adverse events, including an increased risk of hypoglycaemia. The safety concerns raised led to DTN recommending that Medtrum users be switched to an alternative system. While we understand that there have been updates to the Medtrum system since this pilot took place, we have not seen any evidence to date to demonstrate that these issues have been resolved.
3. We have received communication from international colleagues that current users of the Medtrum Hybrid Closed Loop system are experiencing similar issues to those observed during the NHS England Pilot.
4. There are alternative, cost-effective systems included on the framework where published evidence of efficacy and safety is available.

HCL SYSTEM:	SMARTGUARD	CONTROL IQ	CamAPS FX	SMART ADJUST
<b>PUMP:</b>	Medtronic 780G	Tandem t:slim X2	DANA I Ypsopump	Omnipod 5
<b>CGM:</b>	Medtronic Guardian 4 or Simplera	Dexcom G6 or G7	Dexcom G6 Freestyle Libre 3	Dexcom G6 or G7 Freestyle Libre 2 PLUS
<b>LICENSE:</b>	7 to 80 years old TDD 8 to 250 units/day Weight 10 to 300kg Rapid acting insulins	>6 years TDD 10 to 100 units/day Weight 25 to 140kg Rapid acting insulins and LYUMJEV	>1 years Pregnancy TDD 5 to 350 units/day Weight 10 to 300kg Rapid and ultra rapid acting insulins	>2 years TDD 5 to 200 units/day <i>(however need &lt;60 units/day to get 3 day pod wear)</i> Weight 25 to 140kg Rapid acting insulins
<b>PARAMETERS FOR AID:</b>	Uses TDD from last 2 to 6 days to calculate algorithm parameters. Ongoing adjustment	Personal profile (basal rates/ICR/ISF). Uses weight and TDD input by user to determine algorithm parameters.	Uses weight and TDD input by user to determine algorithm parameters. Ongoing adjustment	Target glucose is only factor affecting insulin delivery. Aggressiveness of algorithm is learnt from TDD history of previous 4 to 5 pods.
<b>BASAL INSULIN:</b>	Basal insulin adjusted every 5 minutes	Basal adjustments if SG predicted to be outside target range	Extended boluses given every 10 to 12 minutes	Adaptive basal rate given as micro boluses every 5 minutes
<b>AUTOCORRECTIONS:</b>	If SG >6.7mmol/L and max auto- basal	If SG predicted to be >10mmol/L, 60% of ISF, 1 per hour	Automatic correction boluses delivered as part of modulation of basal	Automatic correction boluses delivered as part of modulation of basal

HCL SYSTEM:	SMARTGUARD (Medtronic)	CONTROL IQ (Tandem t:slim)	CamAPS FX (Dana/Ypsopump)	SMART ADJUST (Omnipod 5)
<b>BOLUS:</b>	Manual bolus NO extended boluses Uses programmed ICR Meal Detection feature- gives more insulin if system detects a meal time bolus was missed	Manual bolus Extended bolus available for up to 2 hours Uses programmed ICR & ISF	Remote bolus (phone App) Slowly absorbed meal function Uses programmed ICR	Remote bolus (controller) SmartBolus- takes account of current glucose levels and TREND NO extended boluses Uses programmed ICR & ISF
<b>TARGET:</b>	5.5 (default), 6.1, 6.7mmol/L	6.25 to 8.9mmol/L Bolus target 6.1mmol/L	Personalised glucose target between 4.4 and 11mmol/L Default 5.8mmol/L Customise across 24hrs	6.1, 6.7, 7.2, 7.8, 8.3mmol/L 8 time blocks available
<b>ADJUSTABLE PARAMETERS THAT AFFECT ALGORITHM:</b>	ICR Active insulin time Target glucose	Basal profile ICR ISF Weight TDD	ICR Weight Target glucose ADD MEAL functions	Target glucose Active insulin time, ICR & ISF for bolus doses
<b>OVERRIDES:</b>	TEMP target- 8.3mmol/L, no autocorrections, reduces aggressiveness of algorithm	EXERCISE activity- 7.8 to 8.9mmol/L, suspends if predicted <4.4mmol/L SLEEP activity- 6.3 to 6.7mmol/L, no autocorrections	EASE OFF- reduces insulin delivery, raises personal glucose target, 'softens' the algorithm BOOST- increases insulin delivery by up to 35% but only if needed	ACTIVITY- increases target to 8.3mmol/L and 'relaxes' algorithm
<b>REVERTS TO MANUAL MODE:</b>	Loss of CGM data Sensor integrity concerns Max basal limit reached	Loss of CGM data Max insulin delivery reached	Loss of CGM data Loss of connection to pump	Loss of CGM data Maximum or minimum delivery reached AUTOMATED LIMITED- will deliver lowest from preset basal or usual automated rate at that time
<b>DATA PLATFORM:</b>	Carelink (automatic upload with App or manual upload)	Glooko (manual upload)	Glooko (automatic upload)	Glooko (automatic upload)

# System Quiz

## What can you adjust?

Q1. In which system/s do basal rate adjustments affect the HCL algorithm?

A1. Tandem Control IQ

Q2. With which system/s can you do an extended/slowly absorbed meal bolus

A2. Tandem Control IQ = Extended bolus (only up to 2 hour duration)  
CamAPS FX = Slowly absorbed meal function

Q3. In which system/s does adjusting active insulin time affect the HCL algorithm?

A3. Medtronic SmartGuard- recommended active insulin time of 2 to 3 hours

Q4. Which system/s have a single fixed bolus glucose target?

A4. Tandem Control IQ bolus target fixed at 6.1mmol/L

Q5. Which system/s have a personal glucose target adjustable between 4.4 and 11mmol/L?

A5. CamAPS FX

# Case Studies

## Which system/s would you recommend and why?

- 26 year old male
- Diagnosed with T1DM 2005
- HbA1c 80mmol/mol prior to starting pump therapy (HbA1cs since diagnosis 71 to >140mmol/mol)
- Registered as severely visually impaired
- TDD 52 units
- BMI 22

### **CamAPS FX with Ypsopump and Freestyle Libre 3**

\*Mobile phone App (text to talk)

\*Wide personal glucose target

\*Prefilled reservoirs



# Case Studies

## Which system/s would you recommend and why?

- 42 year old male
- Diagnosed with T1DM 2007
- On pump therapy since 2009 (started in South Africa)
- Regular high dose steroids for limited EGPA
- TDD 80 units
- BMI 30

### **Tandem t:slim X2 with Dexcom G7**

\*Different personal profiles which affect the HCL algorithm. Allows for much higher personal profile to be used for high dose steroids

\*300 unit reservoir

# Case Studies

## Which system/s would you recommend and why?

- 72 year old female
- Diagnosed T1DM 1963
- GOLD score 5
- Limited dexterity
- High glucose variability
- Not 'tech savvy', no SmartPhone
- TDD 19 units
- BMI 20

### **Omnipod 5 with Libre 2 PLUS:**

\*Already using Libre 2

\*Separate controller- large screen, can adjust brightness

\*Found pods easier to fill and attach than cannulas

\*Does not need to access pump to give a bolus

# Case Studies

## Which system/s would you recommend and why?

- 83 year old man
- T1DM since 1962
- Pump therapy since 2012
- HbA1c 59mmol/mol
- No hypoglycaemia awareness GOLD score 7
- Last severe hypoglycaemic episode Dec 2024
- Does not carb count, does not always bolus for meals
- Gives large correction boluses via pump
- Does not change cannulas and set regularly
- Significant lipohypertrophy
- TDD 45 units
- BMI 24

### **Medtronic 780G with Simplera sensor**

- \*Has always used Medtronic pumps so comfortable with how to use
- \*Missed meal detection will help with missed mealtime boluses
- \*Extended wear sets, Mio Advance cannulas

# Interpreting data

# PANTHER tools

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Point of care tools for different HCL systems:

- Omnipod 5 (only UK version)
- Tandem t:slim CONTROL IQ
- Medtronic 780G SmartGuard

# Why use them?

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Standardise reviews, ensuring consistency

Useful for HCPs who are not as familiar with the different systems

Provide structure to reviewing downloads

Easy to understand and use in practice

PANTHER Program's **C|A|R|E|S Framework**  
standardizes and streamlines key points for clinicians.

C

**CALCULATE**

How each AID system  
**calculates** insulin  
delivery

[Read more](#)

A

**ADJUST**

Which pump settings  
can be **adjusted**  
when using AID

[Read more](#)

R

**REVERT**

When will the  
system **revert** from  
AID to Manual Mode

[Read more](#)

E

**EDUCATE**

Important  
**education**  
points

[Read more](#)

S

**SENSOR  
SHARE**

Key aspects of the  
**sensor** and data **sharing**  
capabilities

[Read more](#)

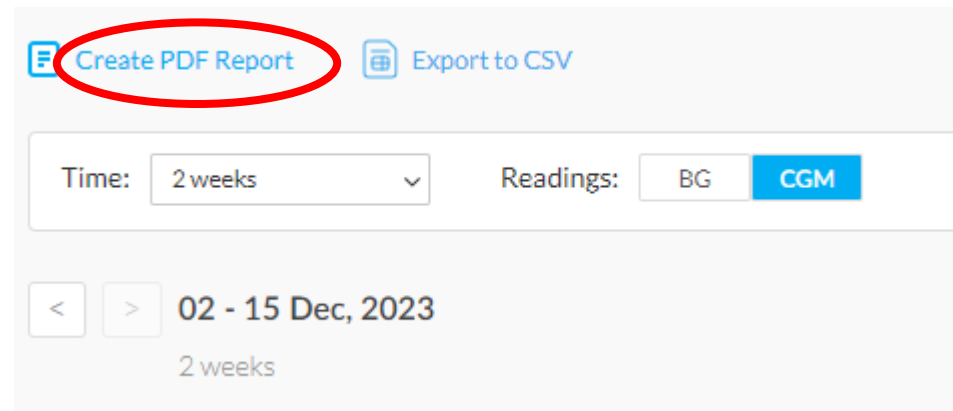
# Omnipod 5 example: Data review using the PANTHER tool

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Ensure Omnipod 5 is uploaded to Glooko

Check target range: 3.9 and 10mmol/L (3.5 to 7.8mmol/L pregnancy)

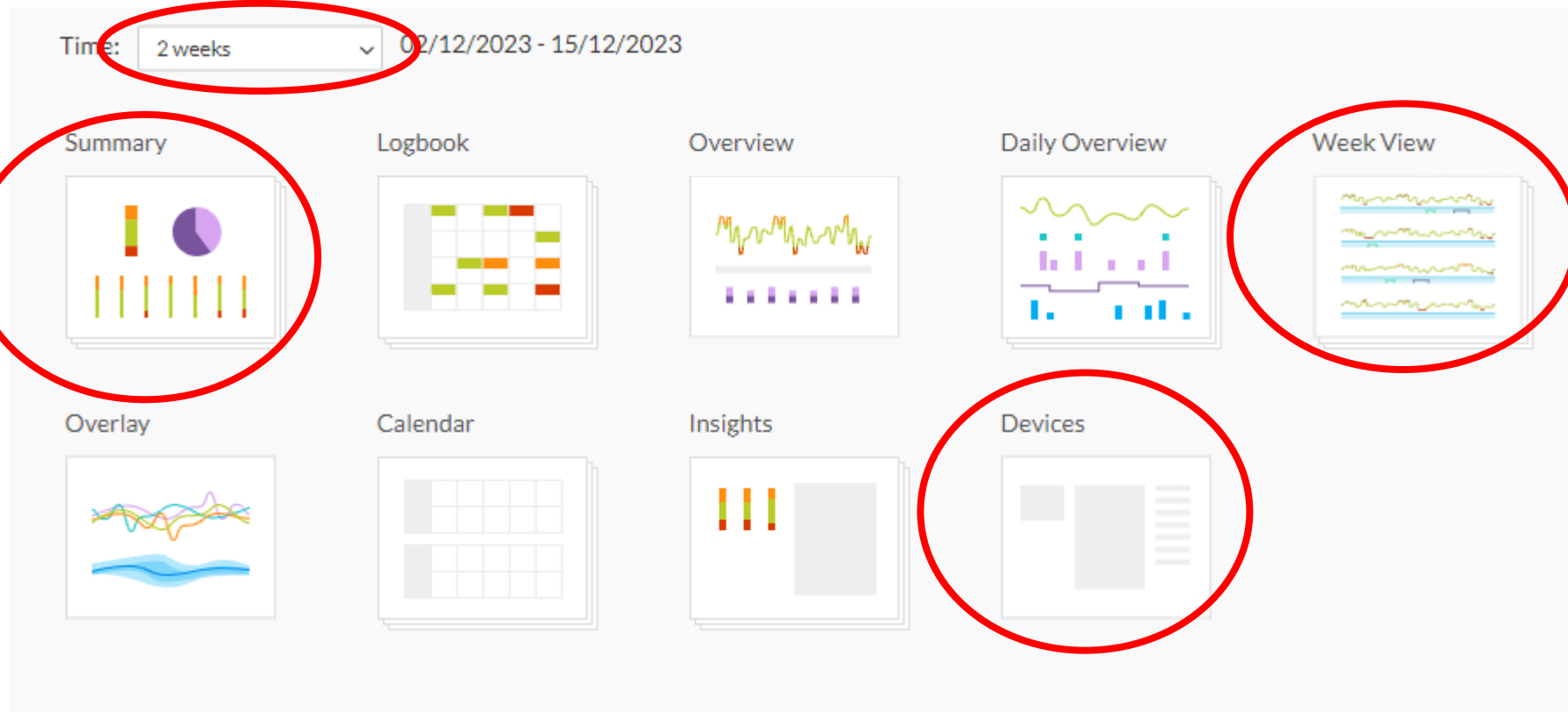
Create reports:



The screenshot displays the PANTHER tool interface for generating reports. At the top, there are two buttons: "Create PDF Report" (highlighted with a red circle) and "Export to CSV". Below these buttons, there are two dropdown menus: "Time:" set to "2 weeks" and "Readings:" with "BG" and "CGM" options, where "CGM" is selected. At the bottom, there are navigation arrows and a date range "02 - 15 Dec, 2023" with "2 weeks" below it.



# Omnipod 5: Data review using the PANTHER tool



# Omnipod 5: Data review using the PANTHER tool

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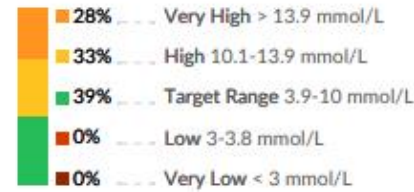
Follow worksheet:

3 steps:

- BIG picture (patterns)
- SMALL picture (reasons)
- PLAN (solutions)

# CGM Summary (Big picture)

## Glucose - Time In Range



## Summary

GMI	8.3% (67.3 mmol/mol)	SD	4 mmol/L
Average	11.6 mmol/L	CV	34.5%
% Time CGM Active	96.3% (14.4 days)	Median	11.1 mmol/L
		Highest	HI mmol/L
		Lowest	3.1 mmol/L

### A Is the person using the CGM and Automated Mode?

% Time CGM Active

If <90%, discuss why:

- Problems accessing supplies/sensors not lasting 10 days?  
→ Contact Dexcom for replacement sensors
- Skin problems or difficulty keeping sensor on?  
→ Rotate sensor insertion sites (arms, hips, buttocks, abdomen)  
→ Use barrier products, tackifiers, over tapes and/or adhesive remover to protect skin



SCAN TO VIEW:  
[panthebprogram.org/skin-solutions](http://panthebprogram.org/skin-solutions)

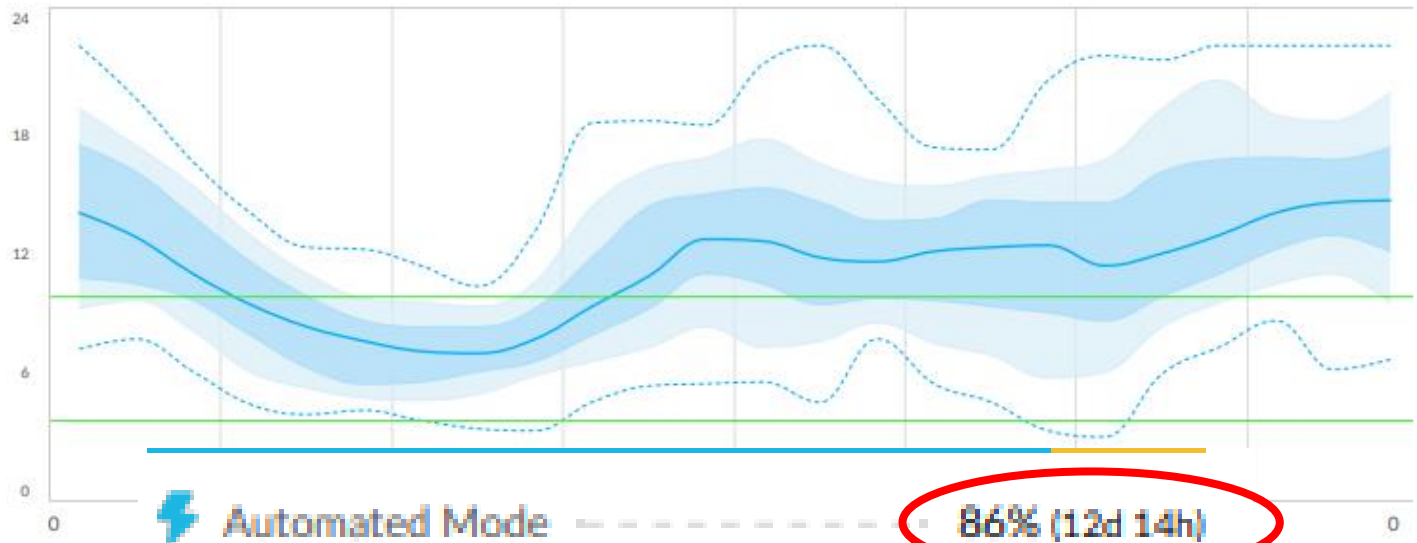
Automated Mode %

If <90%, assess why:

Emphasise goal is to use Automated Mode as much as possible

## Ambulatory Glucose Profile (AGP)

Target Range (3.9 - 10 mmol/L) 25 - 75% Lowest - Highest  
Median 10 - 90%



Insulin - Devic  
From Insulin Pump



Automated: Limited 1% (5h)



Automated: Activity 0%

Insulin/day



Manual Mode 14% (2d 2h)

Overrides (%)

# Bolus/Day 8.8

# CGM Summary

Automated:Limited %: 

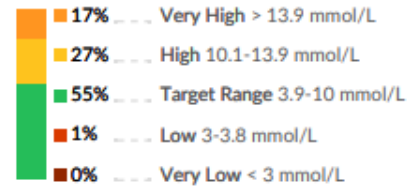
If >5%, assess why:

- Due to gaps in CGM data?
  - Review device placement: wear Pod and CGM on same side of body / in "line of sight" to optimise Pod-CGM communication
- Due to automated delivery restriction (min/max delivery) alarms?
  - Educate user to clear alarm, check BG as needed, and after 5 minutes switch mode back to Automated Mode (will not return to Automated Mode automatically)



# CGM Summary

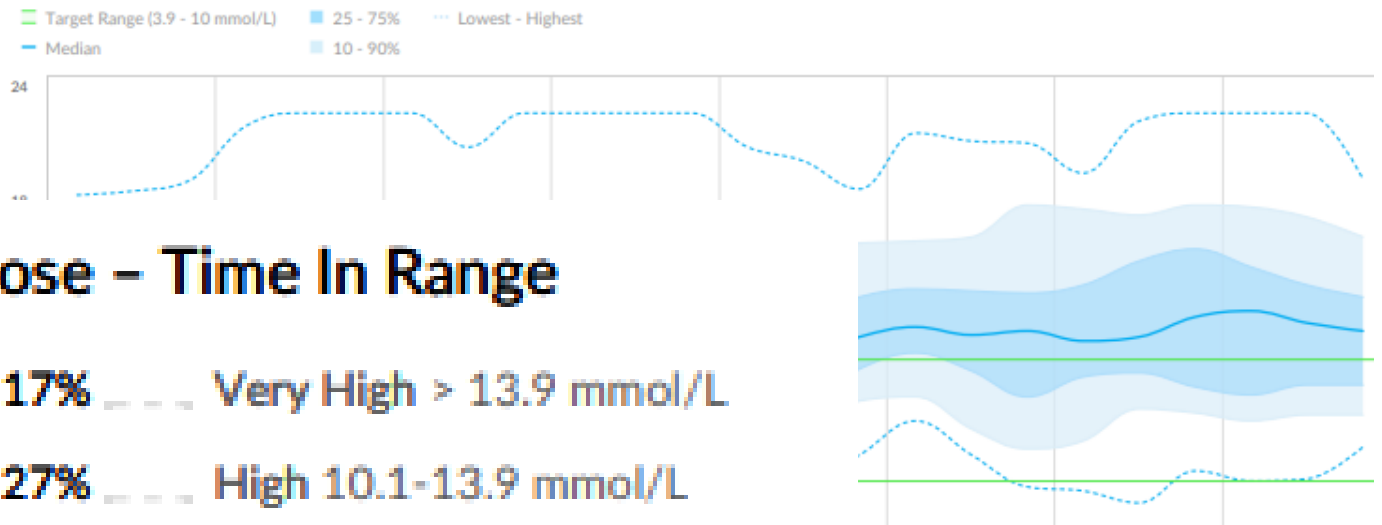
## Glucose - Time In Range



## Summary

GMI	7.7% (60.9 mmol/mol)	SD	4.2mmol/L
Average	10.2 mmol/L	CV	40.5%
% Time CGM Active	99.3% (14.9 days)	Median	9.4mmol/L
		Highest	HI mmol/L
		Lowest	2.6mmol/L

## Ambulatory Glucose Profile (AGP)



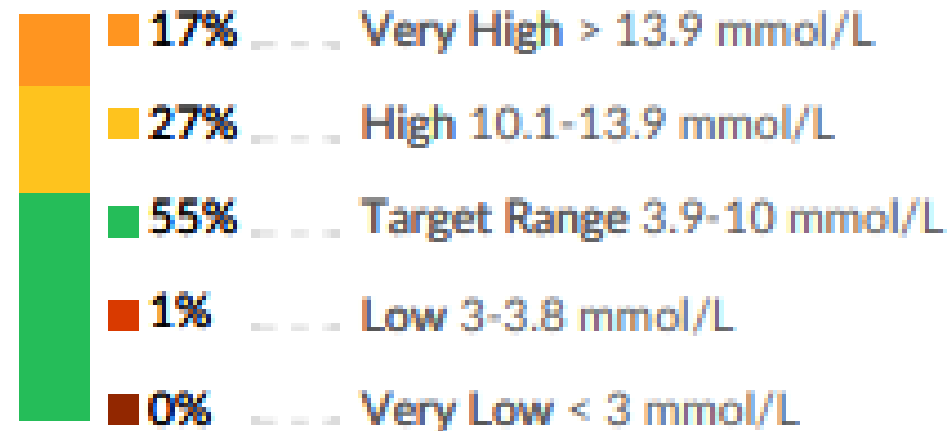
### B Is the user giving meal boluses?

Number of Diet Entries/Day?

Is the user giving at least 3 "Diet Entries/Day" (boluses with carbs added)?

→If not, ASSESS for missed meal boluses

## Glucose - Time In Range



Day **67.7g**  
 /Day **1.9**

### C Is the user meeting Glycemic Targets?

Time in Range (TIR)  Goal is >70%  
 3.9-10.0 mmol/L "Target Range"

Time Below Range (TBR)  Goal is <4%  
 < 3.9 mmol/L "Low" + "Very Low"

Time Above Range (TAR)  Goal is <25%  
 >10.0 mmol/L "High" + "Very High"

4d 5h  
 % (4h)  
 - 0%  
 (19h)  
**Fitness**  
 No fitness tracker connected  
**Comments**

# CGM Summary

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## **D** What are their patterns of hyperglycaemia and/or hypoglycaemia?

Ambulatory Glucose Profile compiles all data from reporting period into one day; shows median glucose with the blue line, and variability around the median with the shaded ribbons. Wider ribbon = more glycaemic variability.

Identify the overall patterns by primarily focusing on the dark blue shaded area.

## PANTHERPOINTERS™ FOR CLINICIANS

- 1** The goal of this therapy review is to increase Time in Range (3.9-10.0 mmol/L) while minimising Time Below Range (<3.9 mmol/L)
- 2** Is the Time Below Range **more** than 4%?  
If **YES**, focus on reducing patterns of **hypoglycaemia**  
If **NO**, focus on reducing patterns of **hyperglycaemia**

# Week View (Small picture)

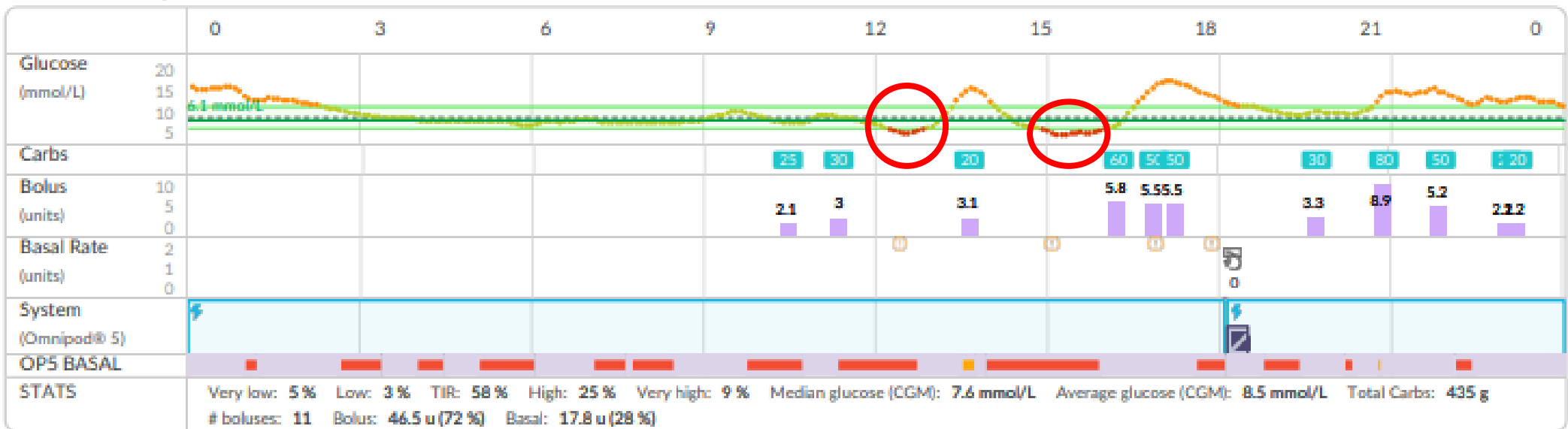
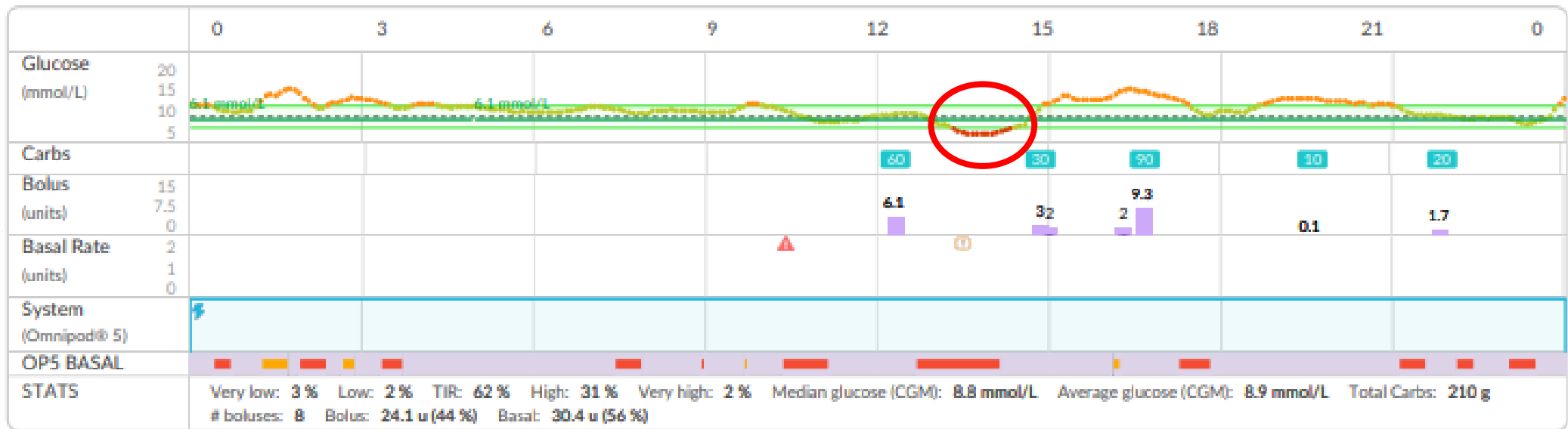
Identify the predominant 1-2 causes of the hypo- or hyperglycaemia pattern.

Is the **hypoglycaemia** pattern occurring:

- Fasting/Overnight?
- Around mealtime?  
(1-3 hours after meals)
- Where low glucose levels follow  
high glucose levels?
- Around or after exercise?

Is the **hyperglycaemia** pattern occurring:






- Fasting/Overnight?
- Around mealtime?  
(1-3 hours after meals)
- Where high glucose levels follow  
low glucose levels?
- After a correction bolus was given?  
(1-3 hours after correction bolus)

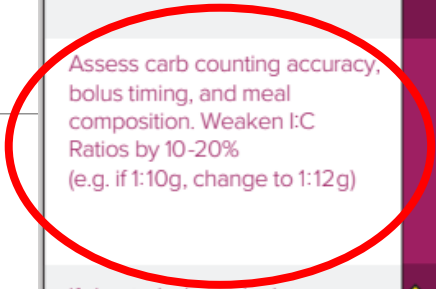




## Hypoglycaemia

## Hyperglycaemia

SOLUTION	PATTERN	SOLUTION
<p>Raise Target Glucose (algorithm target) overnight (highest is 8.3 mmol/L)</p>	<p><b>Fasting / Overnight</b></p> 	<p>Lower Target Glucose overnight (lowest is 6.1 mmol/L)</p>
<p>Assess carb counting accuracy, bolus timing, and meal composition. Weaken I:C Ratios by 10-20% (e.g. if 1:10g, change to 1:12g)</p>	<p><b>Around mealtime (1-3 hours after meals)</b></p> 	<p>bolus was missed. Give all meal boluses prior to eating. Assess carb counting accuracy, bolus timing, and meal composition. Strengthen I:C Ratios by 10-20% (e.g. from 1:10g to 1:8g)</p>
<p>If due to bolus calculator overrides, educate user to follow the bolus calculator and avoid overriding to give more than recommended. There may be a lot of IOB from AID that user is not aware of. Bolus calculator factors in IOB from increased AID when calculating correction bolus dose.</p> <p>Weaken correction factor by 10-20% (e.g. from 3mmol/L to 3.5 mmol/L) if hypos 2-3 hours after correction bolus.</p>	<p><b>Where low glucose follows high glucose</b></p> 	
	<p><b>Where high glucose follows low glucose</b></p> 	<p>Educate to treat mild hypoglycaemia with fewer grams of carbs (5-10g)</p>
<p>Use the Activity feature 1-2 hours before exercise begins. Activity feature will temporarily reduce insulin delivery. It can be used during times of increased risk of hypoglycaemia.</p> <p>To use Activity feature, go to Main Menu → Activity</p>	<p><b>Around or after exercise</b></p> 	
	<p><b>After a correction bolus was given (1-3 hours after correction bolus)</b></p>	<p>Strengthen correction factor (e.g. from 3 mmol/L to 2.5 mmol/L)</p>

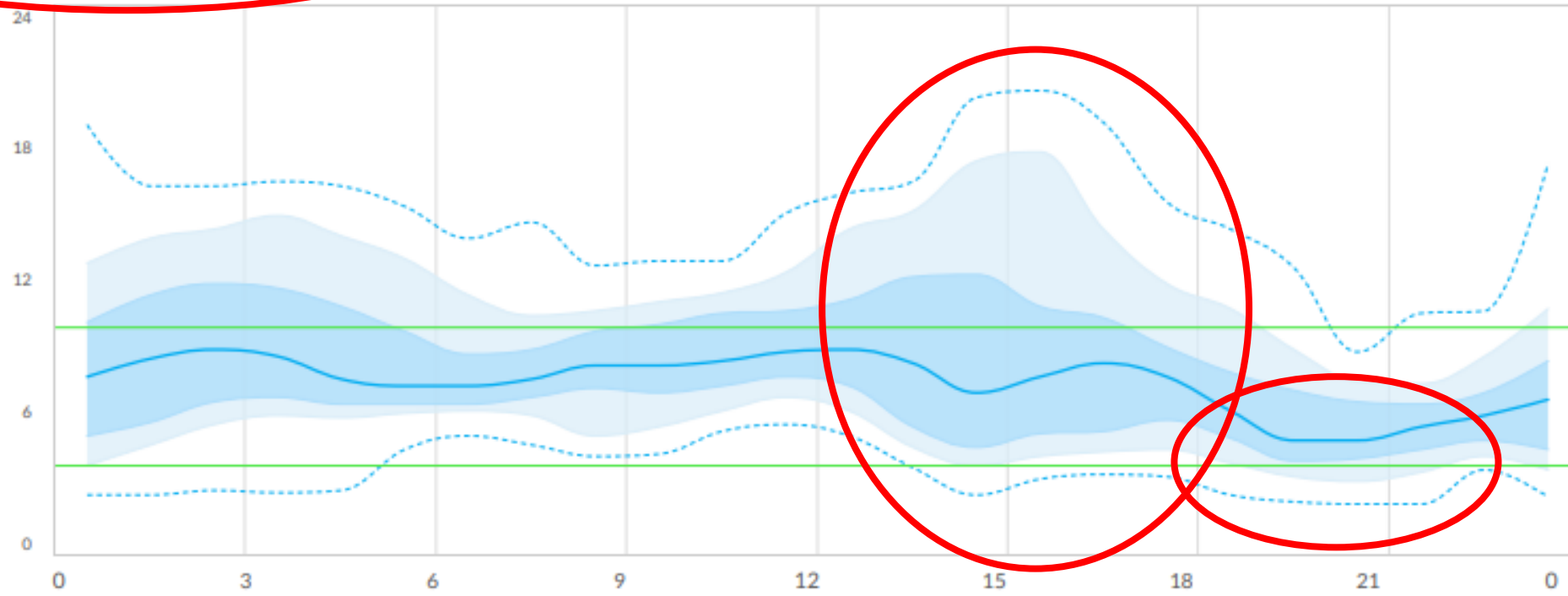
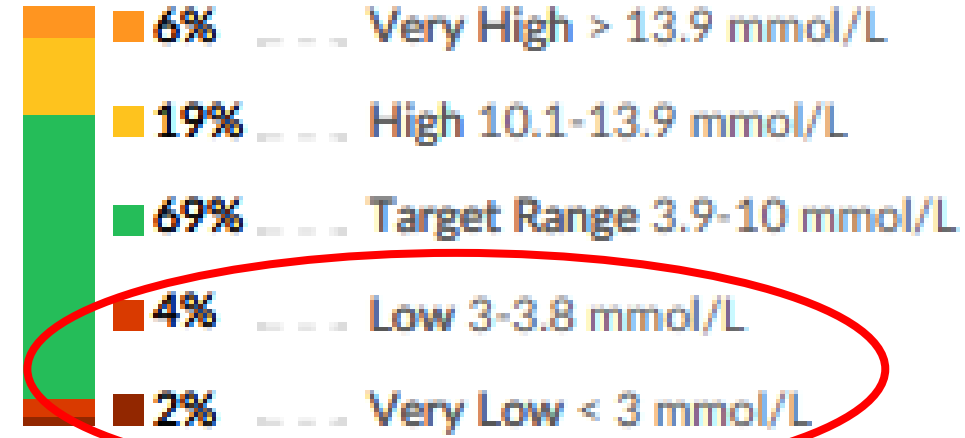


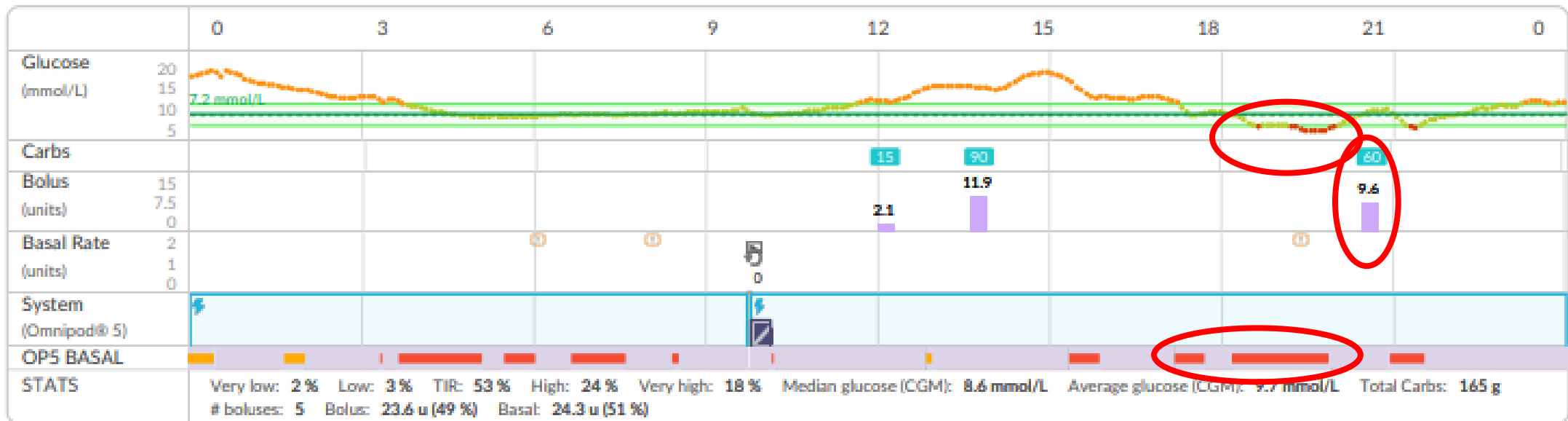
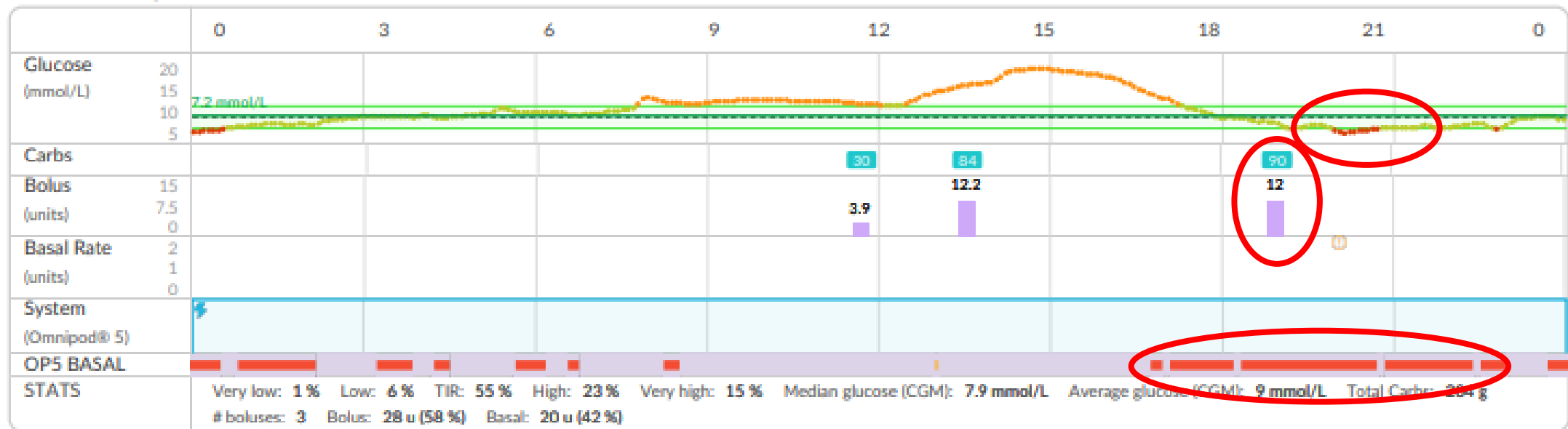
# Glucose - Time In Range

## Summary

GMI  
**6.8% (51 mmol/mol)**  
Average  
**8.1 mmol/L**  
% Time CGM Active  
**98.7% (15.8 days)**






SD ..... **3.3mmol/L**  
CV ..... **40.1%**  
Median ..... **7.6mmol/L**  
Highest ..... **20.4mmol/L**  
Lowest ..... **LOmmol/L**

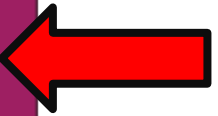
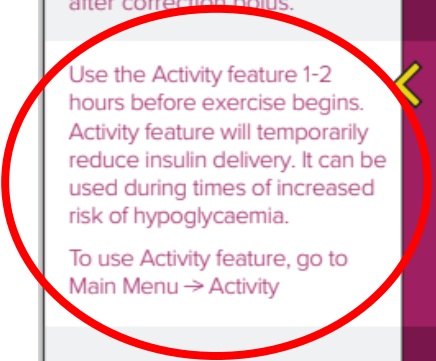




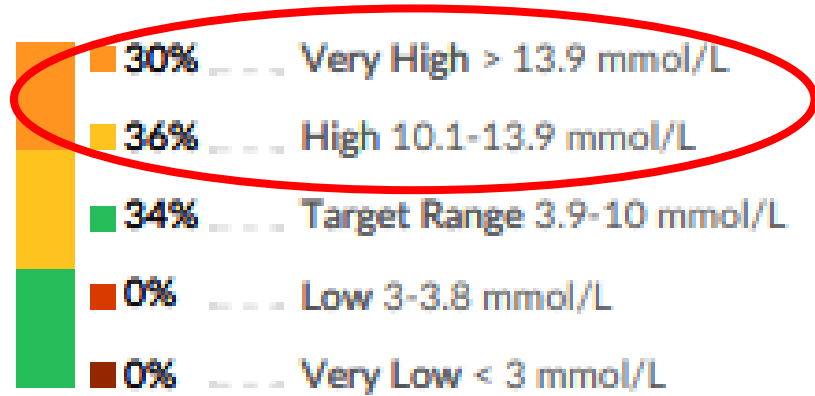
## Hypoglycaemia

## Hyperglycaemia

SOLUTION	PATTERN	SOLUTION
Raise Target Glucose (algorithm target) overnight (highest is 8.3 mmol/L)	<b>Fasting / Overnight</b> 	Lower Target Glucose overnight (lowest is 6.1 mmol/L)
Assess carb counting accuracy, bolus timing, and meal composition. Weaken I:C Ratios by 10-20% (e.g. if 1:10g, change to 1:12g)	<b>Around mealtime</b> (1-3 hours after meals) 	Assess if meal bolus was missed. If yes, educate to give all meal boluses prior to eating. Assess carb counting accuracy, bolus timing, and meal composition. Strengthen I:C Ratios by 10-20% (e.g. from 1:10g to 1:8g)
If due to bolus calculator overrides, educate user to follow the bolus calculator and avoid overriding to give more than recommended. There may be a lot of IOB from AID that user is not aware of. Bolus calculator factors in IOB from increased AID when calculating correction bolus dose.  Weaken correction factor by 10-20% (e.g. from 3mmol/L to 3.5 mmol/L) if hypos 2-3 hours after correction bolus.	<b>Where low glucose follows high glucose</b>   <b>Where high glucose follows low glucose</b> 	Educate to treat mild hypoglycaemia with fewer grams of carbs (5-10g)
Use the Activity feature 1-2 hours before exercise begins. Activity feature will temporarily reduce insulin delivery. It can be used during times of increased risk of hypoglycaemia.  To use Activity feature, go to Main Menu → Activity	<b>Around or after exercise</b> 	
	<b>After a correction bolus was given</b> (1-3 hours after correction bolus)	Strengthen correction factor (e.g. from 3 mmol/L to 2.5 mmol/L)

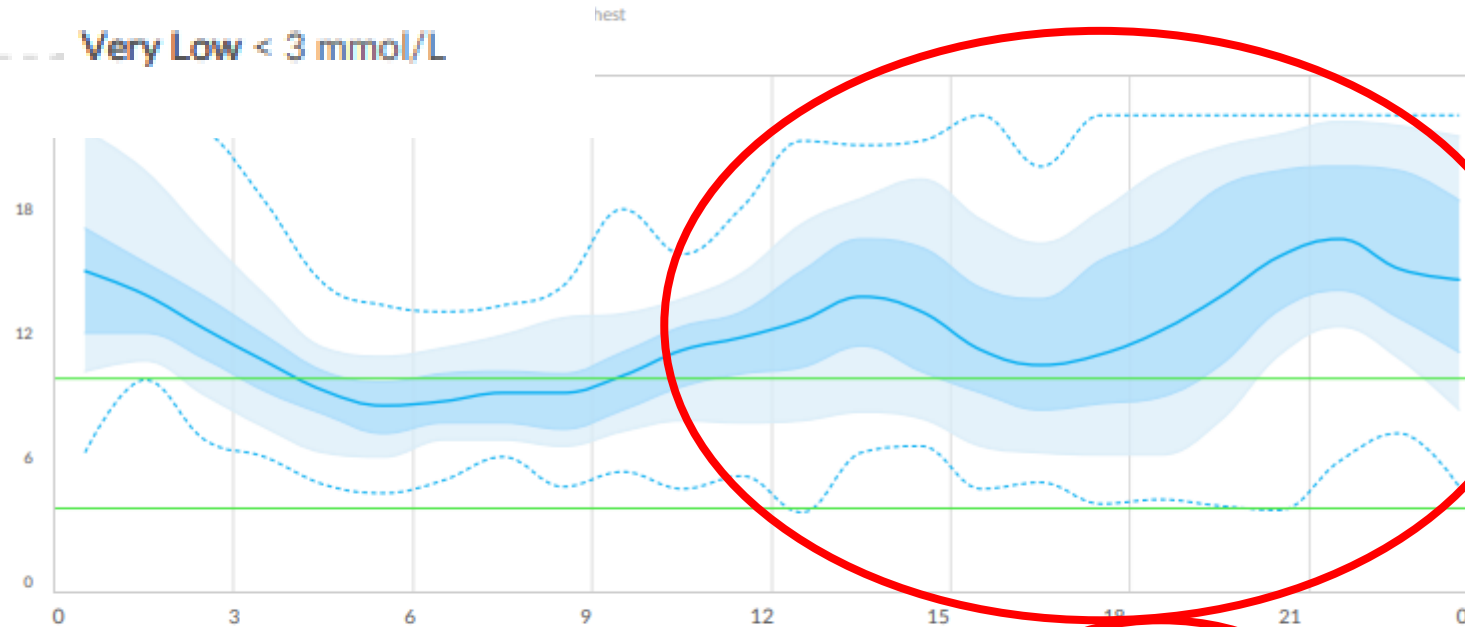


# Glucose - Time In Range



## Summary

GMI	8.6% (70.7 mmol/mol)	SD	4.2mmol/L
Average	12.3 mmol/L	CV	34.4%
% Time CGM Active	87.9% (12.3 days)	Median	11.8mmol/L
		Highest	HImmol/L
		Lowest	3.7mmol/L



## Insulin - Device

From Insulin Pump

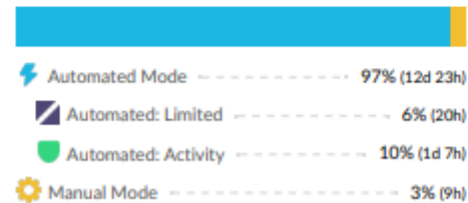


- 66% 6.5 units Basal/Day
- 34% 3.4 units Bolus/Day

Insulin/day... 9.9 units  
 Overrides (%)... 31% (9 boluses)  
 # Bolus/Day... 2.1

## System Details

Insulet Omnipod® 5 System (13d 8h)



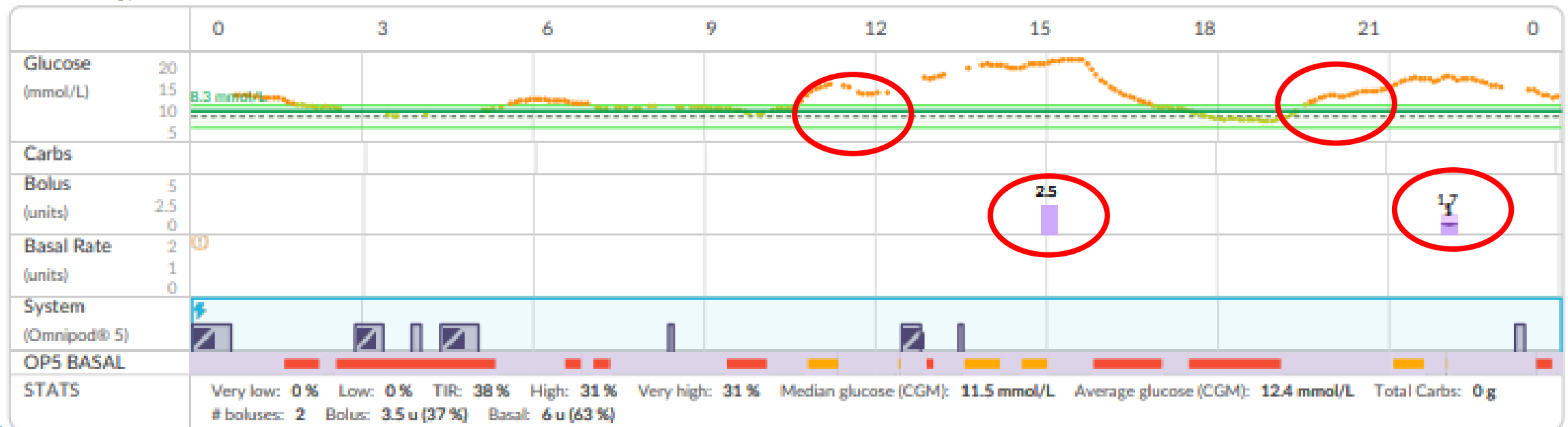
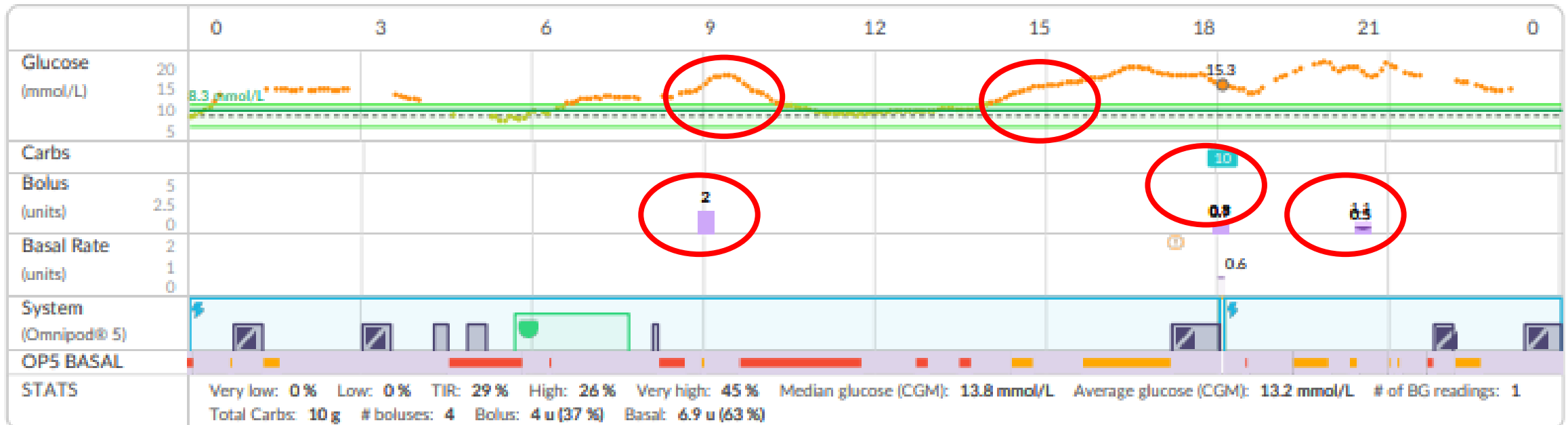
## Diet






Carbs/Day... 10g  
 Entries/Day... 1

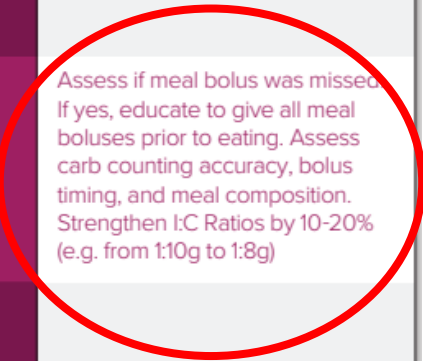
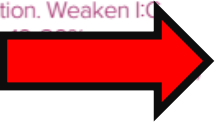
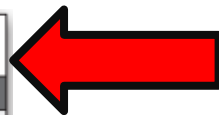
## Fitness

No fitness tracker connected

## Comments



Hypoglycaemia		Hyperglycaemia
SOLUTION	PATTERN	SOLUTION
Raise Target Glucose (algorithm target) overnight (highest is 8.3 mmol/L)	<b>Fasting / Overnight</b> 	Lower Target Glucose overnight (lowest is 6.1 mmol/L)
Assess carb counting accuracy, bolus timing, and meal composition. Weaken I:C Ratios by 10-20% (e.g. if 1:10g to 1:8g)	<b>Around mealtime</b> (1-3 hours after meals) 	Assess if meal bolus was missed. If yes, educate to give all meal boluses prior to eating. Assess carb counting accuracy, bolus timing, and meal composition. Strengthen I:C Ratios by 10-20% (e.g. from 1:10g to 1:8g)
If due to bolus calculator overrides, educate user to follow the bolus calculator and avoid overriding to give more than recommended. There may be a lot of IOB from AID that user is not aware of. Bolus calculator factors in IOB from increased AID when calculating correction bolus dose.  Weaken correction factor by 10-20% (e.g. from 3mmol/L to 3.5 mmol/L) if hypos 2-3 hours after correction bolus.	<b>Where low glucose follows high glucose</b> 	
	<b>Where high glucose follows low glucose</b> 	Educate to treat mild hypoglycaemia with fewer grams of carbs (5-10g)
Use the Activity feature 1-2 hours before exercise begins. Activity feature will temporarily reduce insulin delivery. It can be used during times of increased risk of hypoglycaemia.  To use Activity feature, go to Main Menu → Activity	<b>Around or after exercise</b> 	
	<b>After a correction bolus was given</b> (1-3 hours after correction bolus)	Strengthen correction factor (e.g. from 3 mmol/L to 2.5 mmol/L)



# ADJUST Pump settings and EDUCATE:

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## **Most impactful insulin dose settings to change:**

1. **Target Glucose (for adaptive basal rate)** Options: 6.1, 6.7, 7.2, 7.8, 8.3 mmol/L  
Can program different targets for different times of day
2. **I:C Ratios** It is common to need stronger I:C Ratios with AID
3. **Correction Factor & Active Insulin Time**  
These will only influence bolus calculator doses; has no impact on automated insulin

**\*\*BEFORE making changes to insulin delivery settings, please confirm insulin settings within the user's Omnipod 5 controller.**

To change settings, tap the main menu icon  in top-left corner of **Omnipod 5** controller: → **Settings** → **Bolus**



# Summary of Panther Tools

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PANTHER tools help ensure consistency and structure to reviewing HCL downloads



Useful for HCPs who are not as familiar with the different HCL systems



Easy to use and require very little training

# Data interpretation practical exercise

# Top Tips:

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01

Look at basal/bolus split- aim for 50/50 split. If more than 70% bolus or basal heavy this will be the likely cause of any hypoglycaemia

02

Use a standardised assessment tool and way of recording data

03

Don't be 'blinded' by time in range- listen to the person in front of you.

For example, if they are unable to exercise due to hypoglycaemia or have to 'fake carb' to prevent hyperglycaemia, look at adjusting settings.

04

Don't forget to update manual mode settings, especially if significant changes to weight or TDD



Any  
Questions?

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