

PCDS Wales
Masterclass.
Continuous
Glucose
Monitoring: The
'next generation'

Julie Lewis
May2024.

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Disclosures & Affiliations

Affiliated with:

- NHS Executive for Wales – National Diabetes Strategic Network
- PCDS – Vice co-chair UK-PCDS
- WEDS
- WAND – Committee member
- JBDS – Chair of JBDS-IP Admission Avoidance Review Committee
- QiC – Judging panel member

Honorary contract / lecturer status:

- Bangor University – Diabetes Module
- Swansea University – Diabetes Practice MSc. Senior Clinical Tutor.

Disclosure:

Attended sponsored meetings/ provided presentations for:

- Sanofi, Eli Lilly, BI, AZ, Novo Nordisk, NAPP. Roche. MORPh, Abbott



Welsh Academy for
Nursing in Diabetes

45 minutes



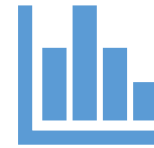
Landscape for CGM
developments



Prescribing to who,
how and why



Education for self-
management



Fundamentals of
data analysis

What is your experience?



Moving into the next generation of CGM

- Rapid advances in technology for self-management of diabetes
- Glucose sensing devices of the future could be non-invasive.
- Public interest, market access and demand for 'self-monitoring' devices (beyond diabetes) is changing the traditional dynamics of Provider to Purchasing, to Prescriber to Patient access
- Wider manufacturer platform will ease acquisition costs, but these are likely to be off-set by a broadening of eligibility for prescribed devices.
- More recent developments.....



Dexcom ONE

- Sensor life: 10 days
- Transmitter life: 90 days
- Provides real-time and predictive glucose data
- A small sensor, usually on the arm or abdomen, sends glucose data continually via a transmitter to a compatible mobile app or reader
- The reader or device shows:
 - current glucose reading
 - graph showing latest 8 hours of glucose data
 - trend arrow



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Dexcom ONE+



- Sensor life: 10 days (3 per month)
- Provides real-time and predictive glucose data
 - A small sensor, usually on the arm or abdomen, sends glucose data continually via Bluetooth to a compatible mobile app or reader
- No transmitter needed
- Warm up time reduced from 2hrs to 30 mins.
- The reader or device shows:
 - current glucose reading
 - graph showing latest 8 hours of glucose data
 - trend arrow



Freestyle Libre 2 / Freestyle Libre2+

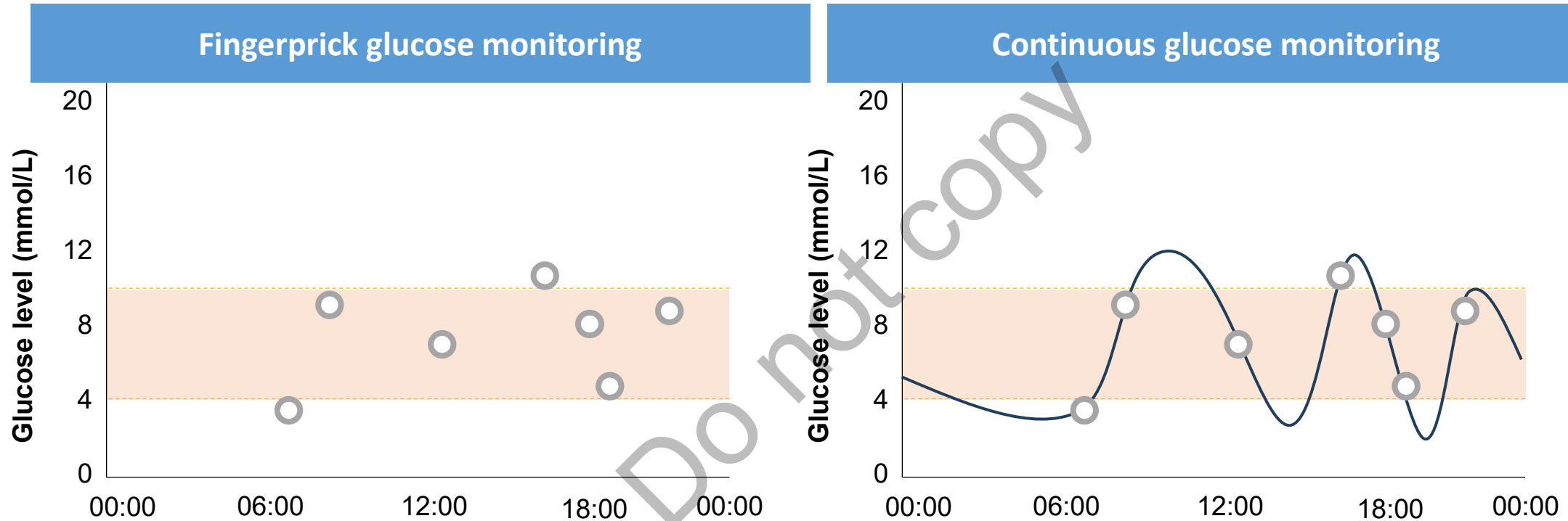
- SENSOR DURATION
 - 14 DAYS LIBRE2
 - 15 DAYS LIBRE2+
- USING A READER?
 - Scan for glucose measurement at least 8hrly
 - Requires minimum 6 scans /day to enhance data (10 recommended)
 - Shows data from last time sensor was scanned
 - Glucose result / Trend arrow and last 8hrs data

Freestyle Libre 2 / Freestyle Libre2+

- SENSOR DURATION
 - 14 DAYS Libre2
 - 15 days Libre2+
- USING YOUR SMART DEVICE?
- Sensor transmits glucose data continuously
- Shows current data
- Compatible with Omnipod5 for HCL
- Libre2+
 - Bluetooth range 6m
 - Improved accuracy
 - No change to warm up time /water depth
 - Cost neutral over 12m (to Libre2)
 - Phase in as L2 to be fully replaced by July 2025
 - Licensed from 2yrs.



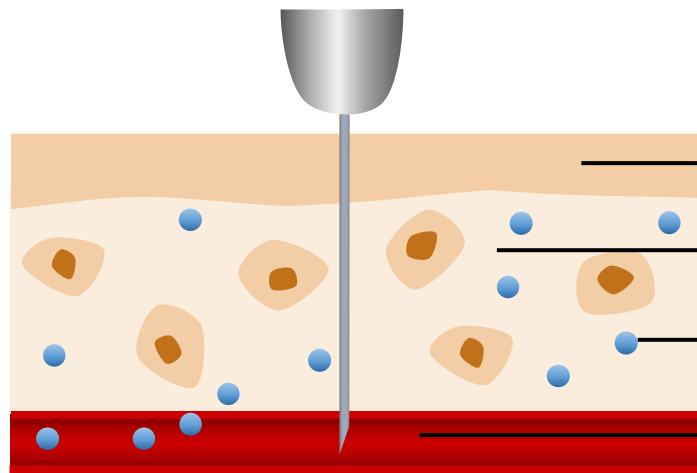
What do blood glucose meters tell us?



Images are for illustrative purposes only. Not real patient data.

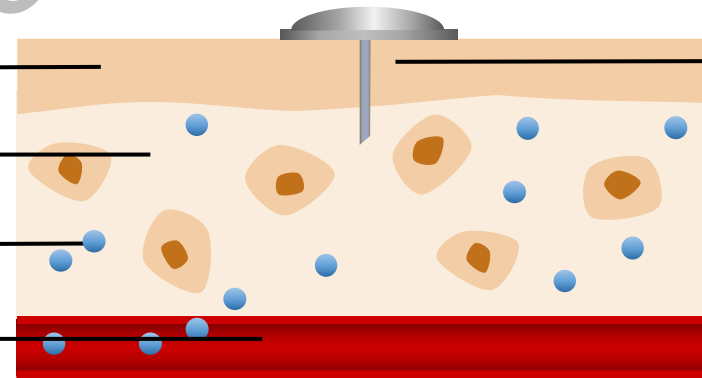
What is Continuous Glucose Monitoring (CGM)?

CLASSIC CAPILLARY BLOOD GLUCOSE METER



Skin
Interstitial fluid
Glucose
Capillary

CGM SYSTEM



Microfilament

Who is eligible for CGM in England or Wales?

Type 1 diabetes: NICE NG17

**Type 1
diabetes**

- All adults with type 1 diabetes
- All children and young people with type 1 diabetes
- Consider CGM for pregnant women who are on insulin therapy but do not have type 1 diabetes if:
 - Problematic severe hypoglycaemia (with or without impaired awareness of hypoglycaemia)
 - Unstable blood glucose levels that are causing concern despite efforts to optimise glycaemic control

Hybrid Closed Loop Systems in Type 1 diabetes

- Usually provided within the All Wales Framework (Procured not prescribed)
- Recent developments to improve cost efficiencies within HCL system delivery
- Libre 2 / 2+ and 3 are prescribed CGM that have compatibility to HCL systems
- Libre3
 - On GP systems to prescribe
 - Specialist initiation for people with T1dm on HCL systems
 - Longer Bluetooth range
 - Compatible with Ypsomed / CamsApp
- Formulary updates: could consider a longer prescription to avoid HCL disruption for dislodged or faulty sensors.

Who is eligible for CGM in England or Wales?

Type 2 diabetes: NICE NG28

**Type 2
diabetes**

For adults with type 2 diabetes on multiple daily insulin injections if any of the following apply:

- Recurrent hypoglycaemia or severe hypoglycaemia
- Impaired hypoglycaemia awareness
- Would otherwise be advised to self-monitor capillary glucose at least 8 times a day
- A condition or disability (including a learning disability or cognitive impairment) that means the user cannot self-monitor capillary blood glucose but could use an isCGM device (or have it scanned for them) or could use rtCGM
- Would otherwise need help from a carer or healthcare professional to monitor their blood glucose

What's the point of finger prick monitoring?

GLUCOSE

- Active monitoring where non-insulin treatments are being titrated within an individualised plan of care in T2dm
- Gestational diabetes – pre insulin
- Pre-pregnancy planning in T2diabetes (not on insulin or when treatments are being changed to prepare safely for pregnancy)
- Back-up glucose monitoring for interruptions in CGM
- To validate a CGM glucose value of concern
- To validate a glucose value in the event of hypoglycaemia whilst driving
- For Group2 DVLA regulation compliance
- POCT compliance for inpatient and community hospital / community nursing glucose monitoring

KETONES

- Ensure blood ketone strips are available to a compatible meter for people with T1dm to assist self-management of sick day rules and avoid DKA.



Providing
prescribed CGM
in Primary Care:
Too much work?

- Education for self-management is key
- Send links via practice communications (e.g. Accu-Rx) to complete training prior to initiation
- Make use of manufacturer support with on-boarding

Initiation Tips Before Fitting : Minimise clinical time – take advantage of online education and manufacturer support for group & 1:1 starts

- Use shared decision making to identify the most appropriate device:
 - Preference
 - Benefits/drawbacks of alerts and alarms
 - Ability to share data with family and carers
- Download the device's compatible mobile app for use with a smart device, prior to fitting
- If a smart device is not available, arrange for a compatible reader before fitting
- Starter kits are available through individual patient ordering / can be provided to practices along with product information

Providing prescribed CGM in Primary Care:

Abbott

Training sessions with Freestyle Libre Academy- independently or with their practice as group sessions.

These sessions can be supported by Abbott to provide the education and letters and training materials.

A starter kit will be provided whether online or face to face training offered with 2 weeks supply of sensor.

There is a follow up session which can be supported by a DSN from Abbott

[FreeStyle Progress - Abbott \(freestylediabetes.co.uk\)](https://freestylediabetes.co.uk)

New Starter training video for FreeStyle Libre 2 <https://youtu.be/-e3yDD0vAlk>

Practices can order sample sensors for new starters on FreeStyle Libre 2 <https://freestylediabetes.co.uk/freestyle-libre/patient-primary-care>

Foreign language materials also available

<https://freestylediabetes.co.uk/freestyle-libre/foreign-languages>

Providing prescribed CGM in Primary Care:

[Dexcom ONE - Learn the basics of CGM | Dexcom](#)

[Ready to get started](#)

[Your first 10 days with Dexcom](#)

[Beyond the basics](#)

[Understand your Diabetes trends](#)

[DEXCOM ONE learn journey](#)

Structured education including videos on the basics of rt-CGM, starting with Dexcom ONE through to understanding diabetes trends and sharing data with HCP's

The Dexcom Representatives and PWD Care Specialists will be available to host webinars for PWDs who have been unable to onboard themselves through the Dexcom ONE app.

How to get started using a smart device

1

Check mobile phone is compatible

If not, offer use of a reader

2

Switch on Bluetooth

Settings → Devices, or Settings → Connections

3

Enable Near Field Communication (NFC)

Settings → Devices, or Settings → Connections

4

Download app

Will need good WiFi signal



5

Open the app

Tips for users

- The app must be within 6 metres of the transmitter to receive glucose information
- The app is intended to run at all times and must be left open to receive data
 - It will capture and store up to 8 hours of “missed data”
- Pressure on the sensor (eg laying down on arm during sleep) can affect readings and may cause alarm to sound

Initiation tips: After fitting

- Warm up time
- Advise person to contact manufacturer's customer support for replacement of defective sensors or in the event that a sensor falls off prematurely
- Signpost the user and/or their family and carers to appropriate education to enable ongoing self-management
- Provide information on future need for capillary glucose testing, driving, etc
- Consider linking to the device's cloud-based system (depending on local data-sharing guidelines) so that data can be shared from the person's own account to the healthcare professional's clinic account, to allow for remote review/consultations
- Ensure the person understands when the data will be reviewed, and that CGM does not mean a professional will be viewing/monitoring their data continuously

Alarms



- Support person to set low and high alarms (refer to individual device user guides) based on individualised target glycaemic range and current glycaemic range
 - Consider alarm fatigue and increased anxiety with sensor detected Hypos when alarm is set at an unnecessarily high level

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Driving



Group 1 (car and motorcycle): Carry SMBG/ Hypo treatments in your car!

- CGM can be used for glucose monitoring
- Drivers must pull over to scan if using isCGM
- Fingerprint glucose equipment must be carried and used to confirm blood glucose levels when:
 - Glucose level reads ≤ 4.0 mmol/L
 - Symptoms of hypoglycaemia are experienced
 - CGM reading is inconsistent with the symptoms being experienced



Group 2 (lorries)

- Group 2 drivers still need to use fingerprint testing for driving

Travel



- Users are advised not to go through full body scanners (eg at airports) or to put components through baggage x-ray machines
 - This may vary according to manufacturer



- Users can swim, shower or bathe
 - **Dexcom ONE:** Sensor and transmitter water-resistant to 8 feet of water for up to 24 hours
 - **Freestyle Libre 2:** Sensor water-resistant to 1 metre of water for up to 30 minutes
- In water, the display device needs to be closer than 6 metres to get sensor readings

Resources

- FreeStyle Libre Tutorials & Downloads
<https://www.freestyle.abbott/uk-en/support/tutorialsanddownloads>
- Dexcom Education & Resources
<https://uk.provider.dexcom.com/education-and-resources>
- Diabetes Technology Network (DTN-UK)
<https://abcd.care/dtn-uk/resource-taxonomy/diabetes-technology-network>

eden Implementing Glucose
Sensing in Primary Care



dexcom one



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Browse Topics / Continuous Glucose Monitoring (CGM)

Continuous Glucose Monitoring (CGM)



Continuous Glucose Monitoring (CGM)



This topic is an introduction to Continuous Glucose Monitoring, the different types of CGM devices available and their use in people living with diabetes.

[Sign in or register](#)

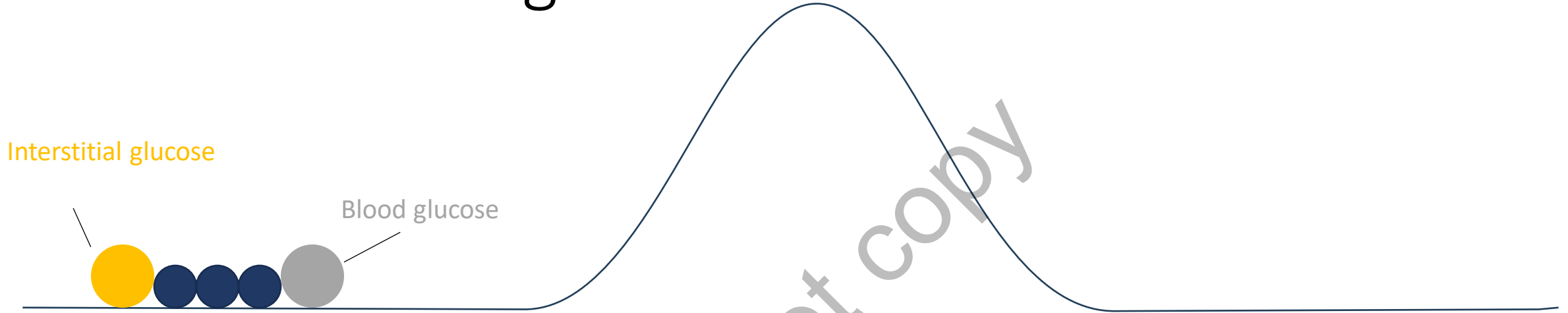
1:49

Fundamentals of data analysis

- Reliability of the data presented
- Stepwise approach
- Keep it simple
- Keep it safe
- Maintain an individualised approach

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Understanding interstitial fluid measurement



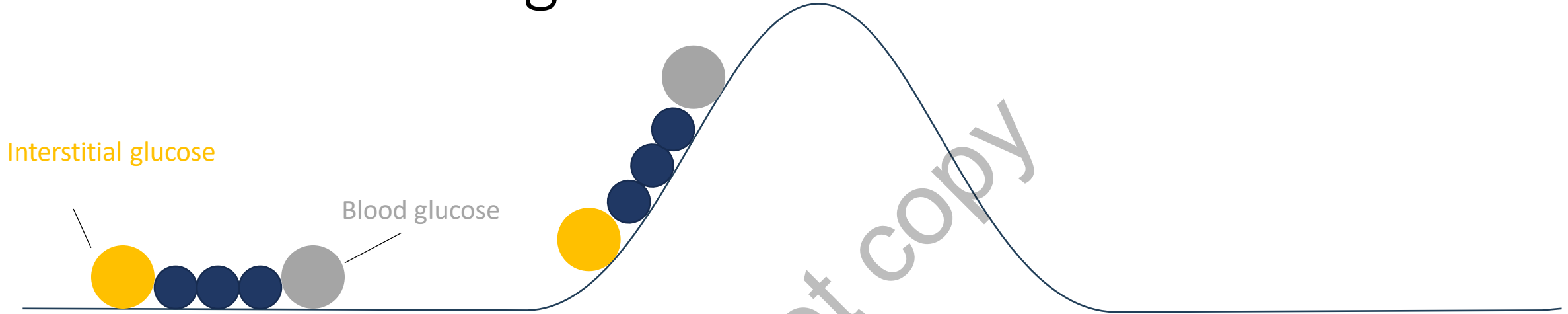
Blood glucose levels

Stable

Interstitial glucose levels

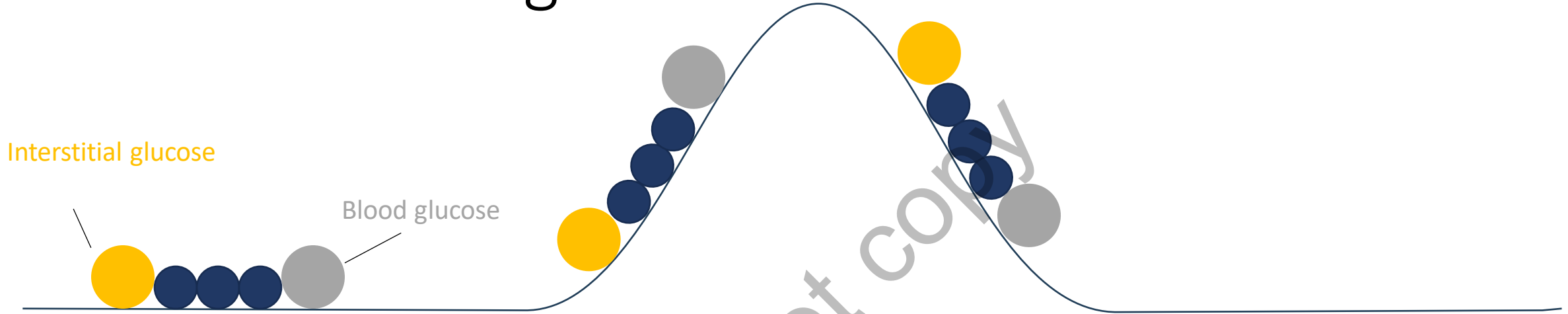
Similar to blood glucose

Understanding interstitial fluid measurement

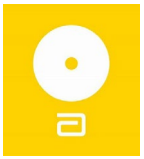


Blood glucose levels	Stable	Increasing
Interstitial glucose levels	Similar to blood glucose	May be lower than blood glucose

Understanding interstitial fluid measurement



Blood glucose levels	Stable	Increasing	Decreasing
Interstitial glucose levels	Similar to blood glucose	May be lower than blood glucose	May be higher than blood glucose



Direction and rate of change of glucose

Glucose is rising rapidly
>0.1 mmol/L per min



Glucose is rising rapidly
>3 mmol/L in 30 mins

Glucose is rising
Between 0.06-0.1 mmol/L per min



Glucose is rising
Between 1.8 – 3 mmol/L in 30 mins

Glucose is changing slowly
<0.06 mmol/L per min



Glucose is changing slowly
<1.8 mmol/L in 30 mins

Glucose is falling
Between 0.06-0.1 mmol/L per min



Glucose is falling
Between 1.8 – 3 mmol/L in 30 mins

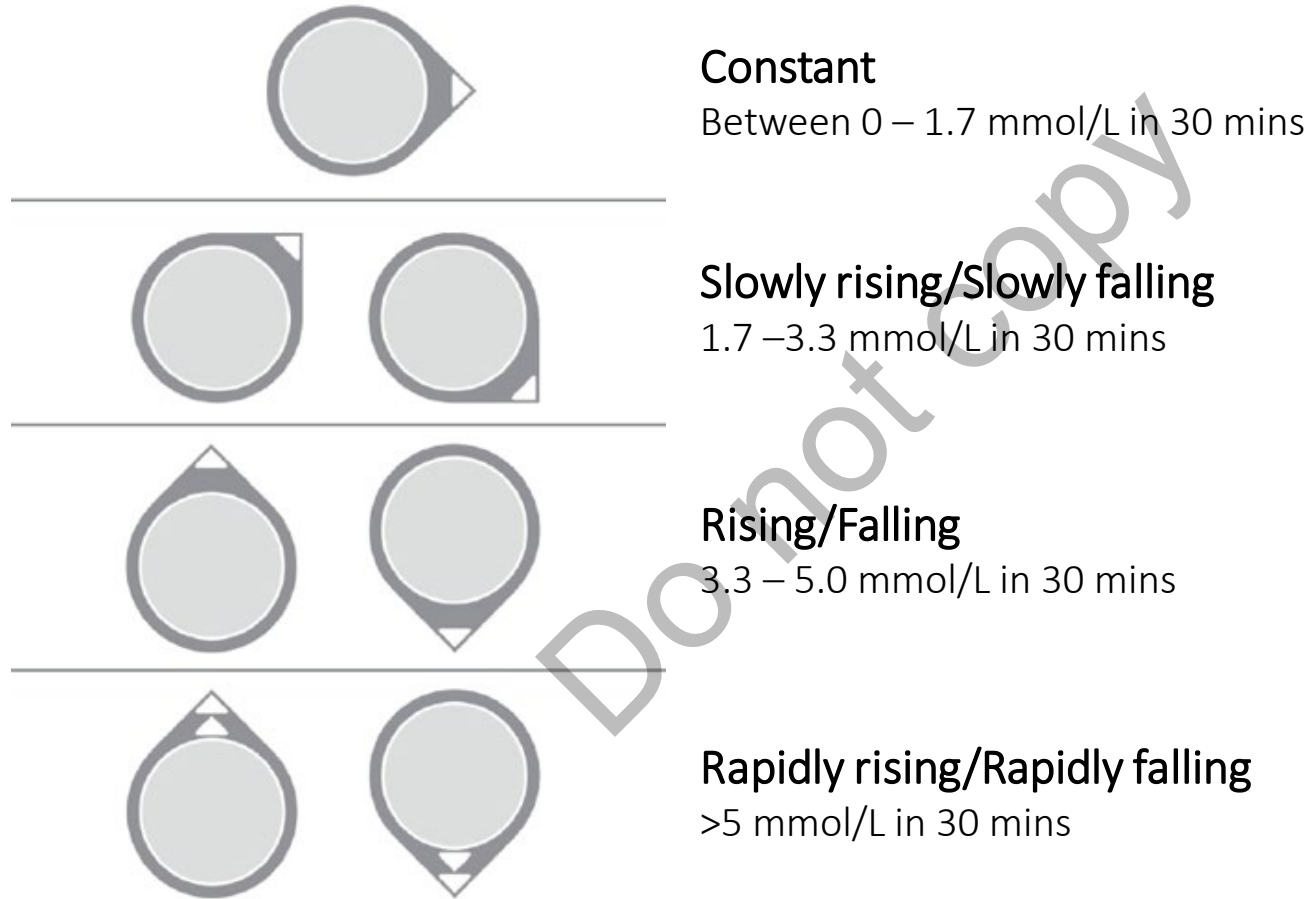
Glucose is falling rapidly
>0.1 mmol/L per min



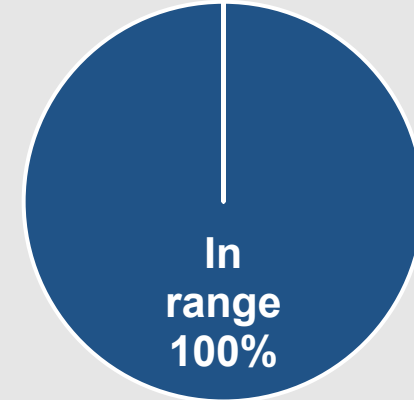
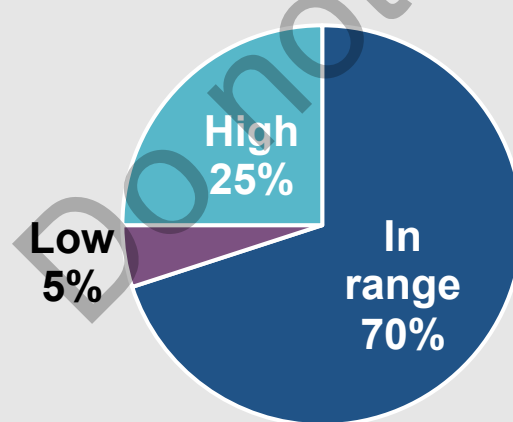
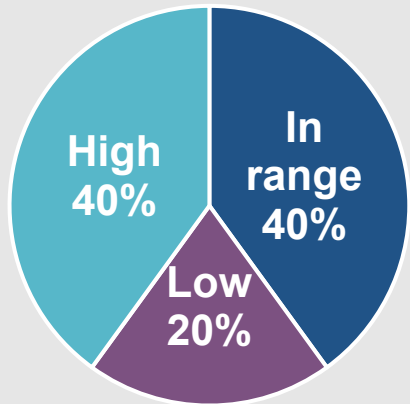
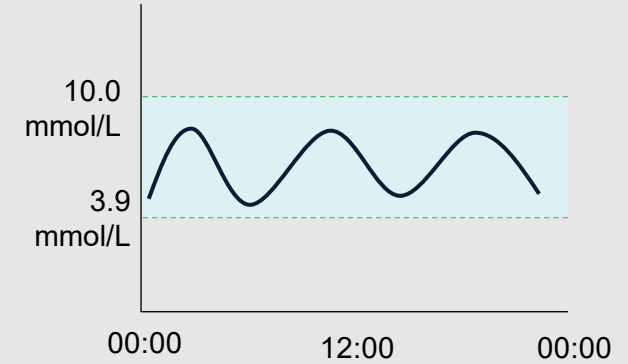
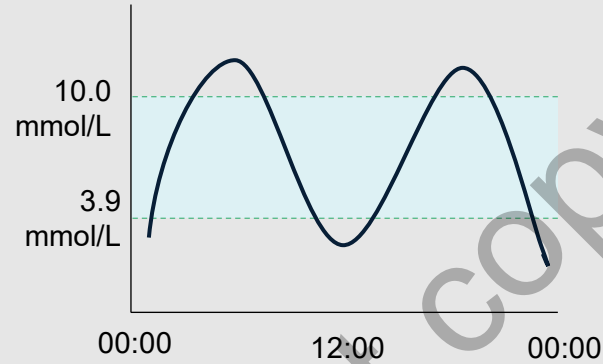
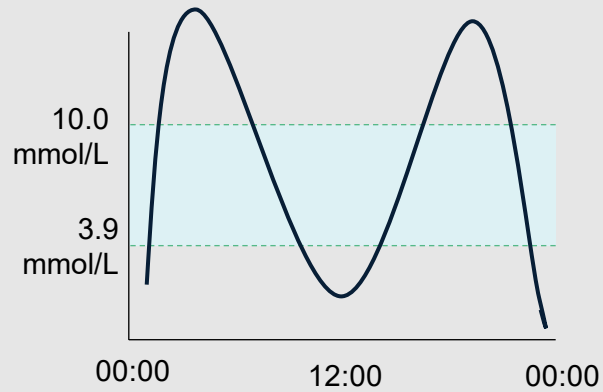
Glucose is falling rapidly
>3 mmol/L in 30 mins



Direction and rate of change of glucose

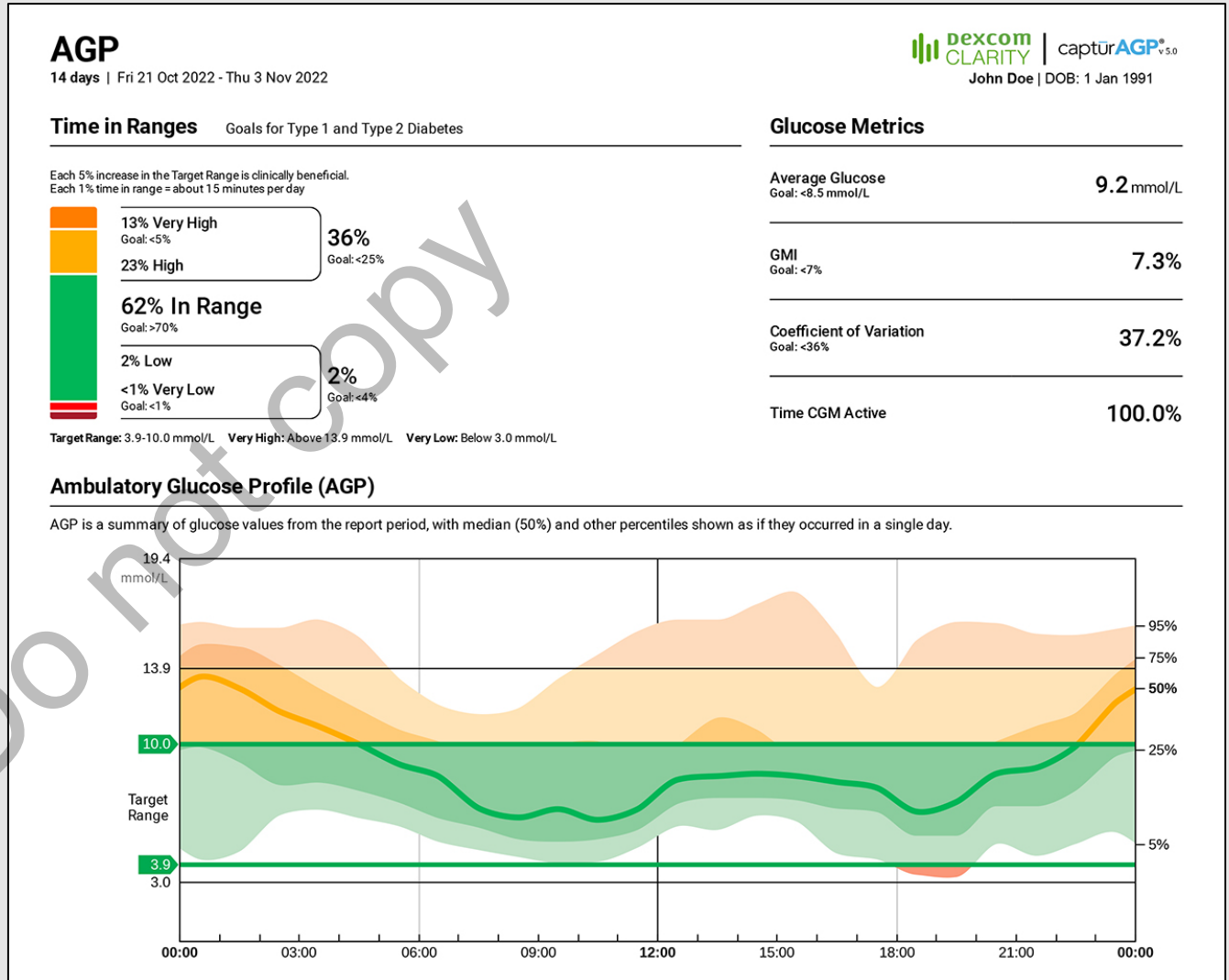
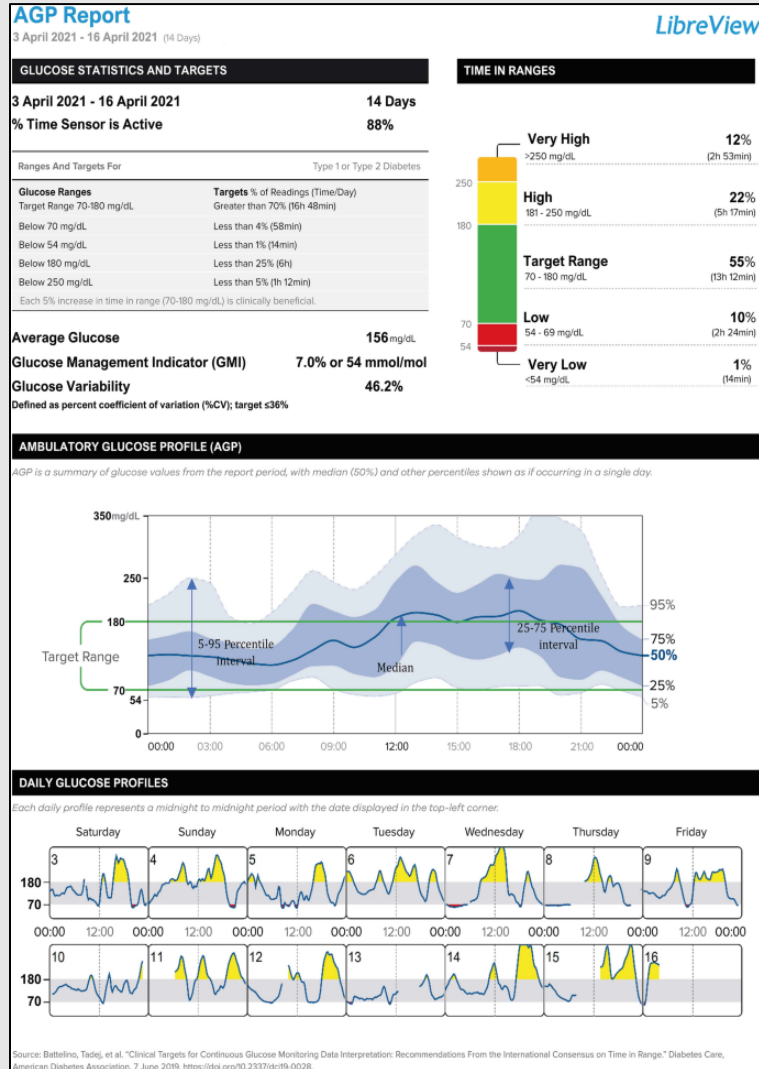


Don't be misled by HbA1c



All three have a HbA1c of 53 mmol/mol

Ambulatory Glucose Reports



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Diabetes Society

Images are for illustrative purposes only. Not real patient or data

1. Validate the data

- Date range
- 14 days data
- > 70% time sensor active

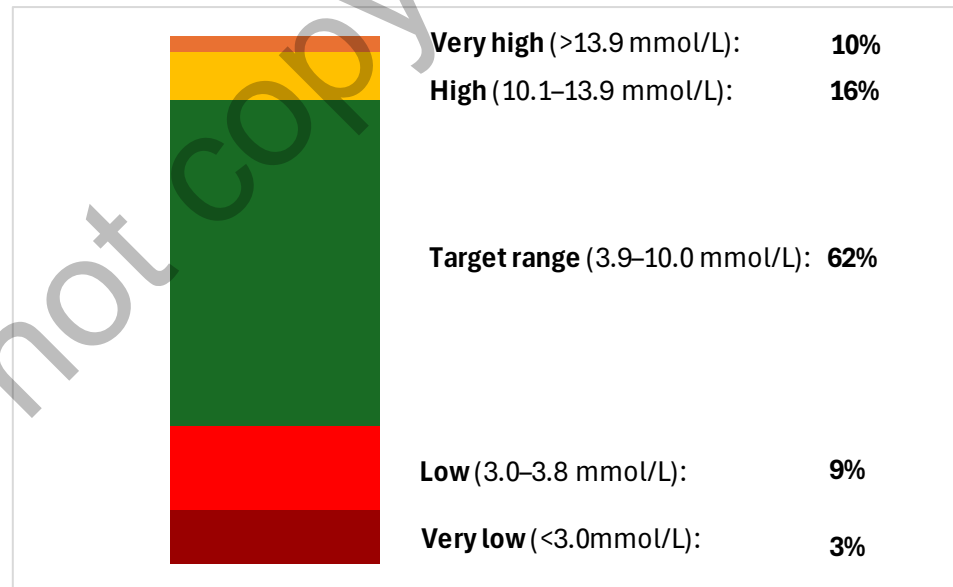
Ambulatory Glucose Profile (AGP)

Glucose Statistics

Date range: 5 Feb – 18 Feb (14 days)
Time active: 97%

Average glucose: 8.0 mmol/L
Glucose Management Indicator (GMI): 6.7% or 64 mmol/mol
Variability (target: <36%): 50.2%

Time In Ranges



2. Assess key glucose metrics

Ambulatory Glucose Profile (AGP)

Glucose Statistics

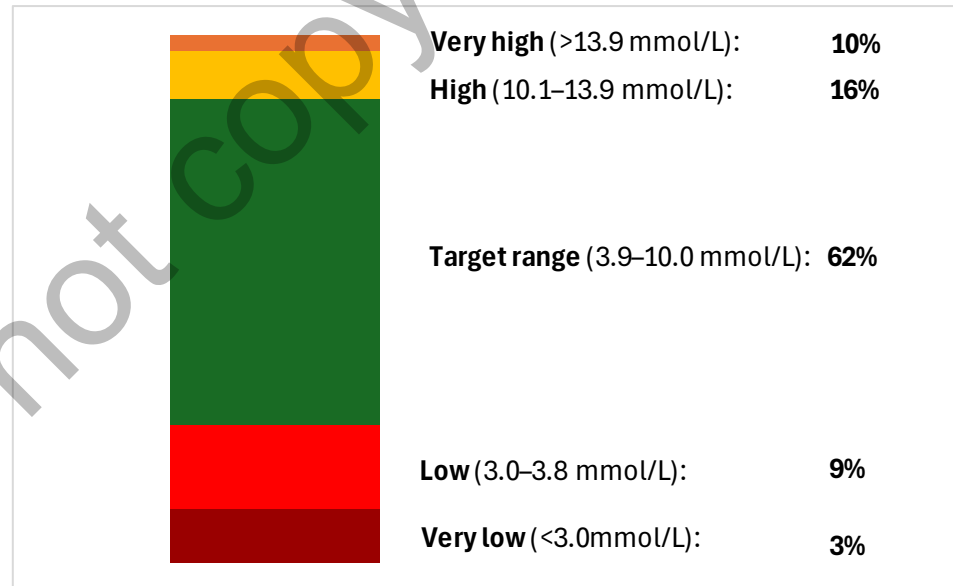
Date range: 5 Feb – 18 Feb (14 days)

Time active: 97%

Average glucose: 8.0 mmol/L
Glucose Management Indicator (GMI): 6.7% or 64 mmol/mol
Variability (target: <36%): 50.2%

- GMI (predicted HbA1c value)
- Glucose variability – target $\leq 36\%$

Time In Ranges



3. Assess Time In Range (TIR)

- %TIR – target >70%
- %TBR – target <4%
- %TAR – target <25%

Ambulatory Glucose Profile (AGP)

Glucose Statistics

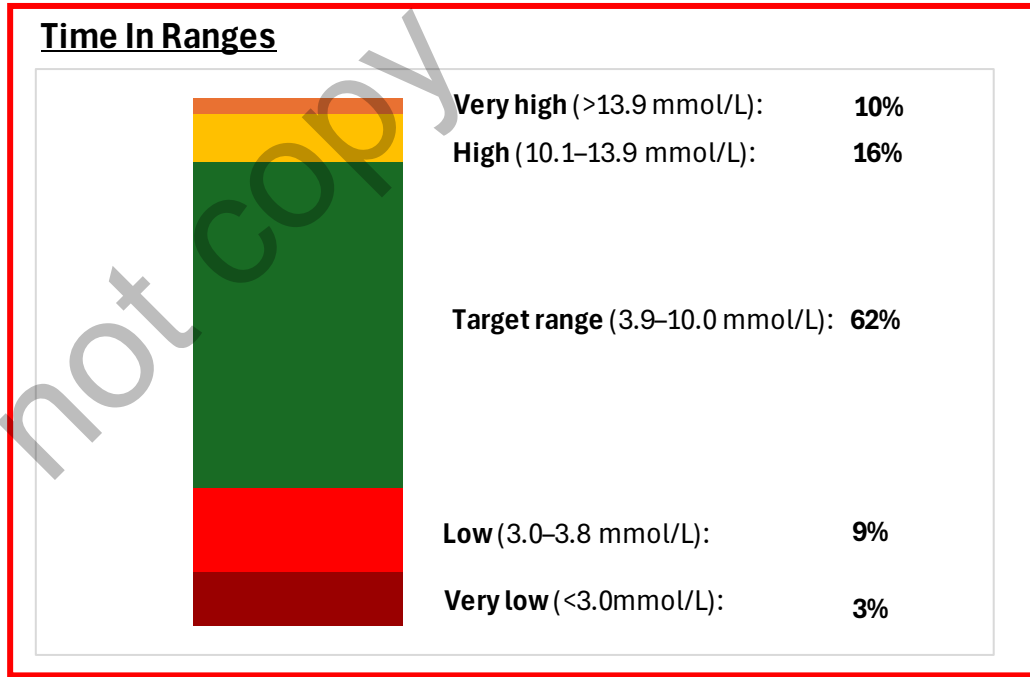
Date range: 5 Feb – 18 Feb (14 days)

Time active: 97%

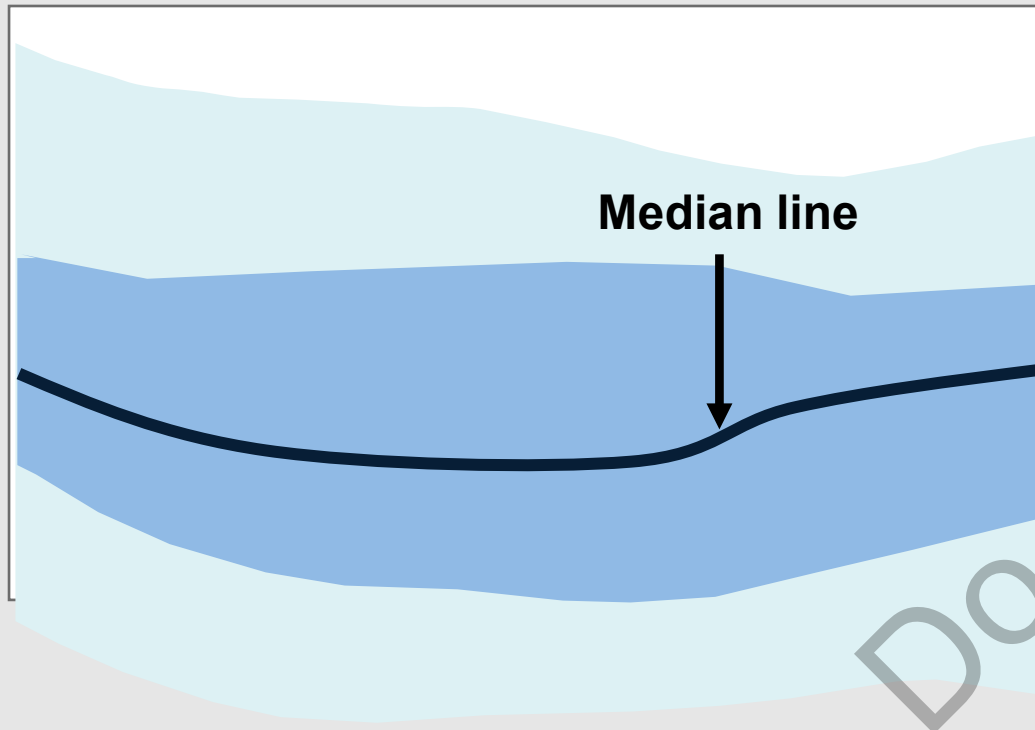
Average glucose: 8.0 mmol/L

Glucose Management Indicator (GMI): 6.7% or 64 mmol/mol

Variability (target: <36%): 50.2%



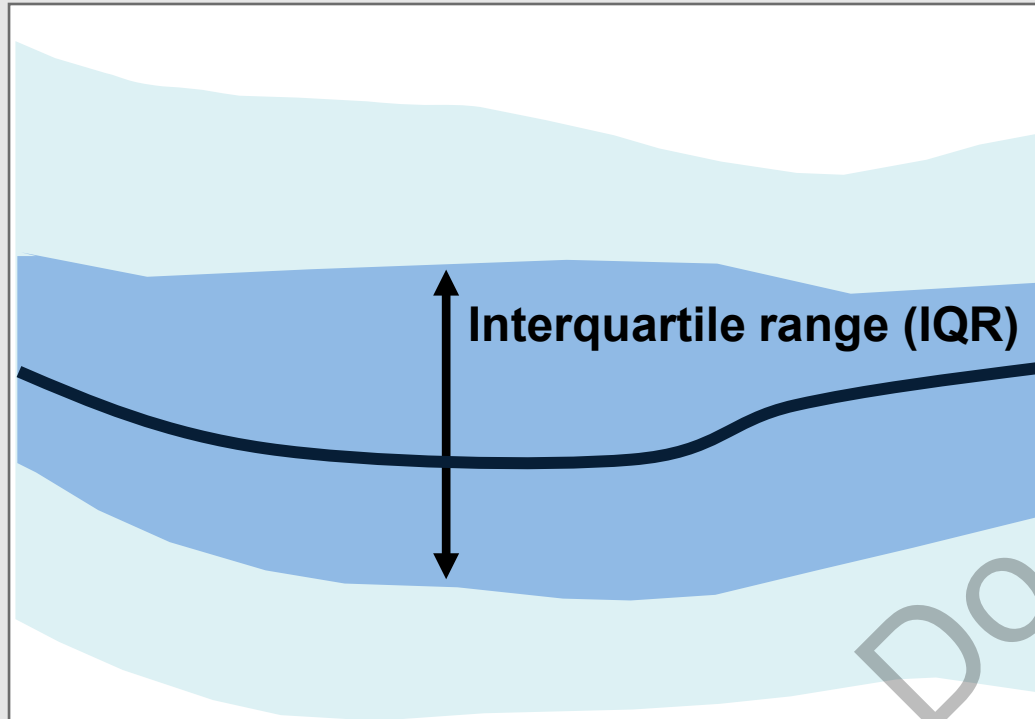
AGP lines of significance



The median line – seen within the modal day – is the line above and below which 50% of all glucose readings sit.

This therefore depicts the median average glucose line.

AGP lines of significance



The interquartile range is the distance between the 25th and 75th percentile readings

50% of all glucose readings sit within this range

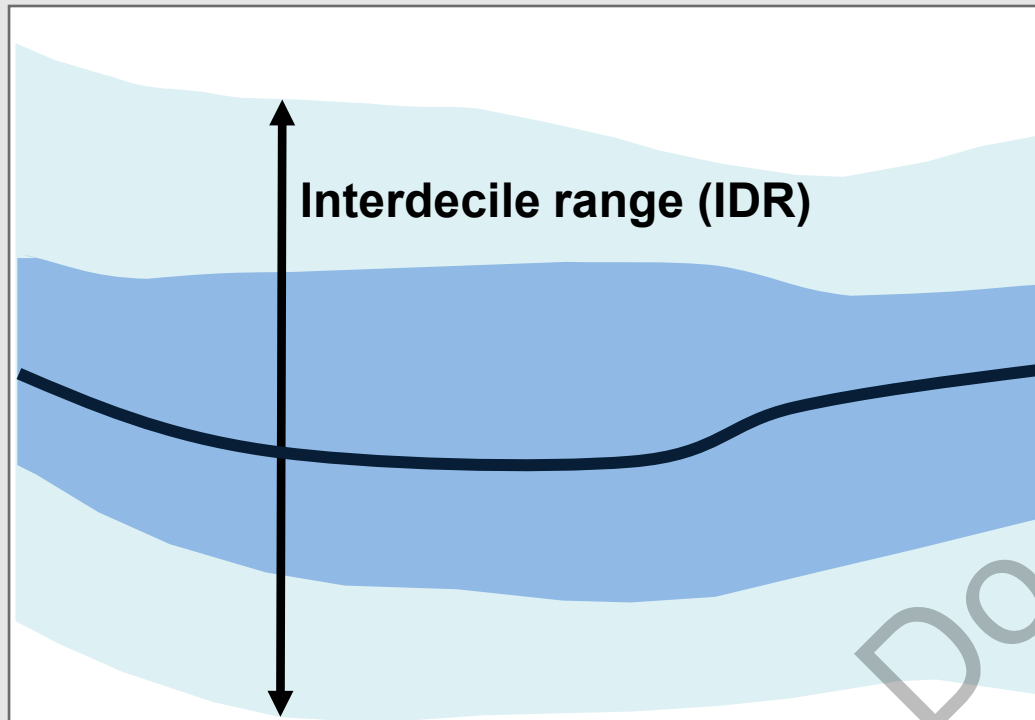
This indicates the range within which the person spends most of the time.

Wide IQR Possible causes

Treatment related

- Mealtime insulin doses and/or timing of dose to meal
- Inadequate carb-to-insulin ratio
- Inadequate correction dose calculation

AGP lines of significance

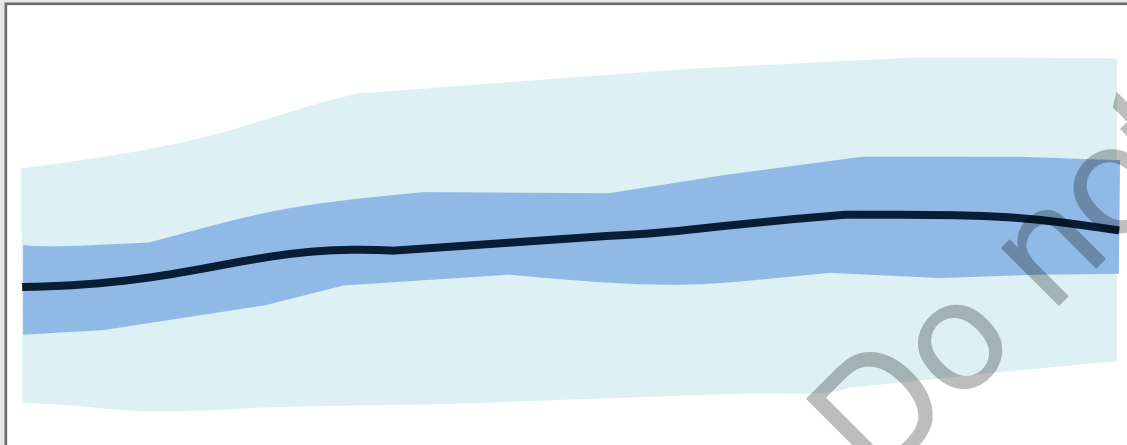


90-97%* of all readings fall in this area

This depicts where a person's glucose level will sit occasionally. This maybe on just a few occasions with the 14 day profile making up the modal day.

Wide IDR with narrow IQR

Variability profile



Interpretation

Low day-to-day glucose variability
Wide occasional variability

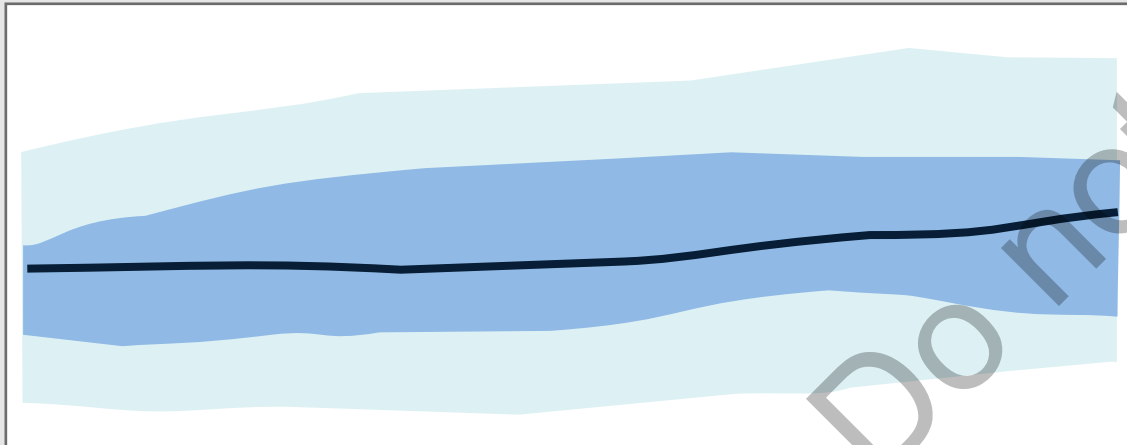
Possible causes:

More likely to be driven by **lifestyle, behavioral and social** causes:

- unplanned exercise
- missed injections
- irregular mealtimes
- unplanned snacking
- alcohol

Wide IDR with wide IQR

Variability profile



Interpretation

High day-to-day glucose variability
Wide occasional variability

Possible causes:

More likely to be driven by **both treatment and lifestyle, behavioral and social** causes

Also check for **lipohypertrophy** and review injection technique

Glucose Statistics

Date range: 3 April – 16 April (14 days)

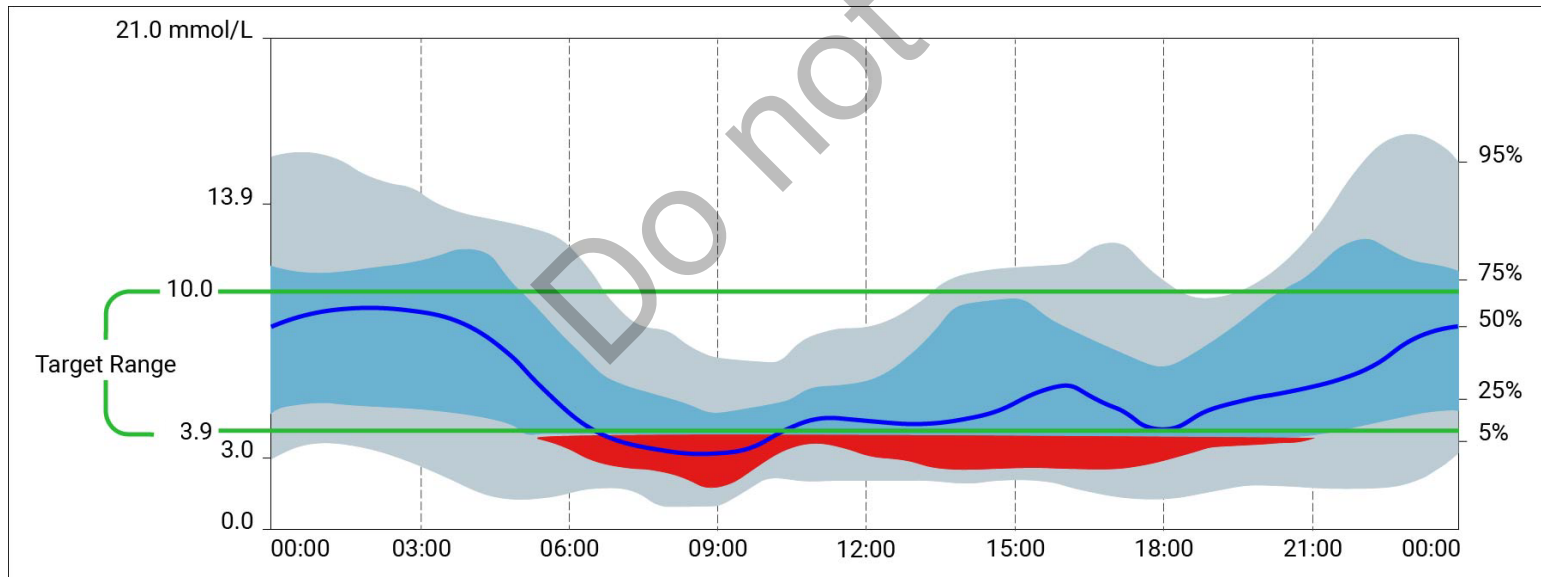
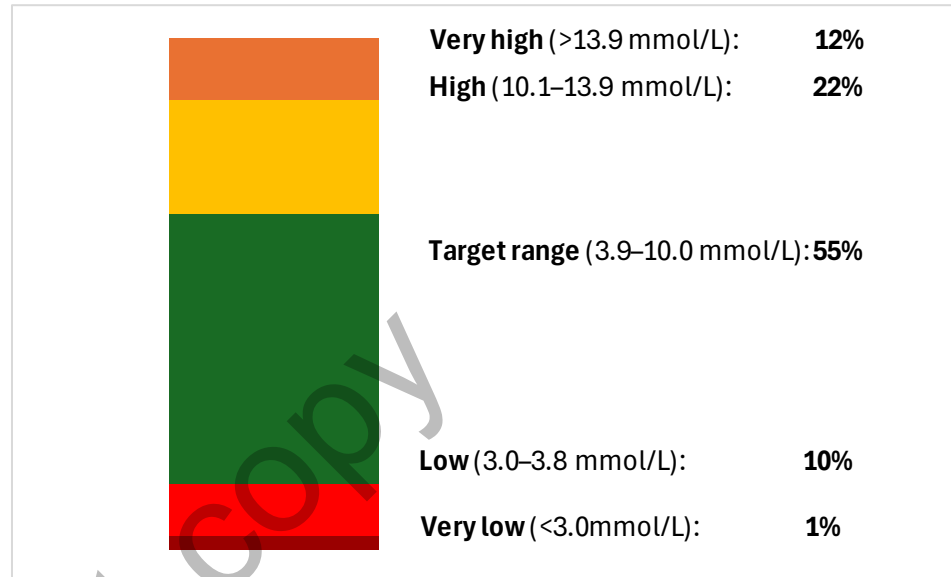
Time active: 88%

Average glucose: 8.7 mmol/L

Glucose Management Indicator (GMI): 7.0% or 53 mmol/mol

Variability (target: <36%): 46.2%

Time In Ranges



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Review possible causes of low glucose/hypoglycaemic episodes

- Over medication
- Insulin doses too high for requirements
- Incorrect timing of insulin doses
- Impaired renal function
- Early pregnancy
- Breastfeeding
- Changing from an area of lypohypertrophy to new injection site
- Loss of appetite
- Reduced food intake
- Fasting
- Missing/forgetting meals
- Weight loss
- Alcohol consumption
- Exercise

Glucose Statistics

Date range: 28 Sept – 11 Oct (14 days)

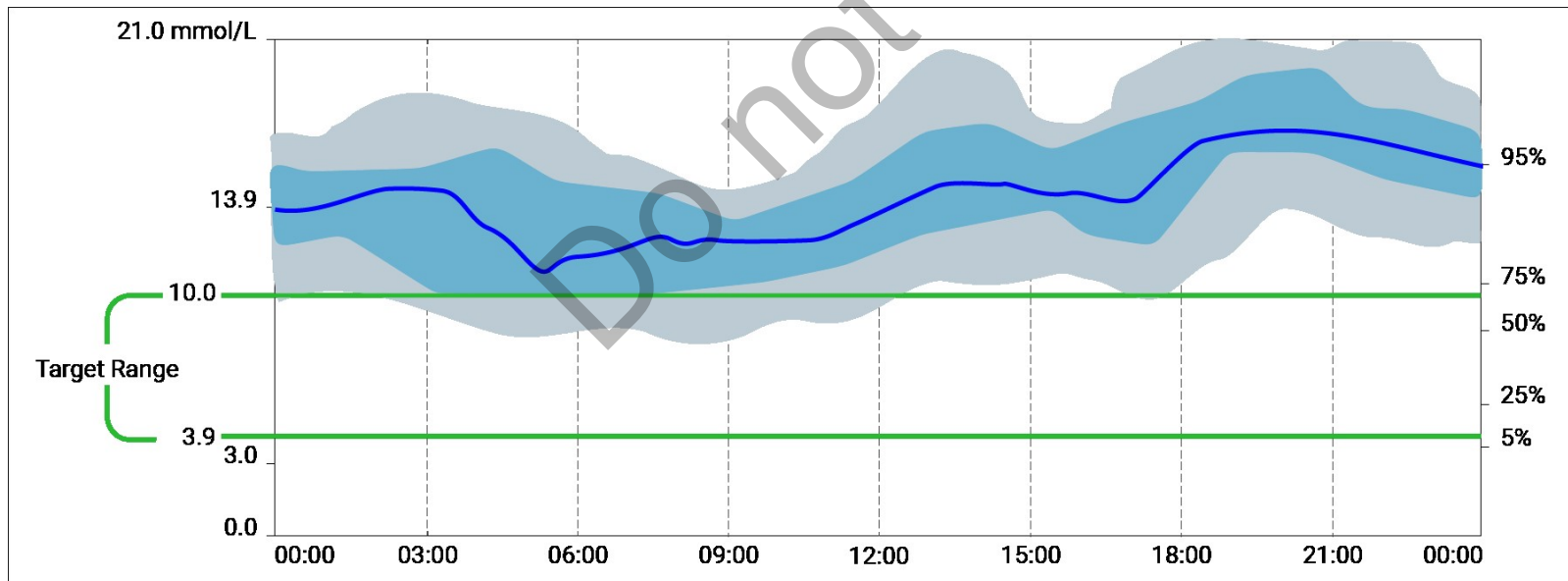
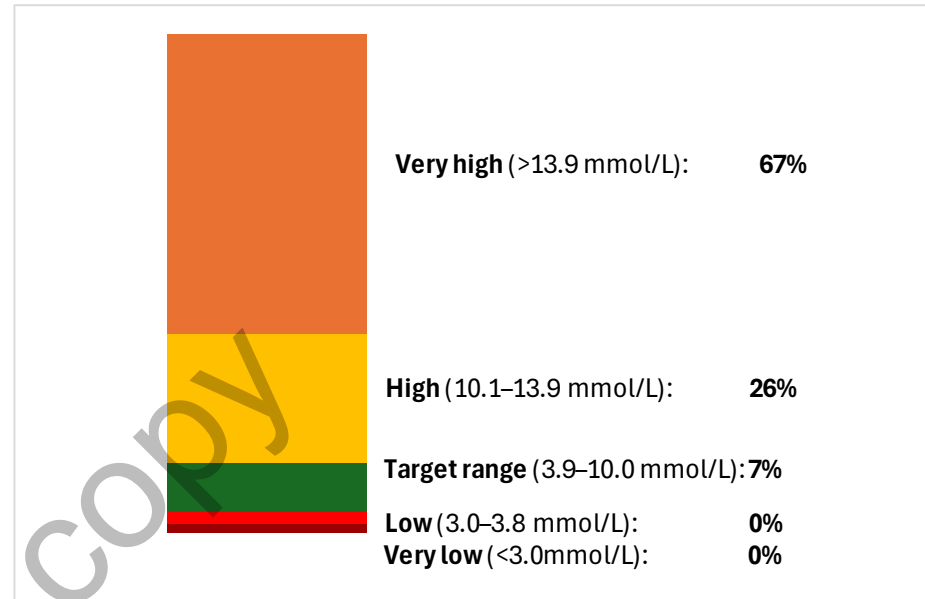
Time active: 84%

Average glucose: 15.1 mmol/L

Glucose Management Indicator (GMI): 9.8% or 84 mmol/mol

Variability (target: <36%): 21.2%

Time In Ranges

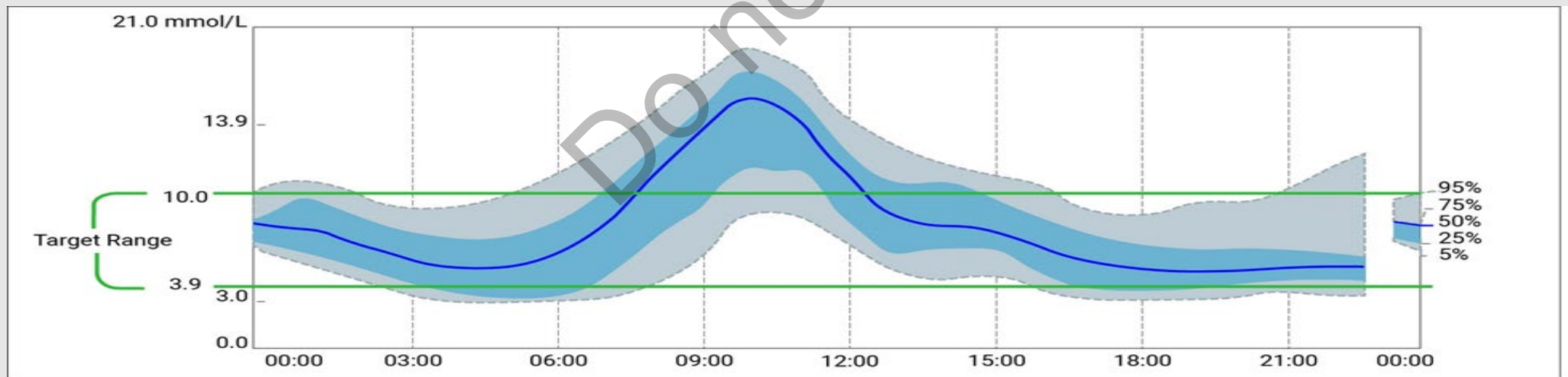


Review possible causes of high glucose levels

- Over-correction of hypoglycaemia
- Incorrect timing of insulin
- Missed insulin or diabetes medication
- Insufficient insulin doses/medication
- Other medications e.g. steroids
- Poor injection technique including injecting into areas of lypohypertrophy
- Meal size/high carbohydrate content
- Snacking
- Lifestyle
- Illness/stress
- Activity/daily routine
- Infection

CGM : Improving safety with HCP administered insulin

Insulin: Humulin I 28 units each Morning	Community Nursing POCT	Dose administered and signed for daily by DN visiting between 0900- 11.00hrs
Dose increased due to pattern of Hyperglycaemia. Target 6-15 mmol/L	15.8 19.3 17.8	No improvement in POCT. Advice sought re safety of further insulin dose increase. Short term CGM



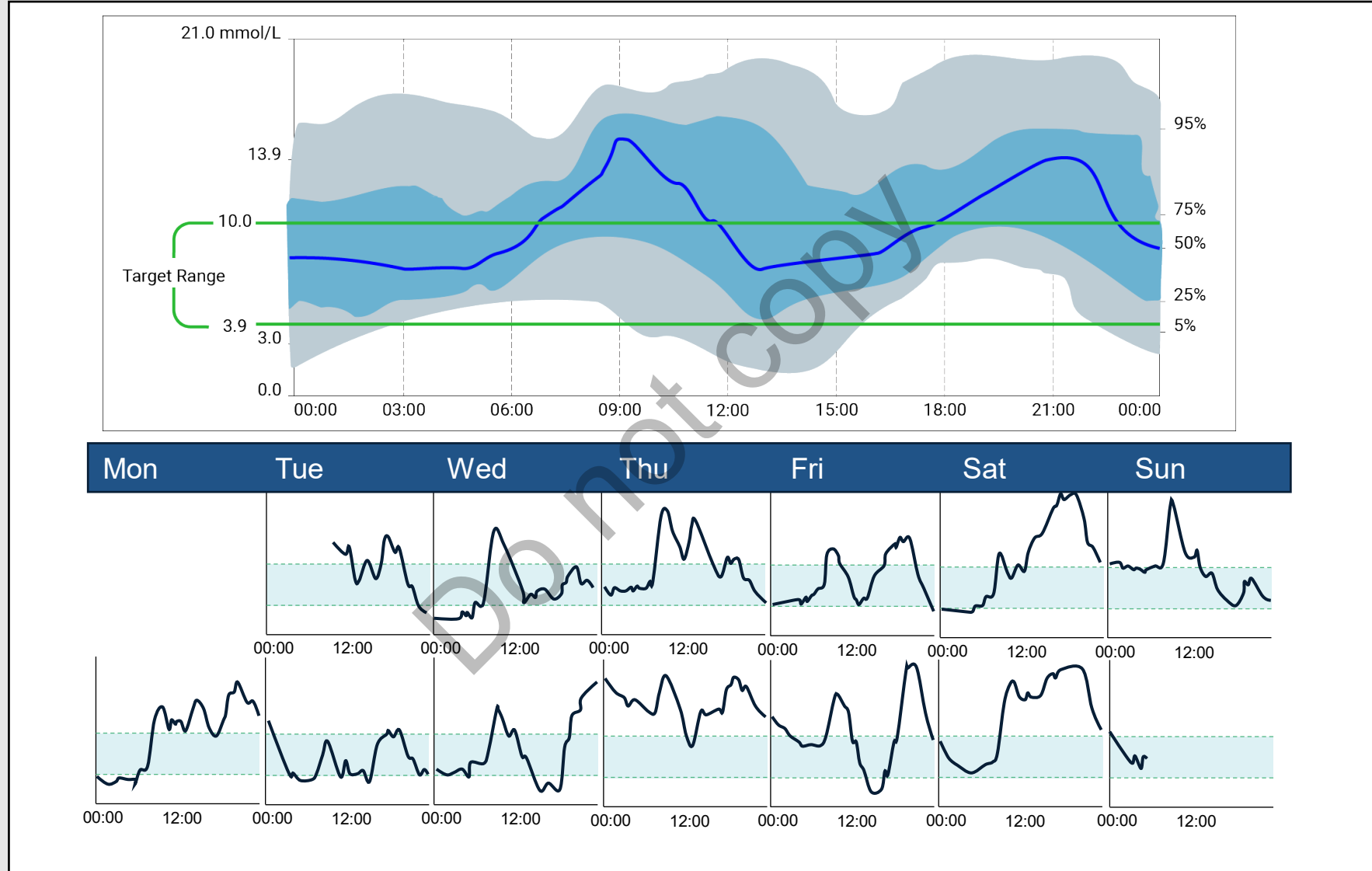
CGM : Improving safety with HCP administered insulin

- Discussion points:
 - TIR for frail elderly person with diabetes needs relaxing - Avoid hyper and hypoglycaemia symptoms
 - Basal insulin dose increased based on post prandial glucose levels
 - Hypoglycaemia undetected until CGM
 - POCT glucose surveillance remains the standard approach for all Community Nursing Teams
 - Supplementing with CGM can offer a safer approach to insulin management in this and similar cases.
- Insulin dose reduced until nocturnal hypoglycaemia eradicated
- Time In Range (TIR) improved, aiming for >50% TIR and <1% time below range (TBR)
- Advised carers to leave bedtime snack: Avoid long fasting state in care planning

Bill, age 74 years

- Attended for annual review of diabetes in GP practice
- Takes basal–bolus regimen insulin:
 - Basal dose insulin: 14 units
 - Varies dose of prandial insulin depending on current glucose levels and food consumed
- Has severe frailty
- HbA1c: 60 mmol/mol

How can we help Bill?



Bill: Recommended next steps

- If Bill had Type 1 diabetes?
- If Bill had type 2 diabetes
- Insulin regimen options?
- Oral therapy options?
- HbA1c Target
- TIR
- Ongoing support

Do not copy

Summary

- Next generation CGM – Improved functionality – The technology is evolving at pace
- Signposting resources that can assist capacity and demand management
- Self-care is the primary indication for CGM
- Back up SMBG is still required
- Signposting to credible resources to help HCP's keep up to date
- Some data analysis examples where CGM review within an individualised plan of care can improve safety & stability of glucose control

Thank you!

Resources

- *Six Steps to Insulin Safety* e-Learning module
<https://diabetesonthenet.com/cpd-modules/the-six-steps-to-insulin-safety>
- Injection Technique Matters
<https://trenddiabetes.online/injection-technique-matters/>
- FreeStyle Libre Tutorials & Downloads
<https://www.freestyle.abbott/uk-en/support/tutorialsanddownloads>
- Dexcom Education & Resources
<https://uk.provider.dexcom.com/education-and-resources>
- Diabetes Technology Network (DTN-UK)
<https://abcd.care/dtn-uk/resource-taxonomy/diabetes-technology-network>

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