

Continuous Glucose Monitoring

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What Is CGM?

- ▶ Real-time glucose monitoring (rtCGM) & intermittently scanned CGM (isCGM) measure glucose levels via interstitial fluid without the need for routine capillary BGM
- ▶ rtCGM records glucose levels continuously and sends data via a transmitter or via Bluetooth to a smartphone
- ▶ isCGM is not linked to a smartphone, the wearer needs to scan the sensor to obtain the data using a reader/receiver
- ▶ Small sensors are worn on the arm or abdomen
- ▶ Measures interstitial glucose every 1–5 minutes.
- ▶ Devices: Dexcom, Freestyle Libre, Medtronic Guardian, etc.

Systems currently available on the NHS

	FreeStyle Libre 2 and Libre 3 systems	Dexcom ONE+	GlucoRx AIDEX	GlucoMen Day
Type of CGM	Libre 2: isCGM/rtCGM* Libre 3: rtCGM	rtCGM	rtCGM	rtCGM
Sensor life	15 days (Libre 2 Plus) 14 days (Libre 3)	10 days	14 days	14 days
Transmitter life	n/a	n/a	4 years	5 years
Warm-up time	1 hour	30 minutes	1 hour	55 minutes
Calibration required?	No	No	No	Every 48 hours

FreeStyle Libre 2 system



- Sensor life: 15 days (Libre 2 Plus sensor)
- *With a reader:*
 - Sensor needs to be scanned at least every 8 hours
 - Data is enhanced from 6 scans per day or more
 - Shows data from the last time the sensor was scanned
- *With a smart device:*
 - Sensor transmits glucose data every minute continuously
 - Shows current data
- The reader or device shows:
 - Glucose reading
 - Graph showing latest 8 hours of glucose data
 - Trend arrow

Dexcom ONE+



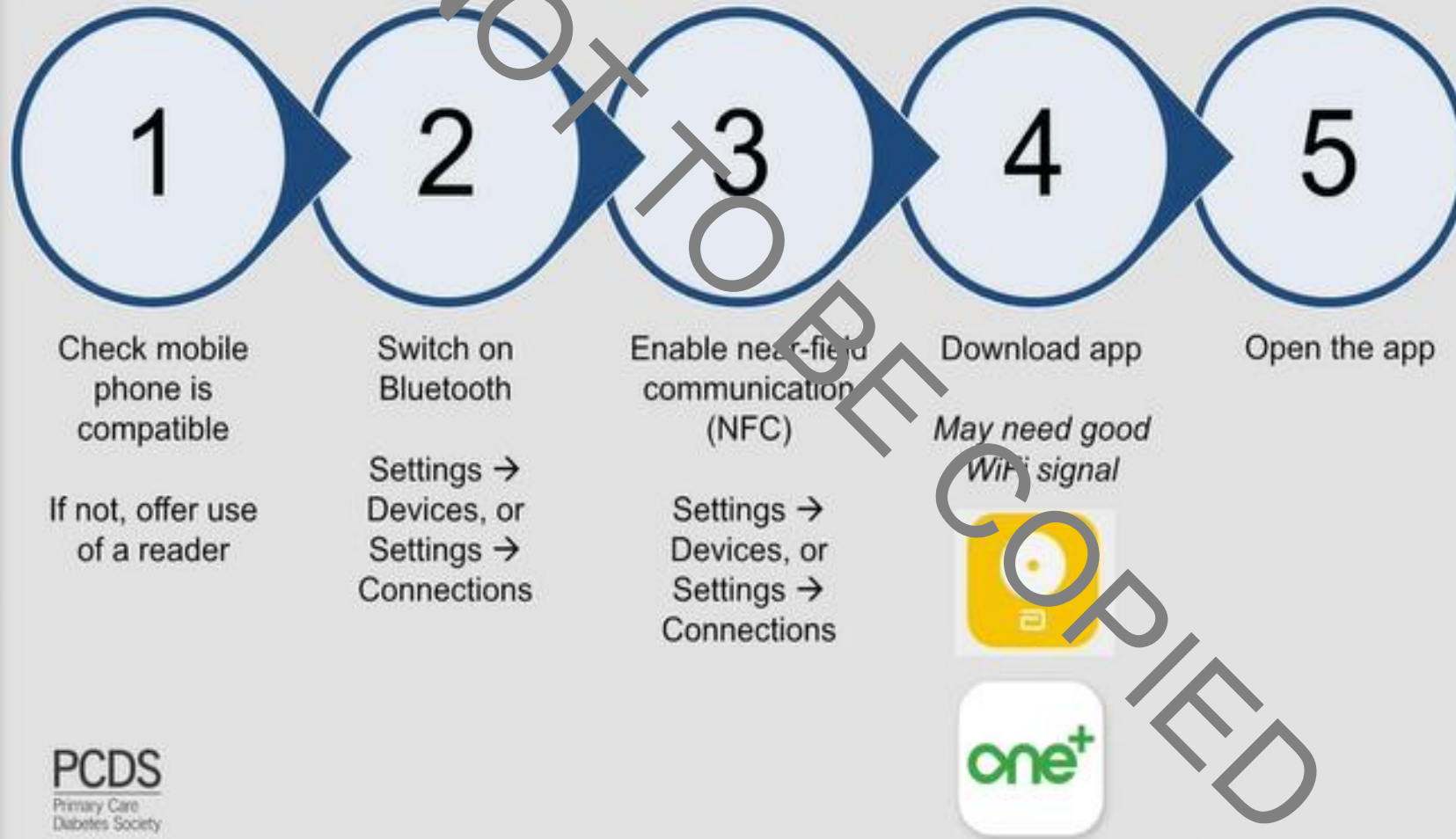
Smart devices sold separately

PCDS

Primary Care
Diabetes Society

- Sensor life: 10 days
- Provides real-time and predictive glucose data
- A small sensor on the arm or abdomen (or, for children 2–6 years, on the upper buttocks) sends glucose data continually via Bluetooth to a compatible mobile app or reader
- The reader or device shows:
 - current glucose reading
 - option to view 3, 6, 12 or 24 hours of glucose data
 - trend arrow

How to get started using a smart device



Starting advice

- ▶ Check glucose frequently
- ▶ On waking, pre-meals, 2-3 hours post meals and before bed
- ▶ Pre and post and during exercise
- ▶ When to check blood glucose using a blood glucose meter?
 - ▶ Not displaying a number/arrow
 - ▶ Readings don't match symptoms
 - ▶ If in doubt, get your meter out

POTENTIAL BENEFITS OF CGM

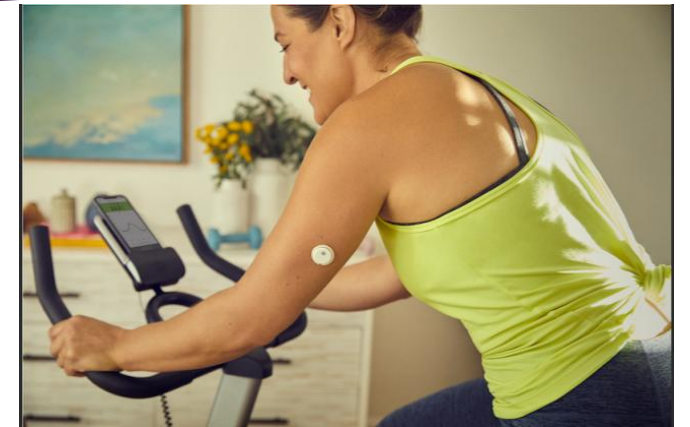
- ▶ Reduces finger-prick testing
- ▶ Trend arrows can help avoid hypoglycaemia/hyperglycaemia
- ▶ Alarms can be set to alert the user to hypo/hyper events
- ▶ Helps improve HbA1c and glucose time in range, reducing risk of long term complications
- ▶ Has been shown to improve outcomes in pregnancy
- ▶ Benefits for those both on insulin pumps & pens
- ▶ Data can be shared with HCPs
- ▶ Cost effective in Type 1 diabetes compared to finger-pricking
- ▶ Positive impact on QOL
- ▶ To make the most of it:
 - ▶ Wear it/: ideally more than 70% of time
 - ▶ Use the alarms to aid hypo avoidance

POSSIBLE DISADVANTAGES

- ▶ Data overload can cause confusion or worry for some users
- ▶ Interstitial fluid glucose time lag; finger-prick test is required in periods of rapidly changing glucose levels
- ▶ CGM should not be prescribed if person unable to use capillary BGM
- ▶ Possible sensor problems – skin irritation or adhesive failure
- ▶ Group 2 drivers still need to check capillary BG as per DVLA regulations

Factors to consider

- ▶ Accuracy of device
- ▶ Availability of alerts or alarms
- ▶ Access to technologies e.g smartphone, phone software
- ▶ Ease of use
- ▶ Fear, frequency, awareness & severity of hypos
- ▶ Psychosocial factors
- ▶ Insulin pump connectivity
- ▶ Data collection & sharing information
- ▶ Would device affect job
- ▶ Sensor renewal & placement
- ▶ Body image



SENSOR INSERTION

Different Dexcom G6 and G7 systems have different sensor sites for sensor insertion. These are the back of the arm, the abdomen and upper buttocks.*

Find more information on how to insert the sensor [dexcom.com/learn](https://www.dexcom.com/learn)

UPPER BUTTOCKS

Dexcom G6: Ages 2-17
Dexcom G7: Ages 2-6
Dexcom ONE+: Ages 2-6



BACK OF THE UPPER ARM

Ages 2+



ABDOMEN

Ages 2+



*Please check individual Dexcom User Guides as to the age limits for sensor insertion sites.

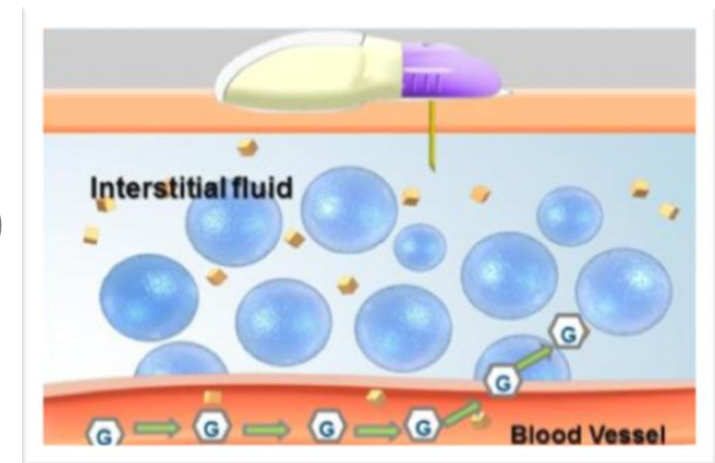
CGM ALARMS

- ▶ Avoid hypos
 - ▶ Alarms when glucose goes low
 - ▶ Alarms when glucose falling
- ▶ Avoid high
 - ▶ Alarms when the glucose is rising

When starting on CGM consider turning off high alarms

Blood glucose vs Interstitial

- ▶ Closely related but not identical
- ▶ Estimated time lag by Freestyle Libre 2 is 2.4mins in adults & 2.1mins in children
- ▶ Dexcom One has a time lag of around 4 mins
- ▶ In times of rapidly changing glucose levels (e.g after eating or exercise) or symptoms of hypos a fingerprick is indicated



Finger-prick Testing

- ▶ People still need access to finger-prick testing whilst using CGM
- ▶ In times of rapidly changing glucose levels
- ▶ When symptoms don't match the sensor reading
- ▶ Group 2 driver (e.g large lorries & buses)
- ▶ In event of CGM failure



NI GUIDANCE for CGM – Type 1 Diabetes

(June 2025)

- ▶ Criteria: offer glucose monitoring devices to adults with:
 1. Type 1 Diabetes AND
 2. Attending secondary care
- ▶ When choosing a glucose monitoring sensor device:
 - ▶ Use shared decision making, identifying needs & preferences
 - ▶ If multiple devices meet their needs offer the device with lowest cost

NI guidance - Type 2 Diabetes (June 2025)

- ▶ Criteria for glucose monitoring devices
 - ▶ Type 2 Diabetes attending secondary care clinic AND
 - ▶ Taking ≥ 2 insulin injections daily AND have one of the following
 - ▶ Recurrent hypoglycaemia or severe hypoglycaemia
 - ▶ Impaired hypoglycaemia awareness
 - ▶ A condition or disability (including learning disability or cognitive impairment) that means they cannot SMBG
 - ▶ Would otherwise be advised to self-measure at least 8 times a day
 - ▶ Insulin treated T2D who would otherwise need help from a care worker or HCP

Supply of sensors and readers

At present the following sensors are available on this pathway:

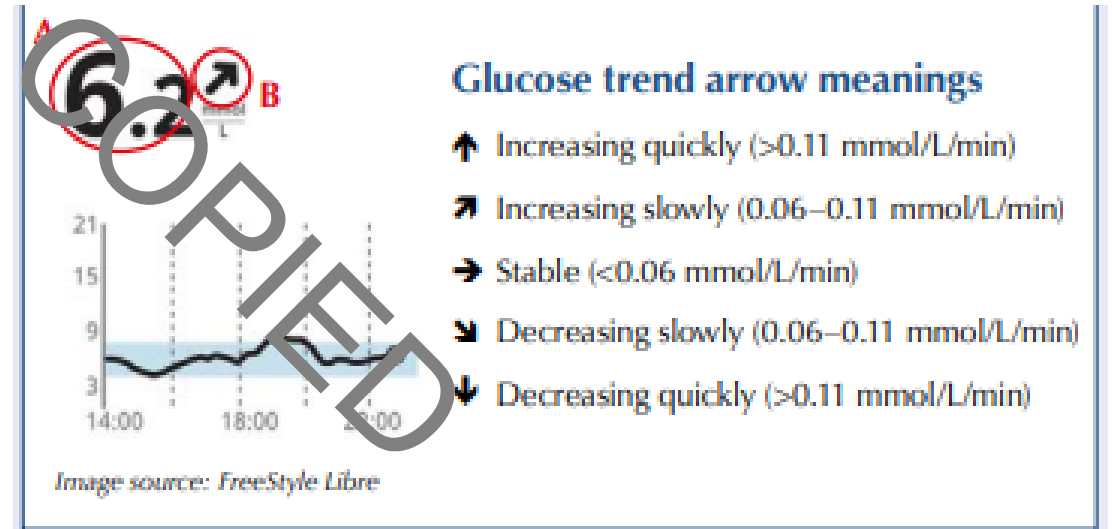
- Dexcom ONE +®
- Freestyle Libre 2 Plus®
- Freestyle Libre 3 Plus® (This sensor must ONLY be prescribed as part of a Hybrid closed loop system with CareAPS FX control algorithm & Ypsopump insulin pump).

These sensors are listed on the N.Ireland Drug Tariff (June 2025) and do NOT require capillary glucose checks for either treatment decisions or calibration.

Sensor Name	Length of time sensor lasts	Pack Sizes available	Maximum quantity to prescribe	Transmitter required Y/N	Reader Available Y/N (for patients who are unable to access or use the smartphone application)
Dexcom ONE +®	10 days	Pack size 1	Prescribe 3 sensors every 30 days	No	Yes, but not prescribable. (based on an assessment of specific patient needs).
Freestyle Libre 2 Plus®	15 days	Pack size 1	Prescribe 2 sensors every 30 days	No	Yes, but not prescribable. It is available free of charge from Abbott (based on an assessment of specific patient needs).

What information/data does CGM provide

- ▶ Current interstitial glucose level (A)
- ▶ Trend Arrows show the direction the glucose is heading & the rate of change (B)
- ▶ Daily patterns
- ▶ Low glucose events



Reviewing data

- ▶ Respect person's data
- ▶ Seek permission to review
- ▶ Avoid negative language
- ▶ Common areas causing variability and/or reduced TIR



Step 1 – Assess user history

1. Quality of data
 - ▶ Number of days worn (aim for 14)
 - ▶ percentage of time CGM is active (aim for >70% of the time)
2. Insulin therapy
 - ▶ What insulin
 - ▶ MDI or insulin pump
 - ▶ Basal and bolus doses
3. Physical activity
4. Working or non-working days
5. Illness – any additional therapy (e.g steroids)

Step 2 Assess Time in Range (TIR)

- ▶ Overall goal (Type 1 & Type 2 Diabetes):
- ▶ Aim for >70% - TIR 3.9-10.0mmol/L
- ▶ Minimise Time Below Range (TBR) - <4%
- ▶ Minimise Time Above Range (TAR)

Step 2: Assess Time In Range (TIR)

Overall goal (type 1 and 2 diabetes):

Aim for >70% of the day
with blood glucose 3.9–10.0 mmol/L

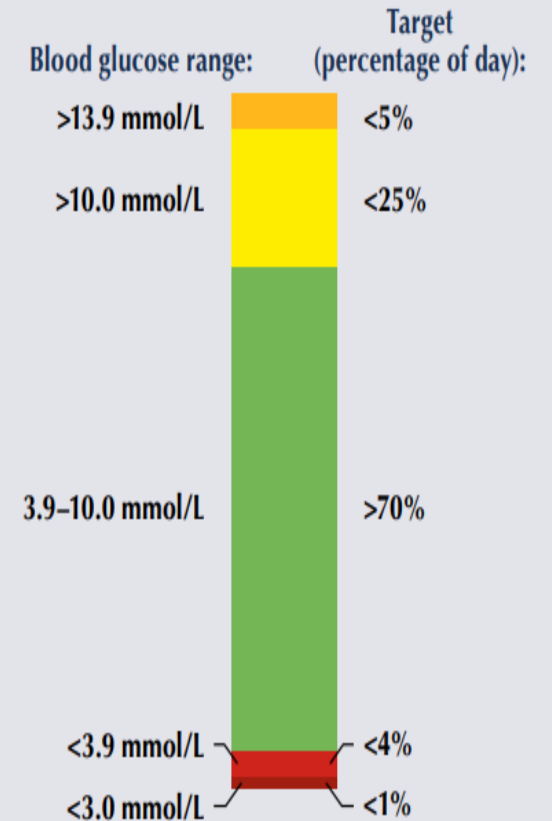
Priority 1:

Minimise Time Below Range
(<3.9 mmol/L)

Priority 2:

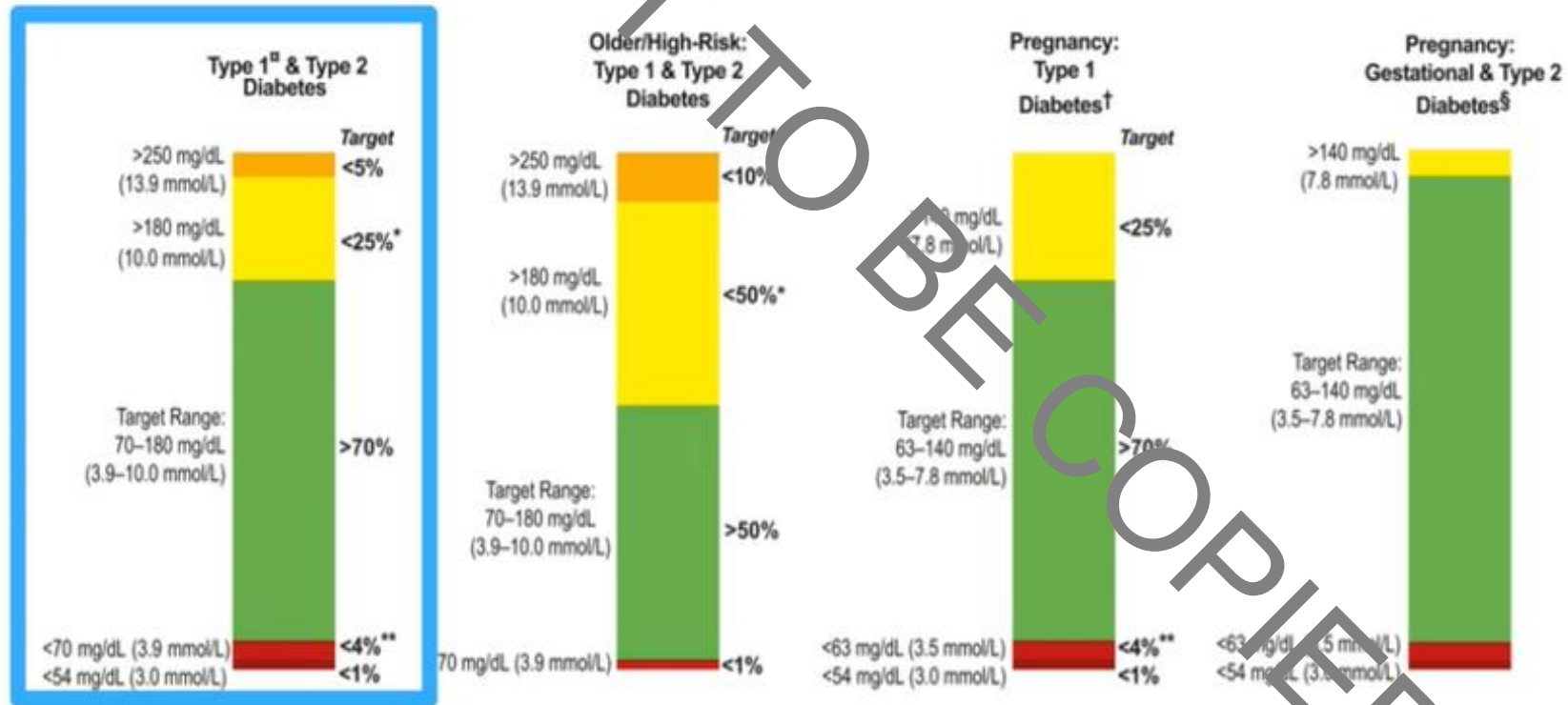
Then minimise Time Above Range
(>10.0 mmol/L)

Note: A TIR of 70% reflects an HbA_{1c} of 53 mmol/mol (7.0%), while each 10% increase in TIR represents an HbA_{1c} reduction of 5 mmol/mol (0.5%).



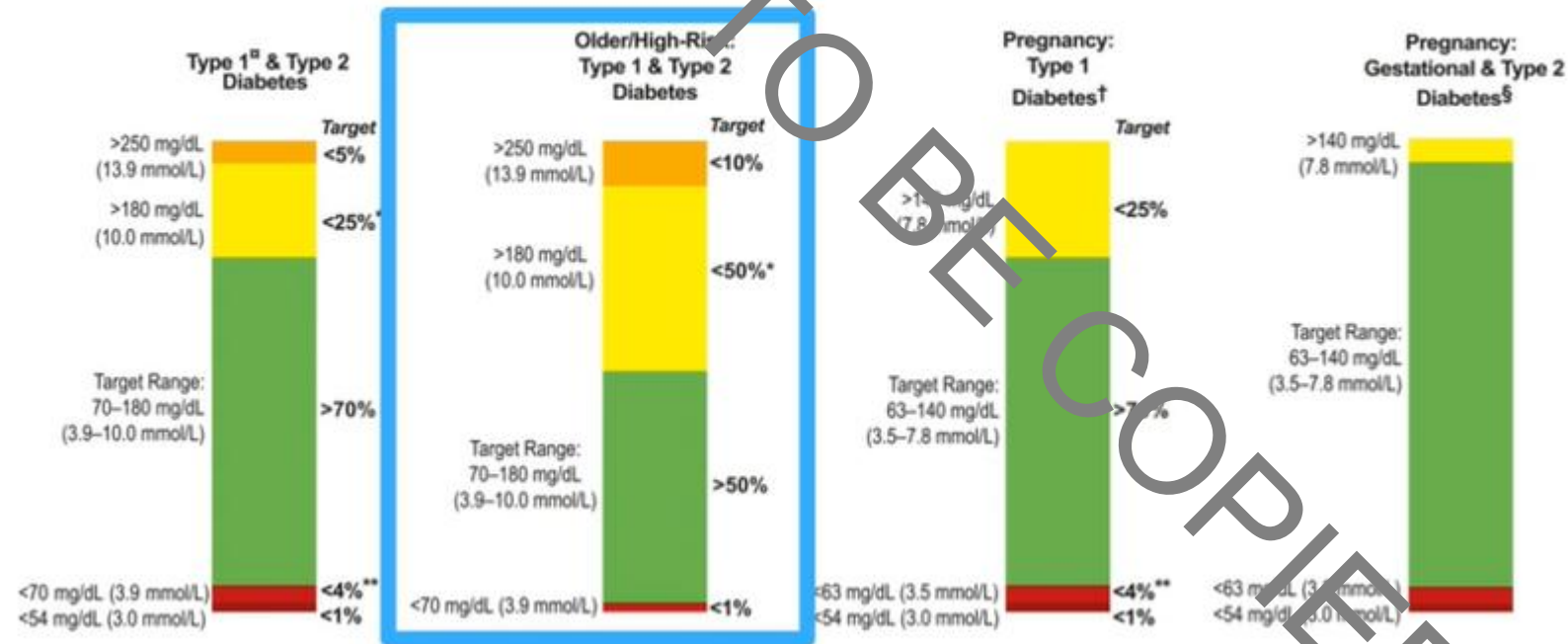
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TIME IN RANGE



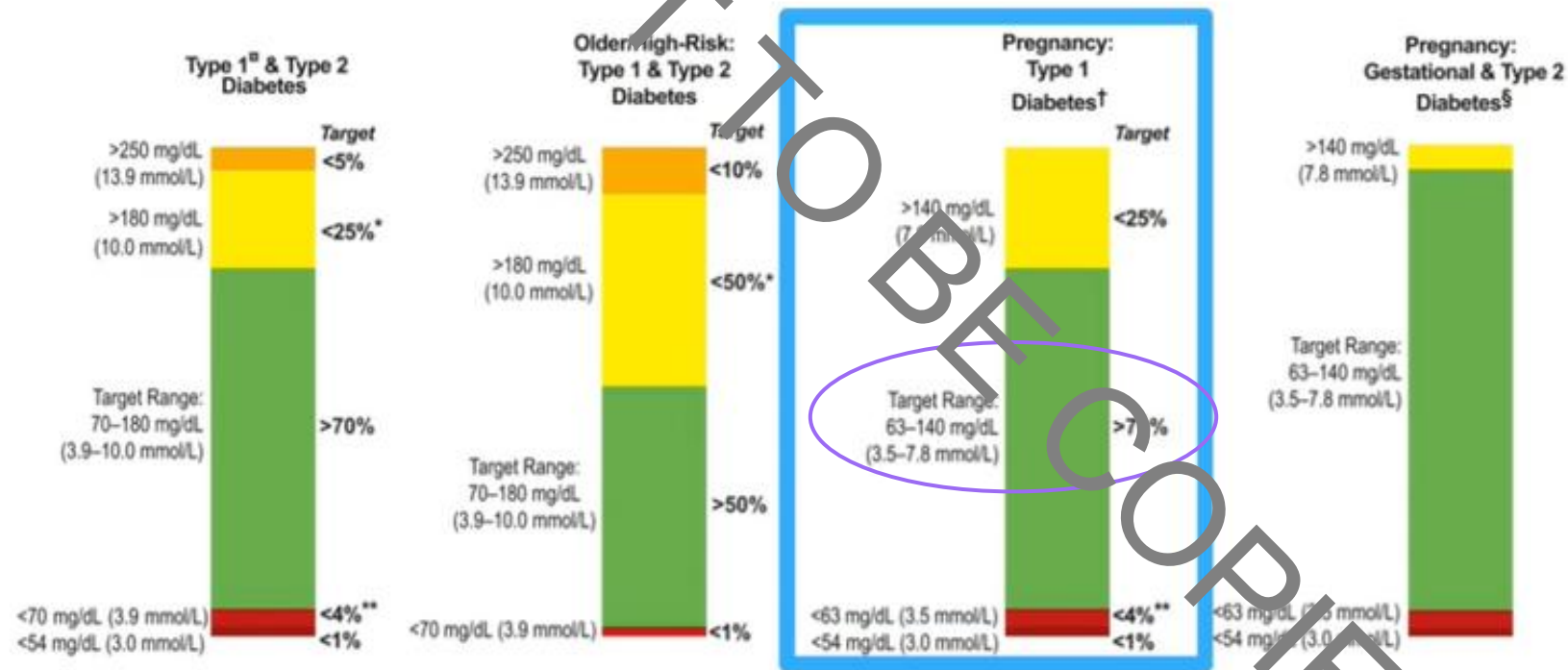
Battelino et al. Diabetes Care 2019 International Consensus on Time in Range

TIME IN RANGE



Battelino et al. Diabetes Care 2019 International Consensus on Time in Range

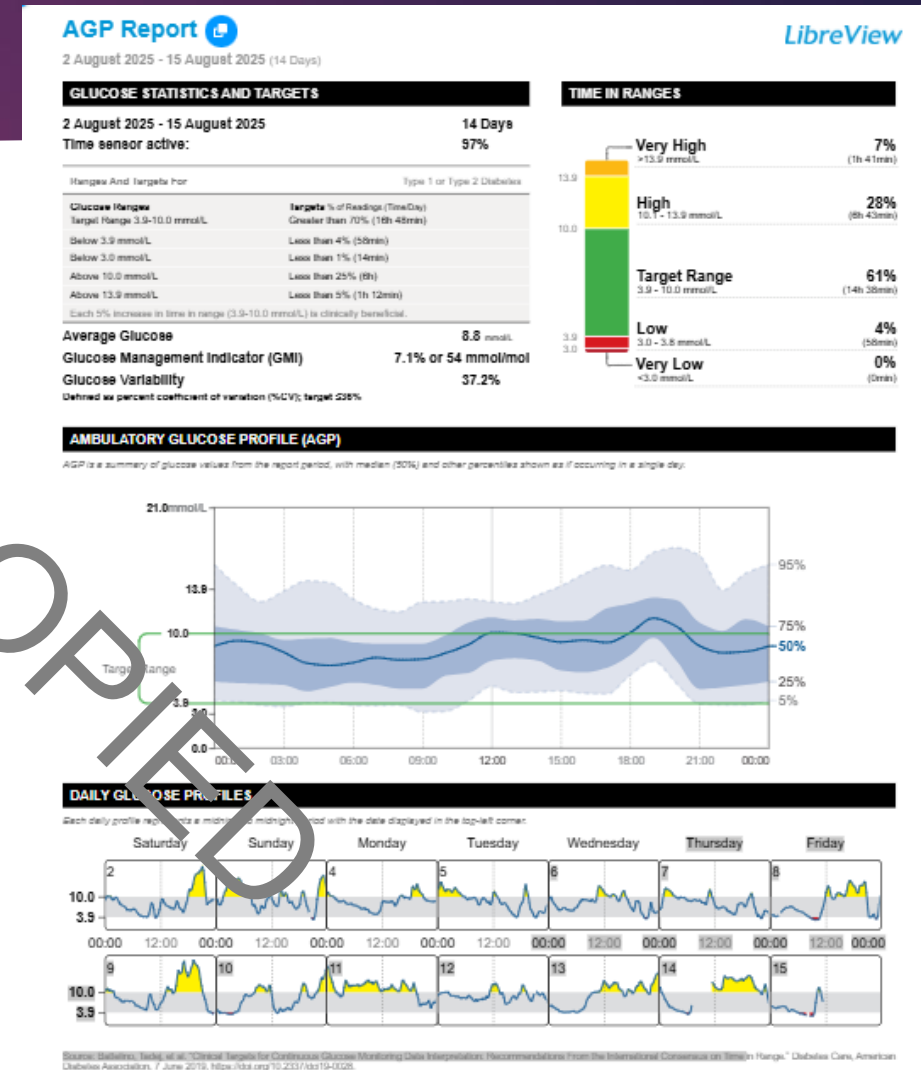
TIME IN RANGE



Battelino et al. Diabetes Care 2019 International Consensus on Time in Range

Step 3 - Review the AGP – Ambulatory glucose profile

- Overview of AGP report layout
- Spot trends: postprandial spikes, nocturnal hypoglycaemia
- Identify patterns for insulin adjustment or lifestyle intervention

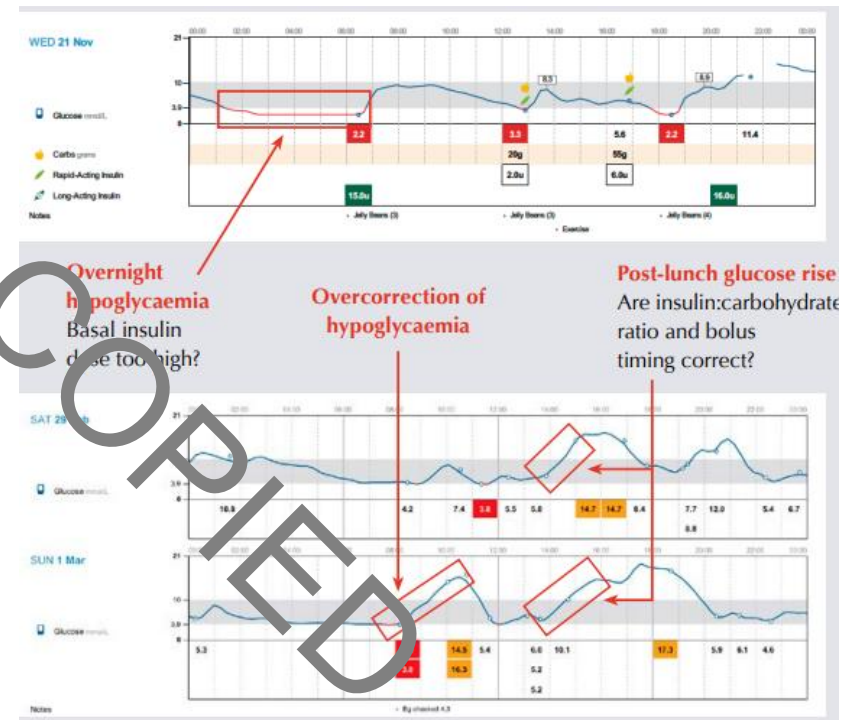


Step 4 – Review daily traces

- ▶ Look for daily patterns
- ▶ Look at baseline glucose levels overnight and after meals
- ▶ Look at prandial glucose excursions



Caution: Avoid initiating change without clear patterns – may need longer to collect data.



Driving

- ▶ CGM can be used for glucose monitoring for group 1 (car & motorcycle) drivers. However finger prick glucose equipment must be carried & used to confirm glucose levels when:
 - ▶ Glucose level reads ≤ 4.0 mmol/L
 - ▶ Symptoms of hypo or CGM is inconsistent with symptoms
- ▶ Group 2 drivers still need to finger-prick
- ▶ Republic of Ireland advice is to use blood glucose monitoring

Travel

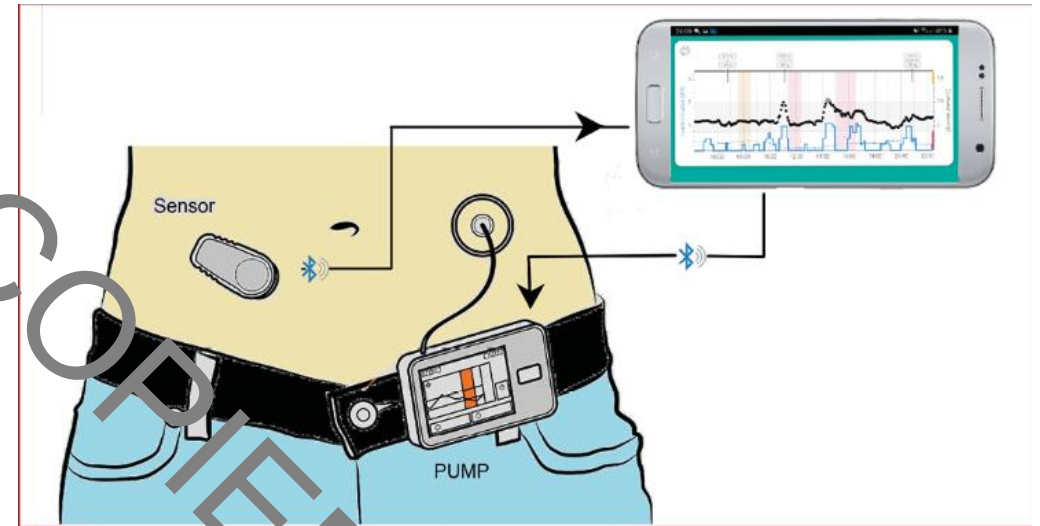


- ▶ Users are advised not to go through full-body scanners or put components through x-ray baggage scanners
 - ▶ This may vary according to manufacturer
 - ▶ <https://bit.ly/CAAcards>
- ▶ Users can swim, shower & Bathe
 - ▶ Dexcom One+ Sensor: waterproof to 2.4metres of water for up to 24 hours
 - ▶ Freestyle Libre 2+ & Libre 3: sensor water resistant to 1 metre of water for up to 30mins
- ▶ In water the display device needs to be closer than 6 metres to get sensor readings

Hybrid Closed Loop system – HCL

3 elements to the HCL system

1. A real-time CGM device
2. An insulin pump
3. A computerised algorithm held either on the pump or on smartphone, that continuously uses data from the CGM device to regulate insulin delivery via the pump



Key benefits of using CGM

- ▶ Effectively reduce hypo/hyperglycaemia
- ▶ Improve HbA1c
- ▶ They have been shown to improve outcomes in pregnancy
- ▶ Benefits for both those on insulin pens and insulin pumps

Questions?

THANKYOU FOR LISTENING