

AROUND THE WORLD WITH CGM?



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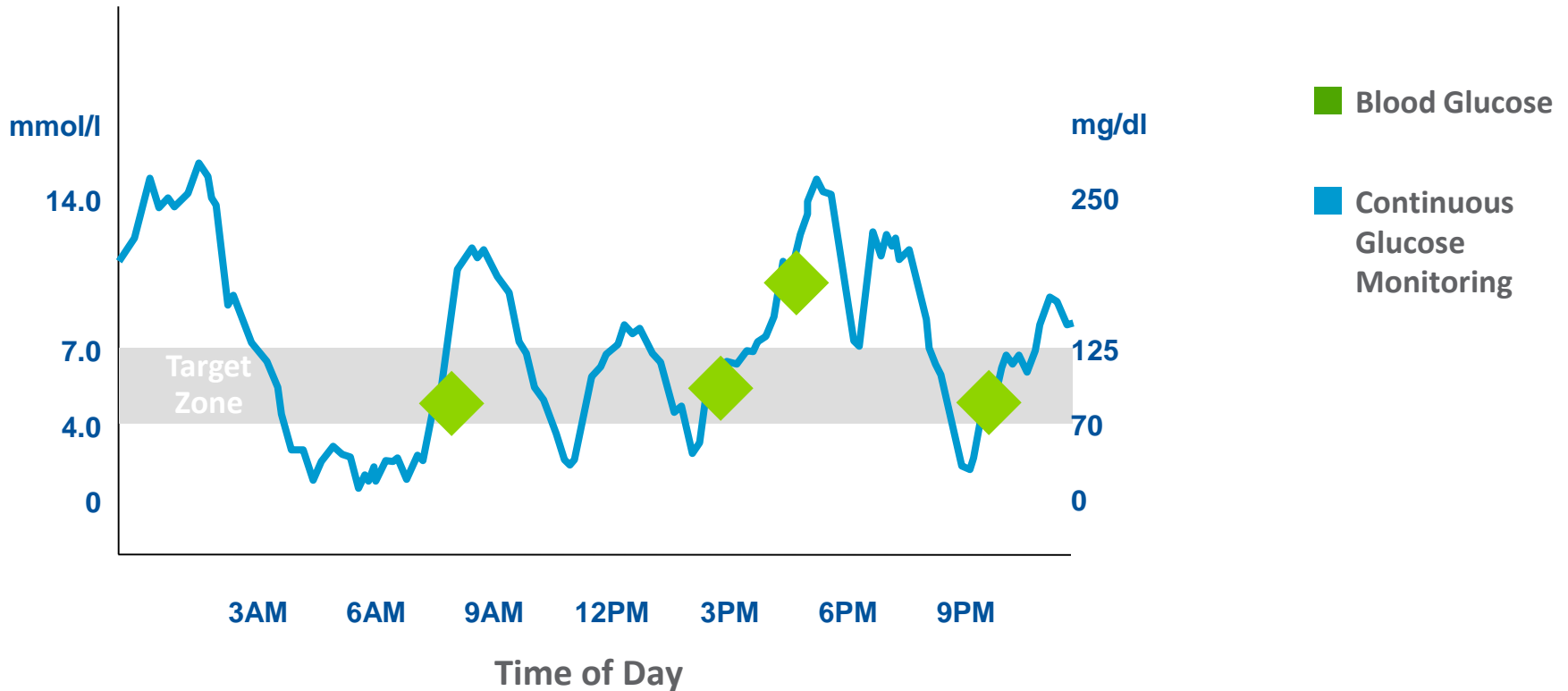
WHAT DO I KNOW ABOUT CGM?



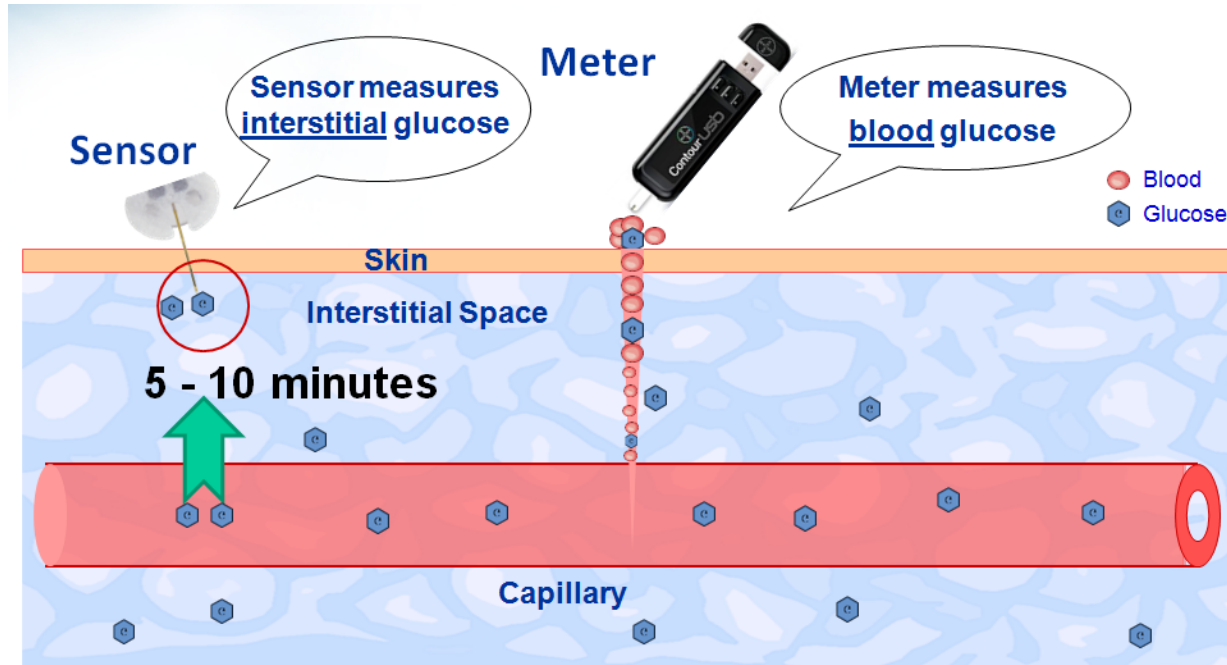
<http://www.diabeticmuscleandfitness.com/>

<http://mm640g.blogspot.com/>

WHAT IS THE DIFFERENCE BETWEEN BLOOD GLUCOSE AND CGM?

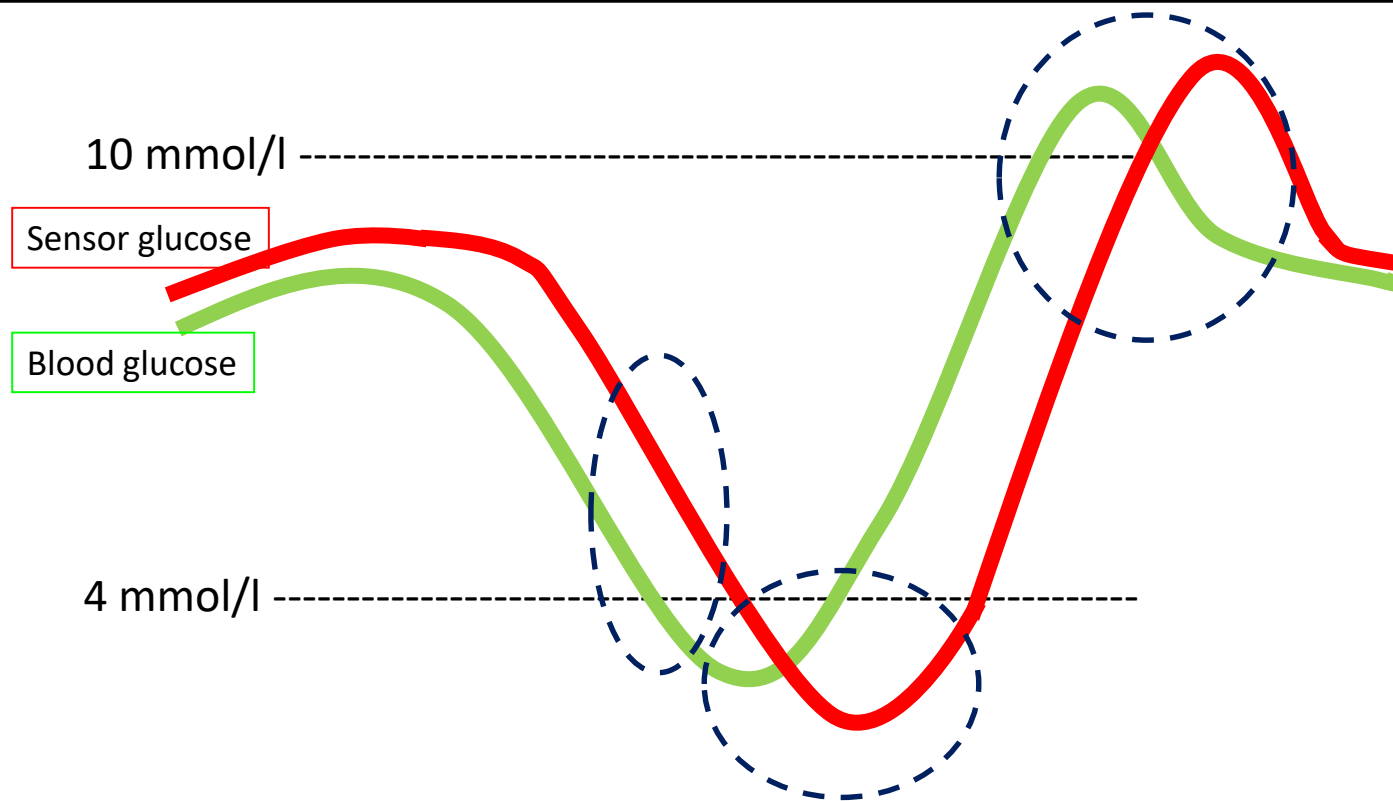


WHAT IS THE DIFFERENCE BETWEEN FINGER PRICK AND CGM?

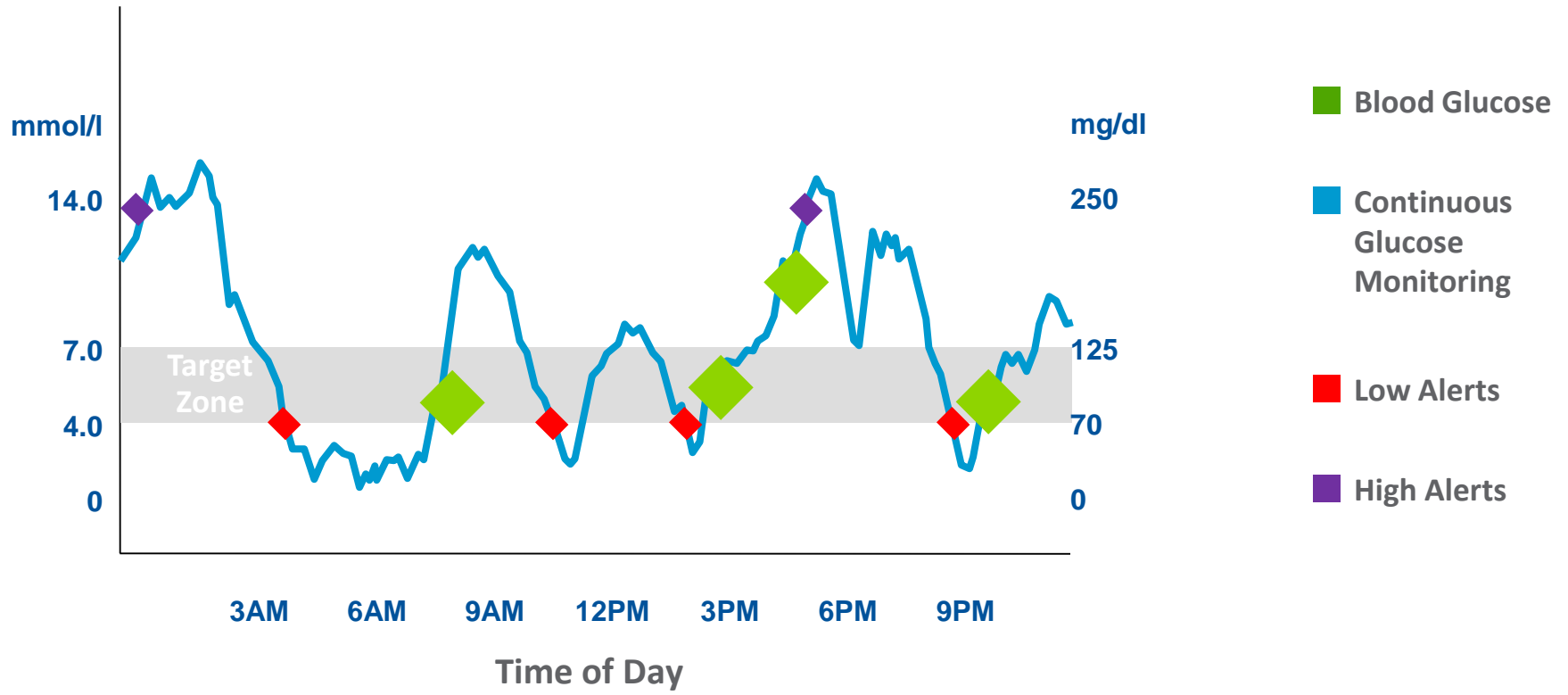


Electrical signals generated from the oxidation of glucose are recorded by the sensor, the signals are “calibrated” with meter readings to calculate CGM values

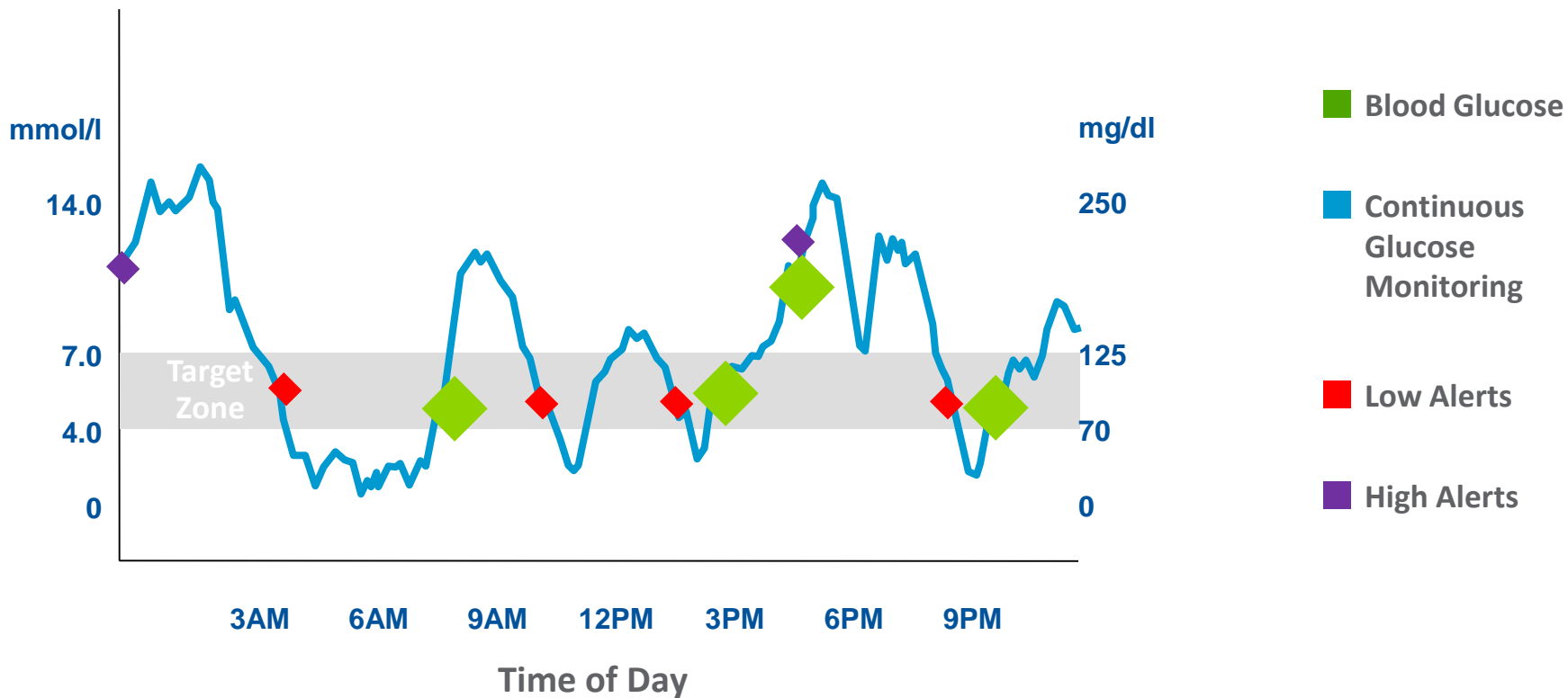
THE LAG TIME 5-10 MINUTES



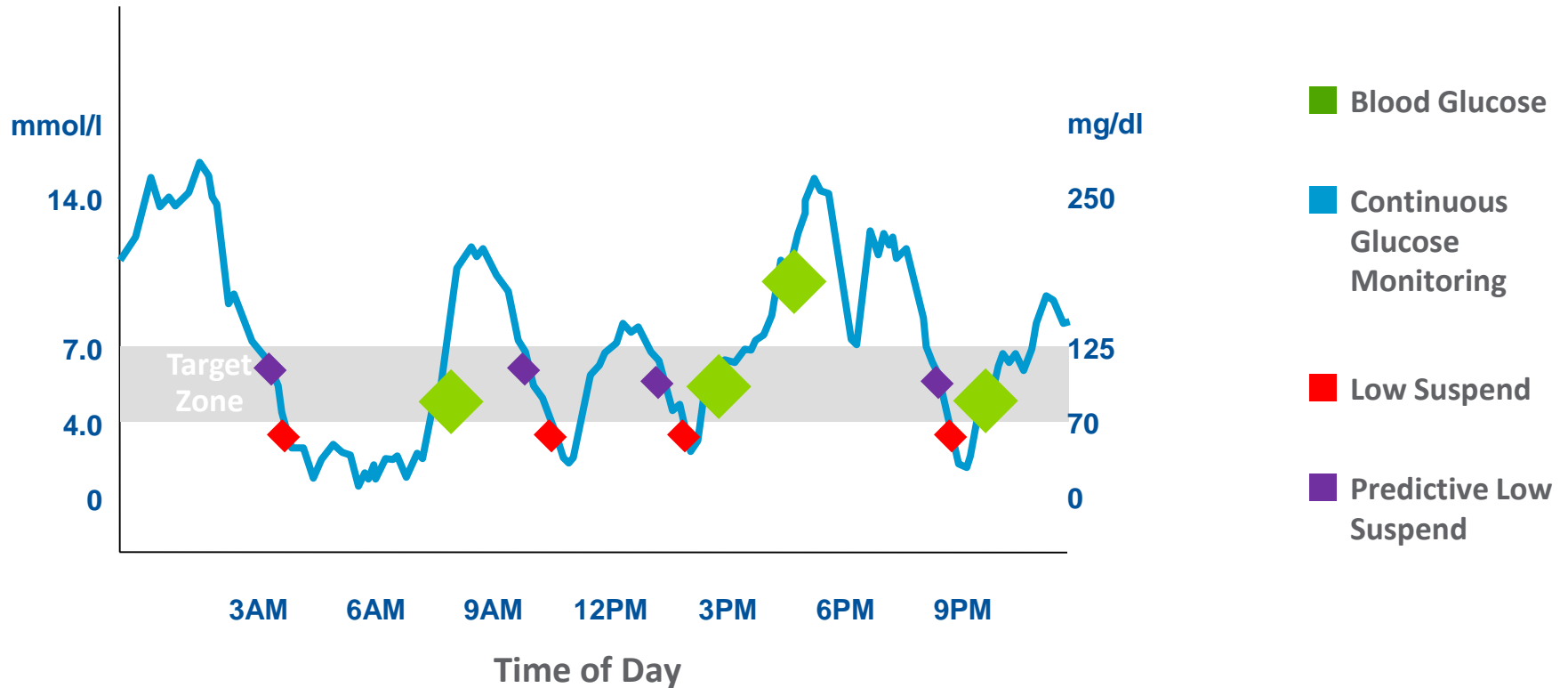
LOW AND HIGH ALERTS



PREDICTIVE LOW AND HIGH ALERTS

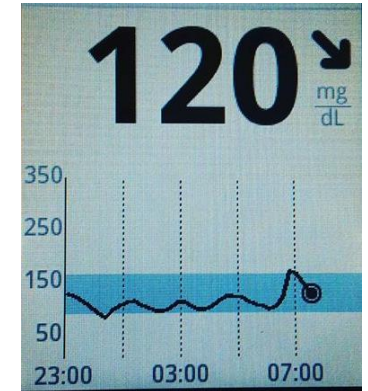


LOW SUSPENDS AND PREDICTIVE LOW SUSPENDS ON A PUMP



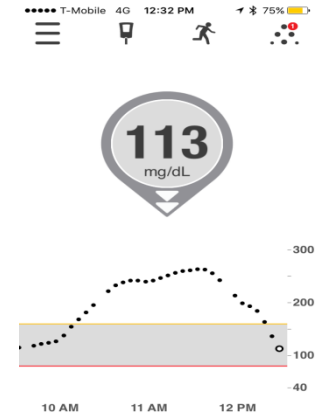
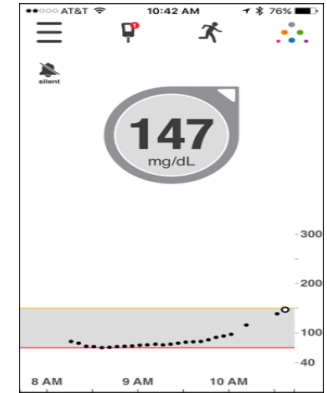
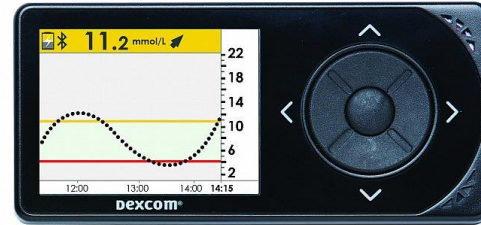
WHAT DO THE TREND ARROWS MEAN - LIBRE

RATE OF CHANGE 15 MINUTES MMOL/L	FREESTYLE LIBRE	RATE OF CHANGE 15 MINUTES MG/DL
>1.7 mmol/l	↑ OR ↓	>30mg/dl
0.8 - 1.7 mmol/l	↗ OR ↘	12 - 30mg/dl
0.0 - 0.8 mmol/l	→	0 - 12mg/dl



WHAT DO THE TREND ARROWS MEAN - DEXCOM

RATE OF CHANGE	DEXCOM	RATE OF CHANGE
15 MINUTES		15 MINUTES
MMOL/L	G5 & G4	MG/DL
>2.50	↑↑ OR ↓↓	>45mg/dl
>1.7	↑ OR ↓	>30mg/dl
0.8 - 1.7	↗ OR ↘	12 - 30mg/dl
0.0 - 0.8	→	0 - 12mg/dl



WHAT DO THE TREND ARROWS MEAN - MEDTRONIC

RATE OF CHANGE	MINIMED	RATE OF CHANGE
15 MINUTES	5306/6406	15 MINUTES
MMOL/L	GUARDIAN	MG/DL
>2.50	↑↑↑ OR ↓↓↓	
mmol/l	N/A 530G	>45mg/dl
>1.7		
mmol/l	↑↑ OR ↓↓	>30mg/dl
0.8 - 1.7		
mmol/l	↑ OR ↓	12 - 30mg/dl
0.0 - 0.8		
mmol/l	No arrow	0 - 12mg/dl



EVIDENCE: ACDC CONSENSUS GUIDELINE 2017

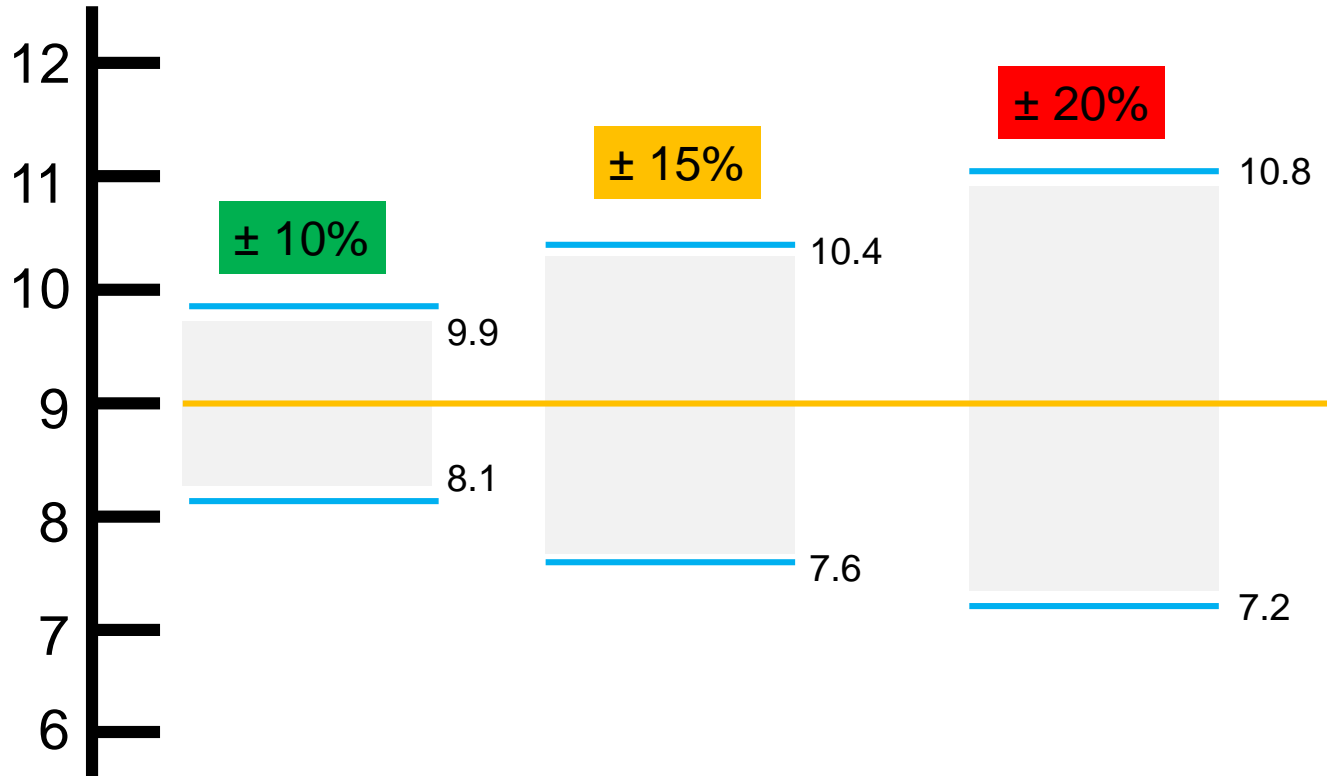
[HTTP://WWW.A-C-D-C.ORG/](http://www.a-c-d-c.org/)

- If used >70% of the time:
 - Improved Hba1c 0.5 - 2.0% (6 - 24mmol/mol)
 - Reduction in hypoglycaemia 20–40%
 - Improved quality of life
 - The more you use proactively the greater the benefit
 - Corrections between meals, temp basals,
 - Preventing hypos

NO TECHNOLOGY APPRAISAL, SO NO GUARANTEE!

- [NICE \(2015\) Type 1 Children - NG 18](#)
 - Offer Real-time with alarms; Hypo issues & Communication issues
 - Consider; pre-school, high level sports, co-morbid
- [NICE \(2016\) DG21 on integrated sensor augmented pumps-](#)
 - VEO for disabling hypo / MM640G / Vibe
 - ? 670G / Tandem with Dexcom / Future hybrids
- [NICE \(2016\) Quality Standard 4 on CGM for children and young people](#)
 - Children and young people with type 1 diabetes who have frequent severe hypoglycaemia are offered ongoing real-time continuous glucose monitoring with alarms.

WHAT IS MARD – MEAN AVERAGE RELATIVE DIFFERENCE?



CGM DEVICES MARD & FINGER STICK REPLACEMENT?

DEVICE	MARD %	FINGER STICK REPLACEMENT
Dexcom G6 -10 days Zero calibrations	9.8% Adults 9.8% Children	FDA Approval & CE Mark full replacement for adults and children
Dexcom G5 - 7 days 2 Calibrations	9.0% Adults 10% Children	G6 = Zero calibration G5 = 2 Calibrations
Freestyle Libre - 14 days Zero calibrations	11.4% Adults 13.9% Children	CE Mark Adults and children - Partial replacement FDA Approval on adults 10 days - Partial replacement
640G / Guardian Mobile - 6 days 2-4 Calibrations	13.0-14.0% Adults & children	No approval - all treatment decisions to be confirmed with a fingerstick
670G - 6 days 2-4 Calibrations	9% - 4 calibrations 10% - 2 calibrations	No approval - all treatment decisions to be confirmed with a fingerstick

NEW STANDARD FOR CGM DEVICES

Sensor Glucose Range	Percentage of sensor glucose readings within 15% of reference glucose for readings
<4.0mmol/l (<70mg/dl)	85%
4.0 - 10.0mmol/l (70-180mg/dl)	70%
>10.0mmol/l (>180mg/dl)	80%

Within 15% or 0.83mmol/l (15mg/dl)

Sensor Glucose
3.5mmol/l or 65mg/dl

Sensor Glucose 3.5mmol/l

+/- 0.83mmol/l = Blood Glucose 2.7 – 4.3mmol/l

Sensor glucose 65mg/dl

15mg/dl = Blood Glucose 50 – 80mg/dl

Sensor Glucose
10.0mmol/l or 180mg/dl

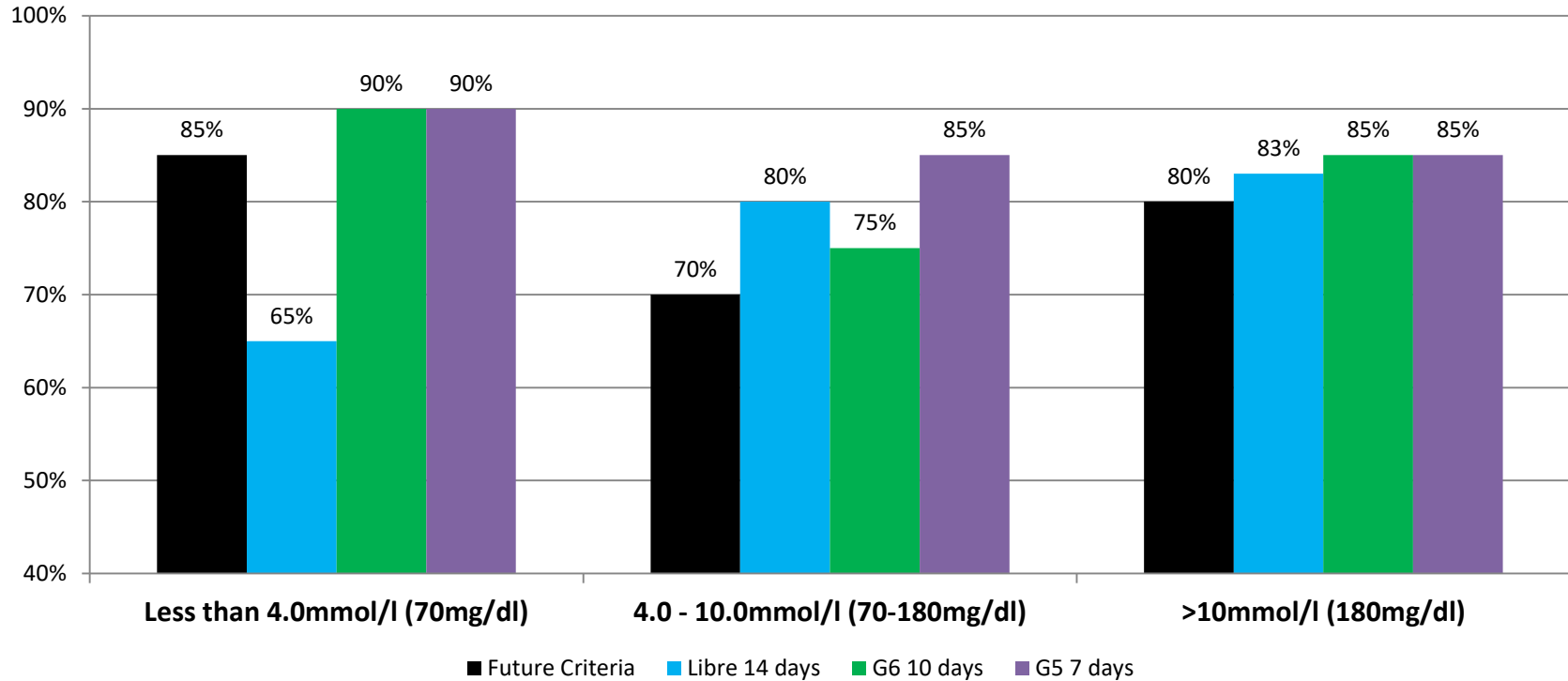
Sensor glucose 10.0mmol/l

15% = Blood Glucose 8.5 – 11.5mmol/l

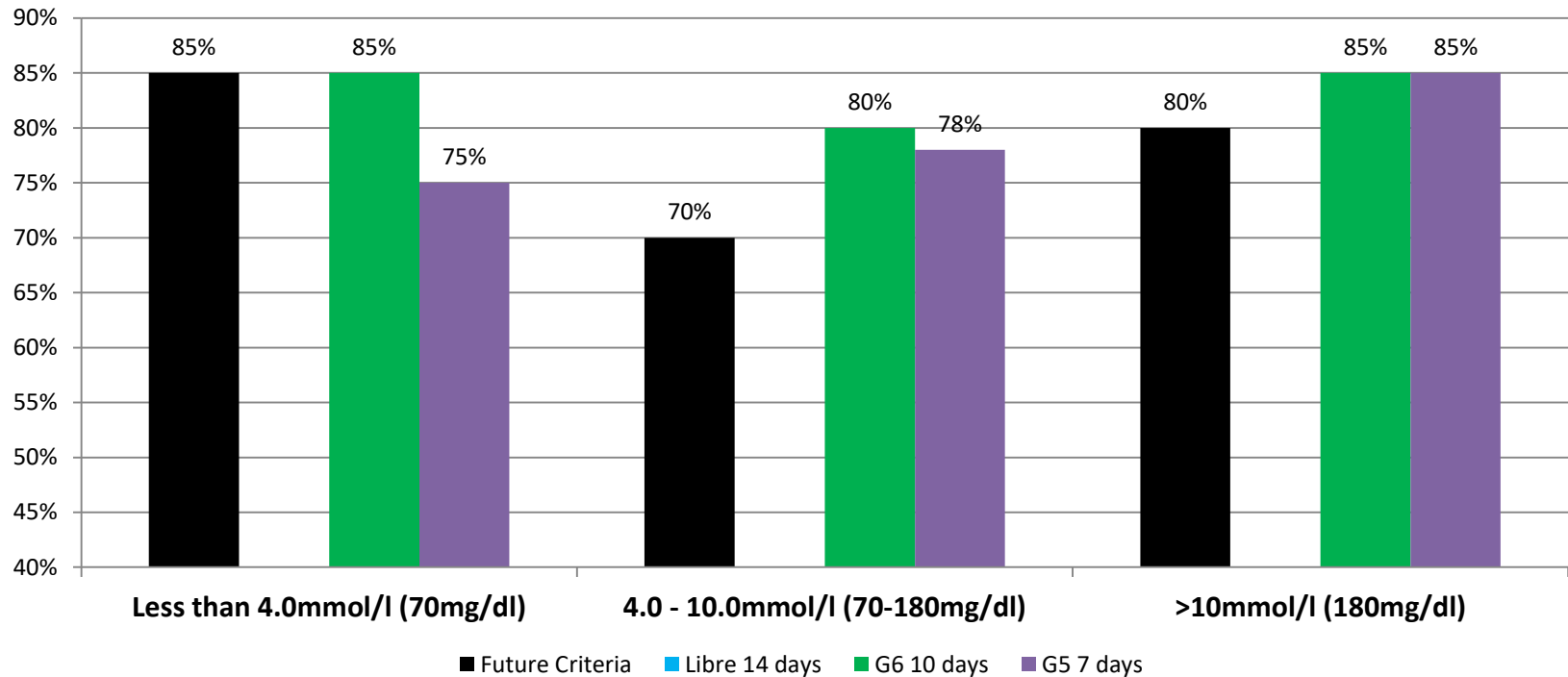
Sensor glucose 180mg/dl

15% = Blood Glucose 153 – 207mg/dl

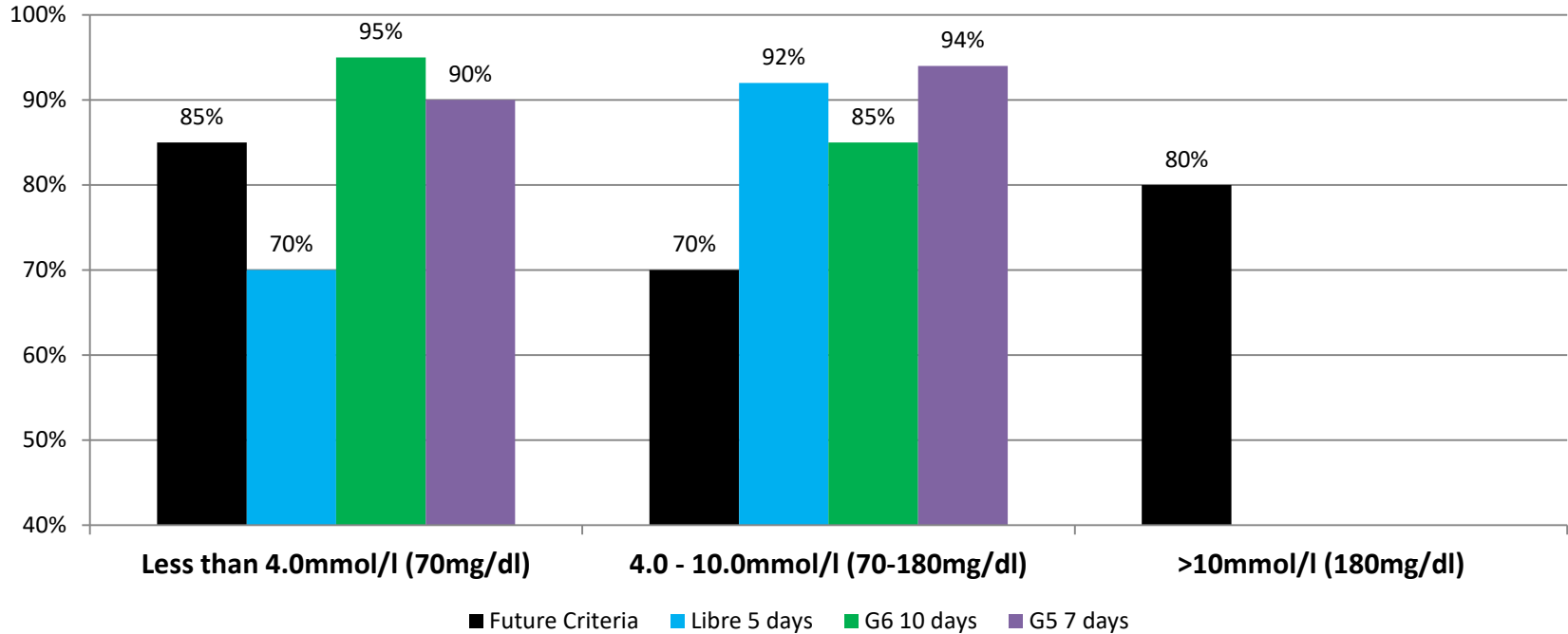
ADULT DATA TO FDA



PEAD DATA TO THE FDA



MY DATA



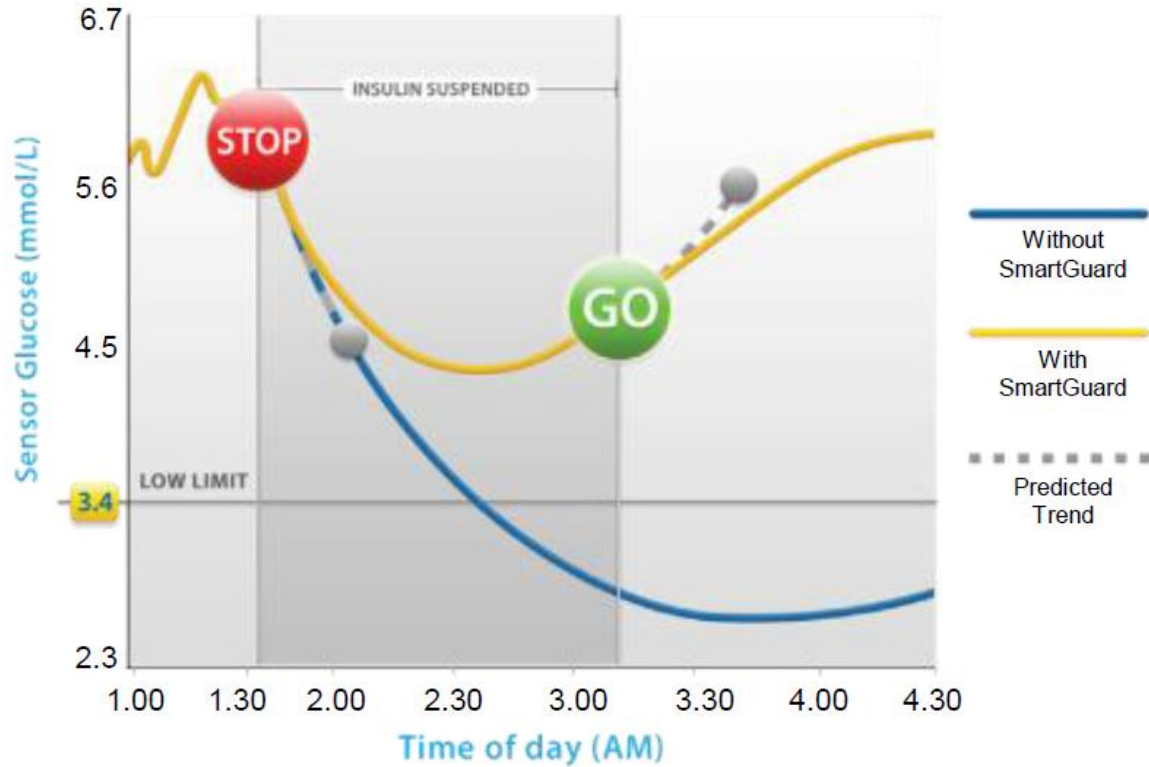
FREESTYLE LIBRE



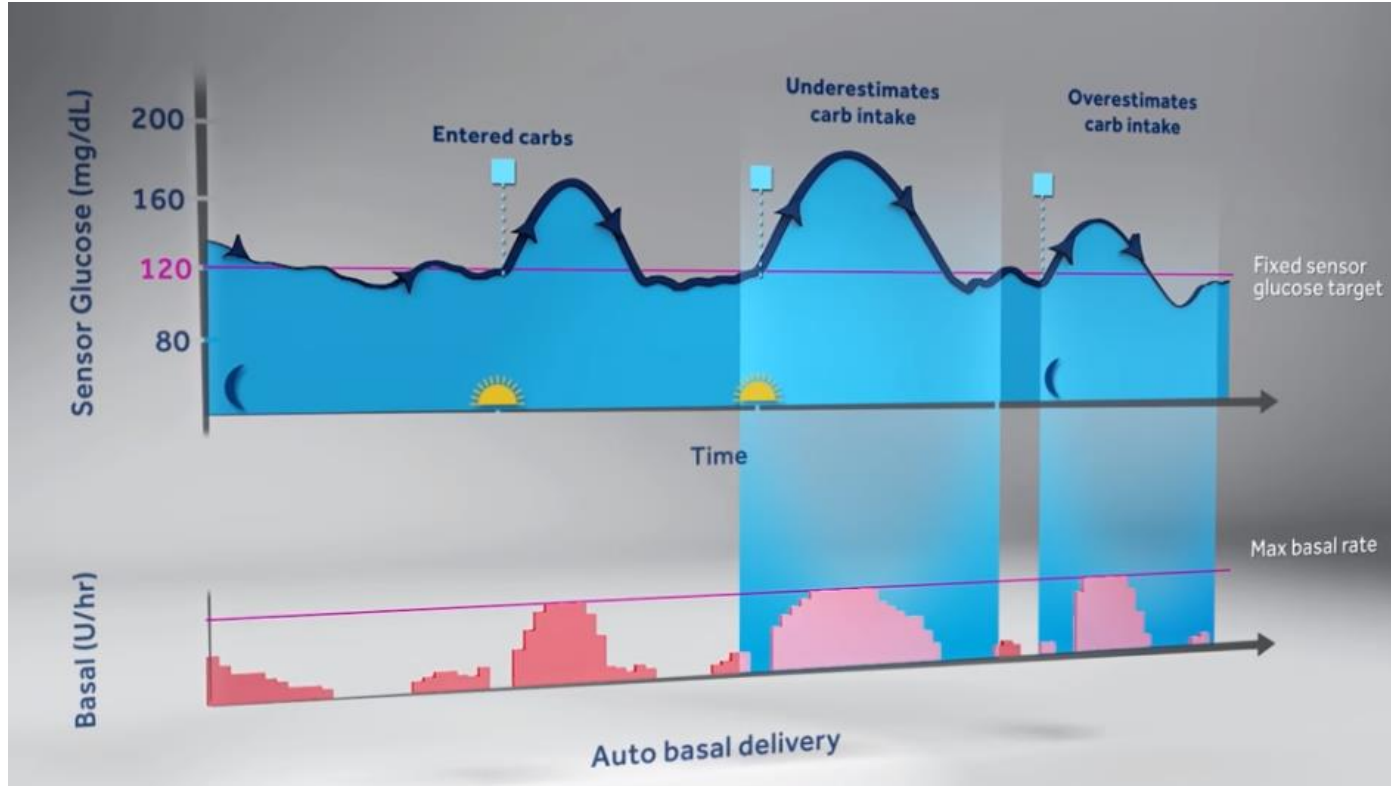
MINIMED 640G



MM640G SMART GUARD



MM670G: AUTO MODE



DEXCOM G6 URGENT LOW SOON

DEXCOM G6 URGENT LOW SOON 20 MINUTES BEFORE 3.1MMOL/L	DEXCOM G6	DEXCOM G6 URGENT LOW SOON 20 MINUTES BEFORE 55MG/DL
>6.9mmol/l	⇓	>124mg/dl
5.4 – 6.9mmol/l	↓	97-124mg/dl
4.2 -5.3mmol/l	↘	75 - 96mg/dl



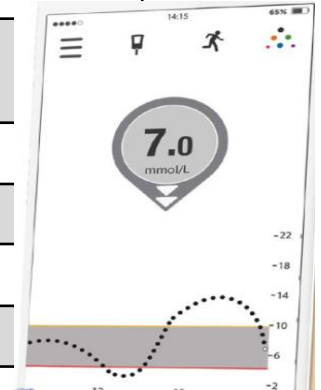
OVERVIEW

CRITERIA	DEXCOM G6	MEDTRONIC 670G	DEXCOM G5	FREESTYLE LIBRE	MEDTRONIC 640G	GUARDIAN MOBILE
Accuracy	★★★★★	★★★★★	★★★★★	★★★★	★★★	★★★
Ease of Use	★★★★★	★★★★	★★★★	★★★★★	★★★	★★★★
Hypoglycaemia Protection	★★★★	★★★★★	★★	★	★★★★★	★★★
Proactive Management	★★★★★	★★★★★	★★★★	★★★★	★★★	★★★
Connectivity	★★★★★	★★★	★★★★★	★★★★	★★★	★★★
Cost	★★★★	★★★	★★★	★★★★★	★★★	★★★
Average star rating	4.6	4.2	3.9	3.5	3.3	3.1

ALTERING BOLUS AMOUNTS

[HTTP://WWW.ENDOCRINE-ABSTRACTS.ORG/EA/0039/EPOSTERS/EA0039EP46_EPOSTER.PDF](http://www.endocrine-abstracts.org/ea/0039/e posters/ea0039ep46_e poster.pdf)

INSULIN SENSITIVITY FACTOR (ISF) 1UNIT: MMOL/L	INSULIN SENSITIVITY FACTOR (ISF) 1UNIT: MG/DL	GLUCOSE RISE OR FALL IN 15 MINUTES BY 0.8-1.7MMOL/L 12-30MG/DL INCREASE OR REDUCE BOLUS INSULIN BY	GLUCOSE RISE OR FALL IN 15 MINUTES BY >1.7MMOL/L >30MG/DL INCREASE OR REDUCE BOLUS INSULIN BY
1mmol/l	18mg/dl	1.5units	3.0units
1.5mmol/l	24mg/dl	1.0units	2.0units
2mmol/l	36mg/dl	0.75units	1.5units
2.5mmol/l	44mg/dl	0.6units	1.2units
3.0mmol/l	52mg/dl	0.5units	1.0units
4.0mmol/l	70mg/dl	0.4units	0.8units
5.0mmol/l	86mg/dl	0.3units	0.6units
6.0mmol/l	104mg/dl	0.25units	0.5units



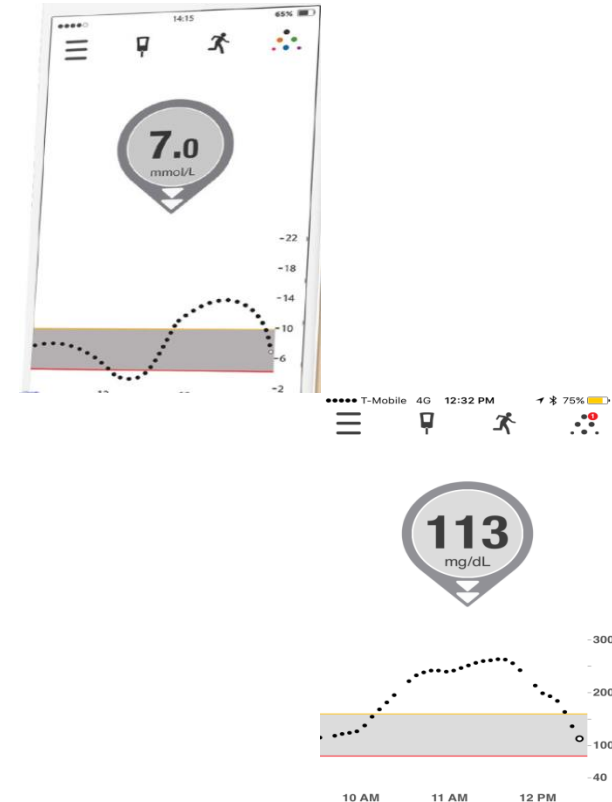
PREVENTING HYPOGLYCAEMIA - LIBRE

SENSOR GLUCOSE MMOL/L	SENSOR GLUCOSE MG/DL	FREESTYLE LIBRE	ACTION
6.5mmol/l or lower	120mg/dl or lower	↓	10-20g fast carbohydrate
5.7mmol/l or lower	100mg/dl or lower	↘	5-10g fast carbohydrate
4.8mmol/l or lower	85mg/dl or lower	→	IF ACTIVE 5-10g fast carbohydrate



PREVENTING HYPOGLYCAEMIA - DEXCOM

SENSOR GLUCOSE MMOL/L	SENSOR GLUCOSE MG/DL	DEXCOM G5 & G4	ACTION
8.0mmol/l or lower	145mg/dl or lower	↓↓	20-30g fast carbohydrate
6.5mmol/l or lower	120mg/dl or lower	↓	10-20g fast carbohydrate
5.7mmol/l or lower	100mg/dl or lower	↘	5-10g fast carbohydrate
4.8mmol/l or lower	85mg/dl or lower	→	IF ACTIVE 5-10g fast carbohydrate



PREVENTING HYPOGLYCAEMIA - MEDTRONIC

SENSOR GLUCOSE MMOL/L	SENSOR GLUCOSE MG/DL	MINIMED 530G/640G GUARDIAN	ACTION
8.0mmol/l or lower	145mg/dl or lower	↓↓↓	20-30g fast carbohydrate
6.5mmol/l or lower	120mg/dl or lower	↓↓	10-20g fast carbohydrate
5.7mmol/l or lower	100mg/dl or lower	↓	5-10g fast carbohydrate
4.8mmol/l or lower	85mg/dl or lower	No arrow	IF ACTIVE 5-10g fast carbohydrate

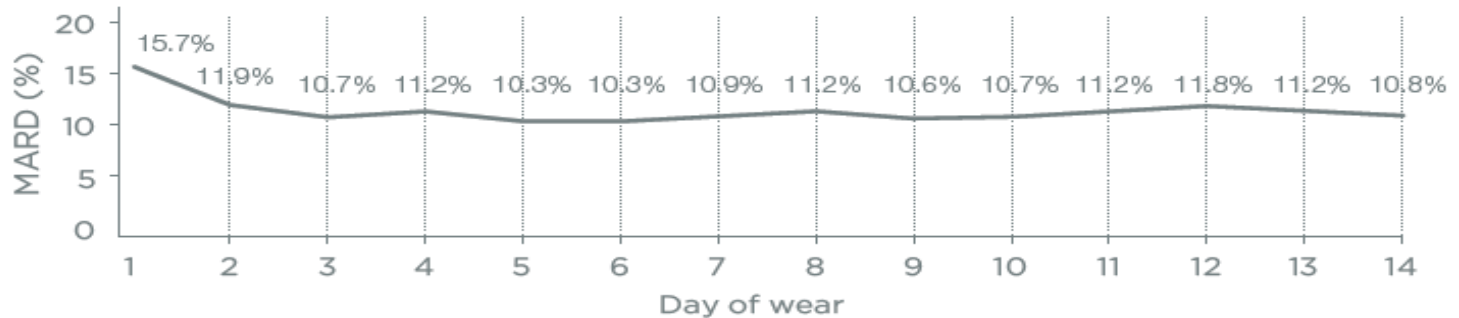


PLACE NEW SENSOR 24HR IN ADVANCE



FreeStyle
Libre

MARD compared to finger prick reference over 14-day period



Day 1: 11%

Day 4: 8%

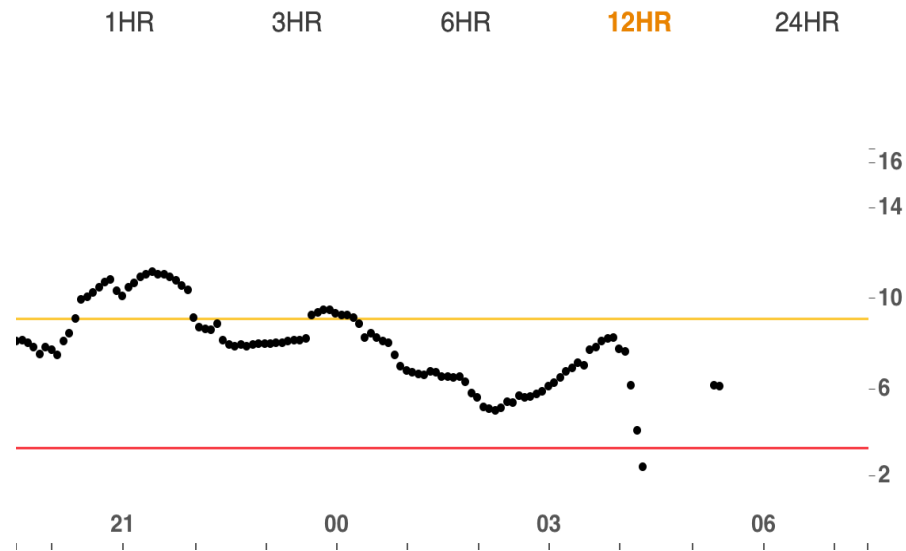
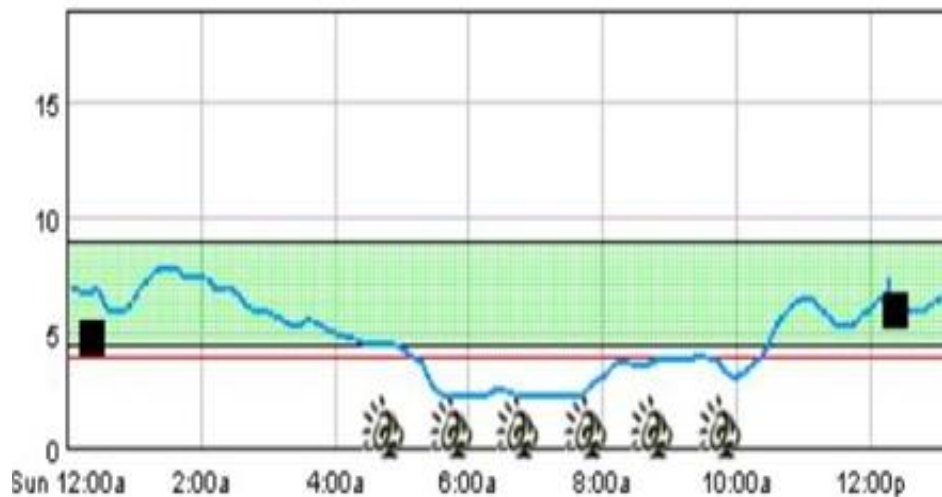
Day 7: 9%

Accuracy Over Time

Mean ARD% (MARD), 40-400 mg/dL (2.22-22.22 mmol/L)

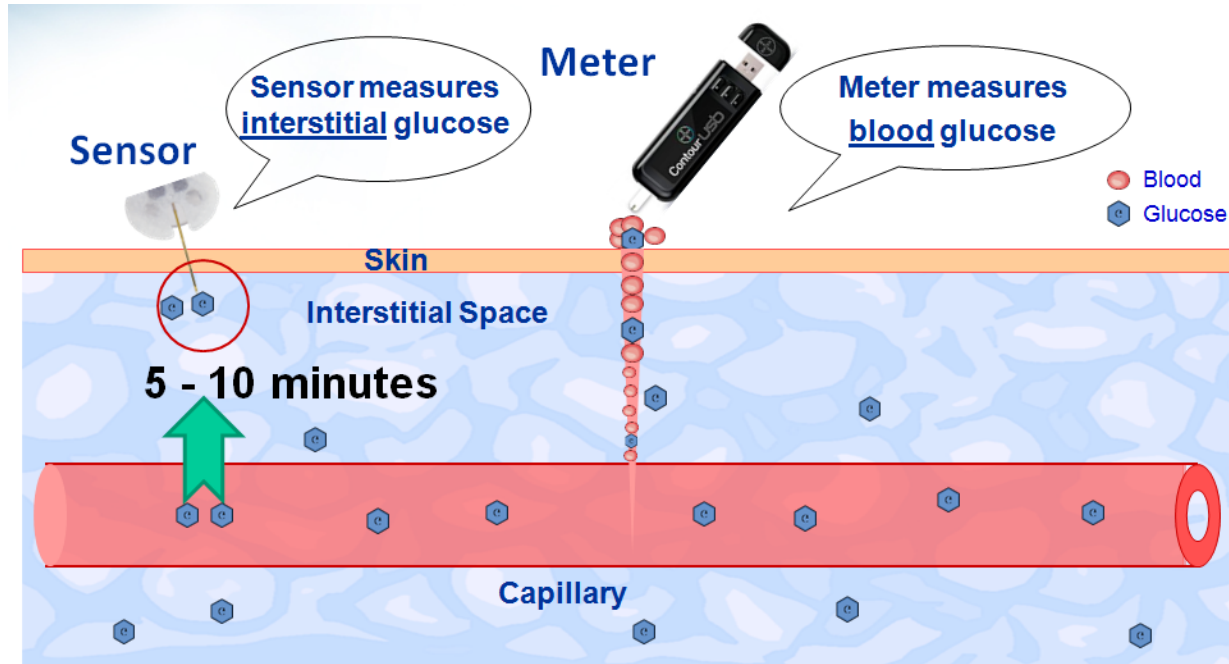
(Consistent sensor performance over time) Average Daily Calibration 2X/day

SITE SENSOR ON AREA OF LEAST PRESSURE



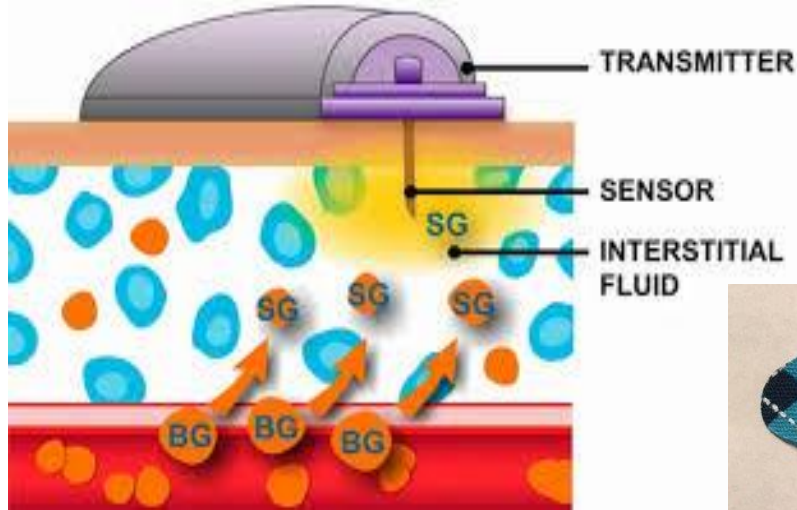
What part of your body do you sleep on?

STAY WELL HYDRATED



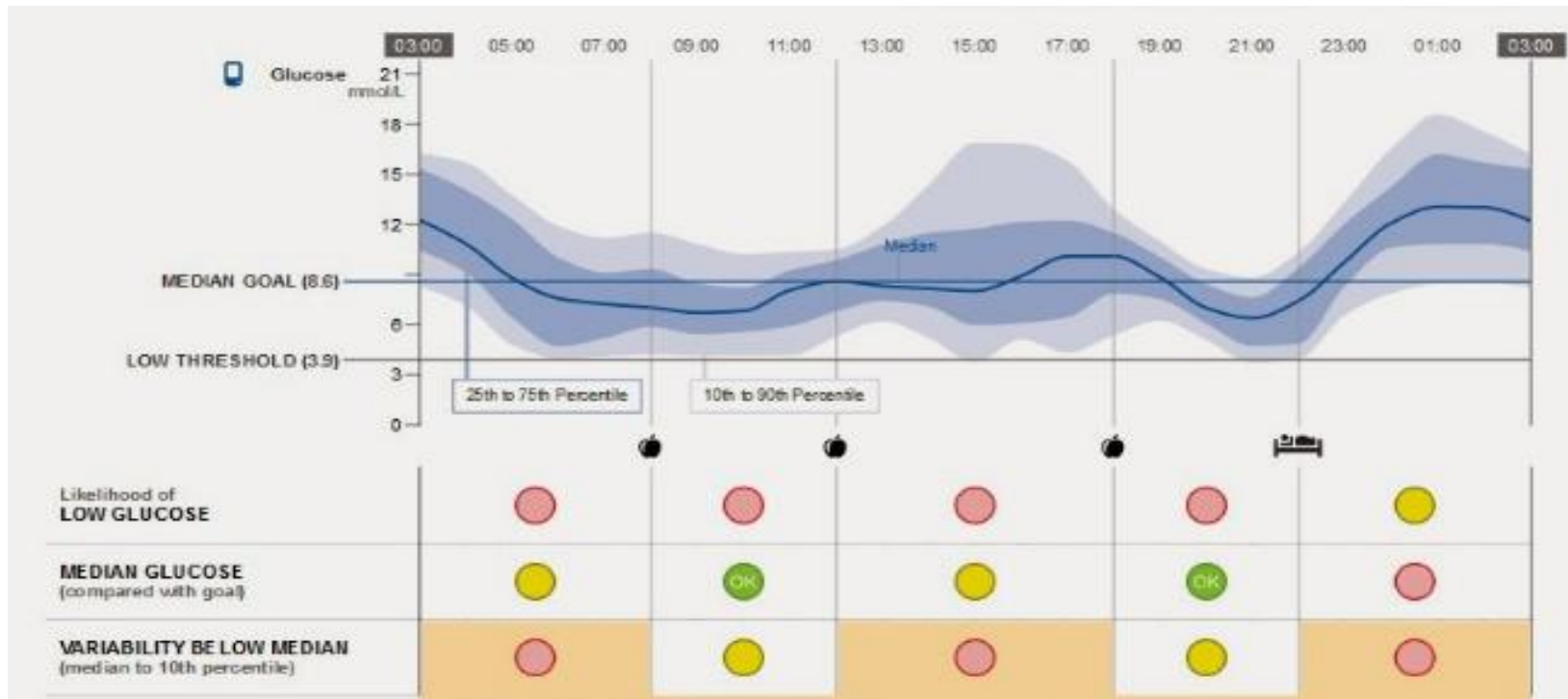
Electrical signals generated from the oxidation of glucose are recorded by the sensor, the signals are “calibrated” with meter readings to calculate CGM values

TAPE DOWN SECURELY TO PREVENT PISTONING

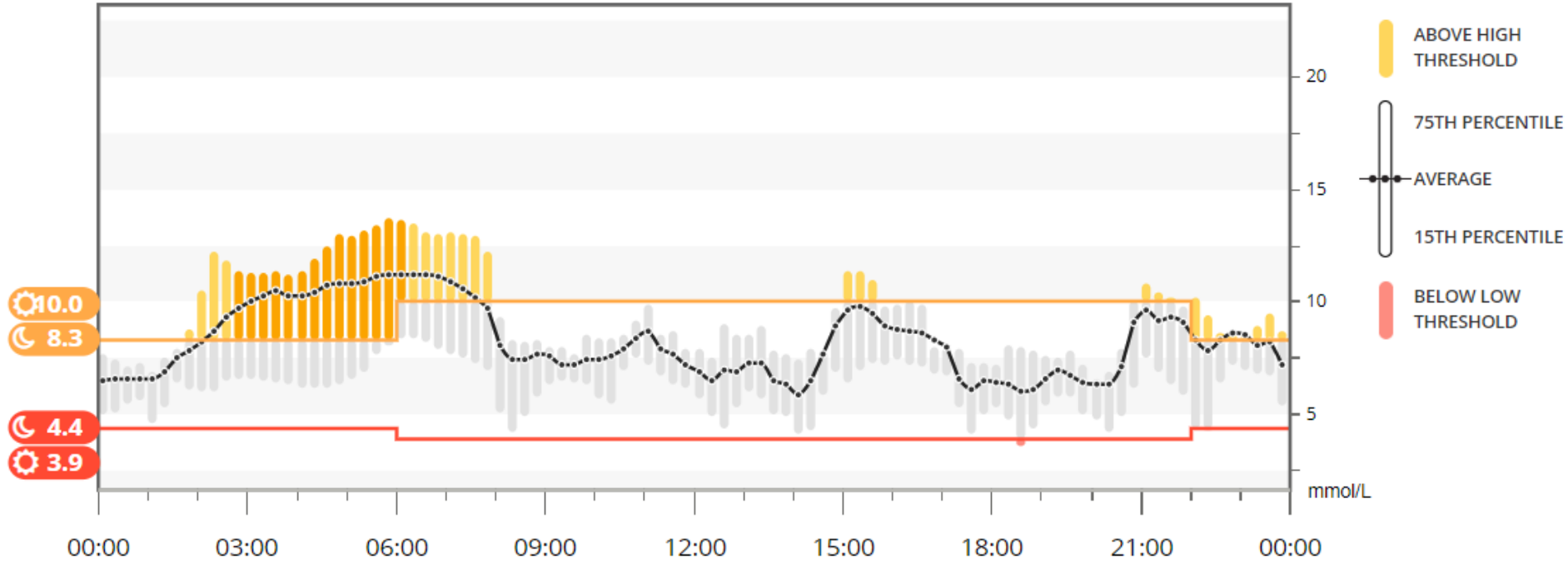


- Rock Tape
- Tegaderm
- Enlite Overtapes
- Opsite
- Skin Tac
- Grifgrips

REVIEWING PATTERNS - LIBRE



REVIEWING PATTERNS – DEXCOM



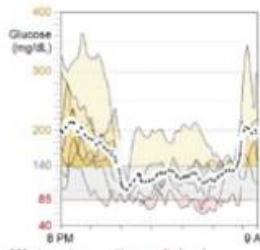
REVIEWING PATTERNS – MEDTRONIC



Bolus Insulin (U) above 4 ug

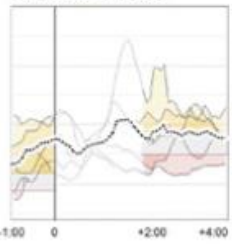
Bedtime to Wake-up

Bedtime: 8:00 PM - 12:00 AM
Wake-up: 5:00 AM - 9:00 AM



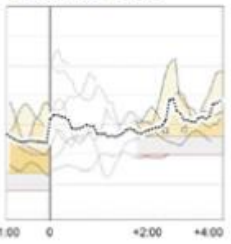
Breakfast: 8:00 AM - 10:00 AM (6)

Pre-meal SG Avg: 146 ± 45mg/dL
Post-meal SG Avg: 162 ± 32mg/dL
Avg Carbs: 14 ± 8g
Avg Food Bolus: 0.9 ± 0.5U



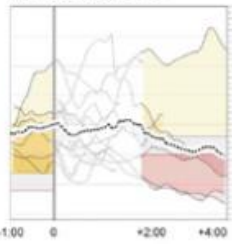
Lunch: 11:00 AM - 3:00 PM (8)

Pre-meal SG Avg: 173 ± 36mg/dL
Post-meal SG Avg: 214 ± 52mg/dL
Avg Carbs: 27 ± 14g
Avg Food Bolus: 1.4 ± 0.8U



Dinner: 4:00 PM - 10:00 PM (19)

Pre-meal SG Avg: 192 ± 43mg/dL
Post-meal SG Avg: 187 ± 53mg/dL
Avg Carbs: 38 ± 29g
Avg Food Bolus: 2.4 ± 1.9U



Statistics	
Avg BG	109 ± 68mg/dL
Estimated A1C	7.5%
BG Readings	13.3 per day
Carbs Entered	156 ± 51g per day

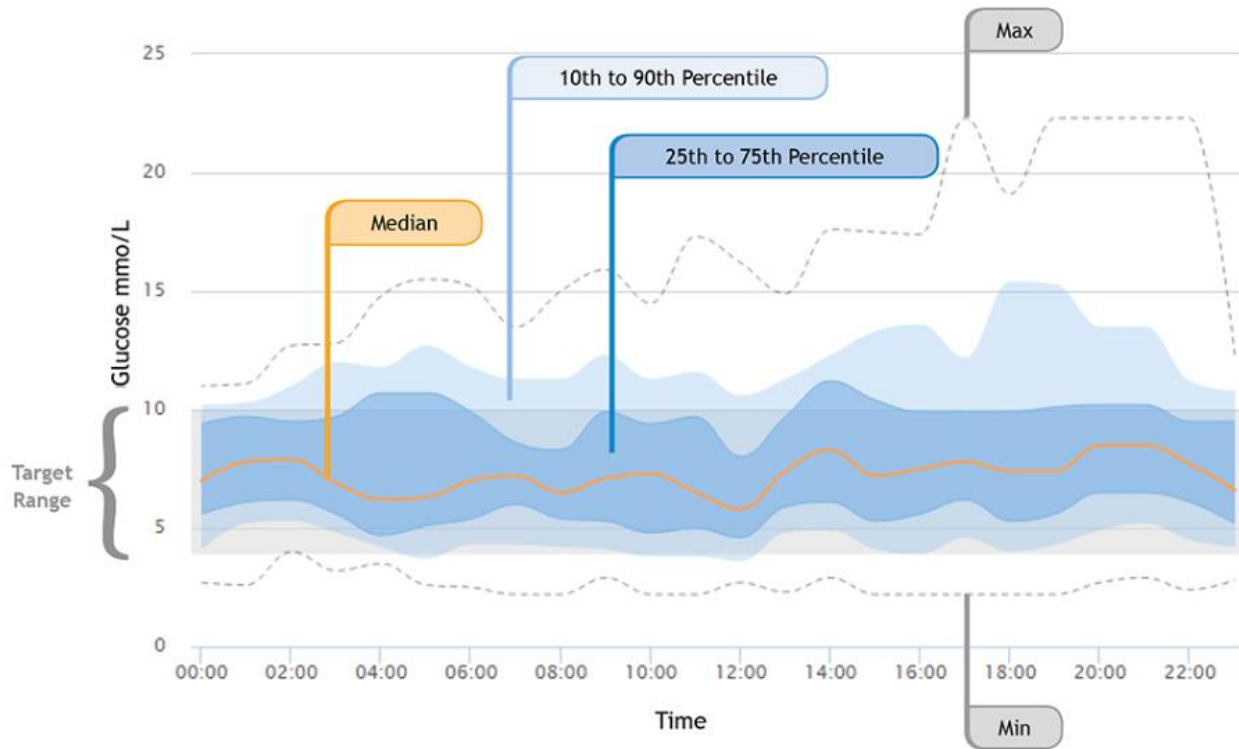
Hypoglycemic Patterns (3)	
Time Period	3:33 AM-7:49 AM (3)
Time Period	1:04 AM-2:19 AM (1)
Time Period	10:34 PM-11:44 PM (1)

Hyperglycemic Patterns (1)	
Time Period	7:40 AM-11:50 PM

Pump Use	Per Day
Insulin TDO	37.9 ± 4.4U
Basal/Bolus Ratio	55 / 45
Manual Boluses	0.3U (0.7 boluses)
Bolus Wizard	16.6U (10.2 boluses)
Food	9.5U (5.7 boluses)
Correction	14.5U (5.8 boluses)
Override (+)	0.3U (0.7 boluses)
Override (-)	-1.4U (0.7 boluses)
Suspend Duration	22m per day
Res./Site Change	Every 2.0 / 2.0 days

Sensor Use	
Avg SG	168 ± 58 mg/dL
Wear Duration	6d 15h per week
Low SG Alarms	5.8 per day
High SG Alarms	4.7 per day

REVIEWING PATTERNS – DIASEND



SUMMARY

- CGM is the future
- New accuracy standards:
 - Hypo - 85% accuracy
 - Normal range 70%accuracy
 - High - 80% accuracy
 - FORGET MARD!
- Semi-automated pumps and hybrids are coming
- Only get the benefit if you are proactive:
 - Extra bolus's
 - Hypo prevention
 - Exercise management
 - SUGAR SURFING -Stephen Poynder