Utilizing Glucose Values In Diabetes Management

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1230 - 1300

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Presenter

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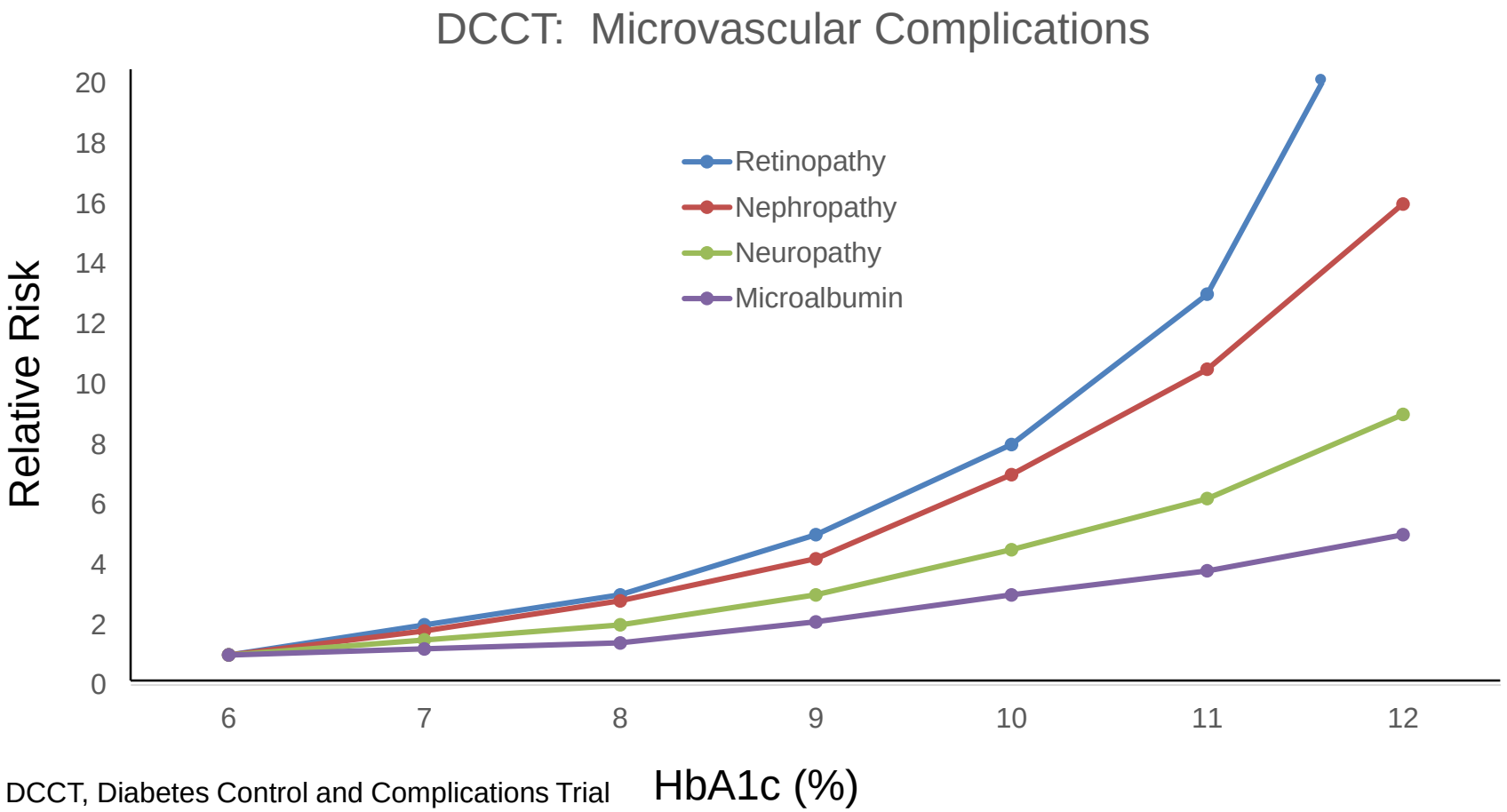
Learning Objectives

At the conclusion of this knowledge-based activity, participants will be able to:

1. Review glucose monitoring options
2. Identify glycemic targets and those at increased risk of hypoglycemic complications
3. Manage glucose patterns

Hyperglycemic Complications

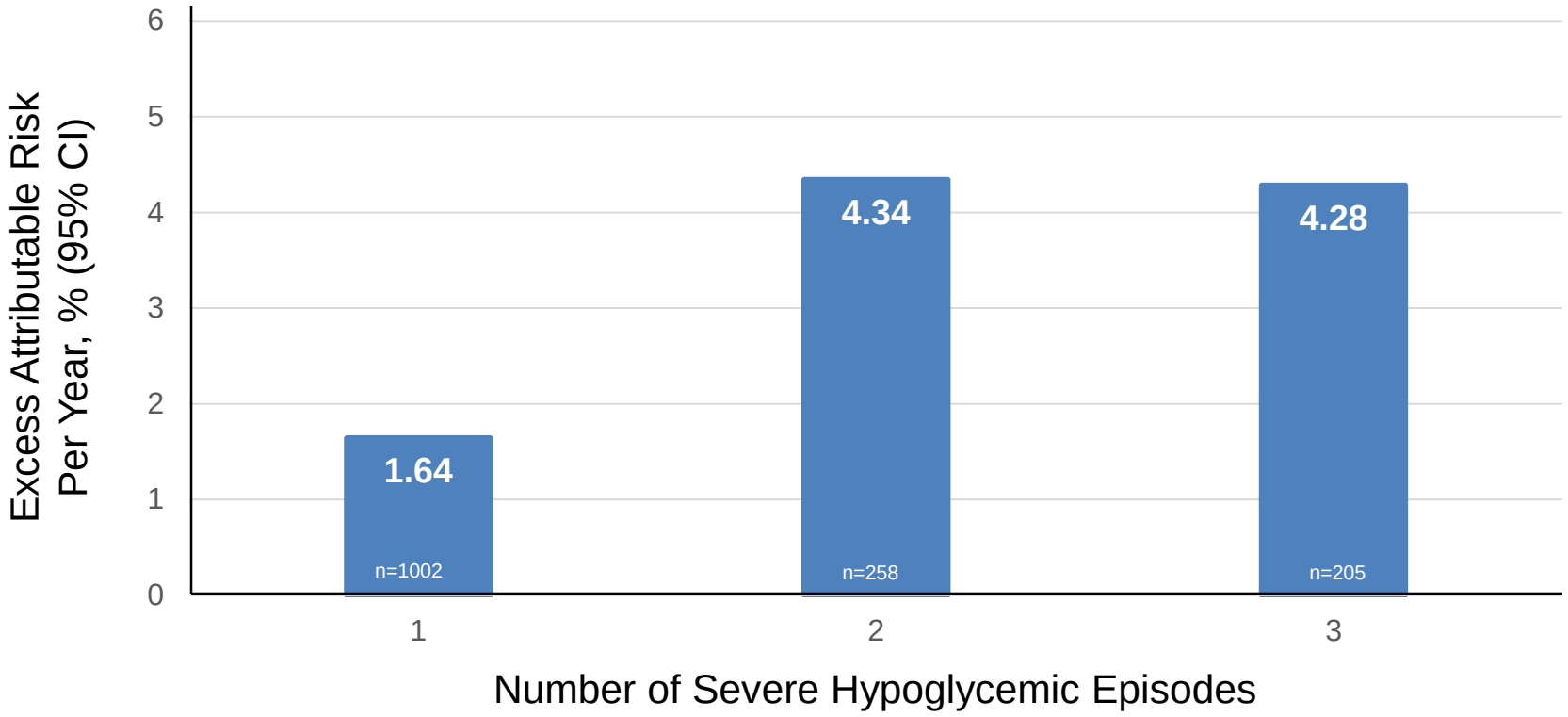


DCCT, Diabetes Control and Complications Trial

Adapted from Skyler JS Endocrinol Metab Clin North Am 1996;25:243-254
DCCT. N Engl J Med 1993;329:977-986

Severe Hypoglycemia Associated With Risk of Dementia

Attributable risk of dementia with any hypoglycemia: 2.39% (1.72 - 3.01)



The clinical significance of minor glycemia episodes with dementia risk is unknown

Whitmer RA et.al. JAMA 2009:1565-1572

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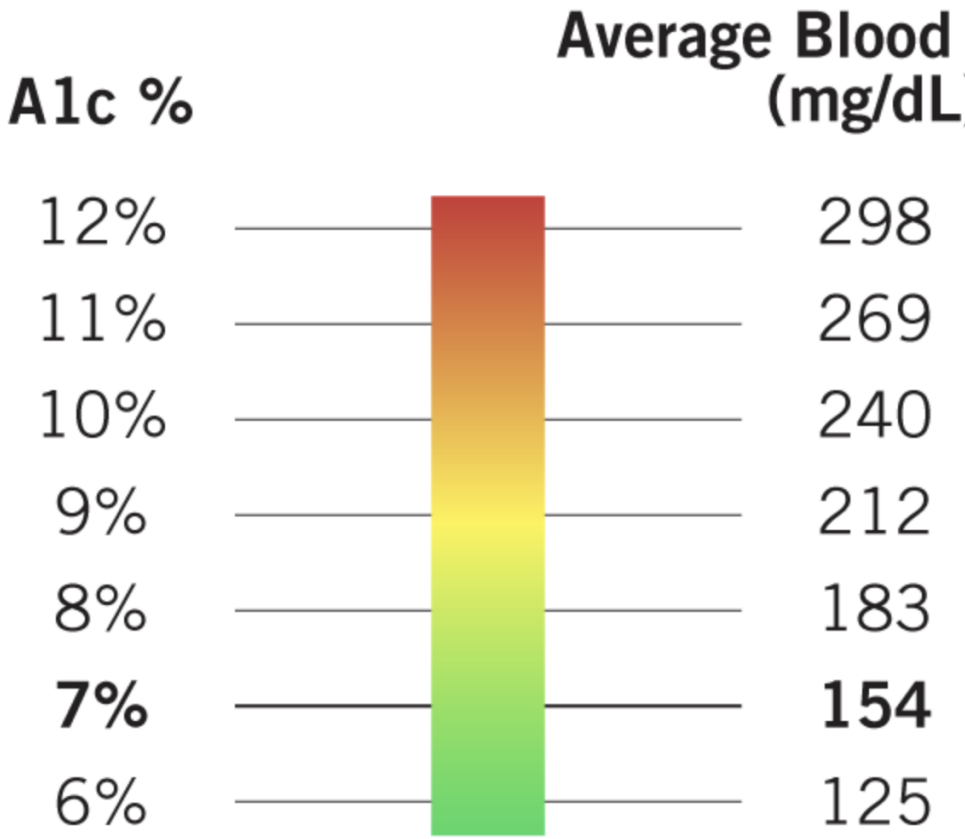
What is a HbA1c



Best to **empower** patients with tools they can use

Monitoring Options

- Glucometer
- Flash glucometer
- Continuous glucose monitoring

Glucose monitoring is one of the **most** important tools in the management of diabetes!

Glucometer

Diabetes – Self-monitoring of blood glucose

Advantages:

- Readily available
- Generally easy to use
- Real-time feedback
- Accurate
- Empowers patient to make adjustments to medication or diet based on results

Disadvantages:

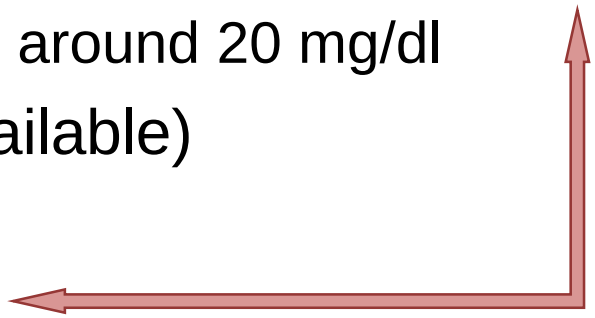
- Occasionally painful
- Inconvenient
- Difficult to use if dexterity issues
- Cost of supplies
- Spot result – no trending information
- Training to perform correctly

Glucometer – Provider Issues

- Patient forgets to bring meter to clinic
  - Because they didn't check or clinic never reviews
- Clinic unable to download meter for review
  - Having averages, sd, and trends are very helpful
- Limited time to review 3-4 months of glucometer data
  - Typically review last 1-2 weeks
  - Inference to patient – only check 1-2 weeks before appointment

Reviewing Glucometer Download

- Review Average Glucose
  - Goal is to be <154 mg/dl (HbA1c = 7.0%)
  - Patients without DM have average glucose 100 mg/dl
- Assess variability → look at standard deviation
  - SD changes based on glucose values (no universal number)
  - Goal is < 1/3 average glucose (3 times sd < average)
  - Patients without DM have sd around 20 mg/dl
- Coefficient of variability (if available)
  - Goal is <33%
  - This is (SD/Glucose)x 100



Importance of Variability

- The higher the variability the greater the risk of severe hypoglycemia
  - Especially if average glucose is withing target
- High variability may increase oxidative stress and is listed as an independent risk factor for DM complications
- Patients feel worse when their glucose oscillates between high and low

Freestyle Download: Snapshot

Snapshot

Feb 26, 2011 – Mar 11, 2011 (14 days)

Glucose (mmol/L)

SELECTED REPORTING PERIOD

Tests

77% Above Target

20% Within Target

3% Below Target

6

Standard Deviation*

Target**: +5.6 / -5.6

Actual: +3.9 / -3.9

11.2 Average

1	Average	201.6 mg/dl
	High	351.0 mg/dl
2	Low	82.8 mg/dl
3	Standard Deviation	70.2 mg/dl

	Total Tests	72
4	Avg. Tests/day	4.8
	Days Without Tests	0
	Hypo Events	1

Target Range: 3.9-7.8 mmol/L ** Target Standard Deviation < (Average/2) Hypo Threshold: 3.3 mmol/L

TRENDS (Last 90 Days)

90 DAYS 60 DAYS 30 DAYS

19.4 / 7.7 / 3.9 mmol/L

5

BG Average

	30 DAYS	90 DAYS
Average	11.2	12.8
High	19.5	20
Low	4.6	4.4
Standard Deviation	3.2	3.5
Total Tests	126	359
Avg. Tests/day	4.2	4.0
Days Without Tests	4	13
Hypo Events	1	2

How I review with patient

1) Review average
2) R/O hypoglycemia
3) Ensure 3Xsd < average
4) Appropriate testing per day
5) Review trend
6) Discuss time within target

myfreestyle.com

Significant variability with average above target indicates high spikes

Glucometer Download

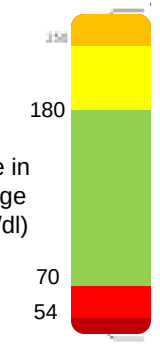
- Ave Glu is within target
- But CV is >33%
- SD (64) x 3 = 192 mg/dl which is more than average glucose
- Patient at high risk of severe hypoglycemia
- Goal is “low” to be <4%

captureAGP® Name _____

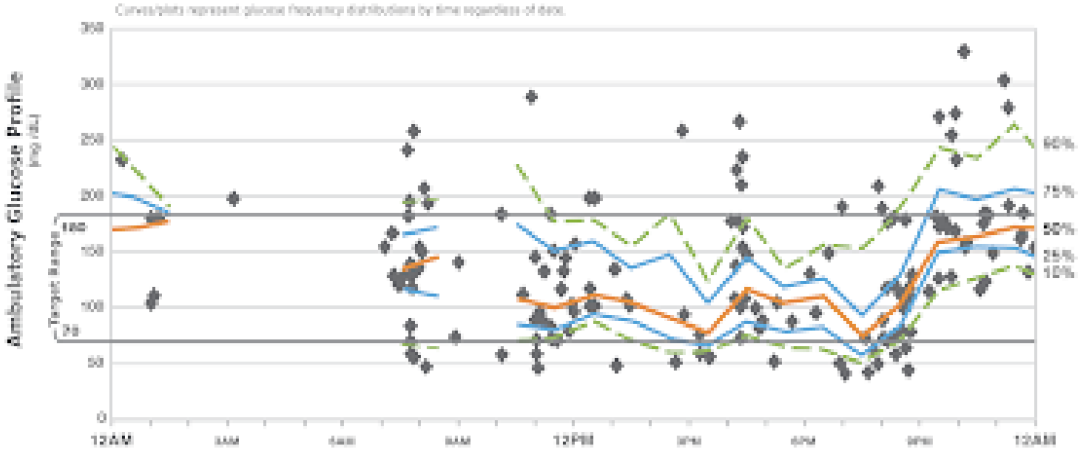
Glucose Statistics

15 Feb 2019 – 01 Mar 2019	14.5 Days
Average Tests per Day	6.4
Average Glucose	135 mg/dl
Glucose Management Indicator (GMI)	6.3%
Coefficient of Variation (CV)	47%
Standard Deviation (SD)	64 mg/dl

Time in Range (mg/dl)



7% Very High
14% High
65% In Target
9% Low
5% Very Low



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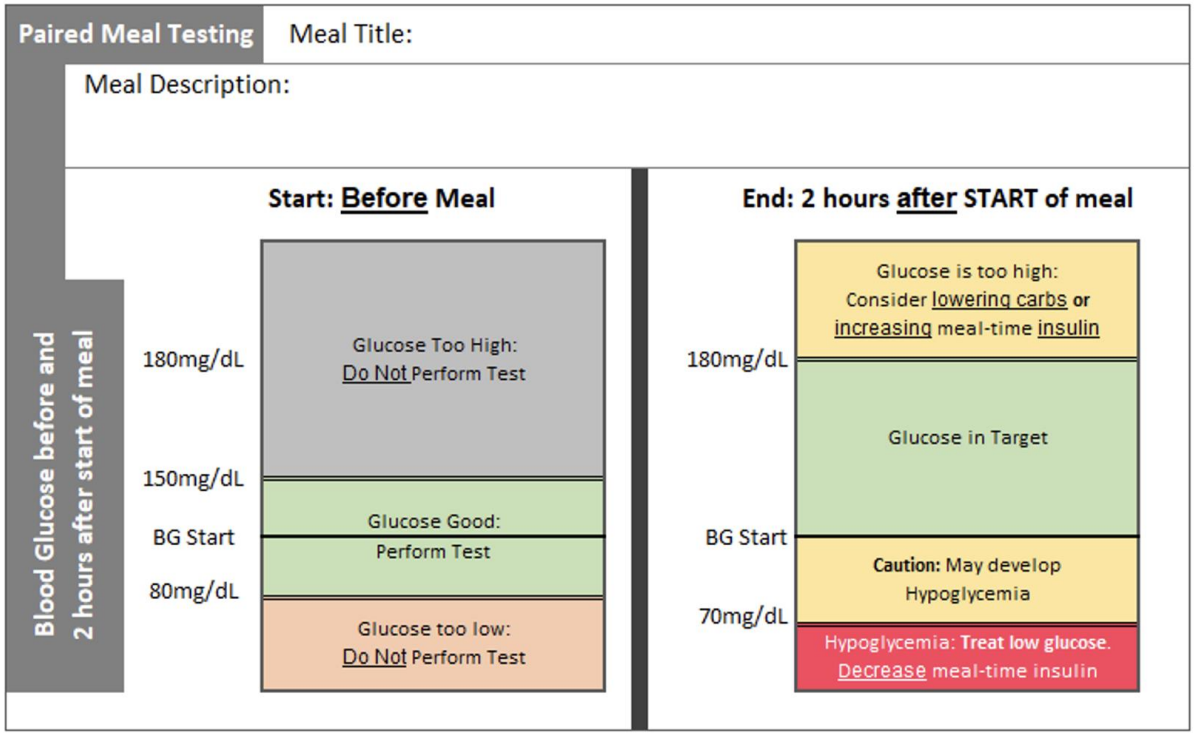
Note: use of GMI and not eA1c

Structured Meal Testing

- Glucometer felt by many to be needed only if on insulin
- At DCOE we recommend glucometer for all patients
- Best (cost effective use) in non-insulin patients is to perform structured meal testing
  - Also beneficial with insulin to adjust Insulin:carb ratio
  - Used to increase meal insulin dose (titration)
- Patient checks finger prick at 2 hr after starting meal
  - Goal is 2hr to be <180 mg/dl

DCOE Structed Meal Example

This example is used in patients on insulin to adjust insulin:carb ratio



	Date	Start Time	Blood Glucose	Novolog Dose	After Meal Time	Blood Glucose
1						
2						
3						
4						
5						

DCOE form

Flash Glucometer

Freestyle Libre

Advantages:

- Fewer finger-pricks required
- Trends easier to identify
- Factory calibrated
- Overnight readings available
- Up-loadable data for virtual visits

Disadvantages:

- Occasional finger-pricks
- Cannot set alarms with older units (2.0 partly corrects this)
- Arm sensor may catch on clothing, towels, etc…
- DME was required in past
- Must scan every 8hr or data is lost

https://www.diabetes.org.uk/guide-to-diabetes/managing-your-diabetes/testing/flash-glucose-monitoring

Standardized Targets

- Standard target range: 70-180 mg/dl
- Hypoglycemia:
  - Level 1: 54-70 mg/dl (goal <4%)
  - Level 2: <54 mg/dl (goal < 1%)
  - Level 3: severe hypo requiring assistance (goal 0%)
- eA1c confusing as usually different than lab hbA1c
  - Different length of assessment
  - Different standards for estimation
  - Bergenstal et.al developed standardized Glucose Management Indicator (CMI)

ADA (2022)
Bergenstal et.al.(2018)

LibreView Download

Jack Sminth
DOB: 03/10/1980
MRN: _____
DEVICE: FreeStyle Libre

PreProd
PHONE: 7607101920
PAGE: 1 / 1
GENERATED: 12/20/2019

AGP Report

December 7, 2019 - December December 20, 2019 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

December 7, 2019 - December 20, 2019	**14 Days**
% Time CGM is Active	**97%**

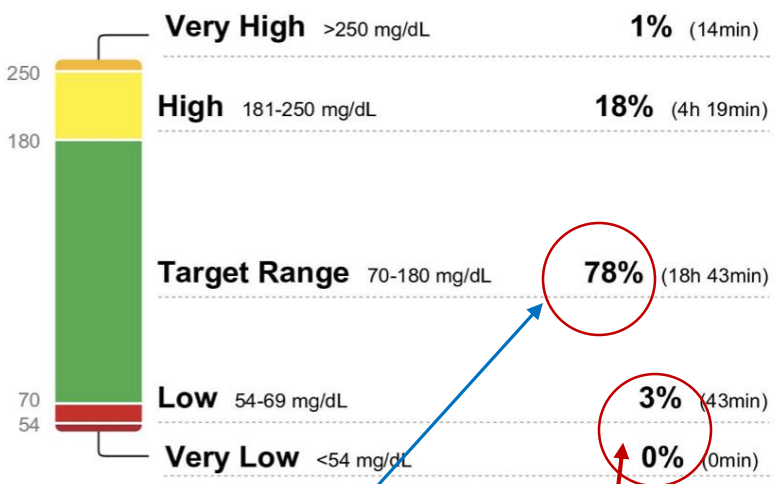
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range70-180mg/dL	**Targets** % of Readings (Time/Day) Greater than 70%(16h 48min)
Below 70 mg/dL	Less than 4% (57min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h 0min)
Above 250 mg/dL	Less than 5% (1h 12min)
Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.	

Average Glucose	**141** mg/dL
Glucose Management Indicator (GMI)	**6.7 %**
Glucose Variability	**31.6%**

Defined as percent coefficient of variation (%CV); target ≤36%

CV <33%

TIME IN RANGES



>70% in goal

<4% hypo

For Illustrative purpose only. Not actual patient data

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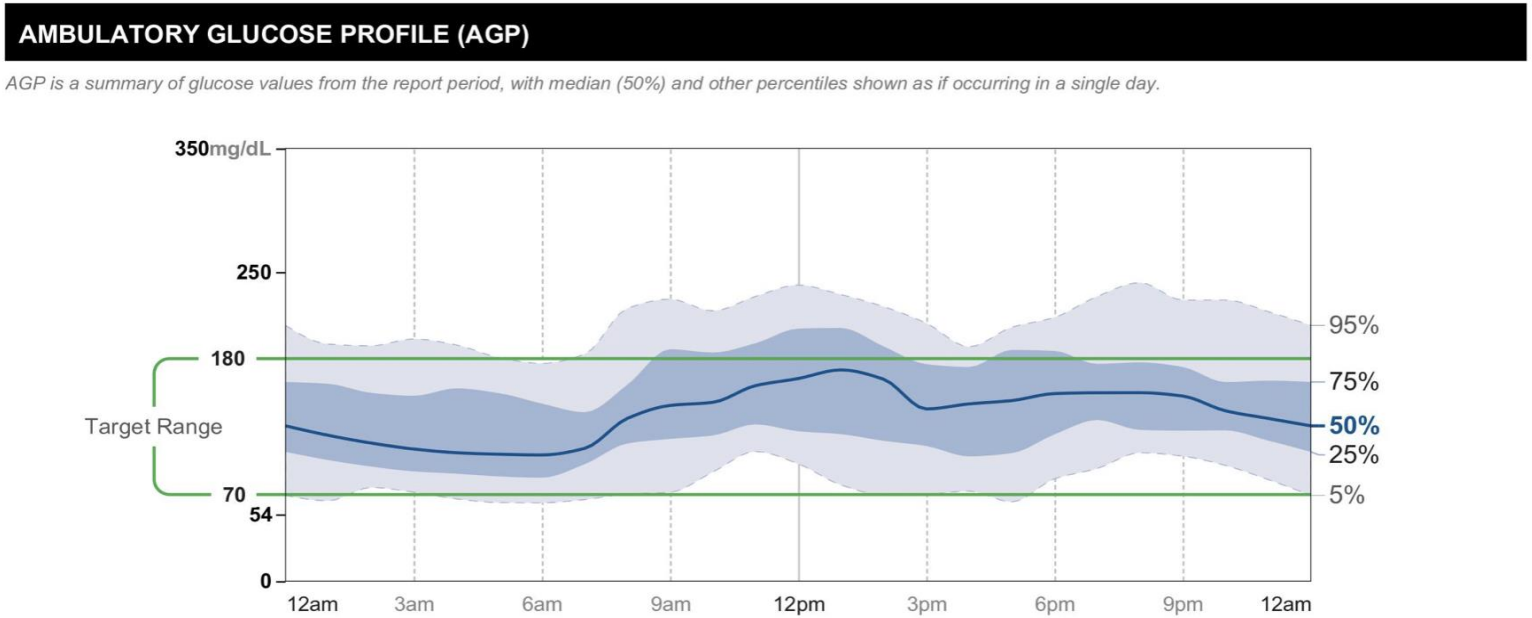
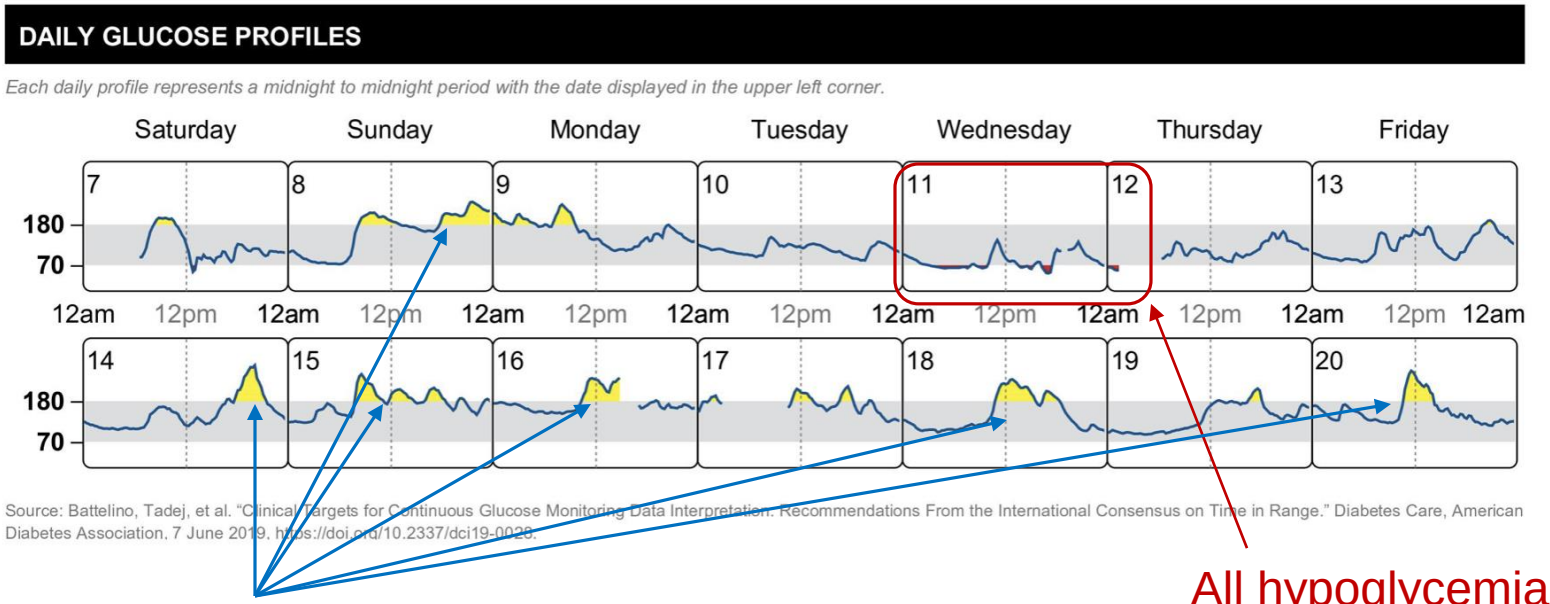
Standardized Day View



Allows reviewer to identify times of day where there is increased variability, highs, or lows

For Illustrative purpose only. Not actual patient data

Daily View



Review:

1) Meal logs (carb content)
2) Insulin dose, I:C ratio, insulin dose timing
3) Missed oral meds

All hypoglycemia occurred on this day

Address: Missed meals, illness, excess physical activity – Why?

For Illustrative purpose only. Not actual patient data

myfreestyle.com/freestyle-libre-resources.

Continuous Glucose Monitor

Dexcom, Medtronic

Advantages:

- Fewer finger-pricks required
- High/low alerts
- Share with family
- Factory calibrated
- Integration with insulin delivery devices – hybrid closed loop
- Up-loadable data for visits

Disadvantages:

- Expensive
- Medtronic requires finger-prick calibration
- Alarm fatigue
- Adhesive issues
- Sensor may catch on clothing, towels, etc…
- Inaccurate or delayed results (sig changes)

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Recommended Targets

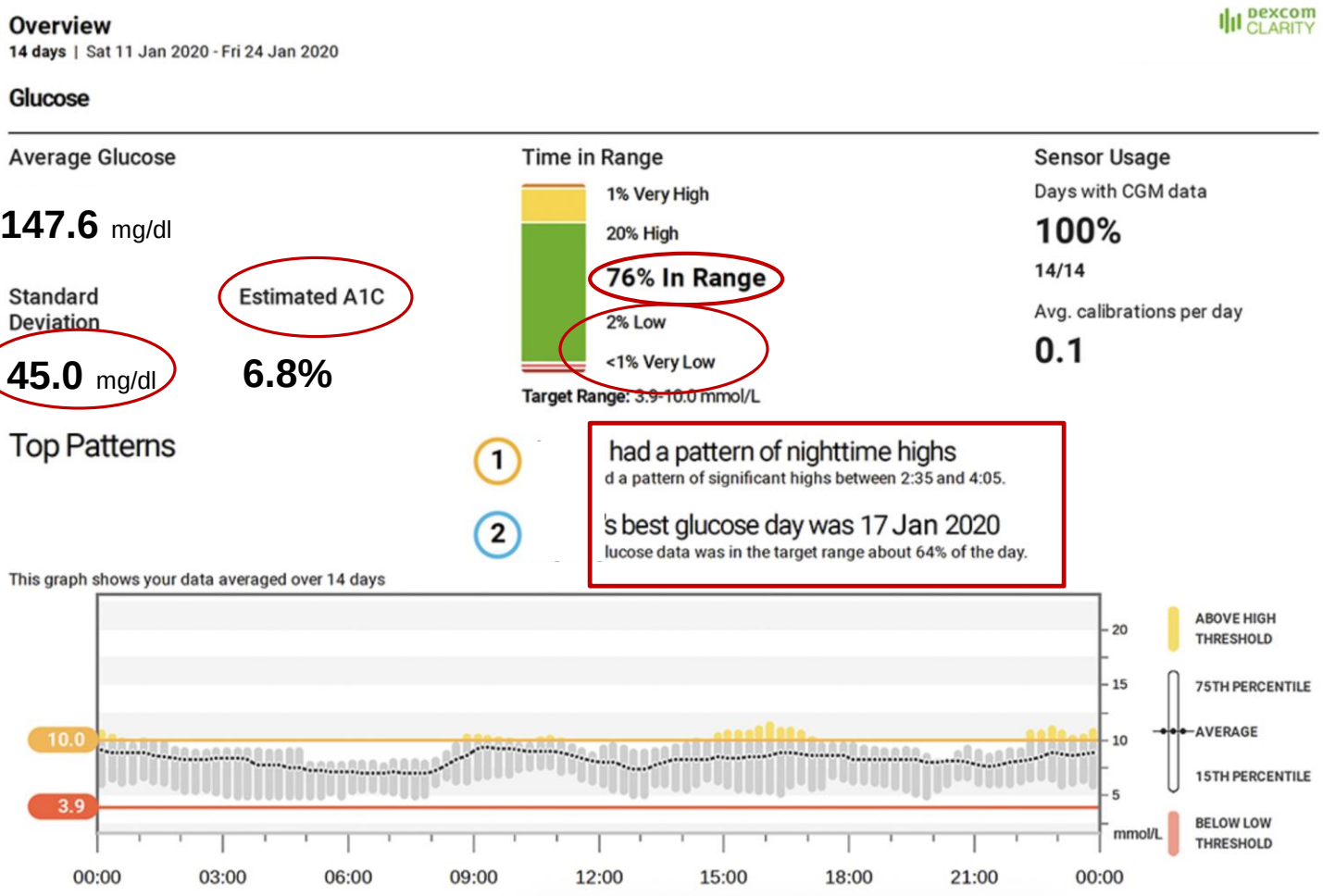
Table 1 Guidance on target for assessment of glycemic control in patients with diabetes

	TIR	Time in hypoglycemia	Time in hyperglycemia
T1DM and T2DM	>70% (70–180 mg/dL)	<4% below 70 mg/dL <1% below 54 mg/dL	<25%
T1DM and T2DM "fragile"	>50% (70–180 mg/dL)	<1% below 70 mg/dL	>90% below 250 mg/dL
T1DM pregnancy	>70% (63–140 mg/dL)	<4% below 63 mg/dL	<25% above 140 mg/dL
Gestational DM and T2DM pregnancy[a]	>85–90% (63–140 mg/dL)	<4% below 63 mg/dL	<10% above 140 mg/dL

[a]Gestational DM and T2DM pregnancy: there are no specific recommendations for these conditions given the limited evidence but that it is expected that it would be significantly higher than in type 1 diabetes pregnancy

Gabbay MA, et al. Diabetology and Metabolic Syndrome. 2020;12,22 https://doi.org/10.1186/s13098-020-00529-z

CGM – Dexcom Clarity



https://clarity.dexcom.com/

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Summary

- 3 glucometers: Standard, Flash, Continuous
- Empower pt with structured meal testing
- Address hypoglycemia and assess risk with SD or CV
- 3 times SD should be < average (CV < 33%)
- Time in Range >70%
- Glucose <70 mg/dl should be <4%
- Glucose <54 mg/dl should be <1%
- eA1c or GMI measure different time periods than HbA1c
- Review food logs with Flash/CGM to identify issues

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Questions