Interactive Interpretation of Continuous Glucose Monitoring

Myriam Z. Allende Vigo, MD CDE FACP FACE
Endocrinologist

Disclosure

- Has multiplicity of interests; no conflicts.
  - Has received honorarium as Speaker &/or Consultant for the following Pharmaceutical Companies: Abbvie & Merck.

OBJECTIVES

- **Be familiar with different CGM modalities**
- **List components of adequate CGM report**
- **Be able to interpret a CGM report**
- **Be capable of using CGM data to help management of patients with Diabetes Mellitus.**

# Glucose Monitoring with SMBG vs. CGM

Continuous Glucose Monitoring gives trend information to help prevent low blood glucoses, complications and decrease variability[1-3]

1. *Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group. Continuous Glucose Monitoring and Intensive Treatment of Type 1 Diabetes. N Engl J Med.; 2008;359(14):1464-1476.*
2. *Garg S, et al. Improvement in glycemic excursions with a transcutaneous, real-time continuous glucose sensor: a randomized controlled trial. Diabetes Care. 2006;29(1):44-50.*
3. *Garg SK, et al. Continuous home monitoring of glucose: improved glycemic control with real-life use of continuous glucose sensors in adult subjects with type 1 diabetes. Diabetes Care. 2007;30(12):3023-3025.*

4 patients with T1D on MDI – all with HbA1c at a central lab of 8.0%

14 days of CGM (AGP) just prior to the HbA1c
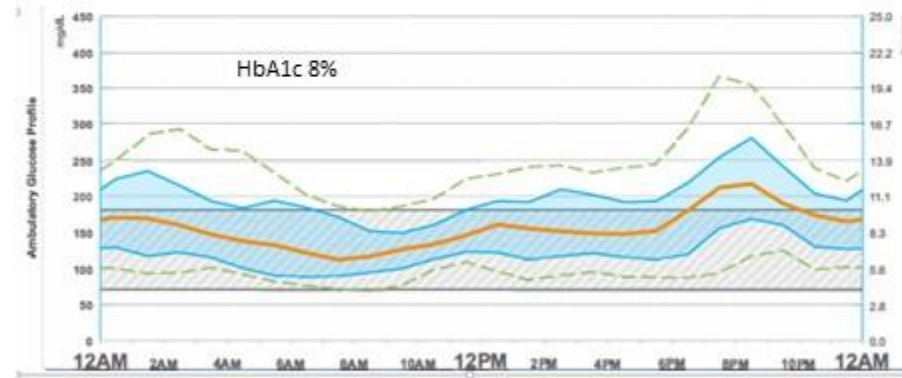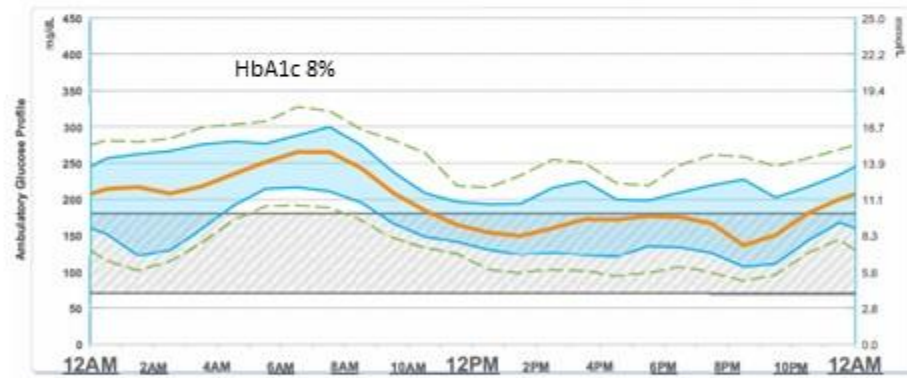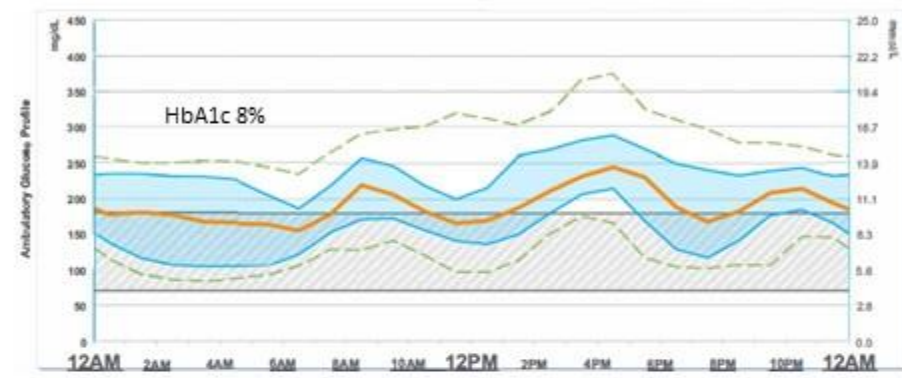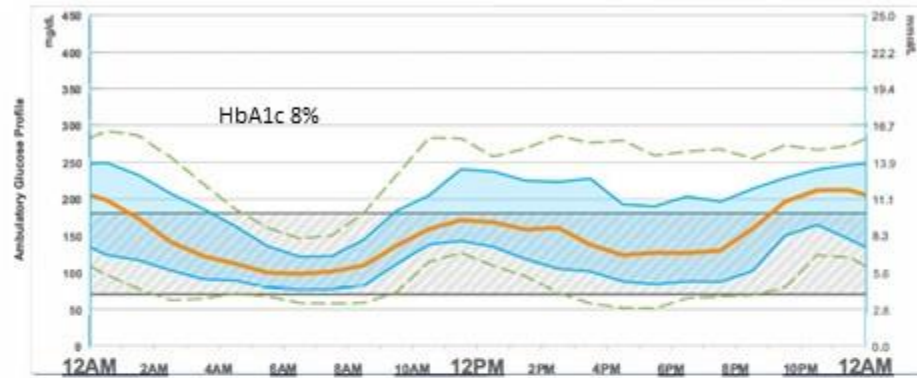
New Definitions of Glycemic Control *(aka "Beyond A1c")*

- **Time in Range**
  - % of time in "safe" range (70-180 mg/dL)
- **Hypoglycemia ("level 1")**
  - % of time < 70 mg/dL
- **Hypoglycemia ("level 2")**
  - % of time < 54 mg/dL
- **Hypoglycemia unawareness**
  - Autonomic/neuropathic complication due to extended time spent in hypoglycemia over time
  - Patients no longer have autonomic symptoms of hypoglycemia
  - 20-25% T1D patients hypoglycemia unaware
- **Hyperglycemia ("level 1")**
  - % time spent > 180 mg/dL
- **Hyperglycemia ("level 2")**
  - % time spent > 250 mg/dL

2015 Proceedings AACE and ACE Consensus Conference on Glucose Monitoring

- CGM is recommended in all patients with type 1 DM and should be available to all type 2 DM on multiple daily injections, basal insulin or sulfonylureas

- CGM should be used in all who are at risk for hypoglycemia and/or have hypoglycemia unawareness

- Intermittent use (1-2 weeks) in patients with type 2 DM might be more effective than daily fasting levels in guiding the need for medication adjustment or advancing to new medications

Grunberger G et al. *Endocr Pract*.2015;21(5):522-533.

How Does Continuous Glucose Monitoring Work?

1. **Sensor:** measures glucose levels just underneath the skin
   Sensor Applicator: (Disposable) used to insert the sensor
2. **Transmitter:** wirelessly sends data to the receiver
3. **Receiver:** displays sensor glucose readings, trend graph, direction and rate of change arrow

Continuous Glucose Monitor

Real-time

- 7.14 When used properly, real-time continuous glucose monitoring in conjunction with intensive insulin regimens is a useful tool to **lower A1C** in adults with type 1 diabetes who are not meeting glycemic targets. A

- 7.16 Real-time continuous glucose monitoring should be used as close to **daily** as possible for maximal benefit. A

Intermittently scanned

- 7.19 Intermittently scanned continuous glucose monitor use may be considered as a substitute for self-monitoring of blood glucose in adults with diabetes requiring frequent glucose testing. C
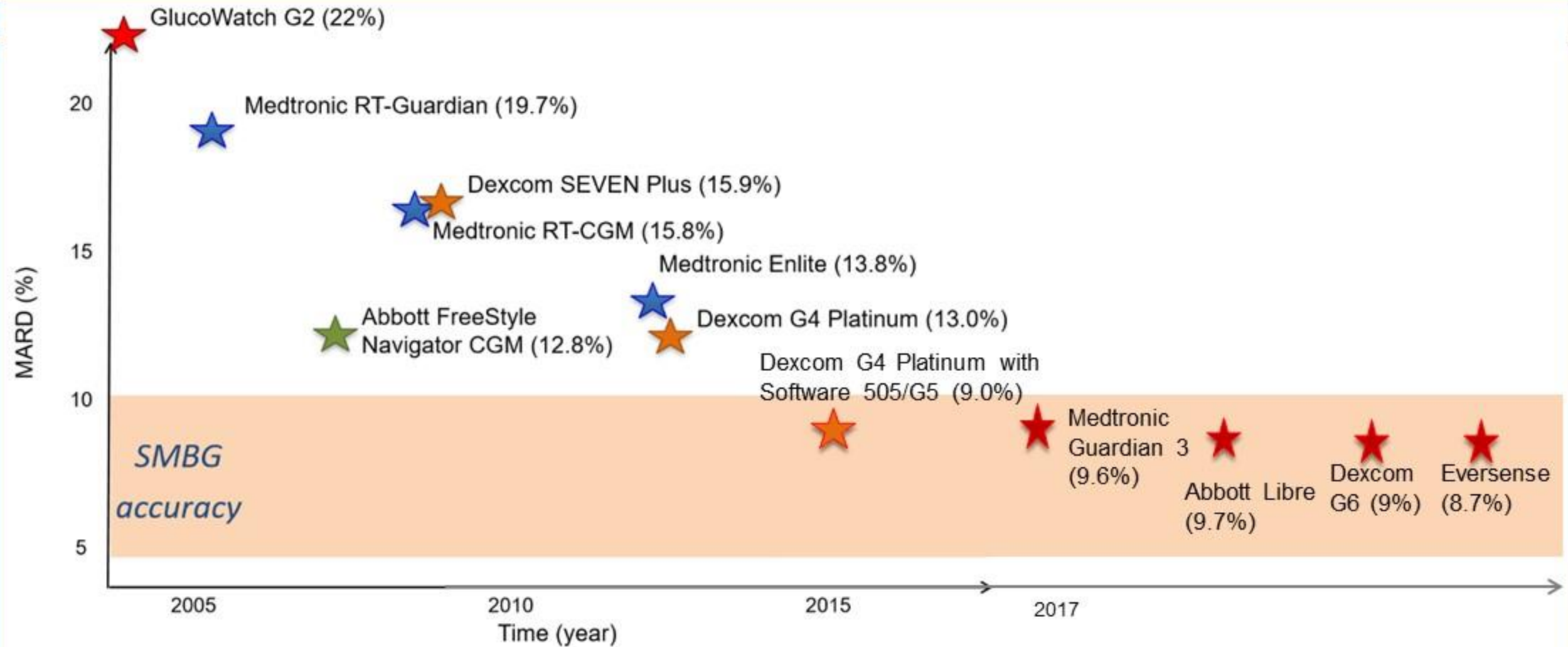
CGM Accuracy Over Time

Figure 1. The accuracy timeline of CGM sensors over the last 15 years.

CGM Categories

Real-Time CGM (rtCGM)

- Dexcom G5

- Dexcom G6

- Medtronic Enlite (530G)

- Medtronic Guardian 3 (670G)

- Medtronic Guardian Connect

- Eversense

Intermittently Scanned CGM (isCGM), FCG

- Freestyle Libre

Professional CGM (blinded CGM)

- Freestyle Libre Pro

- iPro2

- Dexcom G4/5 if blinded

Commercially Available CGM Devices in the US

rtCGM

Dexcom G6

isCGM

Freestyle Libre

Medtronic 670G

Medtronic Guardian Connect

Tandem X2

Overview of the CGM Category

Real-Time CGM

- Data transmitted continuously to a receiver or display device, which allows for alerts and alarms to be provided to the wearer without any action

Intermittently Scanned CGM

- Data not transmitted continuously from the sensor
- Results are available when the sensor is scanned with a reading device
- Full 24-h data can be captured and downloaded if the sensor is scanned at least every 8 hours
- No alerts or alarms without scanning

Petrie JR. et al. EASD and ADA Diabetes Technology Working Group. Diabetes Care 2017 Dec; 40(12): 1614-1621

Medtronic CGM

Medtronic 670G

- Key unique features
  - First hybrid closed loop system
    - Modulates insulin infusion based on sensor glucose information
  - Predictive Low Glucose Suspend and Low Glucose Suspend
  - Calibration at least once every 12 hours (3-4x/day recommended)
  - 7 day sensor use
  - Acetaminophen sensitive
  - Approved for 14 years and older

Medtronic Guardian Connect

- Stand-alone CGM system
- Key unique features
  - No receiver; display device is iOS phone only
  - Predictive Alert Schedules
    - 10-60 minute prediction of hypo-/ hyperglycemia based on threshold settings
  - Calibration at least once every 12 hours (4x/day recommended)
  - 7 day sensor
  - Acetaminophen sensitive
 - Approved for 18 and older

Dexcom G6

- Stand-alone CGM system
- Display devices = Receiver and/or Android or iOS
  - Secondary displays with Android iOS wearables
- No calibration
  - Does accept calibrations
- No confirmatory fingersticks unless:
  - Symptoms do not match CGM reading
  - No CGM number and arrow
- Remote monitoring
- Urgent Low Soon Alert
- 10 day sensor wear
- Non-adjunctive and therapeutic
- Approved for 2 years and older

Abbott CGM

Freestyle Libre (personal version, USA)

- Stand-alone CGM system
- "Flash Glucose Monitoring" System
- Display devices = Receiver only
- Predictive Alerts
- No calibration
  - Does not accept calibrations
- Confirmatory fingersticks when:
  - Hypoglycemia <70 mg/dL
  - Impending hypoglycemia
  - Rapidly changing glucose (≥ 2 mg/dL/min)
  - Symptoms of hypo- or hyperglycemia
- ▪ day wear   14
- Non-adjunctive and therapeutic
- Approved for Medicare
- Approved for 18 years and older
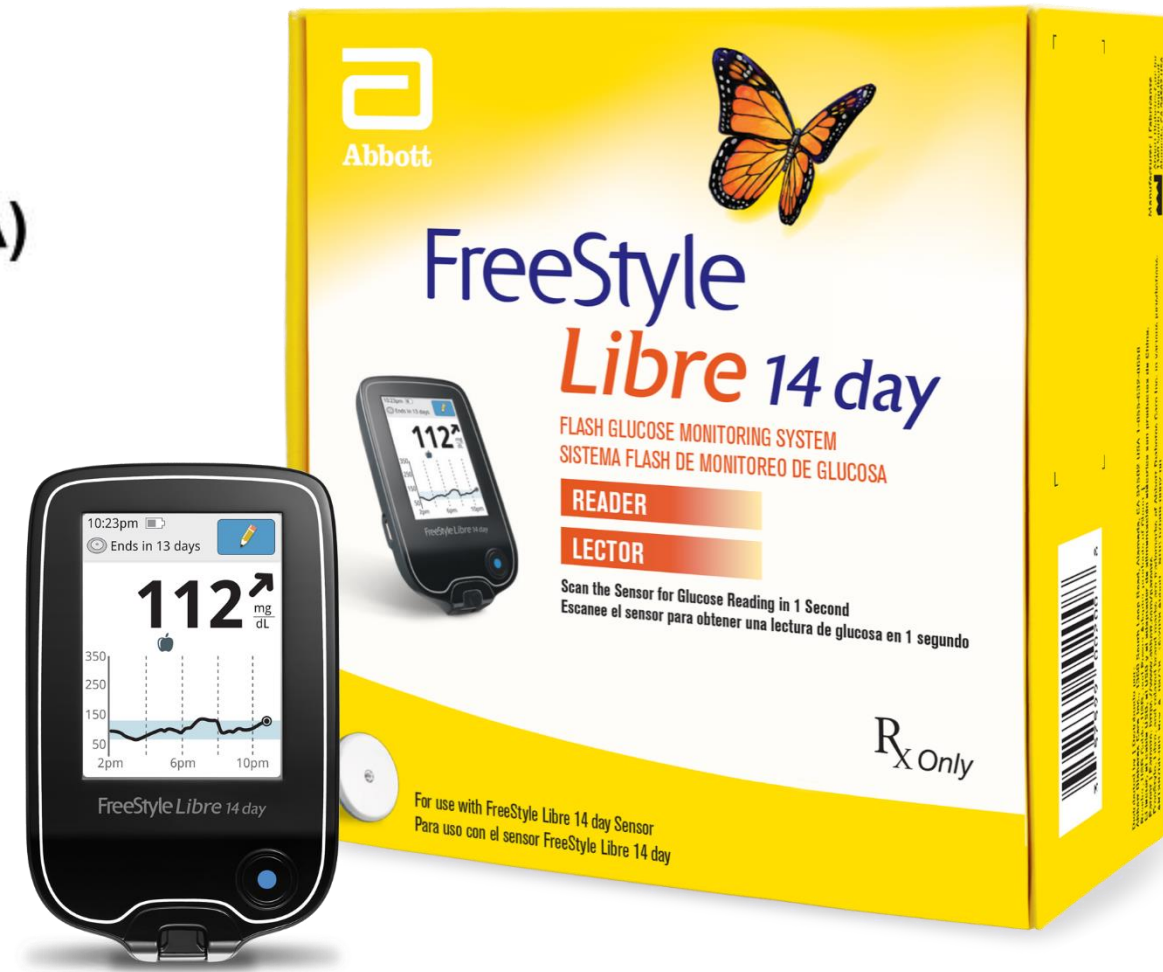
How About Implanting the Sensor?
Eversense System

Sensor

Smart Transmitter

Mobile App

109 mg/dL

Sensor that lasts up to 180 days

No weekly sensor insertion

No open wound

Removable and rechargeable

On-body vibe alerts

Gentle-on-skin adhesive

No extra device to carry

iOS and Android platform

Alarm settings and reports

www.eversensediabetes.com

Accuracy Comparisons of Available CGM Systems

	G6	Medtronic 670G Guardian 3		FreeStyle Libre[3]
Overall MARD%	9.0	abdomen 10.6 (9.6 if 3-4 cal)	arm[2] 9.1 (8.7 if 3-4 cal)	9.7
Overall %20/20	94	88[1]	92 [2]	91
Day 1 MARD%	9.3	13[1]	10.8 [2]	10.7
Day 1 %20/20	92	81[1]	UNK	87.4
Hypoglycemia %20/20 (within 20 mg/dL)	94	93[2]	93 [2]	79.4

[1] *Medtronic 670G User Guide, 2017.*
[2] *Christiansen et al., Diabetes Technol Ther. 2017 Aug 1 19(8): 446-456.*
[3] *SSED, Abbott FreeStyle Libre, Oct 2017.*

CGM Accuracy in Hypoglycemia Range (40-60 mg/dL)

Dexcom
sensor readings matching reference value (YSI)[1]

Abbott Libre
sensor readings matching reference value (YSI)[2]

Medtronic 670G
sensor readings matching reference value (YSI)[3]

63%

25%

31%
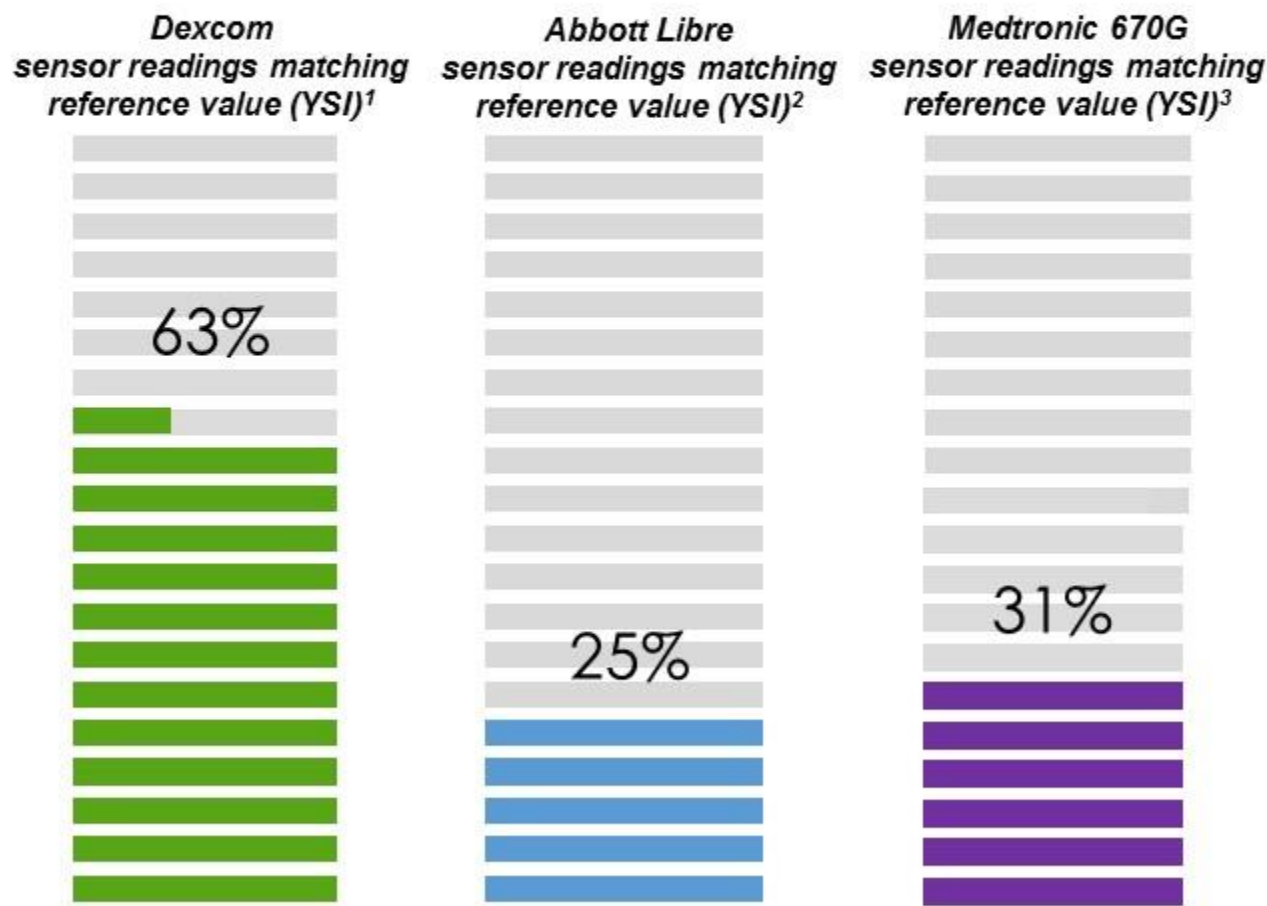
[1]*Dexcom G6 CGM System User Guide, 2018.*
[2]*Summary of Safety and Effectiveness Data (SSED), Abbott FreeStyle Libre, Oct 2017.*
3 *Medtronic 670G User Guide, 2017.*

Lower A1c and Improved Overall Quality of Glucose Control with MDI Patients on CGM

CGM Added to T1D Patients on MDI —> A1c down by 1.0% Within 6 Months

Baseline A1C = 8.6%	CGM Group (n=105)	Control Group (n=53)	Difference	P Value
Change in A1C from baseline Mean adjusted difference, % (99%CI)	-1.0%	-0.4%	-0.6% (0.8-0.3)	<.001
A1C Reduction ≥1.0% or A1C <7.0%	52%	21%	31%	<.001
Time in Target (70-180mg/dL)	⬆ 77 min/day	🚫 no change		<.005
Hypoglycemia (<70mg/dL)	⬇ 22 min/day	⬆ 8 min/day		<.002
Hyperglycemia (>180mg/dL)	⬇ 49 min/day	⬆ 15 min/day		<.001
Glucose variability coefficient of variation, mean (SD), %	38 (6)	42 (7)	-4 (-6 to -2)	<.001

Beck RW et al., JAMA. 2017;317(4):371-378

IN CONTROL RCT: CGM Benefits in People with Impaired Hypoglycemia Awareness

Crossover CGM study In 52 participants with Impaired Hypoglycemia Awareness
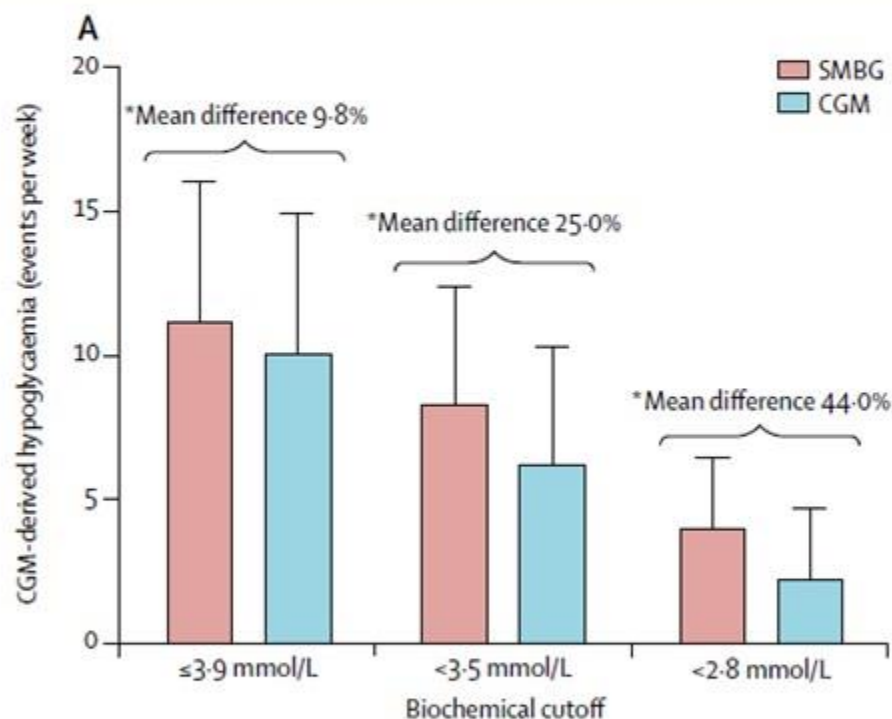
Figure A – CGM derived hypoglycemia
*p<0.05
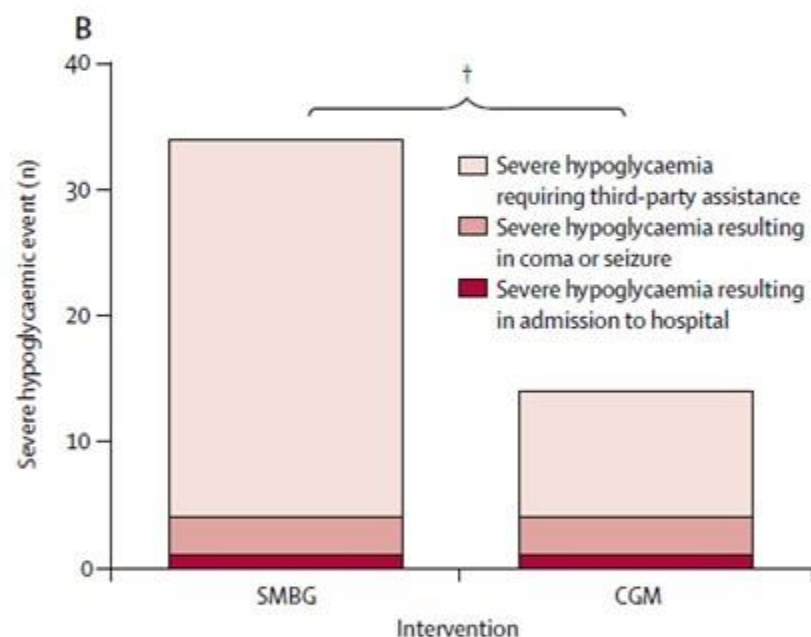
Figure B – severe hypoglycemia
†p=0.033

Van Beers, C.A. et al. The Lancet Diabetes & Endocrinology. 2017; 4(11), 893-902

CGM Benefited Anyone with T1D Regardless of Age or Education

Age
(A1c)
25-45 years = 0.9%
≥ 60 years = 1.0%

Education
(A1c)
≤ Bachelor's degree = 1.0%
≥ Bachelor's degree = 1.0%

Diabetes Numeracy Score
(A1c)
≤60% = 1.1%
>60% = 0.9%

A1c ≥8.5%

Average A1C reduction
1.3%

93% of patients wore CGM ≥ 6 days per week

Patients decreased SMBG ~1.5 finger sticks/day

Beck RW et al., JAMA. 2017;317(4):371-378

GOLD: Reduction in Time Spent in Hypoglycemia with Continuous Use of CGM

Òlafsdòttir AF et al. Diabetes Technol Ther 2018;20:274-284
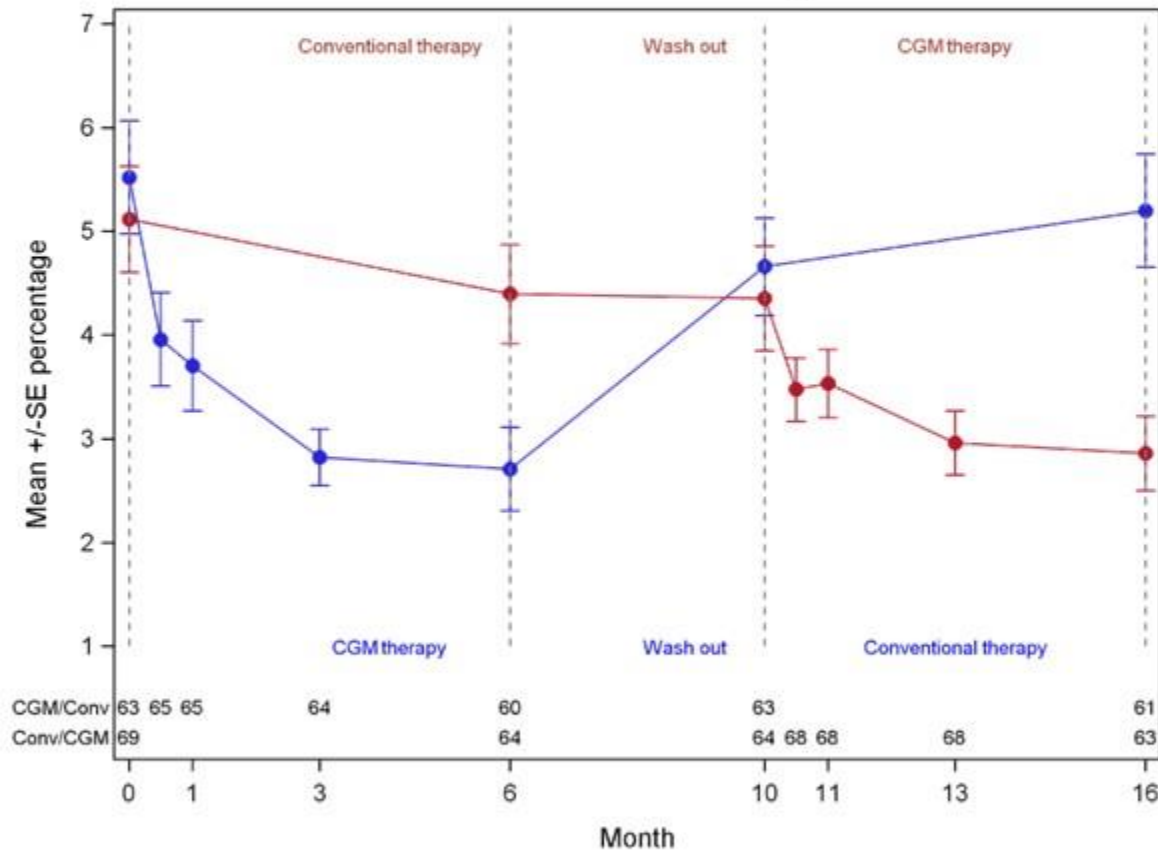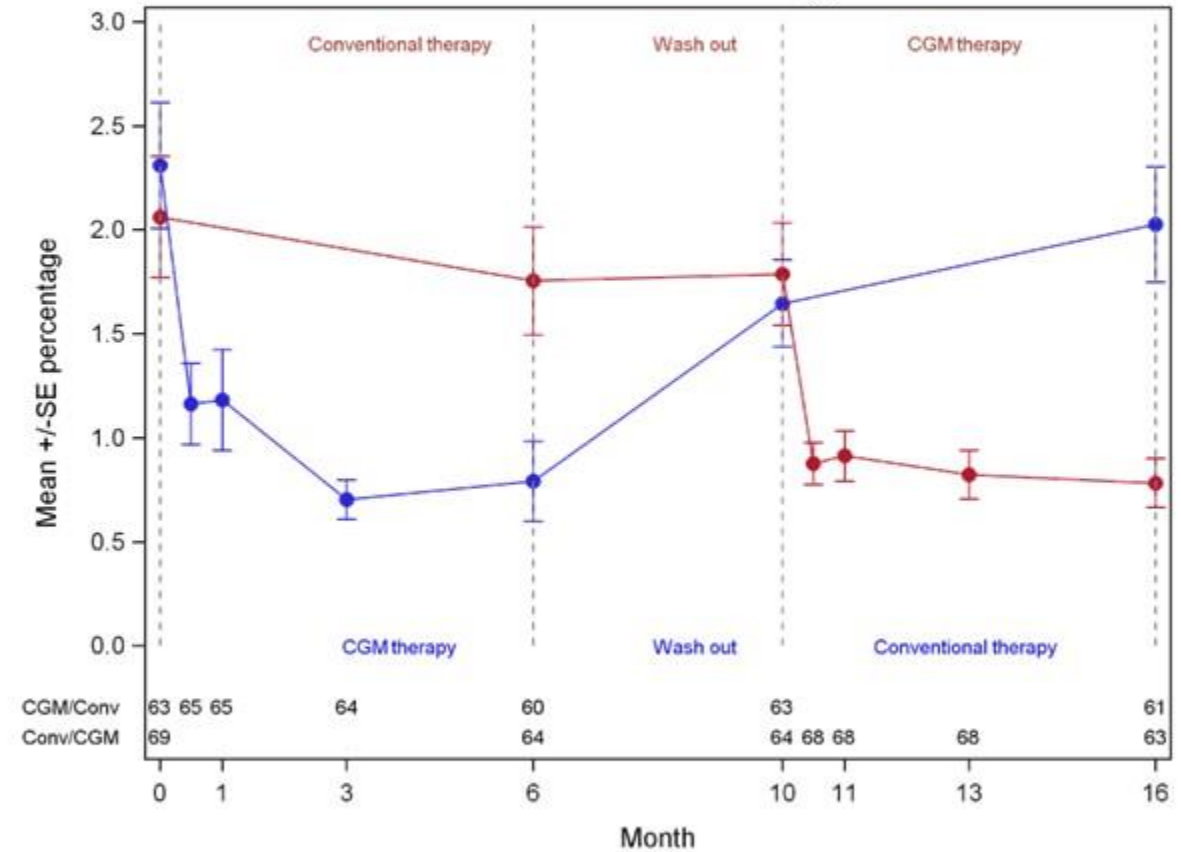
Freestyle Libre CGM Outcome – Type 2 IIT Diabetes

REPLACE: Randomized trial of 224 adult IIT users with T2D

- **FreeStyle Libre reduced hypoglycemia by more than 50%**
- **Nighttime hypoglycemia improved with FreeStyle Libre**
- **FreeStyle Libre improved quality of life and patient-reported outcome measures**

Haak T et al. Diabetes Technol Ther 2016;18(Suppl 1):A28
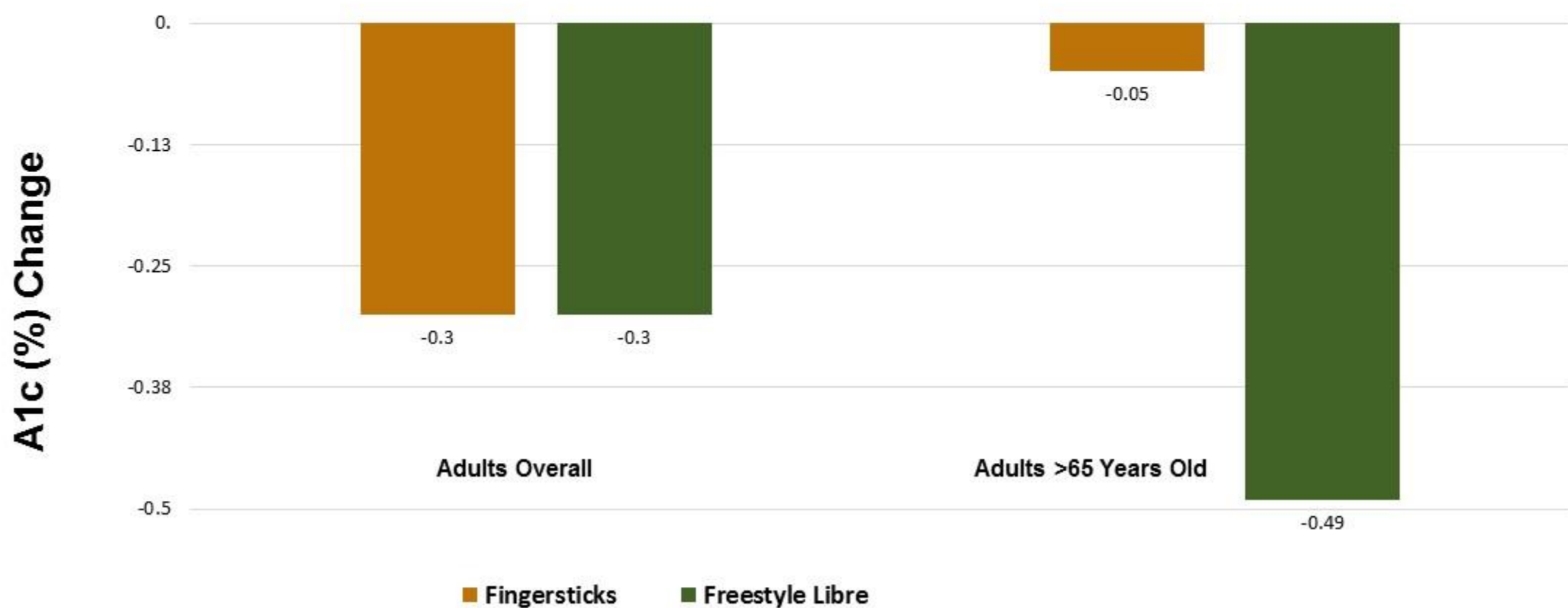
"Seniors": T1D and T2D, insulin taking

≥ 60 yrs

Mean HbA1c Change from Baseline, %

0.0

-0.5

-1.0

N=63 (CGM)

N=53 (Usual care)

-1

P = 0.001

■ CGM   ■ Usual care

97% used CGM > 6 days/wk

Reudy, Parkin, Riddlesworth, Graham., Diamond Study Group. JDST, https://doi.org/10.1177/19322968177044
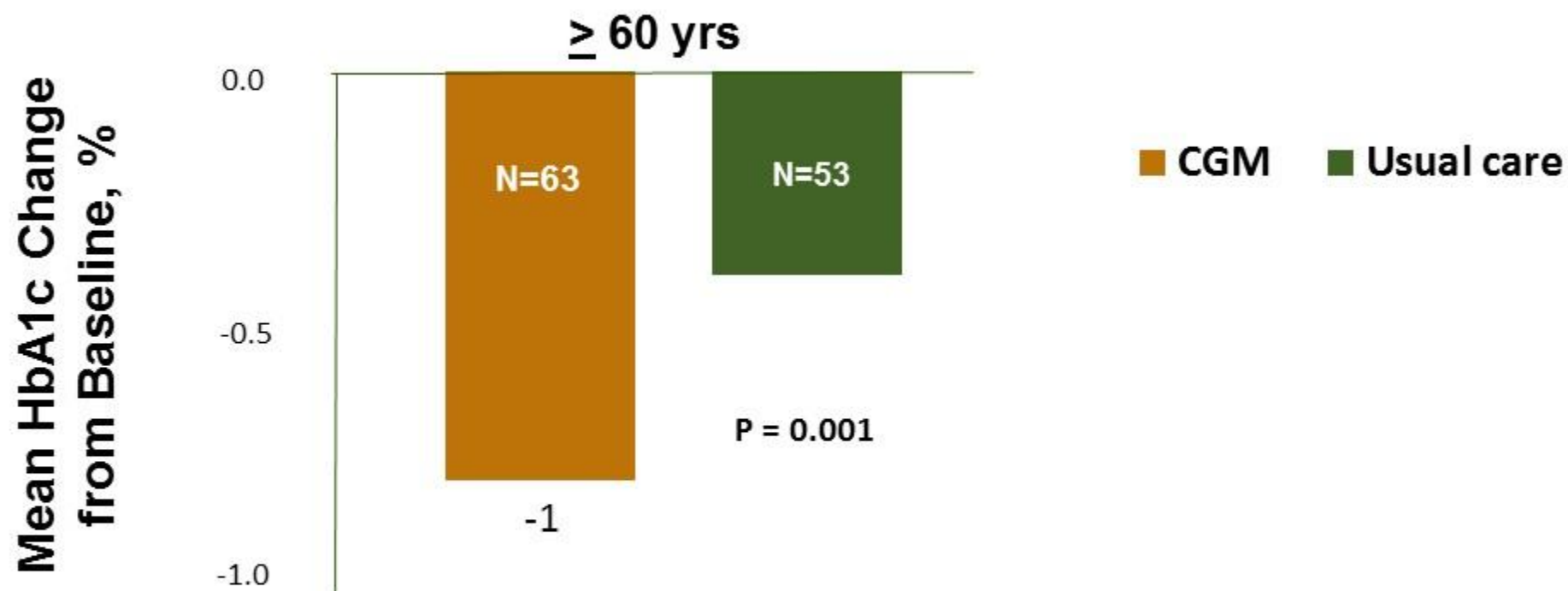
Summary of the Clinical Evidence Around CGM   As Standard of Care

- It is NOT about how you deliver insulin, ***it is about using CGM***
- **CGM** needs to be worn on a near daily basis for sustaining clinical benefit
- **CGM** has a broad value to all different types of patients
    - All patients (T1D and T2D) on intensive insulin therapy regimens
    - Hypoglycemia/hypoglycemia unawareness
    - Patients with high A1c are candidates for CGM
- **CGM** is an appropriate first technology to be added to a patient's diabetes management regimen*
- Patients who do not carb count, do not do 'diabetes math' well, at all education levels and ages seem to benefit from **CGM**

young children may be an exception

The Ideal Candidate for CGM

▶ **<u>Any</u>** patient treated by intensive insulin therapy

▶ Experiencing frequent hypoglycemia

▶ Hypoglycemia unawareness

▶ Excessive glucose variability

▶ Varying and/or intensive activity

▶ Desire to improve glycemic control

▶ Willing and able to use CGM on a nearly daily basis

▶ Willing and able to learn how to use device and receive ongoing education

Aleppo G, Laffel LM, et al. *J Endocr Soc.* 2017 Nov 20;1(12):1445-1460.
Laffel LM, Aleppo G, et al. *J Endocr Soc.* 2017 Nov 20;1(12):1461-1476.
Peters AL, et al. *J Clin Endocrinol Metab.* 2016 Nov;101(11):3922-3937.

Which Patients Are Candidates (continued)?

► Children

► Interested in an insulin pump or wish to own CGM

► To convince patients to progress therapy

► Not at treatment goals but trying so hard to be

► Gastroparesis

► Needs/wants to make lifestyle changes

Benefits to Patients

- Help warn signs of high and/or low glucose levels
- Alert to be pro-active
- Alert to nocturnal "lows"
- Gives feedback on effect on glucose of food, activity, stress and medications
- Provides constant information, not a point in time
- May provide real time information to family members/ physicians if remote applications are used

Why Use Professional CGM in Your Practice?

- Provides insight into trending information/pattern management
- Identifies insulin action (insulin dose effect) and potential need for additional adjustments/medications to control postprandial glucose
- Provides information about timing of food digestion and timing of insulin administration
- Provides continuous data for overnight basal testing and assessment of nocturnal hypoglycemia
- Find patterns that otherwise could not be detected by finger stick alone
- Find patterns of undetected low BG in patients at treatment goal
- Allows for *efficiently and effectively* identifying areas of clinical challenges and applying appropriate medical management to address that specific clinical issue.
- And so much more…

How to Interpret a CGM Report

- Check for adequate data
- Check for factors that affect glucose: food, medications, exercise
- Talk to patient about Time in Range
- Look for patterns of low or high glucose
- Look for areas of high glucose variability
- Agree on an action plan

Stepwise Approach to Interpreting CGM Reports

▶ Fix lows first
  ▶ Overnight
  ▶ Throughout the day
▶ Fix overnight hyperglycemia
  ▶ Look to dinner and/or bedtime control
▶ Fix pre-prandial hyperglycemia
▶ Fix post-prandial hyperglycemia
▶ Address lifestyle issues

Why GMI? A New Way to Gauge Glycemic Management

- Expresses mean CGM glucose in patient friendly A1C
- Replaces estimated A1C (eA1C)
- Avoids confusion when eA1C and laboratory A1C did not match
- Talk to your patients that the GMI and lab A1C may not match due to differences in lifespan of RBC, timing of lab vs. CGM data, A1C is variable
  - About 50% of time absolute difference between GMI and lab A1C will be ≥0.3%

For the math majors!

$$GMI\ (\%) = 3.31 + 0.02392 \times [\text{mean glucose in mg/dL}]$$

Table 1—GMI calculated for various CGM-derived mean glucose concentrations	
CGM-derived mean glucose (mg/dL)	GMI (%)*
100	5.7
125	6.3
150	6.9
175	7.5
200	8.1
225	8.7
250	9.3
275	9.9
300	10.5
350	11.7

CPT Codes for Professional and Personal CGM

- 95249 - CGM patient provided equipment, sensor placement, hook-up, calibration of monitor, patient training, and printout
- 95250 - CGM HCP (office) provided equipment, sensor placement, hook-up, calibration of monitor, patient training, removal of sensor, and printout
- 95251 - CGM analysis, interpretation and report
  - Can be billed monthly on ongoing basis
- General comments:
  - All codes require a minimum of 72 hours of data
  - Use -25 modifier for CGM codes if billing same day as a Problem Visit code (99212-99215) if significant an separately identifiable service took place
    - Ie 99212-99215: Pre-CGM evaluation (+) -25 95250: CGM start-up and instruction

Physician Reimbursement of CGM

Two components:

- Who owns the equipment?
  - Patient or Physician
    - Different codes
    - Service occurs over more than one day
    - Minimum of 72 hours of data
    - Download of receiver must occur in providers office
    - Service is charged on the day of the day of download
    - No physician work involved

  - Interpretation of Data
    - Minimum of 72 hours
    - Non face to face
    - Limitations of who can bill – MD, NP, PAs

Patient Access to CGM - Medicare

Current Medicare guidelines will cover CGM for therapeutic monitoring of blood sugars if

1. Patient has diabetes (type 1 or 2)

2. Insulin regimen requires frequent adjustment by the beneficiary on basis of BGM or CGM

3. 3 or more injections per day or using an insulin pump

4. Testing blood sugar 4 or more times a day

5. Every 6 months following initial prescription of CGM, the treating practitioner has an in-person visit with the beneficiary to assess adherence to their CGM regimen and diabetes treatment plan

Ref: Coding and Coverage – Therapeutic Continuous Glucose Monitors (CGM)." Noridian Healthcare Solutions. Published March 23, 2017

CGM Glucose Pattern Summary
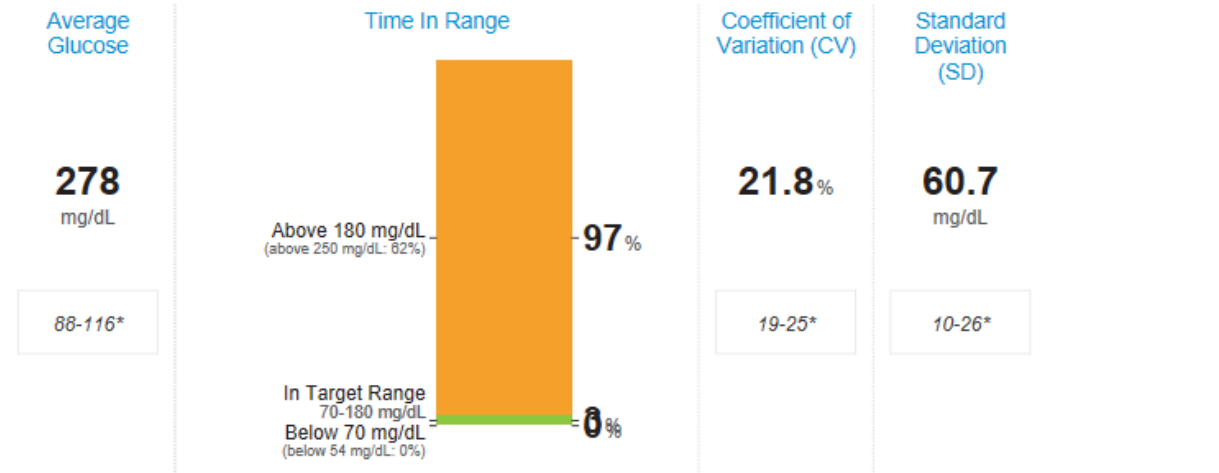May 22, 2018 - June 5, 2018 (15 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
278 mg/dL		**21.8**%	**60.7** mg/dL
88-116*		19-25*	10-26*

Time In Range:
Above 180 mg/dL (above 250 mg/dL: 82%) — **97**%
In Target Range 70-180 mg/dL — **0**%
Below 70 mg/dL (below 54 mg/dL: 0%)

SR 73 y/o male
Type 2 Diabetes Mellitus x 16 years
Insulin user for several years
Current Rx: 60 u Lantus hs + Victoza 1.8 mg d
Stable weight BMI= 38 Kg/mt^2
Asymptomatic
HTN; Dyslipidemia; ASCVD; CKD Stage III with Proteinuria
Hb A1c 9.4%

Ambulatory Glucose Profile

Curves/plots represent glucose frequency distributions by time regardless of date

SR 73 y/o male
Type 2 Diabetes Mellitus x 16 years
Insulin user for several years
Current Rx: Current Rx: Humulin U500 twice daily
+ Victoza 1.6 mg daily
Stable weight BMI= 38 Kg/mt^2
Asymptomatic
HTN; Dyslipidemia; ASCVD; CKD Stage III with
Proteinuria
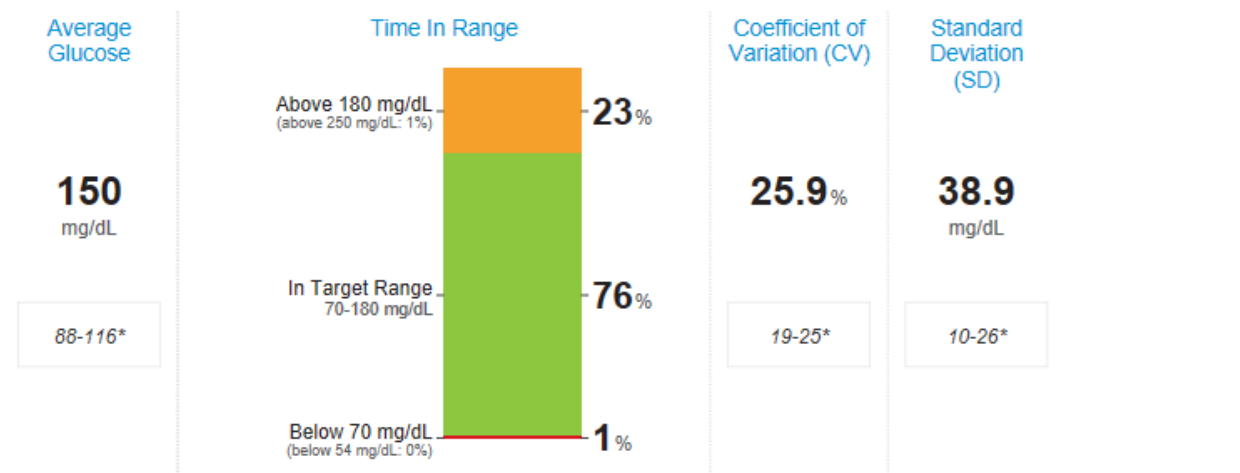HbA1c 7.6 %

CGM Glucose Pattern Summary
February 19, 2019 - February 27, 2019 (9 Days)

LibreView

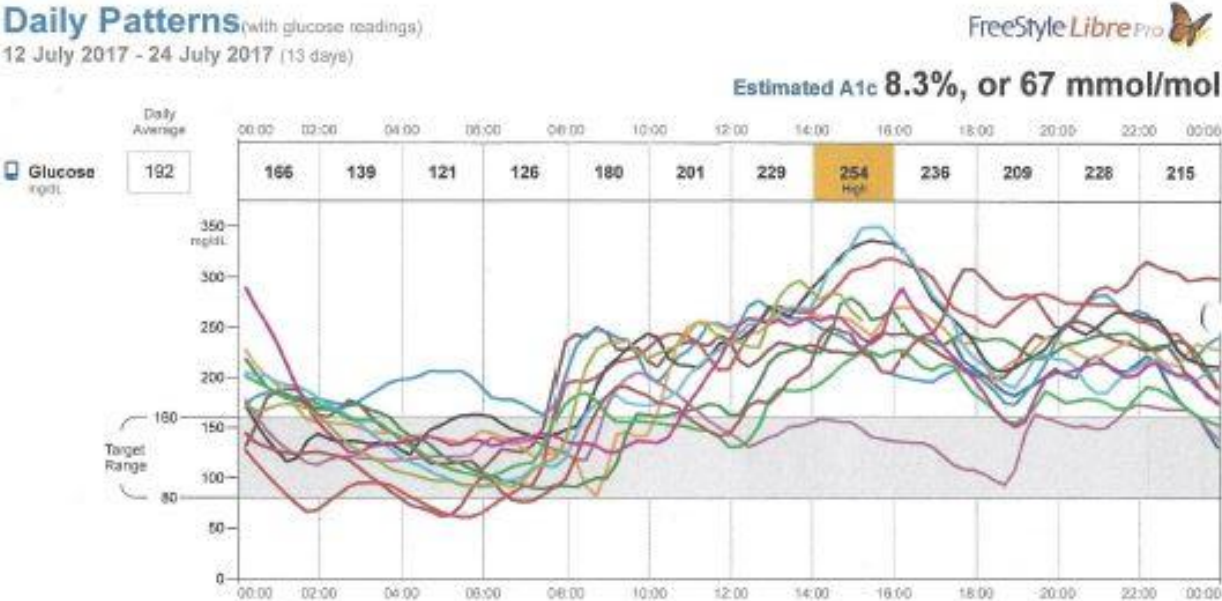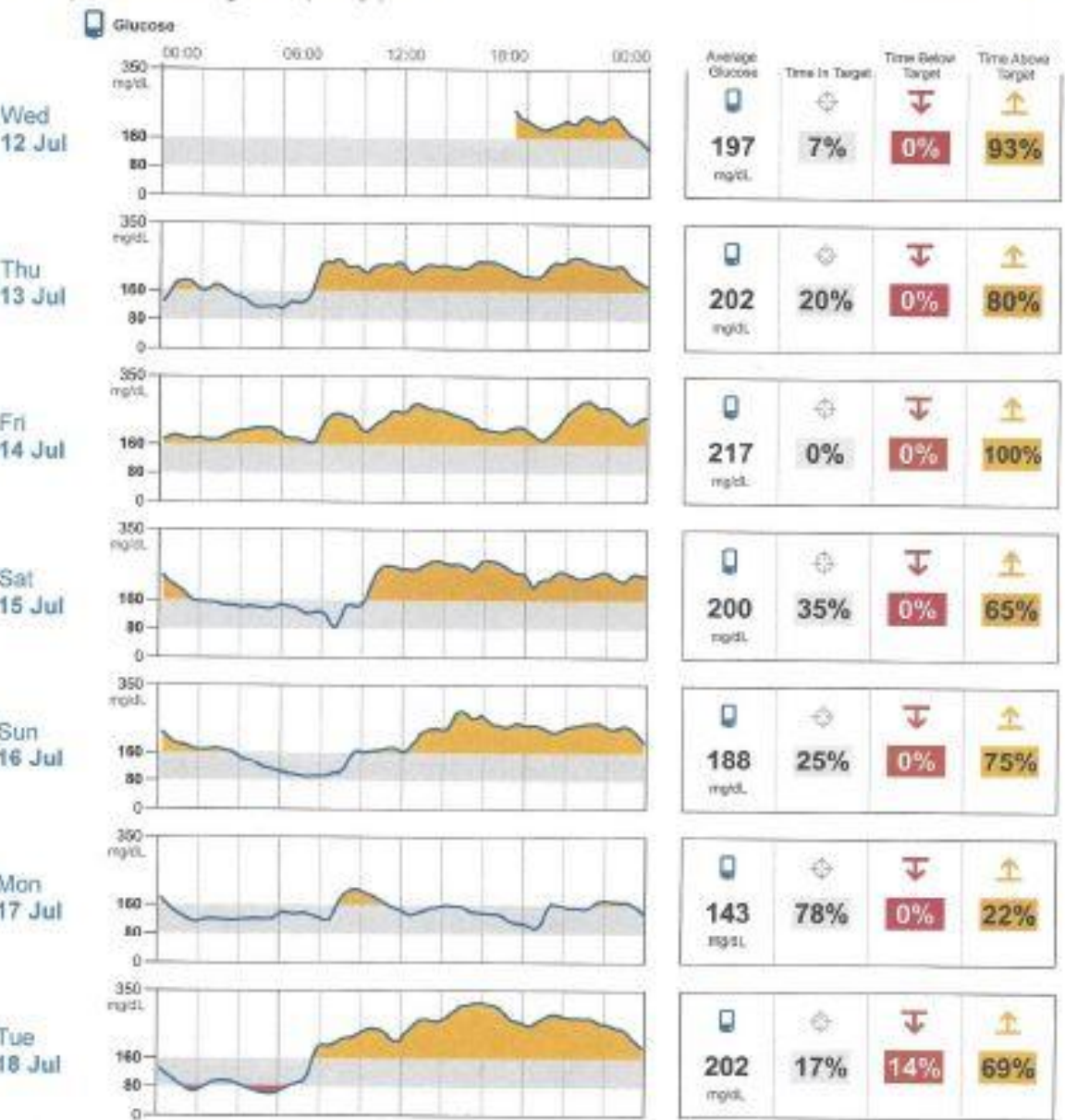CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
150 mg/dL	Above 180 mg/dL (above 250 mg/dL: 1%) **23%**	**25.9%**	**38.9** mg/dL
	In Target Range 70-180 mg/dL **76%**		
88-116*	Below 70 mg/dL (below 54 mg/dL: 0%) **1%**	19-25*	10-26*

Ambulatory Glucose Profile

Curves/plots represent glucose frequency distributions by time regardless of date

Left Report

CGM Glucose Pattern Summary
May 22, 2018 - June 5, 2018 (15 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
278 mg/dL		**21.8**%	**60.7** mg/dL
88-116*		19-25*	10-26*

Above 180 mg/dL (above 250 mg/dL: 62%)   **97**%
In Target Range 70-180 mg/dL
Below 70 mg/dL (below 54 mg/dL: 0%)   **0**%

Right Report

CGM Glucose Pattern Summary
February 19, 2019 - February 27, 2019 (9 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
150 mg/dL		**25.9**%	**38.9** mg/dL
88-116*		19-25*	10-26*

Above 180 mg/dL (above 250 mg/dL: 1%)   **23**%
In Target Range 70-180 mg/dL   **76**%
Below 70 mg/dL (below 54 mg/dL: 0%)   **1**%

DC
72 y/o male Diabetes Mellitus since age 32
Co-morbidities: HTN, CKD Stage 3, Dyslipidemia, microalbuminuria
Insulin user for several years
HbA1c= 7.7%
Rx: 24 units Lantus, Januvia 100 mg po d & Metformin 1Gm po bid

Daily Glucose Summary
12 July 2017 - 24 July 2017 (13 days)
FreeStyle Libre Pro

	Average Glucose	Time In Target	Time Below Target	Time Above Target
Wed 12 Jul	197 mg/dL	7%	0%	93%
Thu 13 Jul	202 mg/dL	20%	0%	80%
Fri 14 Jul	217 mg/dL	0%	0%	100%
Sat 15 Jul	200 mg/dL	35%	0%	65%
Sun 16 Jul	188 mg/dL	25%	0%	75%
Mon 17 Jul	143 mg/dL	78%	0%	22%
Tue 18 Jul	202 mg/dL	17%	14%	69%

Daily Patterns (with glucose readings)
12 July 2017 - 24 July 2017 (13 days)
FreeStyle Libre Pro

Estimated A1c 8.3%, or 67 mmol/mol

Daily Average	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00	00:00
Glucose 192 mg/dL	166	139	121	126	180	201	229	254 High	236	209	228	215	

DC
72 y/o male Diabetes Mellitus since age 32
Co-morbidities: HTN, CKD Stage 3, Dyslipidemia, microalbuminuria
Insulin user for several years
HbA1c= 6.0 %
Rx: Soliqua 20 units daily & Metformin 1Gm po bid
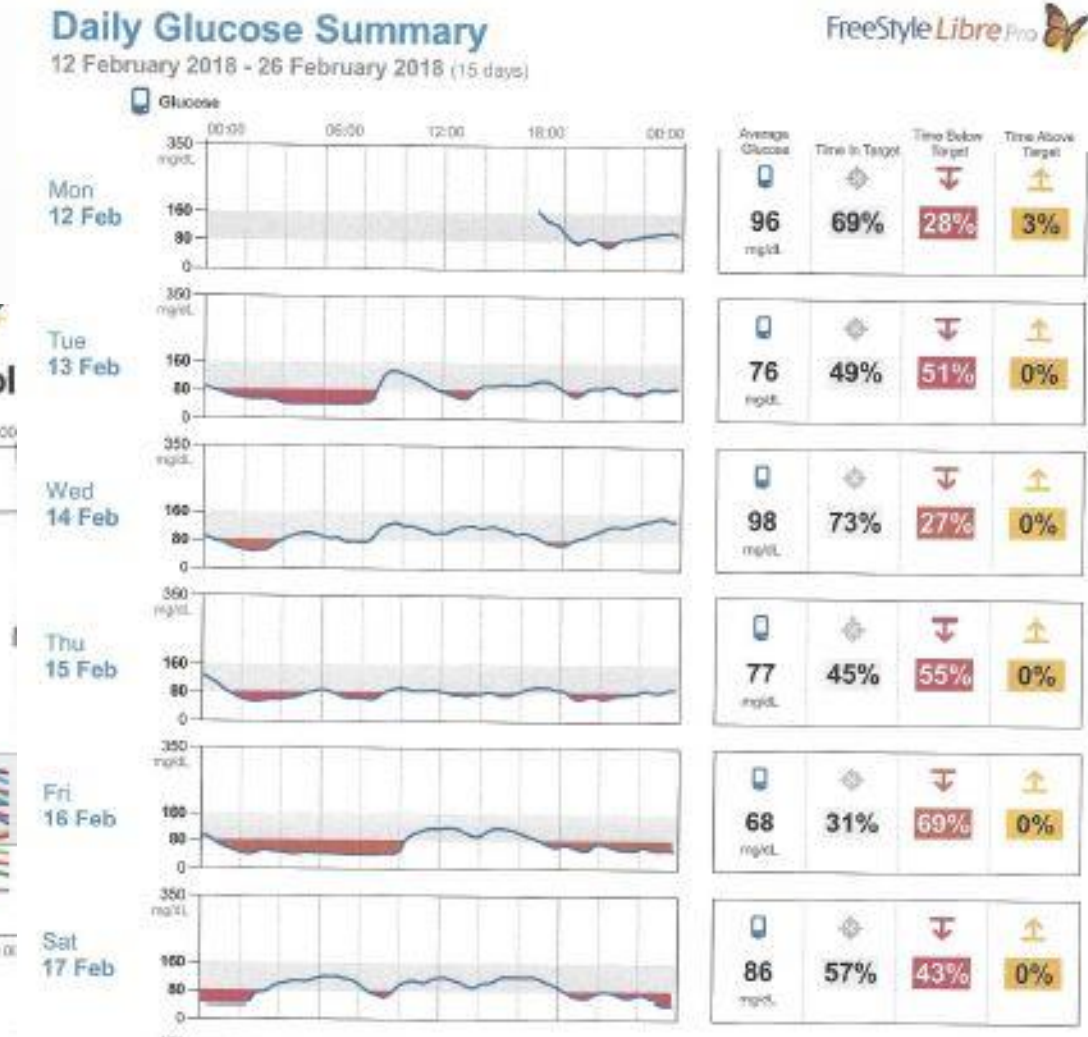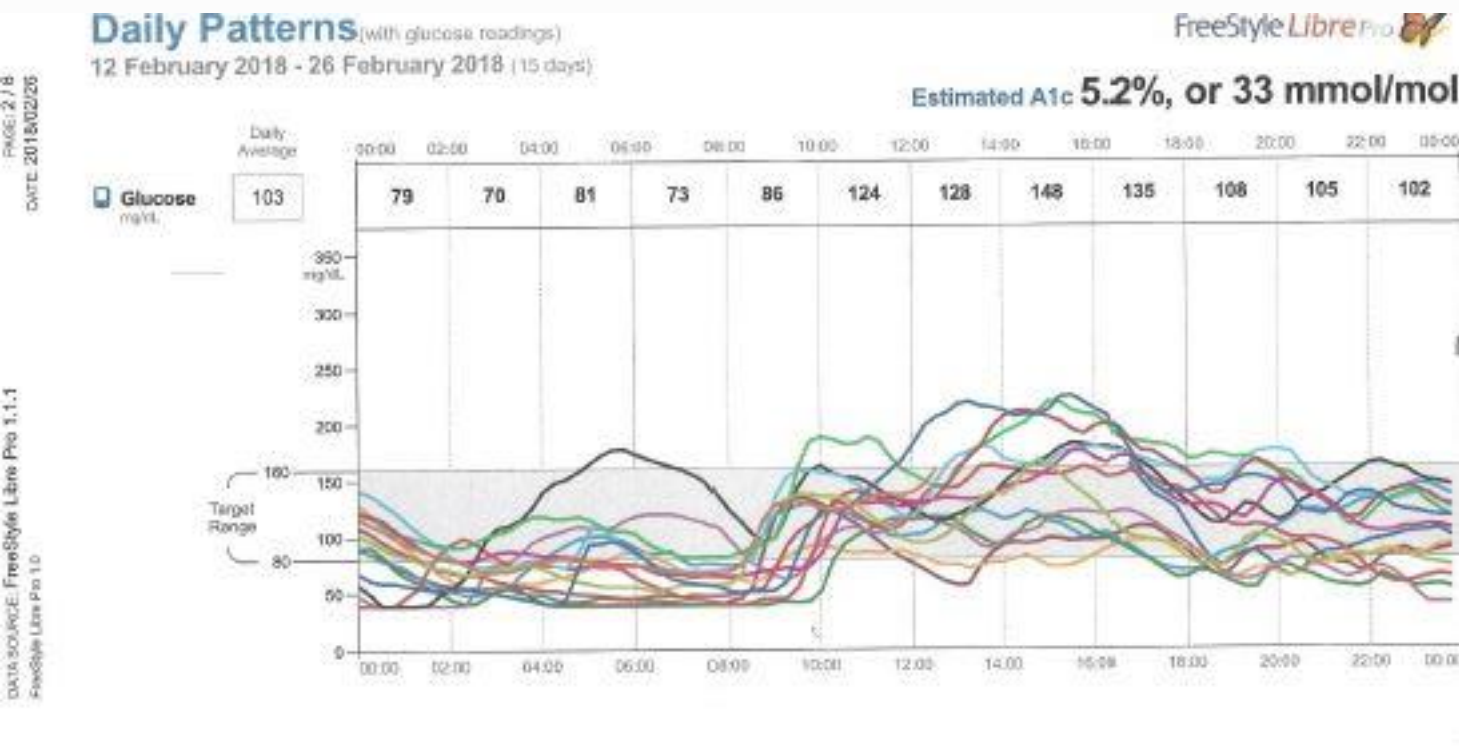
DC
72 y/o male Diabetes Mellitus since age 32
Co-morbidities: HTN, CKD Stage 3,
Dyslipidemia, microalbuminuria
Insulin user for several years
HbA1c= 6.7 %
Rx: Soliqua 18 units daily & Metformin 1Gm
po bid

Daily Patterns (with glucose readings)
1 June 2018 - 15 June 2018 (15 days)

Estimated A1c **6.6%, or 49 mmol/mol**

Daily Average	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00	00:00
Glucose mg/dL 144	124	106	92	100	158	162	160	168	156	156	182	163	

FreeStyle Libre Pro
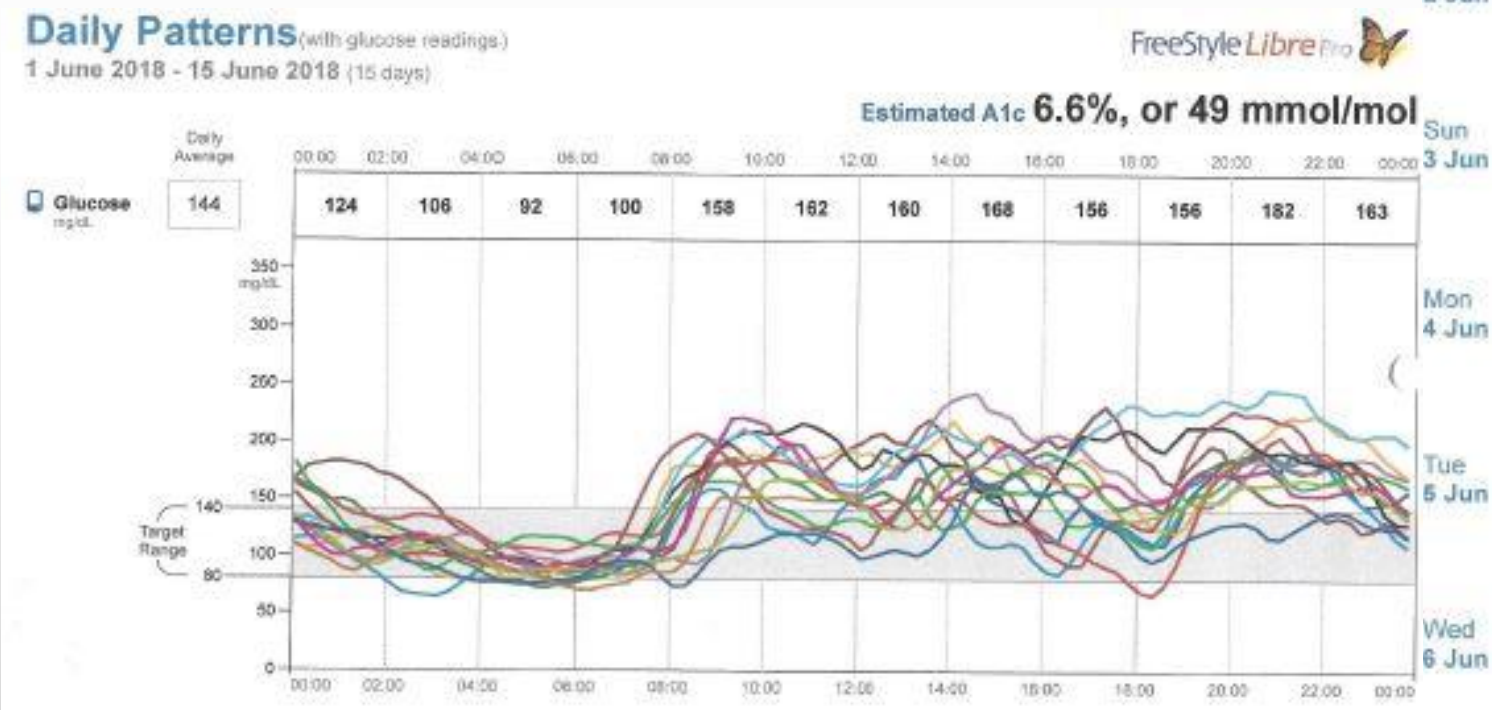
Daily Glucose Summary
1 June 2018 - 15 June 2018 (15 days)

FreeStyle Libre Pro

	Average Glucose	Time in Target	Time Below Target	Time Above Target
Fri 1 Jun	153 mg/dL	33%	0%	67%
Sat 2 Jun	162 mg/dL	31%	0%	69%
Sun 3 Jun	124 mg/dL	57%	9%	34%
Mon 4 Jun	156 mg/dL	34%	3%	63%
Tue 5 Jun	146 mg/dL	22%	8%	70%
Wed 6 Jun	151 mg/dL	39%	0%	61%

CGM Glucose Pattern Summary
December 10, 2018 - December 21, 2018 (12 Days)

LibreView

DOB: 05/08/1939   Practice Phone: 7876282151   PRINTED: 04/21/2019

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose
134 mg/dL
88-116*

Time In Range
Above 180 mg/dL (above 250 mg/dL: 2%) — **21**%
In Target Range 70-180 mg/dL — **65**%
Below 70 mg/dL (below 54 mg/dL: 5%) — **14**%

Coefficient of Variation (CV)
40.1%
19-25*

Standard Deviation (SD)
53.8 mg/dL
10-26*

...ions by time regardless of date

Target Range

MA 77 y/o male
Diabetes Type 2 since 1992
Co-morbidities: HTN; Dyslipidemia;
CKD Stage II with Proteinuria
 Asymptomatic
Stable weight BMI= 28 Kg/mt^2
Hb A1c= 7.2 %
Current Rx:
Glipizide XL 10 mg d
Janumet 50/1000 mg po bid
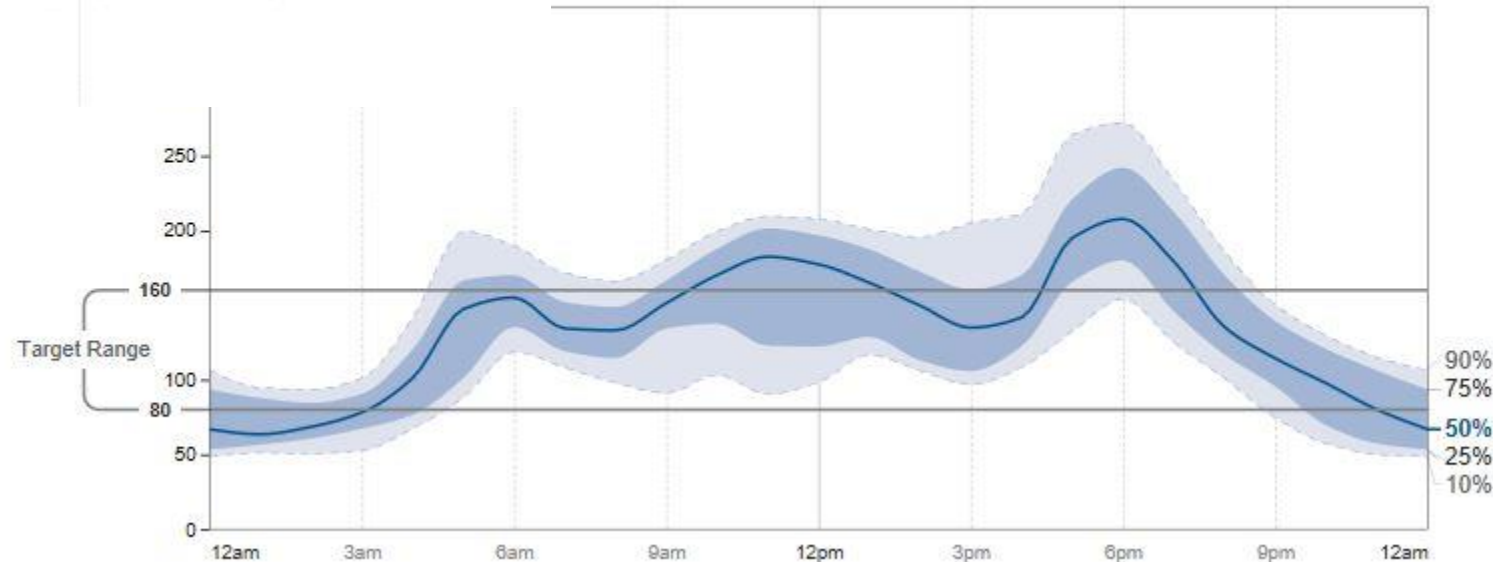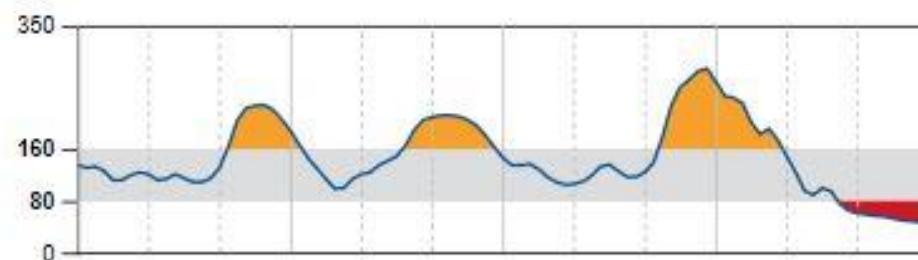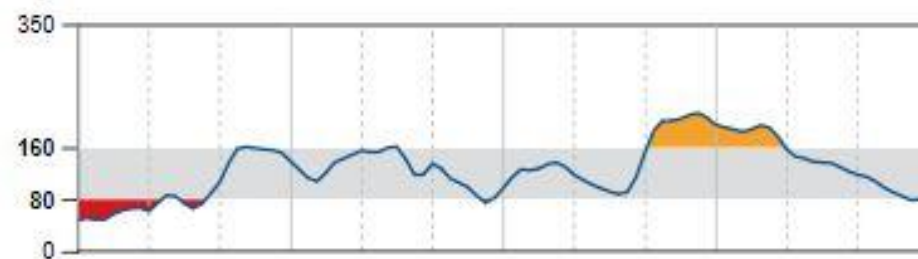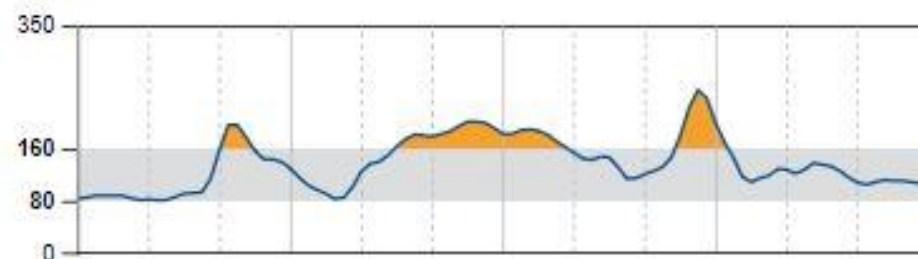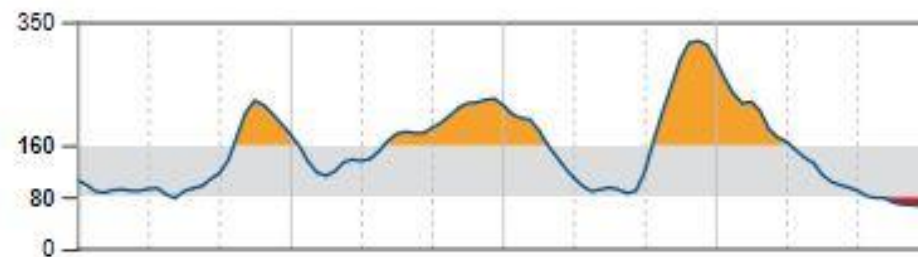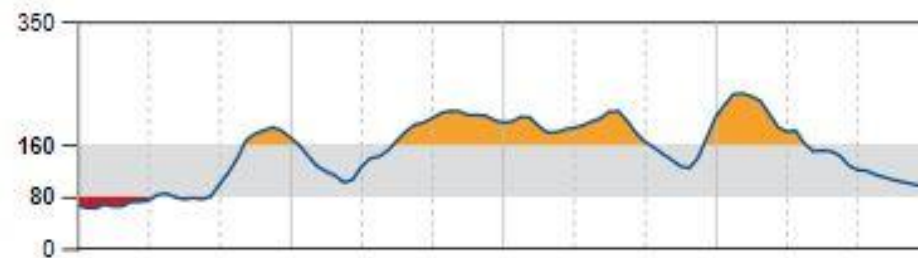
CGM Glucose Pattern Summary

January 23, 2019 - February 3, 2019 (12 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibrat

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
131 mg/dL	Above 180 mg/dL (above 250 mg/dL: 2%) **20%**	**41%**	**53.7** mg/dL
	In Target Range 70-180 mg/dL **63%**		
88-116*	Below 70 mg/dL (below 54 mg/dL: 4%) **17%**	19-25*	10-26*
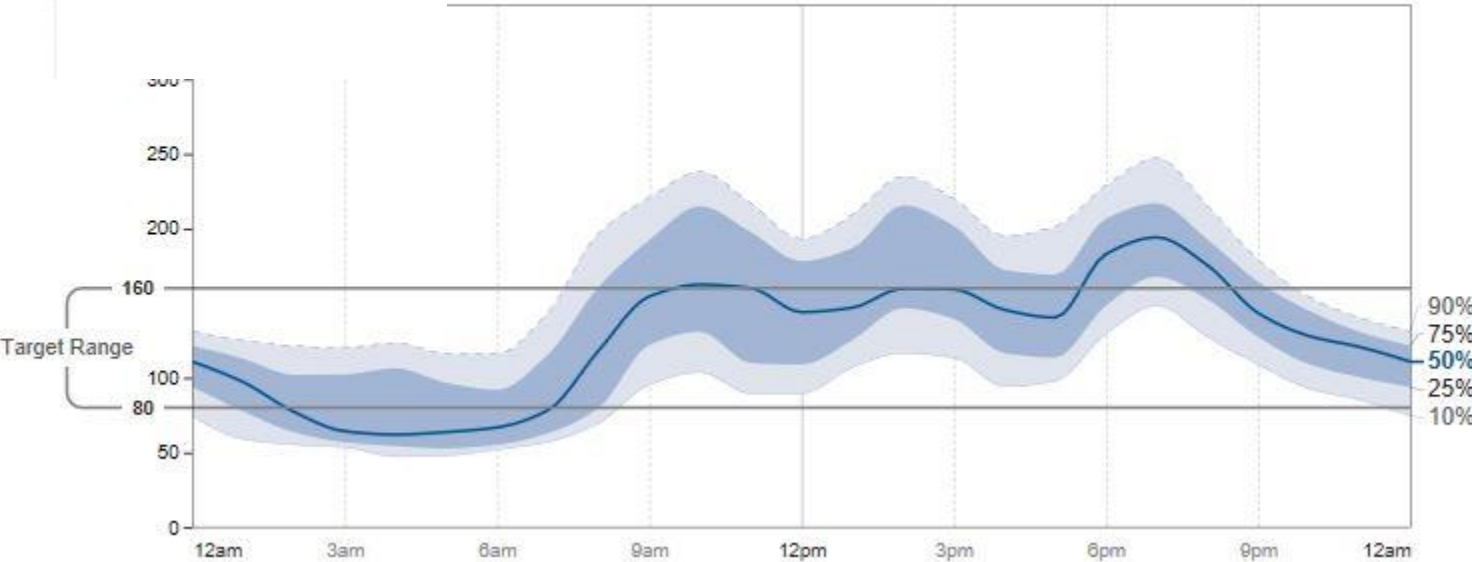
LC 77 y/o female
Diabetes Type 2 x 18 years
Asymptomatic
Stable weight BMI= 32 Kg/mt^2
Hb A1c= ? %
Current Rx:
20 units Lantus hs
Metformin 1000 mg po bid

distributions by time regardless of date

Target Range

90%
75%
50%
25%
10%

12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am
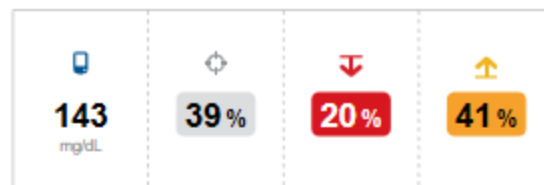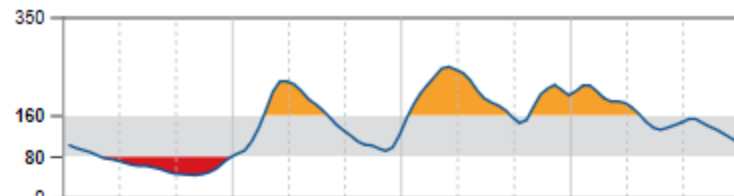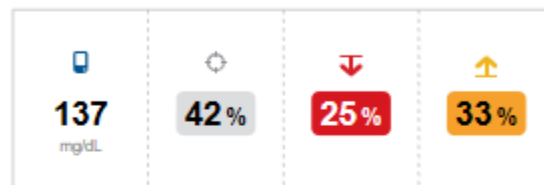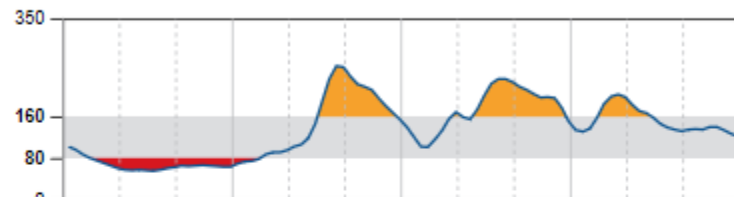
	Fri Jan 25	Sat Jan 26	Sun Jan 27	Mon Jan 28	Tue Jan 29
📱 mg/dL	143	137	133	142	134
◇	39%	42%	50%	22%	63%
⬇	20%	25%	21%	30%	10%
⬆	41%	33%	29%	48%	27%
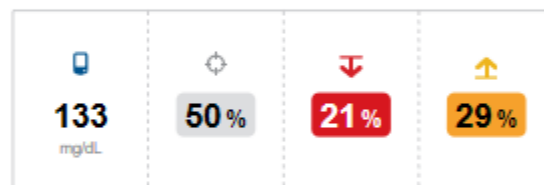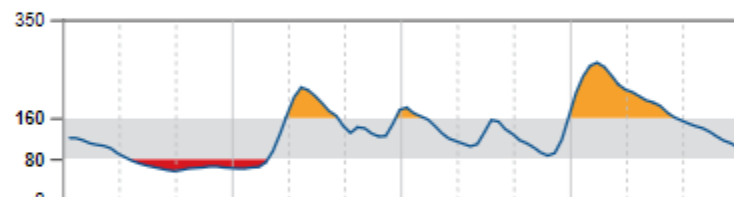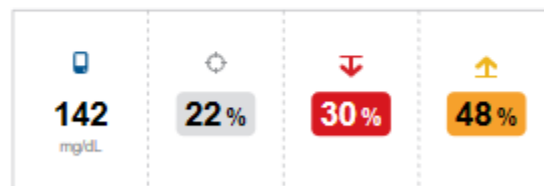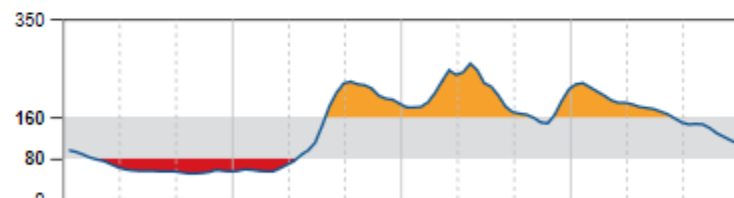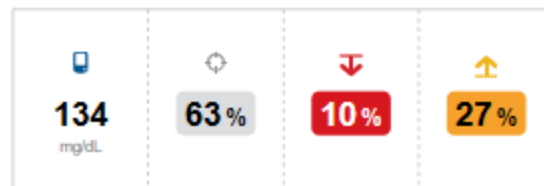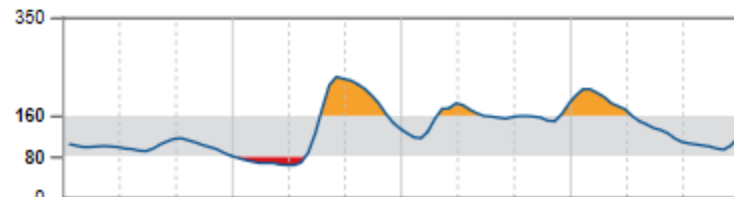
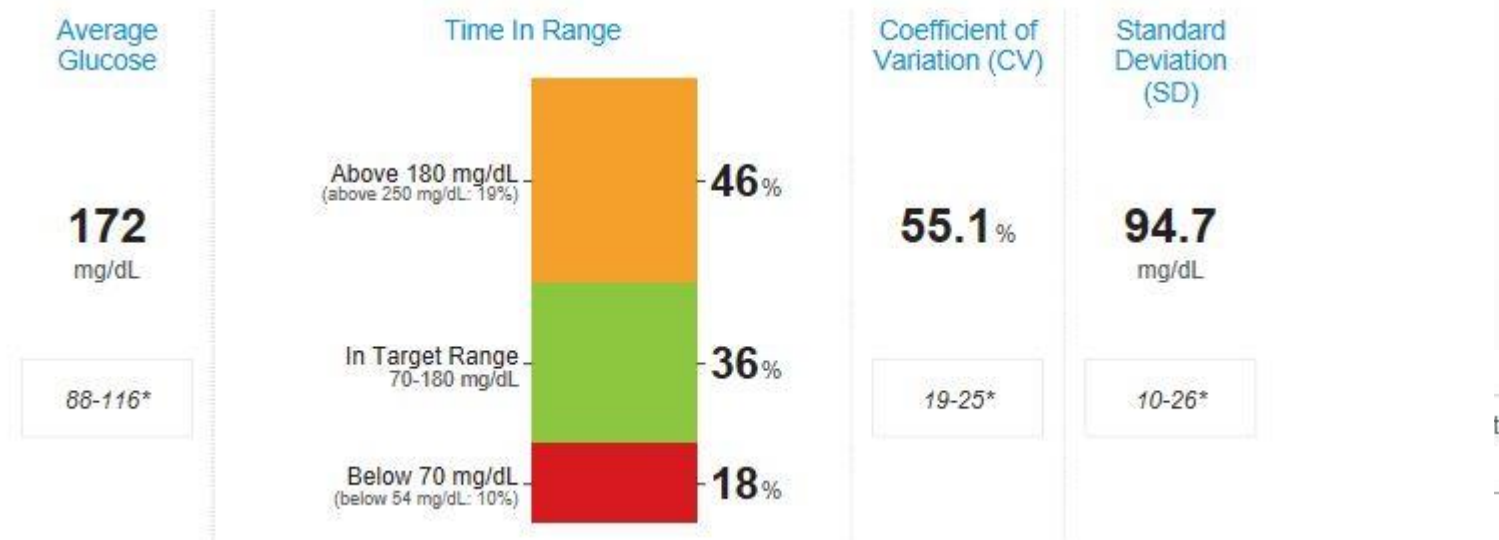|			
FreeStyle	JLGW361-1	1/26/2019 0:28	0	96
FreeStyle	JLGW361-1	1/26/2019 0:43	0	87
FreeStyle	JLGW361-1	1/26/2019 0:58	0	80
FreeStyle	JLGW361-1	1/26/2019 1:13	0	75
FreeStyle	JLGW361-1	1/26/2019 1:28	0	70
FreeStyle	JLGW361-1	1/26/2019 1:43	0	65
FreeStyle	JLGW361-1	1/26/2019 1:58	0	60
FreeStyle	JLGW361-1	1/26/2019 2:13	0	57
FreeStyle	JLGW361-1	1/26/2019 2:28	0	56
FreeStyle	JLGW361-1	1/26/2019 2:43	0	57
FreeStyle	JLGW361-1	1/26/2019 2:58	0	56
FreeStyle	JLGW361-1	1/26/2019 3:13	0	55
FreeStyle	JLGW361-1	1/26/2019 3:28	0	57
FreeStyle	JLGW361-1	1/26/2019 3:43	0	60
FreeStyle	JLGW361-1	1/26/2019 3:58	0	62
FreeStyle	JLGW361-1	1/26/2019 4:13	0	65
FreeStyle	JLGW361-1	1/26/2019 4:28	0	64
FreeStyle	JLGW361-1	1/26/2019 4:43	0	65
FreeStyle	JLGW361-1	1/26/2019 4:58	0	66
FreeStyle	JLGW361-1	1/26/2019 5:13	0	65
FreeStyle	JLGW361-1	1/26/2019 5:28	0	64
FreeStyle	JLGW361-1	1/26/2019 5:43	0	63
FreeStyle	JLGW361-1	1/26/2019 5:58	0	63
FreeStyle	JLGW361-1	1/26/2019 6:13	0	69
FreeStyle	JLGW361-1	1/26/2019 6:28	0	73

CGM Glucose Pattern Summary

March 5, 2019 - March 19, 2019 (15 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose	Time In Range	Coefficient of Variation (CV)	Standard Deviation (SD)
97 mg/dL	Above 180 mg/dL (above 250 mg/dL: 0%) **1**%	**34.2**%	**33.2** mg/dL
88-116*	In Target Range 70-180 mg/dL **75**%	19-25*	10-26*
	Below 70 mg/dL (below 54 mg/dL: 10%) **24**%		
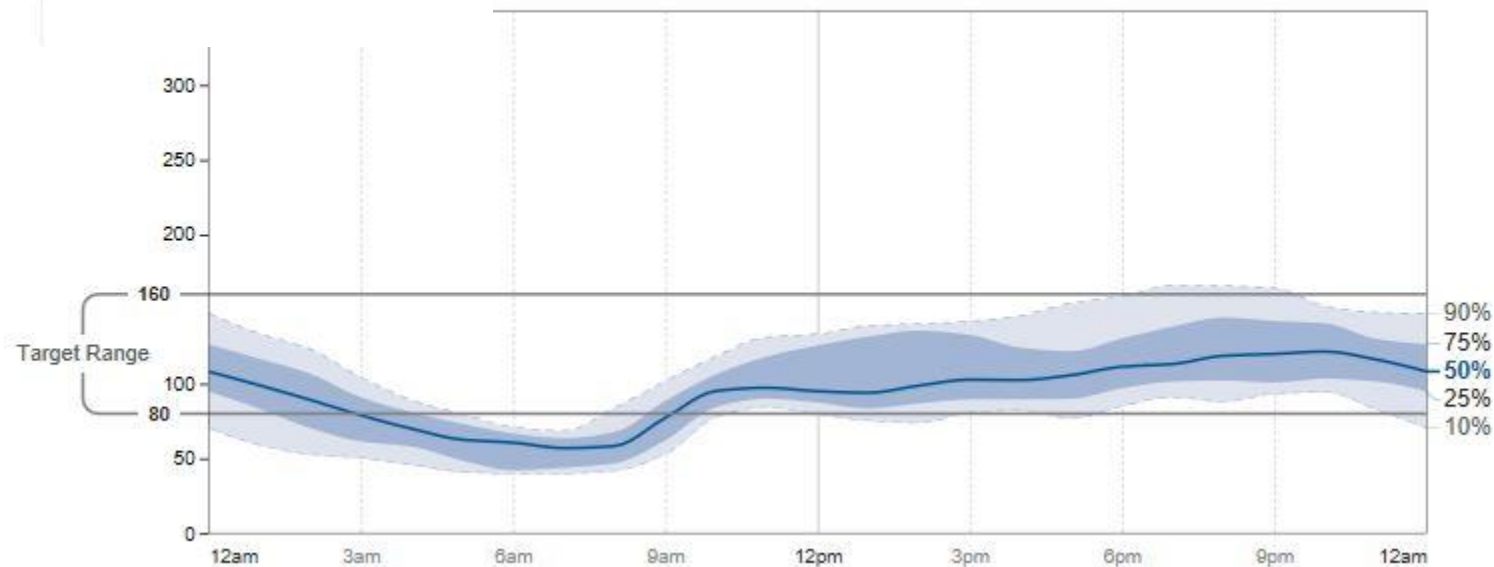
HC 71 y/o female
Asymptomatic
Diabetes Type 2 x 19 years
Co-morbidities: HTN; Dyslipidemia
Stable weight BMI= 38 Kg/mt^2
Hb A1c= 6.9 %
Current Rx:
Glucovance 5/500 mg po bid
Januvia 100 mg po d

...tributions by time regardless of date
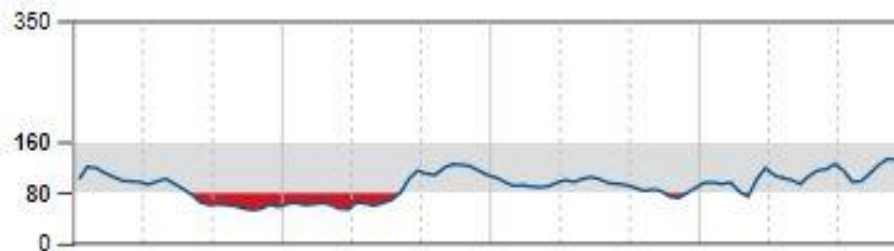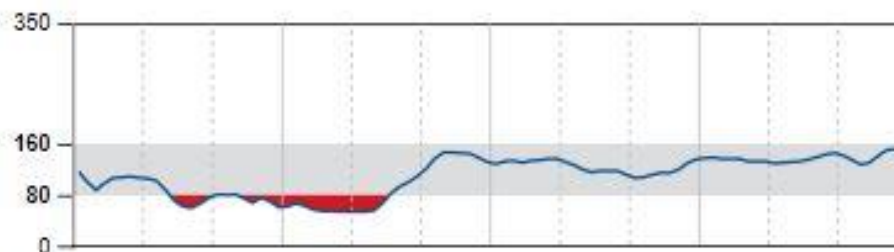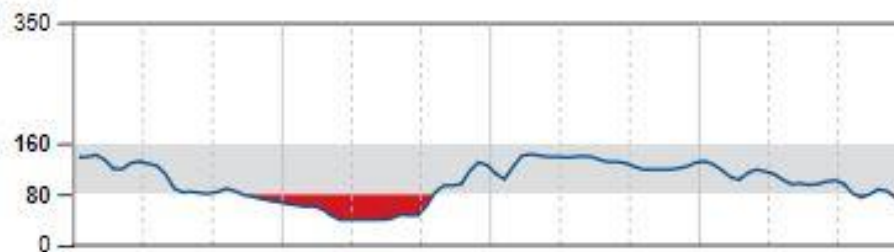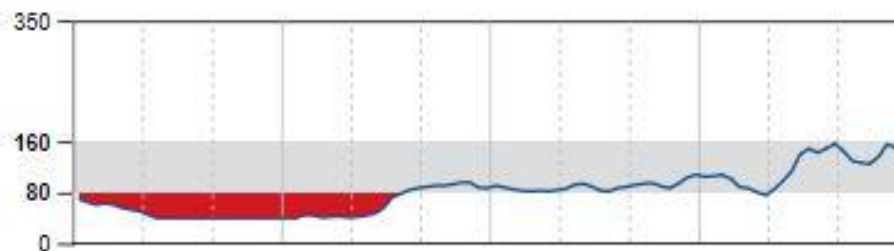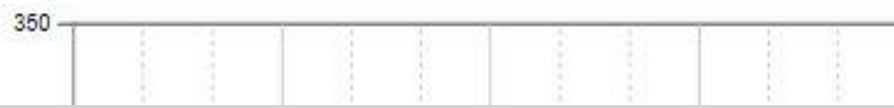
CGM Glucose Pattern Summary

July 17, 2018 - July 29, 2018 (13 Days)

LibreView

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose

120 mg/dL

88-116*

Time In Range

Above 180 mg/dL (above 250 mg/dL: 0%) — **11**%

In Target Range 70-180 mg/dL — **76**%

Below 70 mg/dL (below 54 mg/dL: 4%) — **13**%

Coefficient of Variation (CV)

38.3%

19-25*

Standard Deviation (SD)

46 mg/dL

10-26*

AA 67 y/o female
Diabetes since 1999
Insulin user for over 15 years
Stable weight BMI= 34.9 Kg/mt^2
Hb A1c= 8.3 %
Current Rx:
NPH 35 u + Humalog 15 u ac am
NPH 20 u + Humalog 15 u am ac pm

...terns
...ly 29, 2018 (13 Days)

LibreView

120 mg/dL — Average Glucose

56% — Percent in target

Average Glucose mg/dL

12am	2am	4am	6am	8am	10am	12pm	2pm	4pm	6pm	8pm	10pm
124	99	83	73	83	129	128	147	154	118	139	156

Median

Target Range

25th to 75th Percentile

10th to 90th Percentile

LibreView
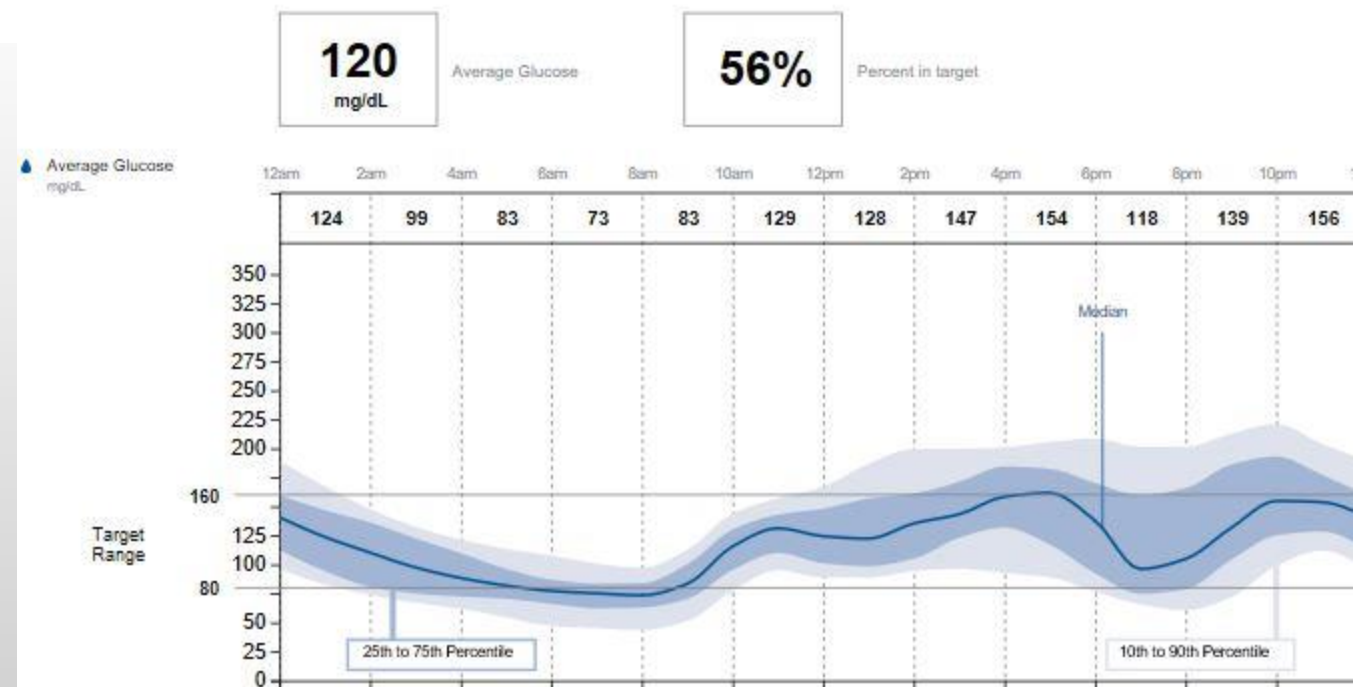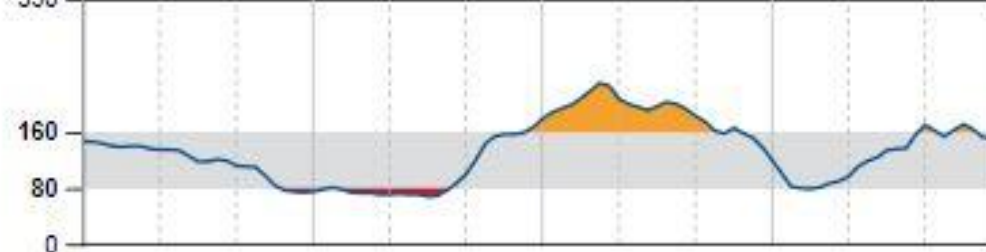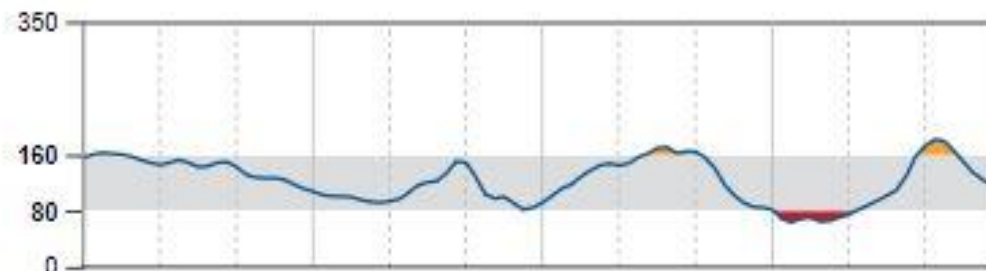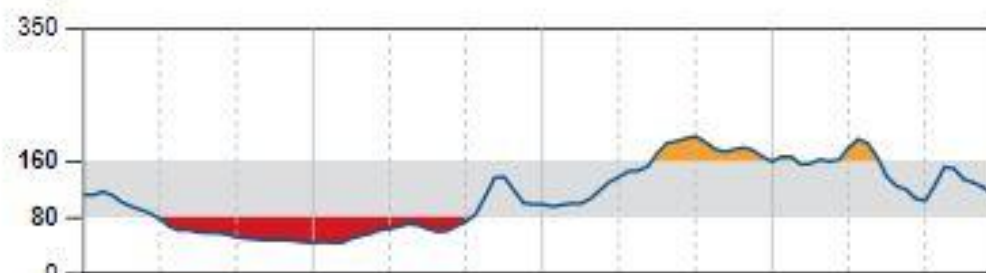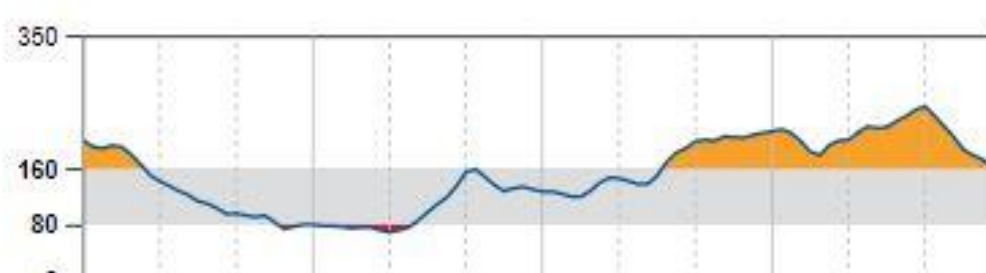
CGM Glucose Pattern Summary
January 10, 2019 - January 18, 2019 (9 Days)

CGM Device: FreeStyle Libre Pro   [N/A]% Compliant w/Calibration*   100% Time Worn

*Not applicable to FreeStyle Libre or FreeStyle Libre Pro which do not require calibration.

Summary

Average Glucose

172 mg/dL

88-116*

Time In Range

Above 180 mg/dL (above 250 mg/dL: 19%) — **46**%

In Target Range 70-180 mg/dL — **36**%

Below 70 mg/dL (below 54 mg/dL: 10%) — **18**%

Coefficient of Variation (CV)

55.1%

19-25*

Standard Deviation (SD)

94.7 mg/dL

10-26*

CE 70 y/o female
Diabetes for 30 years
On insulin Pump for several years
Stable weight BMI= 38 Kg/mt^2
Asymptomatic
Co-morbidities: HTN; Dyslipidemia; ASCVD; CKD Stage III with Proteinuria
Hb A1c = 6.5 %

...tributions by time regardless of date
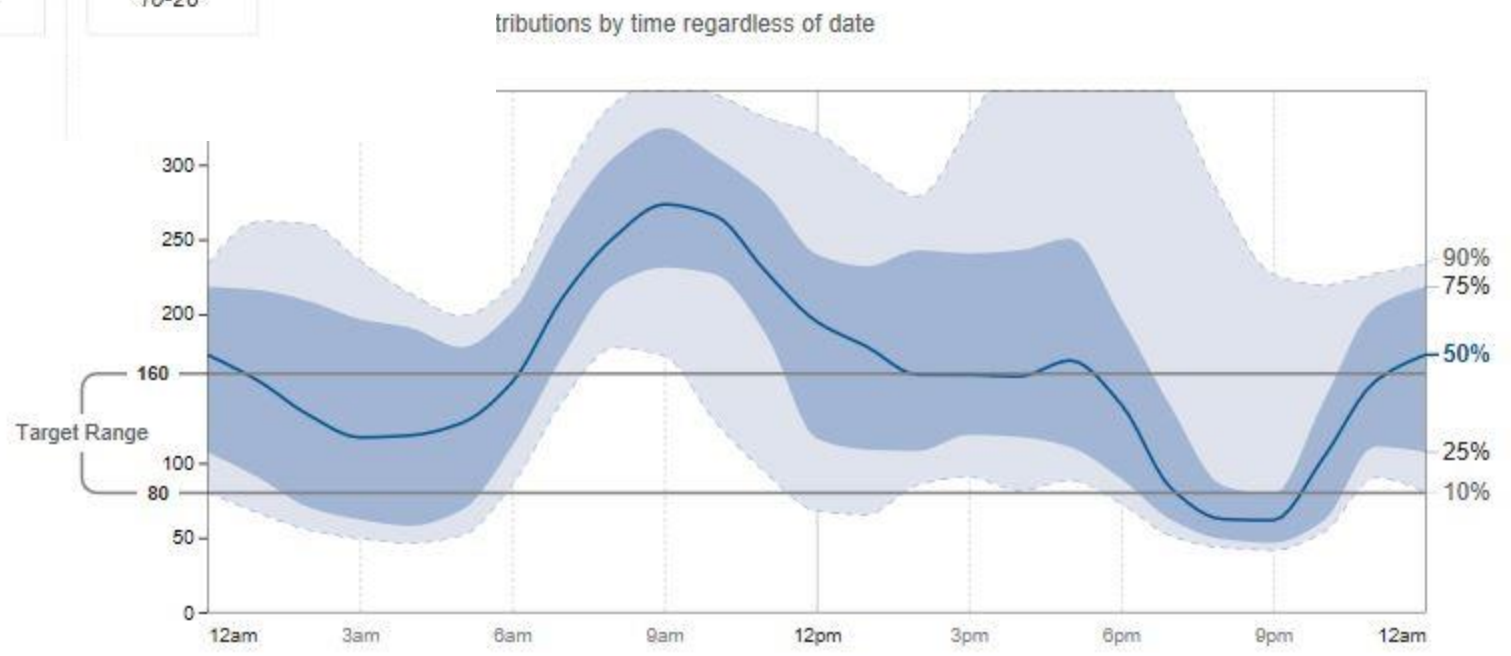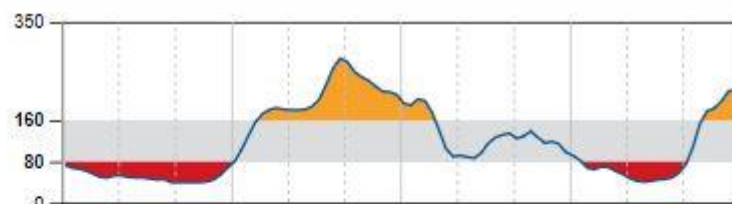
Fri **Jan 11**	📱 **119** mg/dL	◇ **28** %	⬇ **41** %	⬆ **31** %
Sat **Jan 12**	📱 **267** mg/dL	◇ **0** %	⬇ **0** %	⬆ **100** %
Sun **Jan 13**	📱 **144** mg/dL	◇ **30** %	⬇ **26** %	⬆ **44** %
Mon **Jan 14**	📱 **204** mg/dL	◇ **30** %	⬇ **15** %	⬆ **55** %
Tue **Jan 15**	📱 **158** mg/dL	◇ **59** %	⬇ **7** %	⬆ **34** %
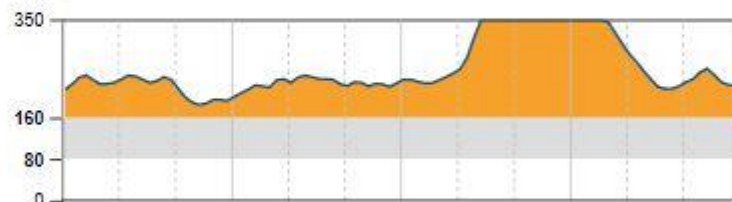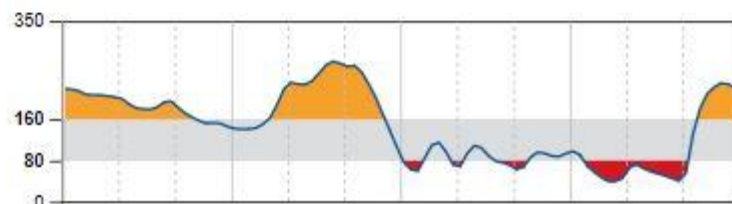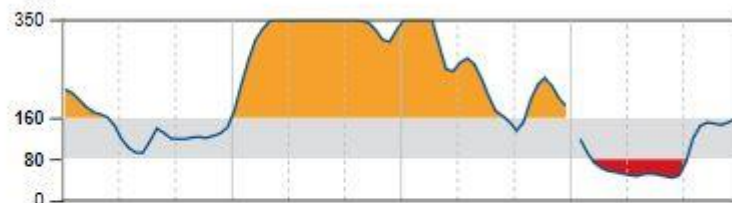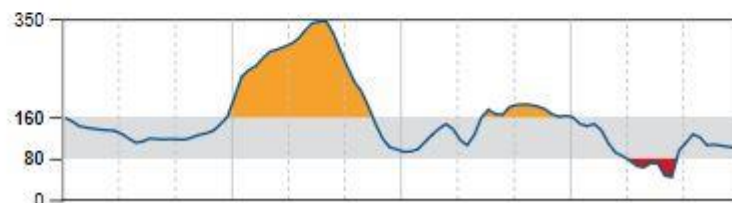
Tue, April 2, 2019

Glucose (mg/dL)
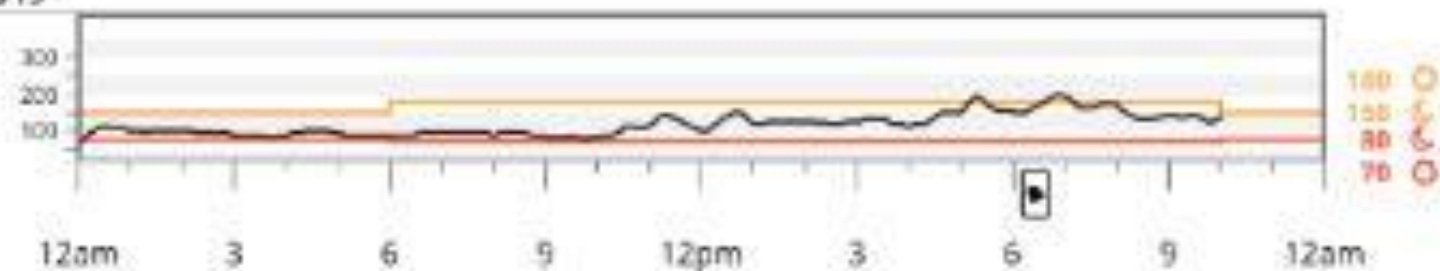
Statistics for this day

119

mg/dL

Average glucose (CGM)

29

mg/dL

Standard deviation (CGM)

Time in range

Legend

- CALIBRATIONS
- HEALTH
- LONG-ACTING INSULIN
- EXERCISE
- CARBS
- FAST-ACTING INSULIN / INSULIN
- ALERTS
- MULTIPLE EVENTS

Before

Food + Correction = Insulin Dose

Now

Food + Correction + Arrow = Insulin Dose

Previous Methods to Adjusting Insulin Dose Using Trend Arrows
Not all arrows are the same

Dexcom G5/G6		Medtronic 630G/670G		Abbott FreeStyle Libre	
Trend Arrow	**Meaning**	**Trend Arrow**	**Meaning**	**Trend Arrow**	**Meaning**
↑↑	Glucose is rapidly rising Increasing >3 mg/dL/min	↑↑↑	Glucose is rising >3 mg/dL/min		—
↑	Glucose is rising Increasing 2–3 mg/dL/min	↑↑	Glucose is rising 2–3 mg/dL/min	↑	Glucose is rising quickly >2 mg/dL/min
↗	Glucose is slowly rising Increasing 1–2 mg/dL/min	↑	Glucose is rising 1–2 mg/dL/min	↗	Glucose is rising 1–2 mg/dL/min
→	Glucose is steady Increasing/decreasing <1 mg/dL/min		Sensor glucose is not rising or falling quickly	→	Glucose is changing slowly <1 mg/dL/min
↘	Glucose is slowly falling Decreasing 1–2 mg/dL/min	↓	Glucose is falling 1–2 mg/dL/min	↘	Glucose is falling 1–2 mg/dL/min
↓	Glucose is falling Decreasing 2–3 mg/dL/min	↓↓	Glucose is falling 2–3 mg/dL/min	↓	Glucose is falling quickly >2 mg/dL/min
↓↓	Glucose is rapidly falling Decreasing >3 mg/dL/min	↓↓↓	Glucose is falling >3 mg/dL/min		—

Conversion: mg/dL × 0.0555 = mmol/L.

Using Trend Arrows to Fine-Tune Insulin Doses: The New 'Standard' Approach

- ▶ This is a starting point

- ▶ Start using the approach at mealtimes

- ▶ Insulin stacking will continue to be a challenge

- ▶ Individualize the approach for your patient/family
  - ○ Continue education and refinement with patients

- ▶ Goal is to increase time in range; reduce excursions