SWEET SUCCESS: UNVEILING THE POWER OF CONTINUOUS GLUCOSE MONITORING

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Alaska Native Health Consortium

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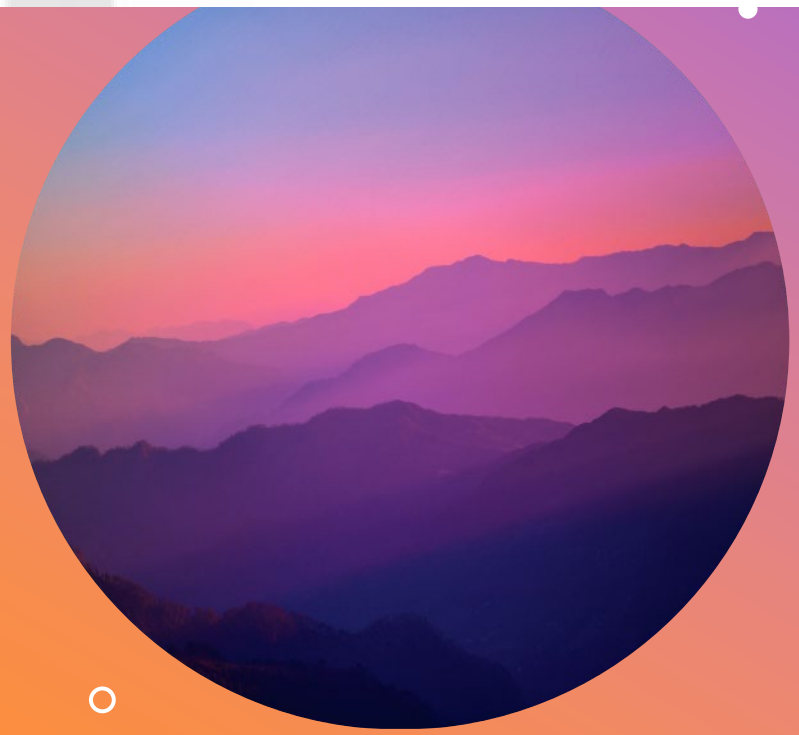
I have no conflict of interest to disclose for this presentation.



OBJECTIVES

1) Learn the history of glucose monitoring

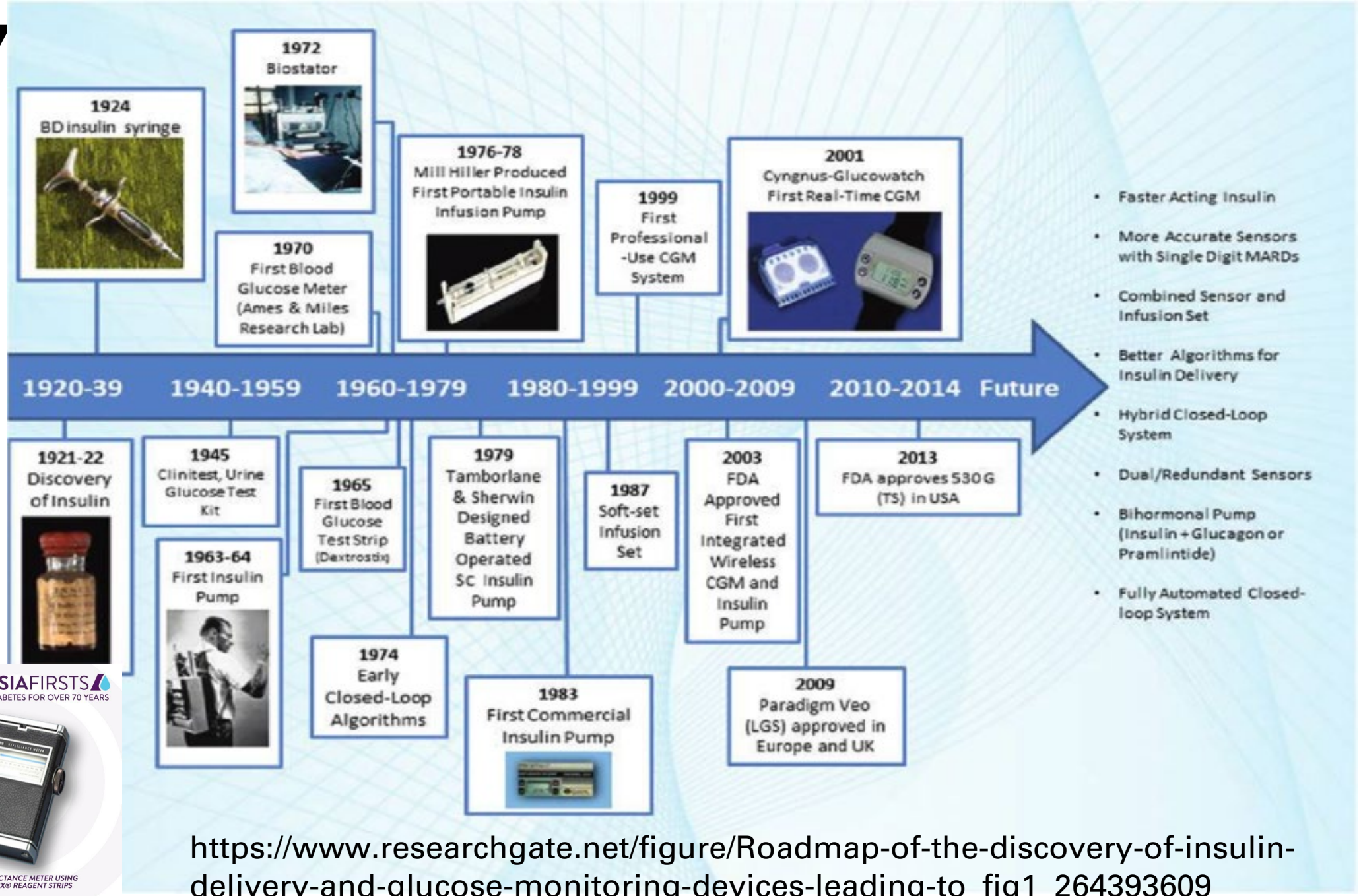
2) Review the various types of Continuous glucose monitors(CGM)

3) Discuss who would most benefit from CGM's.

4) Pitfalls of CGM monitoring and how to overcome them

5) Learn about CGM interpretation with studies and medication adjustment.

HISTORY LESSON



1969

DID YOU KNOW?

THE **FIRST** PORTABLE BLOOD GLUCOSE METER WEIGHED NEARLY 3LBS (1.2 KILOS)

#ASCENSIAFIRSTS
INNOVATING IN DIABETES FOR OVER 70 YEARS

AMES REFLECTANCE METER USING DEXTROSTIX® REAGENT STRIPS

https://www.researchgate.net/figure/Roadmap-of-the-discovery-of-insulin-delivery-and-glucose-monitoring-devices-leading-to_fig1_264393609

CGM'S: WHY, WHAT, WHO, WHEN?

Libre 2 or 3

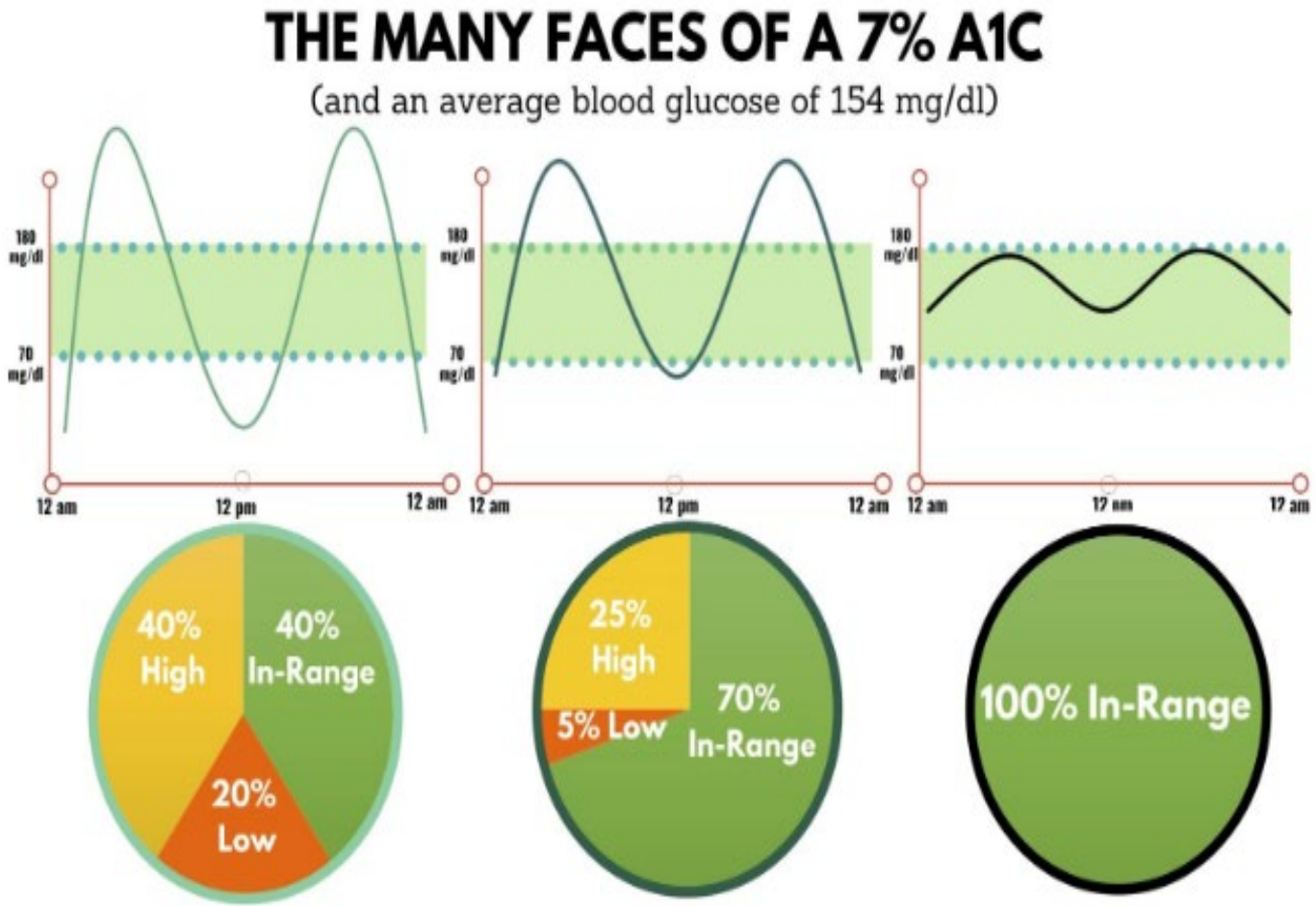
Dexcom 6 or 7

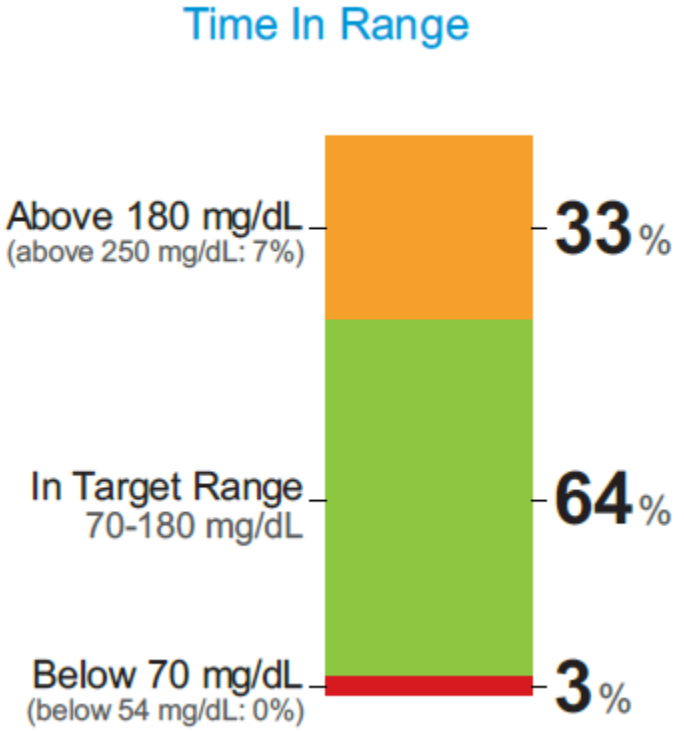
Guardian Sensor 3 or 4

TIME IN RANGE VS A1C

Average Glucose

164 mg/dL





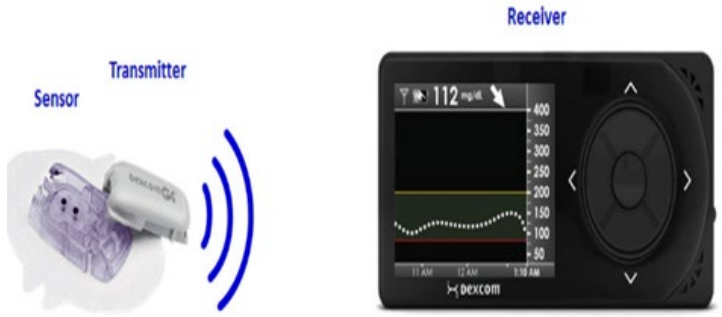
https://diatribe.org/time-range

GLUCOMETER

- Test capillary glucose- closer to venous glucose
- Patient should be taught how to use SMBG data to adjust food intake, exercise, or pharmacologic therapy
- Correlation between greater self monitoring blood glucose (SMBG) frequency and lower A1C.

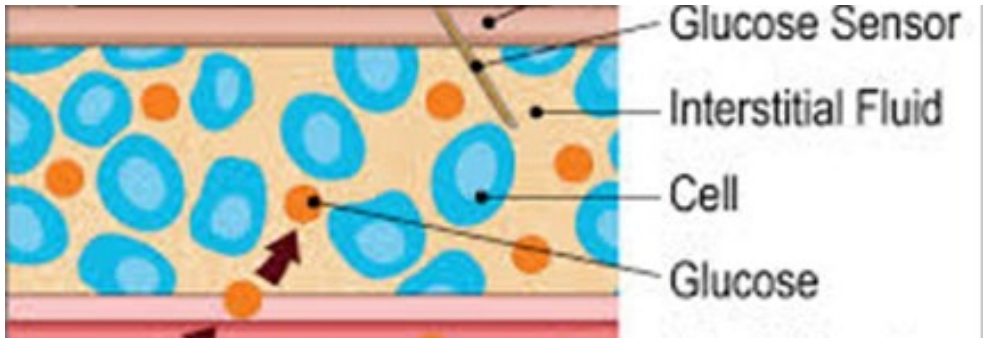
Continuous Glucose Monitoring

- Real-time CGM (rtCGM)
- Intermittently scanned CGM (iCGM)
- Blinded CGM
  - **Pro**fessional version
  - Like a “cardiac holter monitoring” but for blood glucose



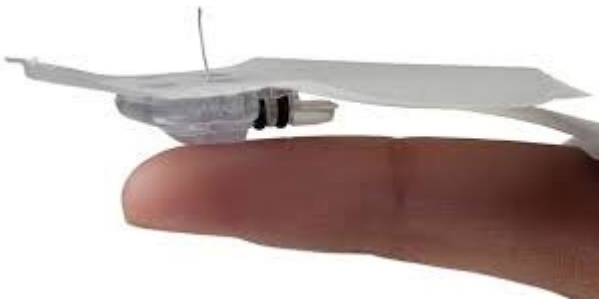
CONTINUOUS GLUCOSE MONITOR (CGM)

Sensor under the skin which measures glucose in the interstitial tissues (instead of blood) every 1-5 minutes



CONTINUOUS GLUCOSE MONITOR

- Basic components
  - Sensor
  - Transmitter
  - Monitor/Receiver



WHO??

Multidose insulin

Basal insulin

High risk of hypoglycemia

ADA SOC 2024

Recommendations

7.14 Real-time CGM (rtCGM) **A** or intermittently scanned CGM (isCGM) **B** should be offered for diabetes management in adults with diabetes on multiple daily injections (MDI) or CSII who are capable of using the devices safely (either by themselves or with a caregiver). The choice of device should be made based on the individual's circumstances, preferences, and needs.

7.15 rtCGM **A** or isCGM **B** should be offered for diabetes management in adults with diabetes on basal insulin who are capable of using the devices safely (either by themselves or with a caregiver). The choice of device should be made based on the individual's circumstances, preferences, and needs.

7.16 rtCGM **A** or isCGM **E** should be offered for diabetes management in youth with type 1 diabetes on MDI or CSII who are capable of using the devices safely (either by themselves or with a caregiver). The choice of device should be made based on the individual's circumstances, preferences, and needs.

APPROPRIATE CANDIDATES FOR A CGM

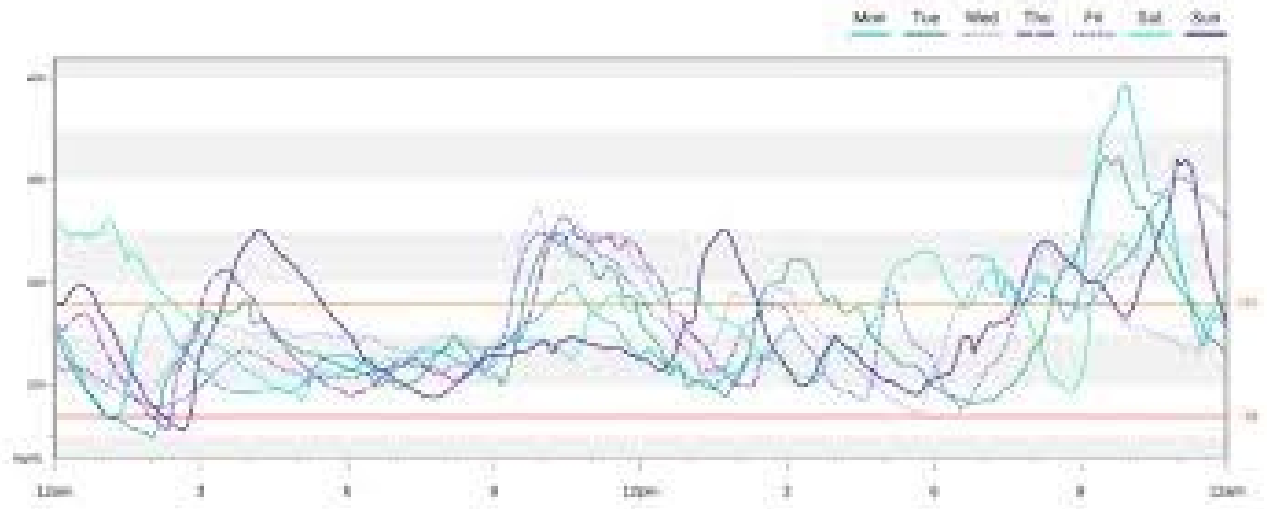
- Type 1 DM
- Type 2 DM on insulin (MDI or Pump)
- Patients with high risk of hypoglycemia
- Large variability (ex low fasting, still high A1C)
- Have not achieved target A1C
- Want more data to further improve diabetes
- Suspect medication non-adherence

What are we looking at?

STANDARDIZED CGM METRICS

CONTINUOUS GLUCOSE MONITOR (CGM)

- The information can be downloaded to evaluate trends



CONTINUOUS GLUCOSE MONITOR (CGM)

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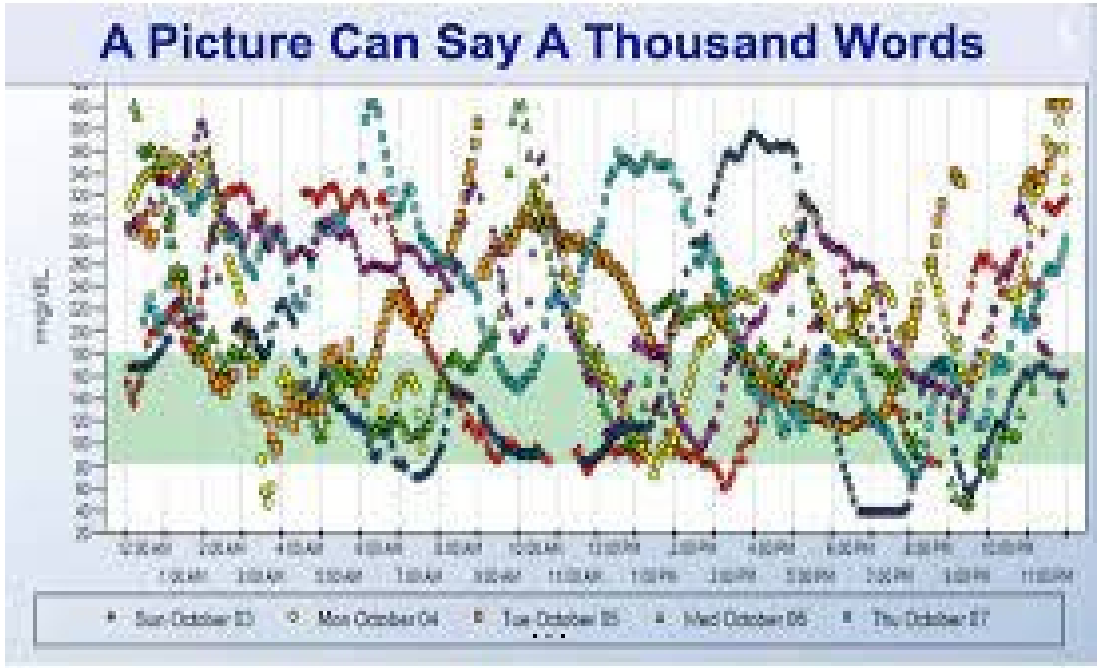


STANDARDIZED CGM METRICS FOR CLINICAL CARE IN NONPREGNANT INDIVIDUALS WITH TYPE 1 OR TYPE 2 DIABETES

- Goal is 14 day wear report with 70% date captured
- Avg glucose value
- GMI is calculated if >50% wear captured- think of as an A1C
- Glycemic variability <36%
- Time in range 70-180 mg/dl goal >70% or >50% in older adult
- Time below range <4% or <1% in older adults

- 18F with DM1
- Medtronics insulin pump

GLUCOSE STATISTICS AND TARGETS

February 1, 2020 - February 14, 2020 — **14 Days**

% Time CGM is Active — **85%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 70-180 mg/dL	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

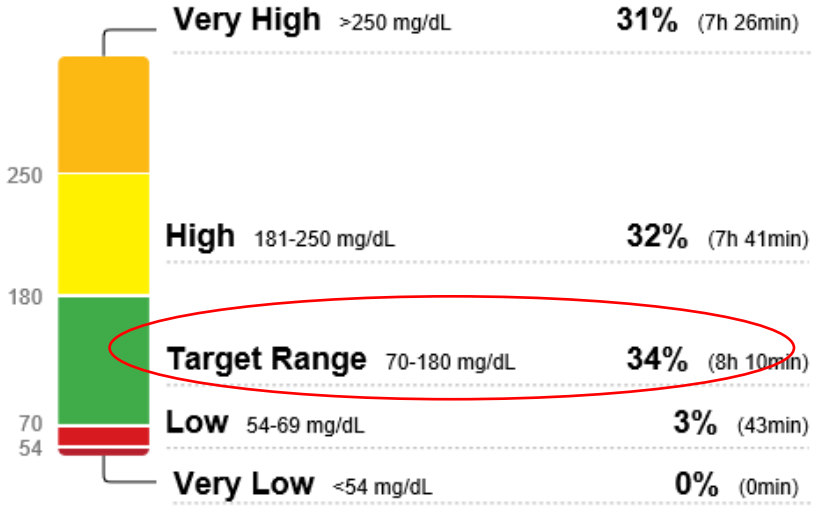
Average Glucose — **208** mg/dL

Glucose Management Indicator (GMI) — **8.3 %**

Glucose Variability — **38.1%**

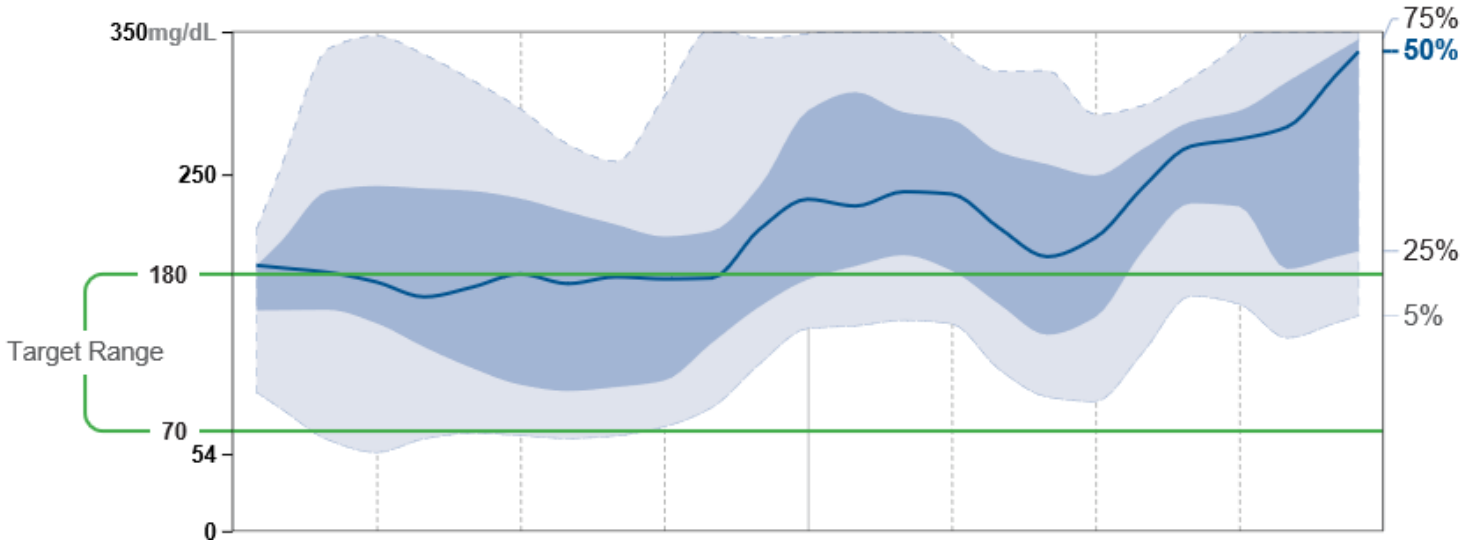
Defined as percent coefficient of variation (%CV); target ≤36%

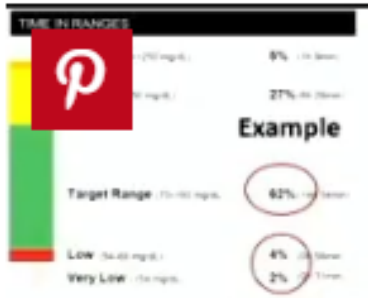
TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.





CGM Guided Background (Basal) Insulin Adjustment for Type 2 Diabetes

Step 1: Determine if patient has comorbidities (ASCVD, CHF, CKD) for which GLP-1 receptor agonist or SGLT2 inhibitor should be considered

Step 2: Find the %TIR and %TBR from the AGP Report (see example to left).

- Is time in range (TIR) [70-180 mg/dL] >70%?
- Is time below range (TBR) [< 70 mg/dL] ≤2%?

Step 3: Find TIR/TBR category in table and adjust background insulin regimen; consider referral to diabetes educator

TIR/TBR Category	Action	Medication Adjustment Considerations	Follow-up
Time in range >70% and Time below range ≤2%	Continue regimen	• Continue to optimize current therapy; reinforce lifestyle changes and taking insulin as prescribed	3-4 months
Time in range >70% and Time below range >2%	Address hypoglycemia	• Stop sulfonylurea if present and reduce background insulin by 10% if TBR is 8-12% or 15% if TBR is >12% • If not on sulfonylurea, decrease total background insulin dose by 10% if TBR >2-7%; 15% if TBR 8-12%; 20% if TBR >12%	2 weeks
Time in range ≤70% and Time below range ≤2%	Address hyperglycemia	• Consider adding or adjusting GLP-1 RA, otherwise increase background insulin dose by 10% if TIR 51-70%; 15% if TIR 30-50%; 20% if TIR <30% • If overnight hypoglycemia, consider smaller increase in insulin dose	2 weeks
Time in range ≤70% and Time below range >2%	Address hypoglycemia today; consider referral to diabetes educator	• Stop sulfonylurea if present and reduce background insulin dose by 10% if TBR is 8-12% or 15% if TBR is >12% • If not on sulfonylurea, decrease background insulin dose by 10% if TBR >2-7%; 15% if TBR 8-12%; 20% if TBR >12% • Refer to diabetes educator for options to treat hyperglycemia including: • Add or adjust GLP-1 RA ***(preferred)*** **or** add mealtime insulin before one or all meals; consider premixed insulin twice per day if cost or concern over insulin regimen complexity	2 weeks

https://www.diabetotech.com/blog/do-you-want-to-know-how-c-gm-works

CGM PEARL'S AND TROUBLE SHOOTING

CGM PEARL'S/TROUBLE SHOOTING

DO NOT TREAT solely on CGM data, when glucose in question- treat based on finger stick after hands have been washed.

Monitor trend arrows for rapidly rising and falling BG's.

Use alarm alerts for early detection of hypo/hyperglycemia

- But be careful of too many alarms due to "Alarm Fatigue"

Use graphs to look for trends

Patient's need to advise medical staff if they have one- particularly if having any radiology procedure

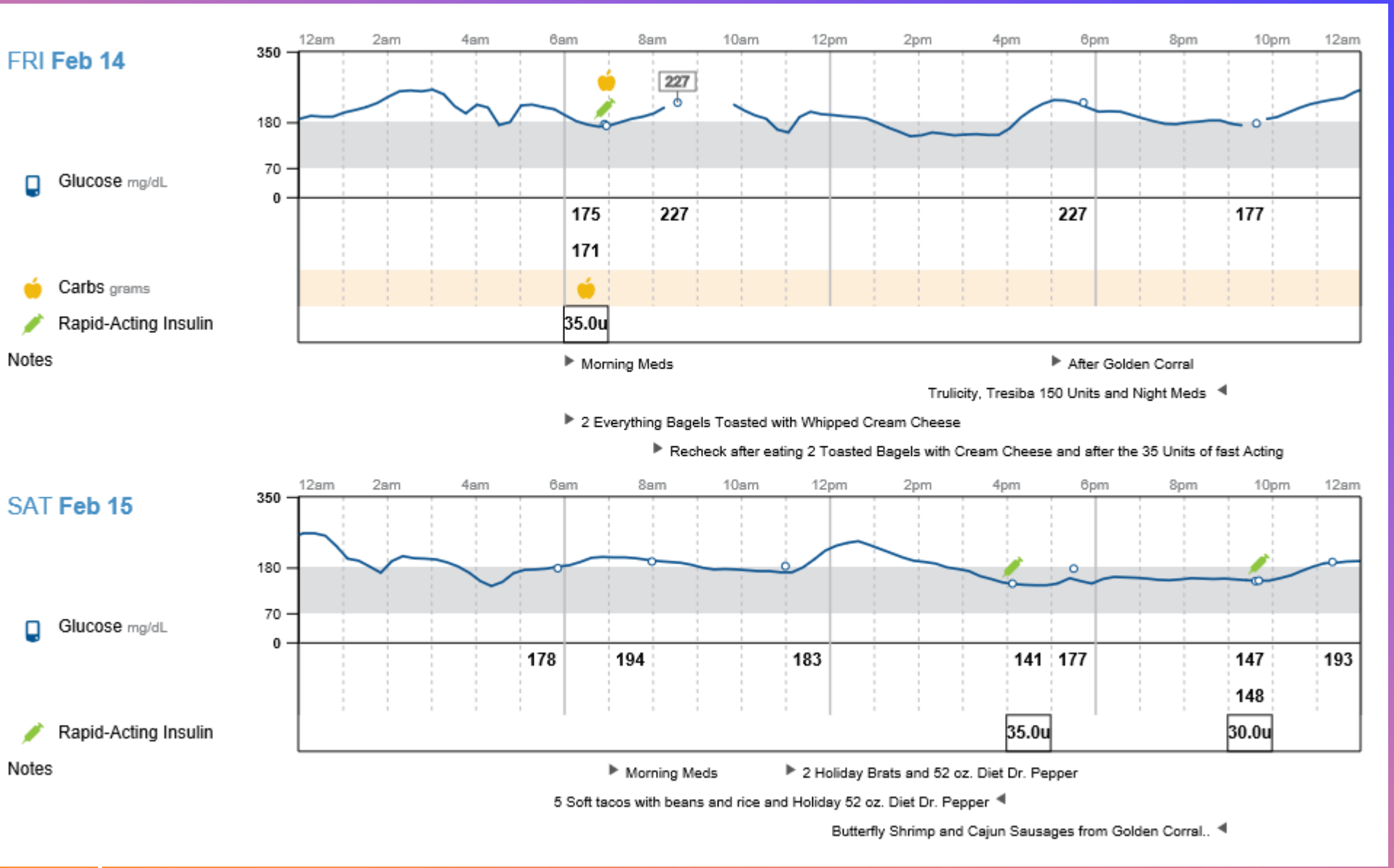
CGM PEARL'S/TROUBLESHOOTING

Advise	Caution	Caution
Advise patient to call manufacturer if CGM is not working appropriately or comes off early for replacement. • Example: Dexcom or Abbott or Medtronic	Caution high dose Tylenol/acetaminophen with Dexcom's and Guardian may falsely raise BG (more than 1000 mg every 6 hrs)	Caution >500 mg Vit C with Libre's may falsely raise BG, missing a low (Emergen-C has 1000 mg vit C)

Tips to getting the CGM to stick

- 1) Clean, Clean, clean, dry dry dry
  - 99% issue with process, not pr
- 2) Placement
  - Not in folds
  - Avoid hair
  - Avoid waistband
- 3) Use patch or tegaderm
- 4) For irritated areas- Skin glue or mastisol (order online)
  - Or Flonase on the skin prior to application
  - Skin-Prep by Smith & Nephew

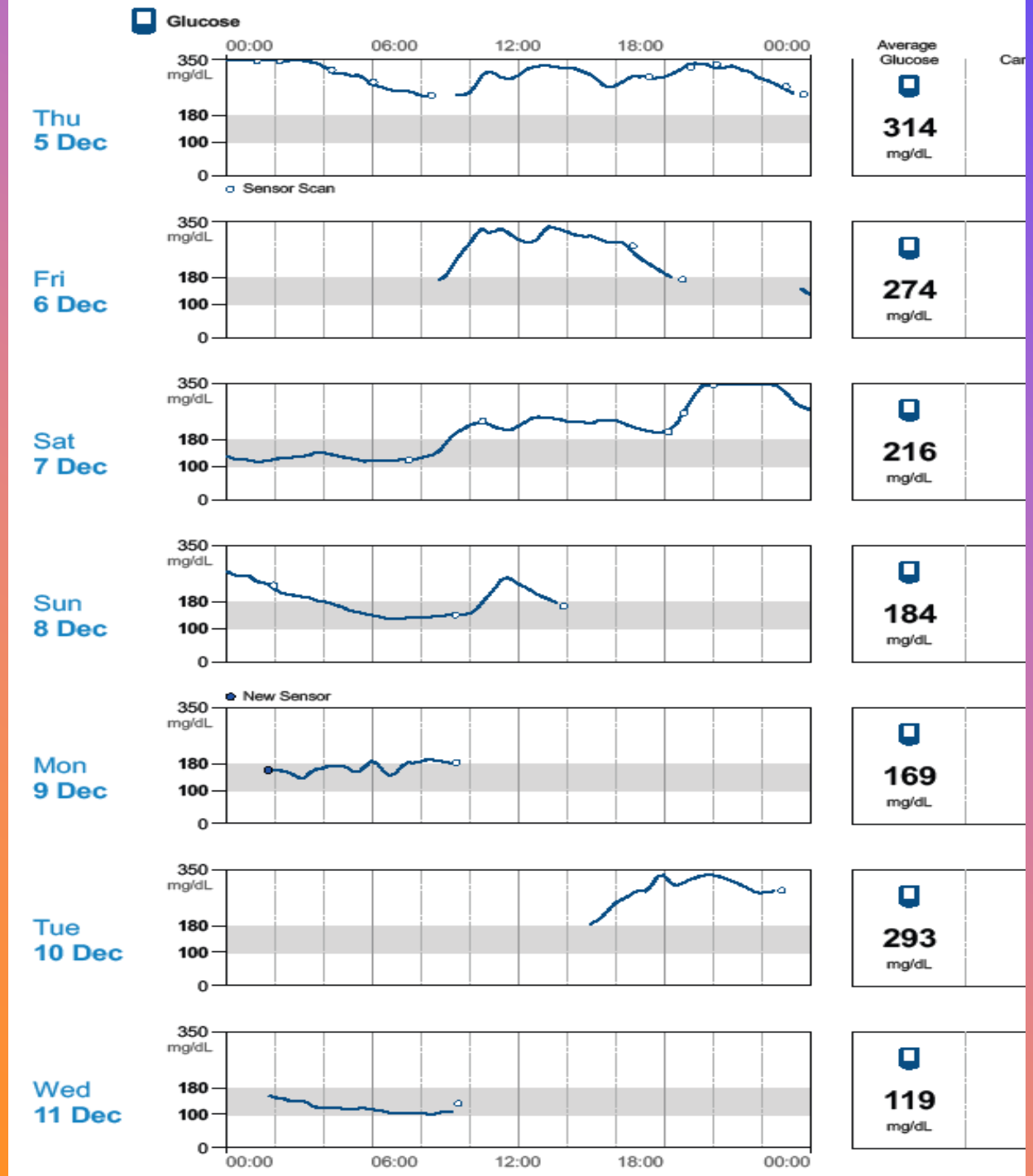

OOOH, WOW... IT'S... IT'S...
PERFECT. UM... THANKS.
MATCHING TIE & TEST STRIP SET
PERFECT FOR YOU!



50M

Hx of DVT on apixaban, htn/hld, DM2

Tresiba 150u with novolog, metformin/glipizide/trulicity weekly



GLP1 WEEKLY GLARGINE DAILY

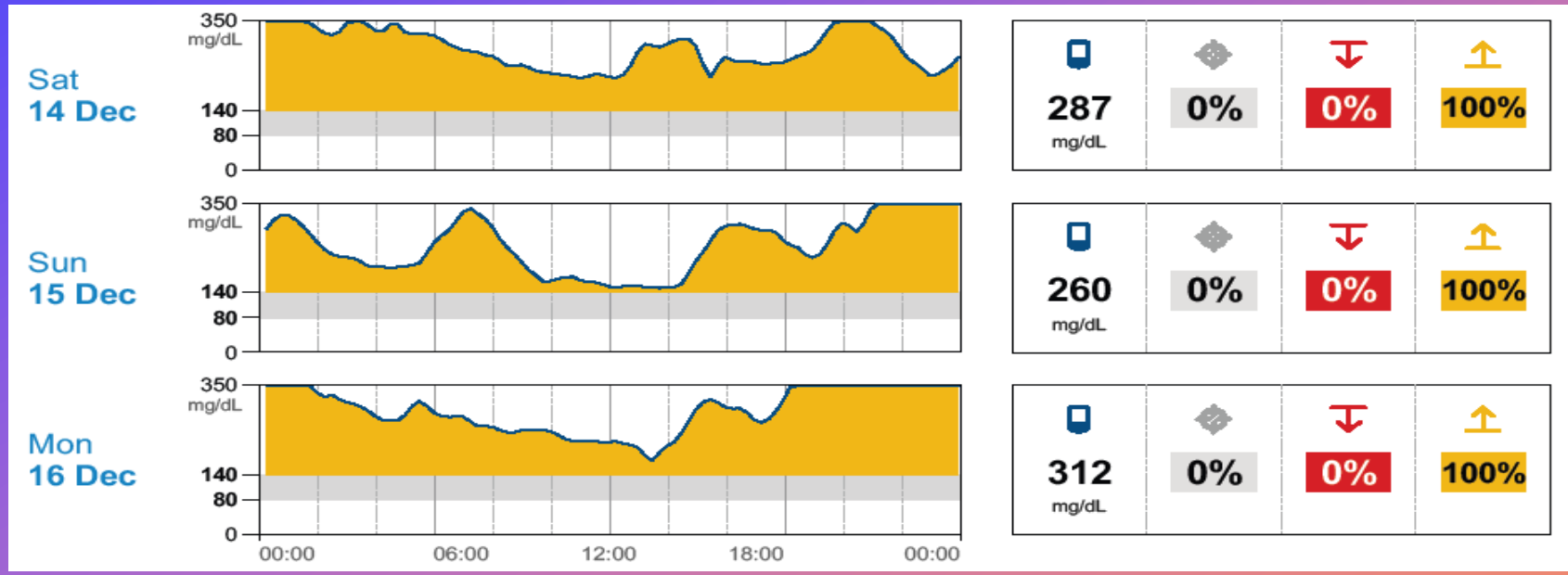
iCGM

Needs to scan q8hr at least

AVERAGE GLUCOSE	281	mg/dL
% above target	83	%
% in target	17	%
% below target	0	%
LOW GLUCOSE EVENTS	0	
Average duration	0	Min

Sensor Usage

SENSOR DATA CAPTURED	35	%
Daily scans	2	



61 yr female

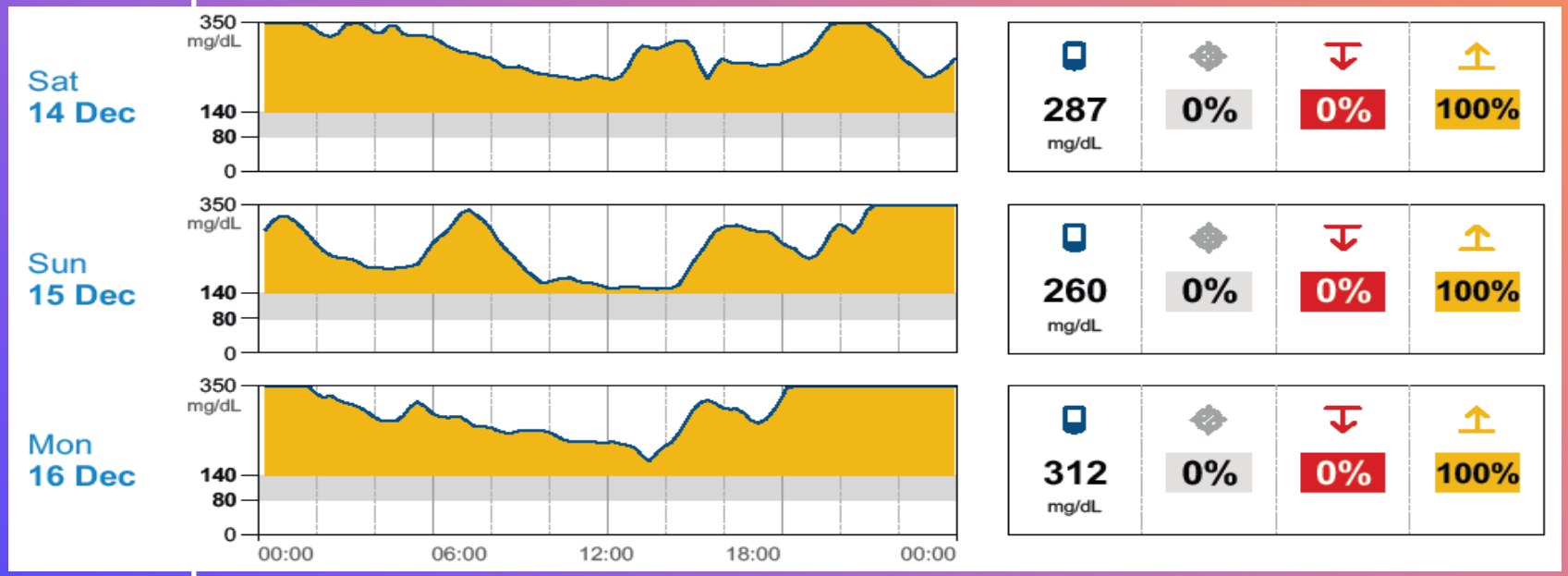
PMHX: DM2, HTN, HL, CAD s/p stent 2 weeks ago

Current DM Meds: Lantus 20 units daily

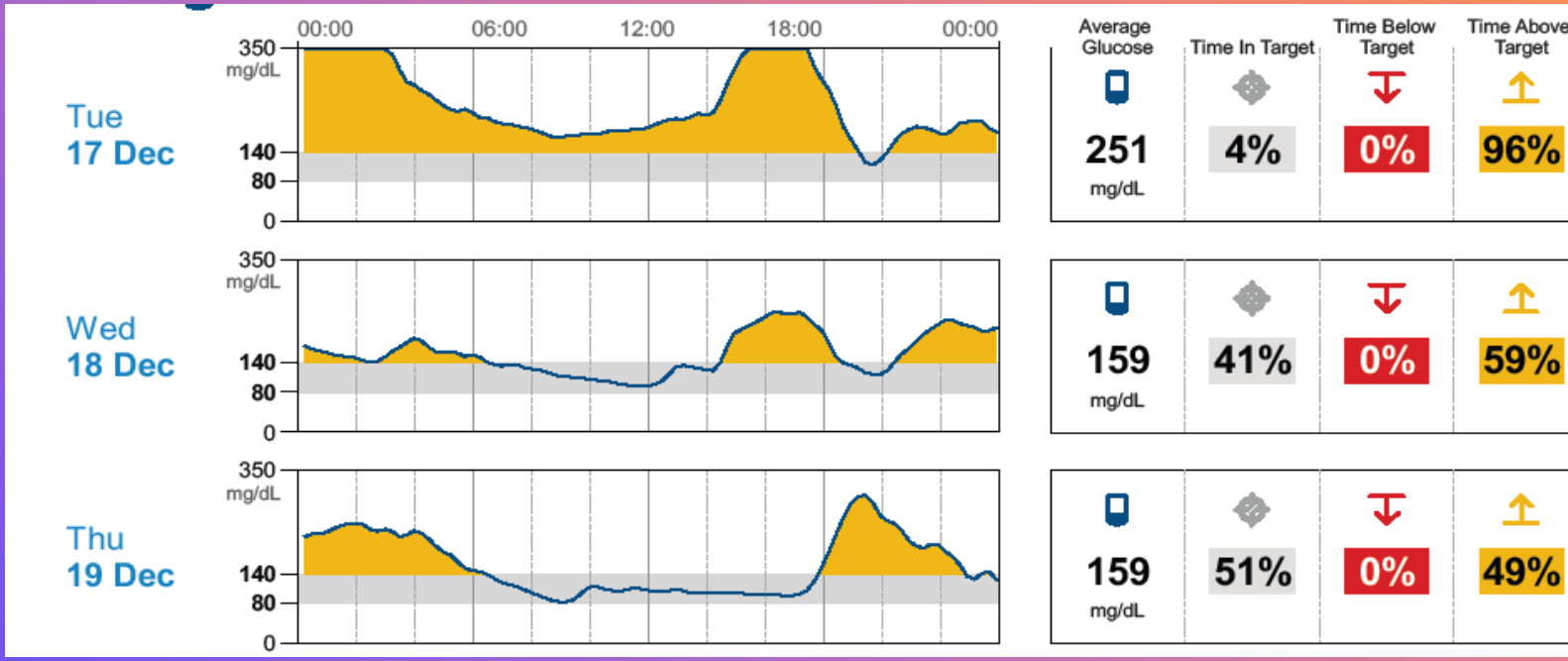
CMP: WNL

A1c: 9.1%

BMI 34

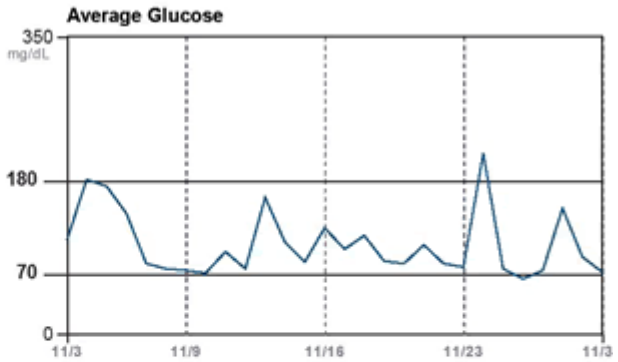


ADDING GLP1 0.6MG DAILY ON 12/17 TO GLARGINE 20U

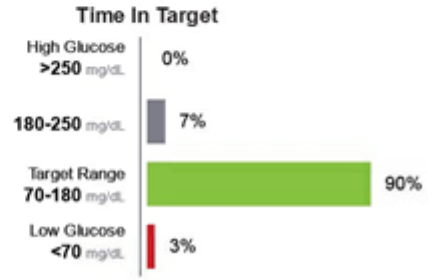


Glucose

AVERAGE GLUCOSE	106 mg/dL
Standard Deviation	37.3 mg/dL
Highest Result	213 mg/dL
Lowest Result	65 mg/dL
Hypo Events	1



AVERAGE TESTS/DAY	1
Total tests	29
Days without tests	0



- 83 yo male
- PMHX dementia, DM2, HLD, HTN, CVA'S, CKD 3
- Weight: 105 kg BMI 35.41
- A1c 8.8%

- Meds
- -Tresiba 38 units qpm
- -Ozempic 1 mg weekly
- -Jardiance 25 mg daily

GLUCOSE STATISTICS AND TARGETS

July 24, 2024 - August 6, 2024	14 Days
Time CGM Active:	98%

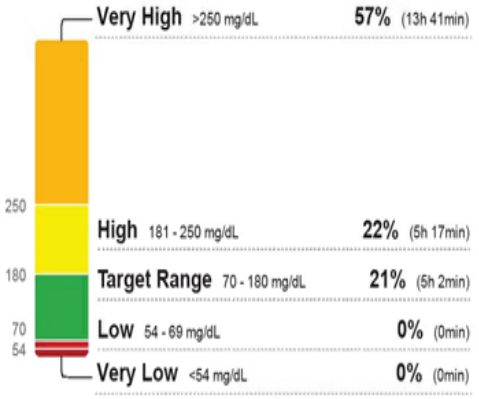
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	264 mg/dL
Glucose Management Indicator (GMI)	9.6%
Glucose Variability	33.1%

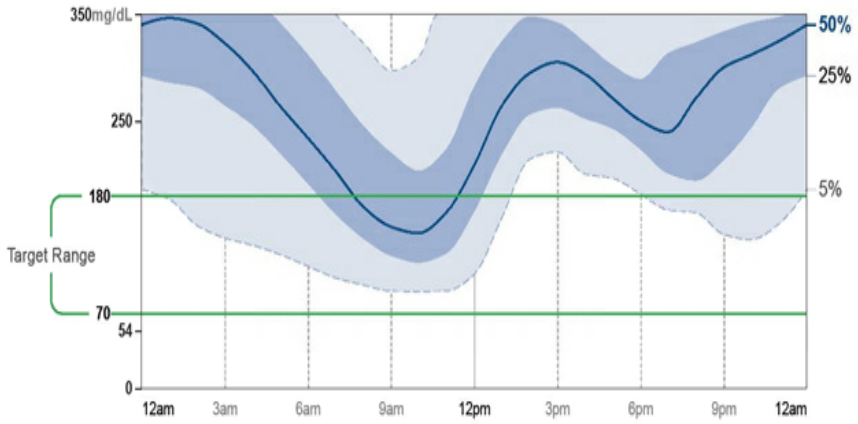
Defined as percent coefficient of variation (%CV); target ≤36%

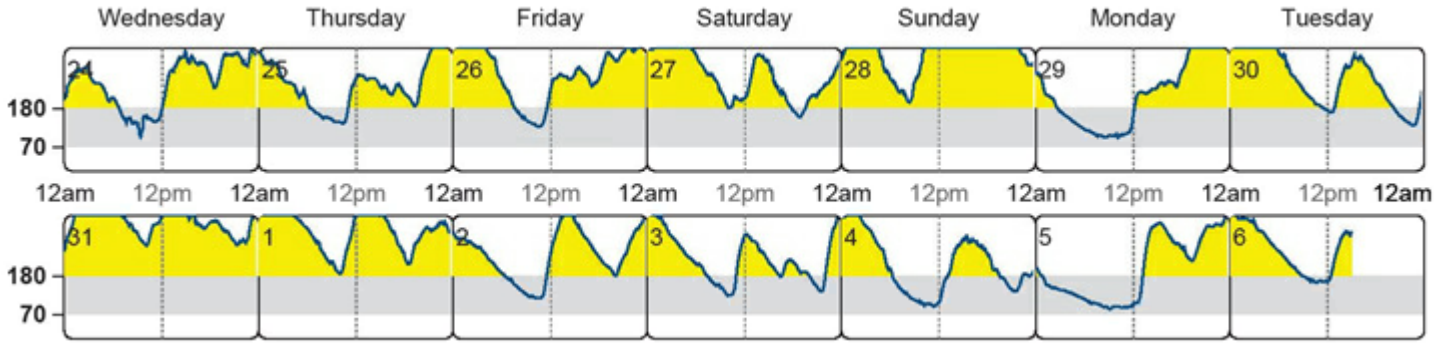
TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



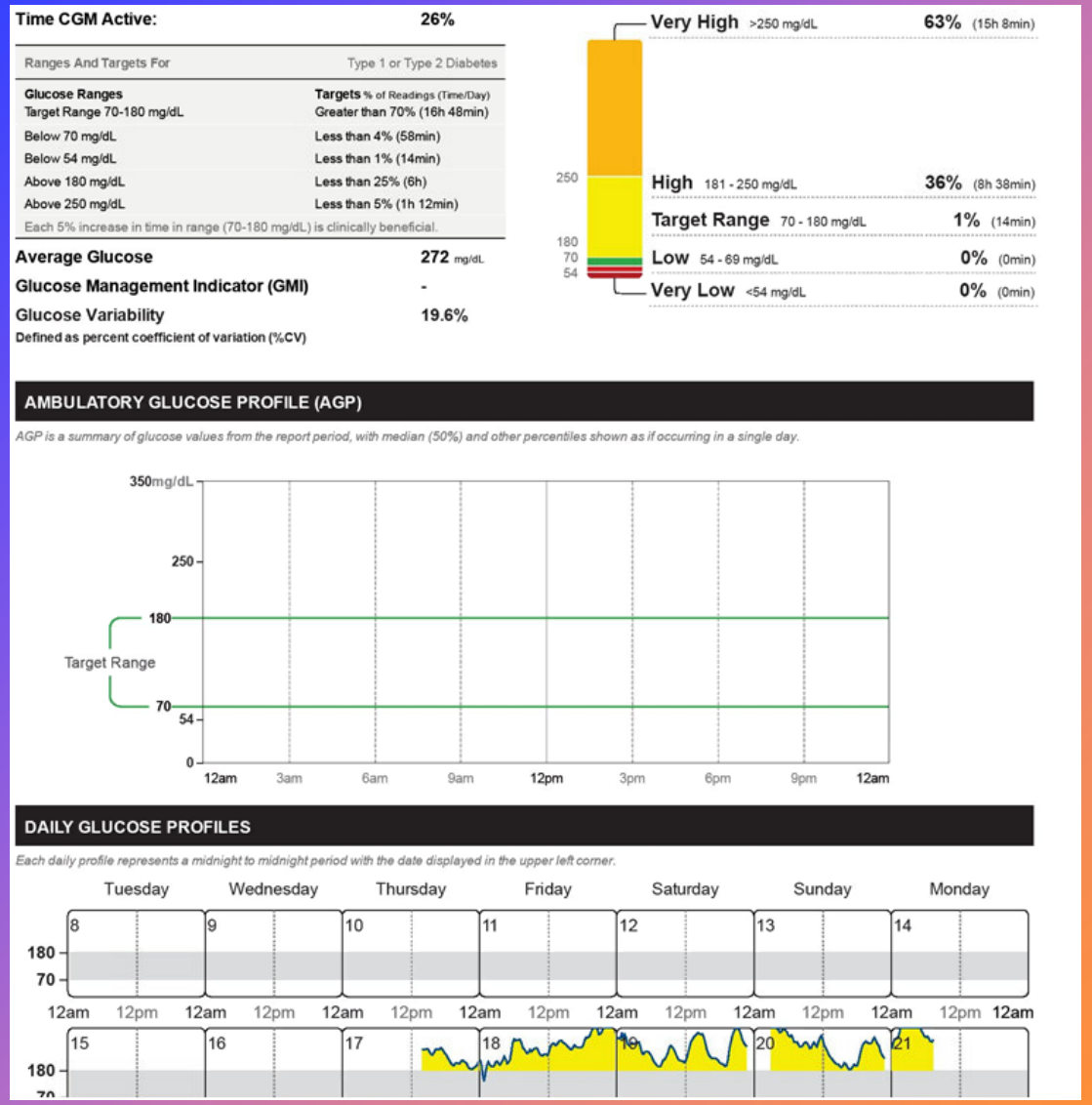


- 83 yo male
- PMHX dementia, DM2, HLD, HTN, CVA'S, CKD 3
- Weight: 105 kg BMI 35.41
- A1c 9% previous 12.4%

- Meds
- -Tresiba 38 units qpm
- -Ozempic 1 mg weekly
- -Jardiance 25 mg daily

54 YR FEMALE

Tresiba 90 units daily
NovoLog 28-32 units with meals 2-3 times a day
Jardiance 25 mg



Time CGM Active:	26%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
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	**272** mg/dL
Glucose Management Indicator (GMI)	-
Glucose Variability	**19.6%**

Defined as percent coefficient of variation (%CV)

Very High	>250 mg/dL	**63%**	(15h 8min)
High	181 - 250 mg/dL	**36%**	(8h 38min)
Target Range	70 - 180 mg/dL	**1%**	(14min)
Low	54 - 69 mg/dL	**0%**	(0min)
Very Low	<54 mg/dL	**0%**	(0min)

250
180
70
54

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

350mg/dL
250
180
Target Range
70
54
0
12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am

DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.

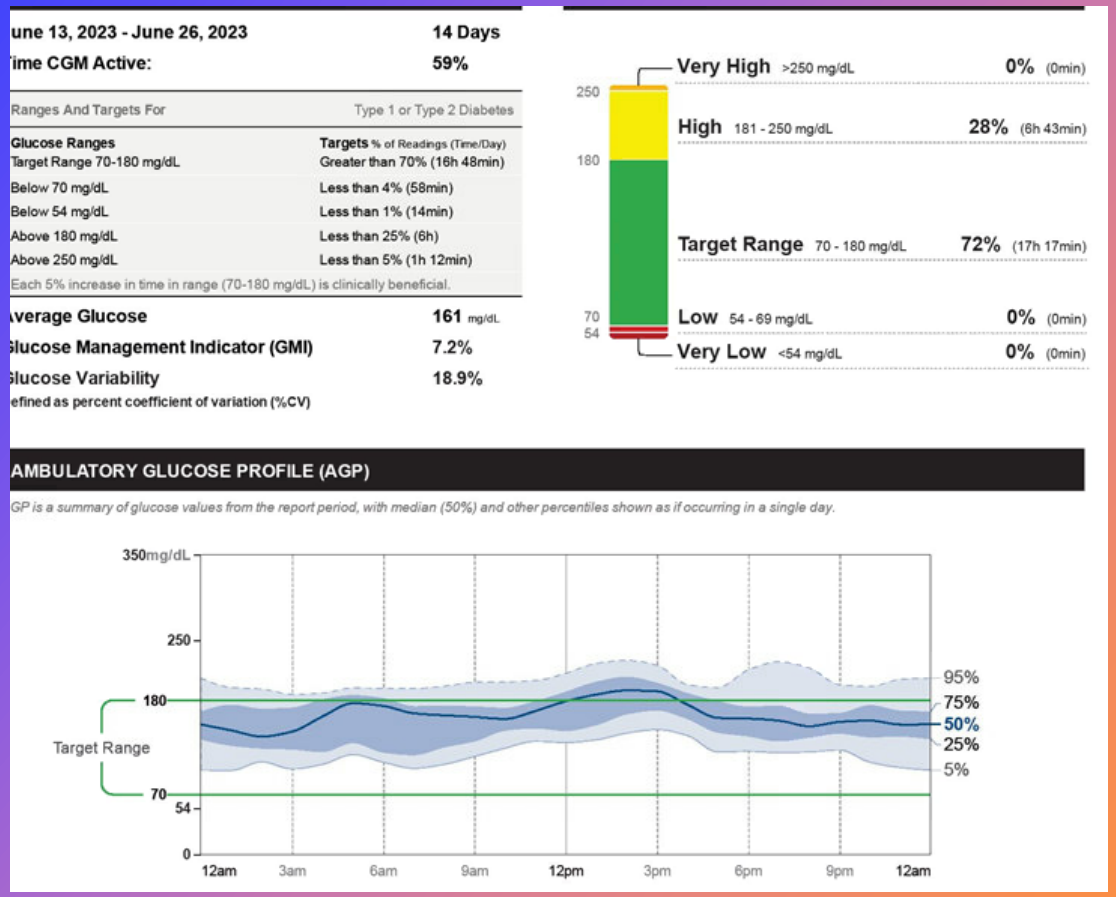
Tuesday Wednesday Thursday Friday Saturday Sunday Monday

8 9 10 11 12 13 14
180
70
12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am

15 16 17 18 19 20 21
180

54 YO FEMALE

Tresiba 70 units daily
NovoLog 28-32 units with meals, but eating only about once a day and rarely uses
Jardiance 25 mg
Metformin 500 mg Bld- ordered-
Mounjaro 5 mg weekly



une 13, 2023 - June 26, 2023 14 Days
ime CGM Active: 59%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 70-180 mg/dL	Targets % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

verage Glucose	161 mg/dL
lucose Management Indicator (GMI)	7.2%
lucose Variability	18.9%

efined as percent coefficient of variation (%CV)

Very High >250 mg/dL 0% (0min)
High 181 - 250 mg/dL 28% (6h 43min)
Target Range 70 - 180 mg/dL 72% (17h 17min)
Low 54 - 69 mg/dL 0% (0min)
Very Low <54 mg/dL 0% (0min)
250
180
70
54

AMBULATORY GLUCOSE PROFILE (AGP)

GP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

GLUCOSE STATISTICS AND TARGETS

May 5, 2023 - May 18, 2023	14 Days
Time CGM Active:	82%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
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	144 mg/dL
Glucose Management Indicator (GMI)	6.8%
Glucose Variability	37.2%

Defined as percent coefficient of variation (%CV)

TIME IN RANGES

AMBULATORY GLUCOSE PROFILE (AGP)

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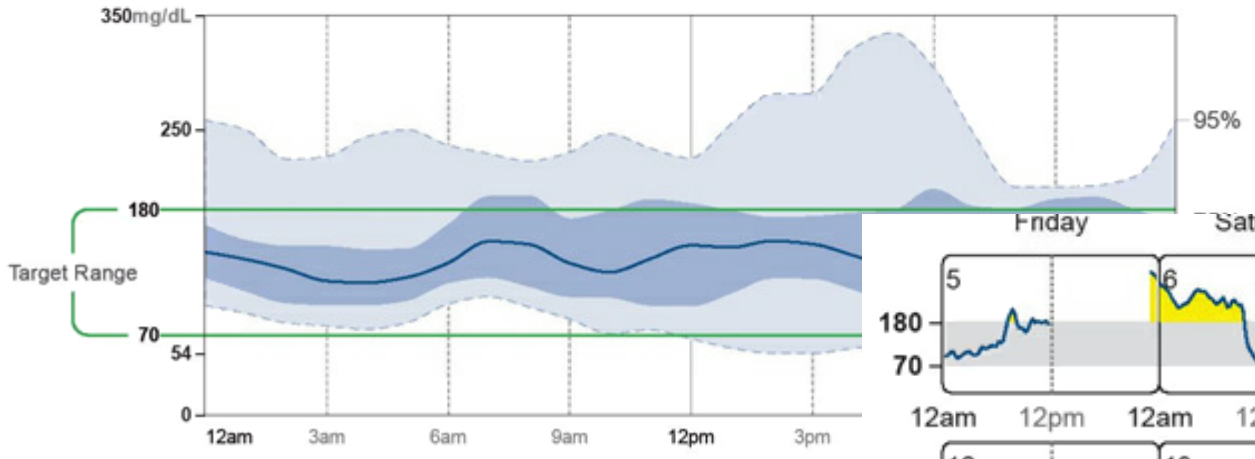
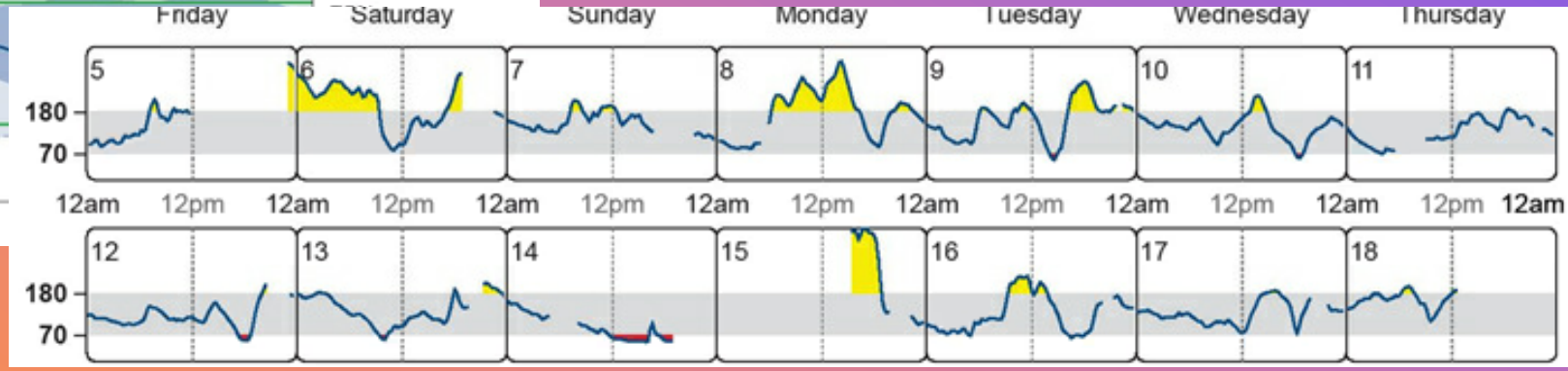




77yo, 108 kg, PMHX DM, HTN, HL,CKD 3

- Tresiba 120 units daily
- NovoLog averaging 20-30 units 3-4 times a day
- Metformin 1000 mg BID
-History of mildly increased Lipase in 2017 with Liraglutide with mild belly pain in ER so was stopped, but no DX of pancreatitis

AGP Report

March 14, 2024 - March 27, 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

March 14, 2024 - March 27, 2024	**14 Days**
Time CGM Active:	**74%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 70-180 mg/dL	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

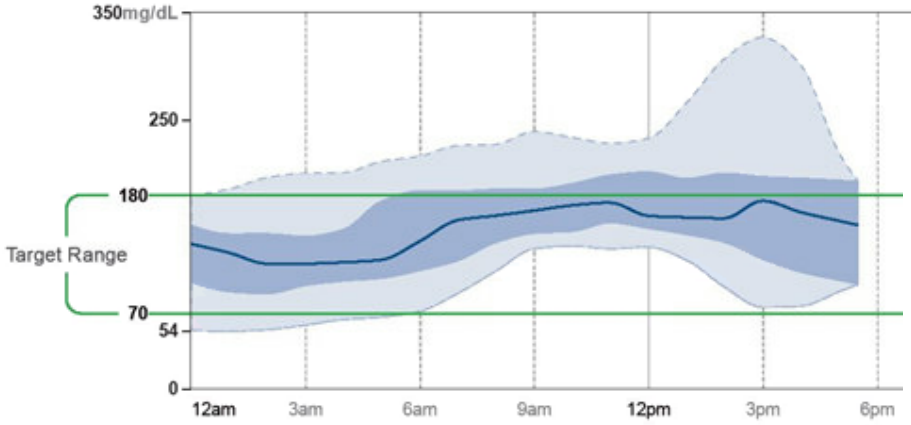
Average Glucose	**151** mg/dL
Glucose Management Indicator (GMI)	**6.9%**
Glucose Variability	**31.9%**

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

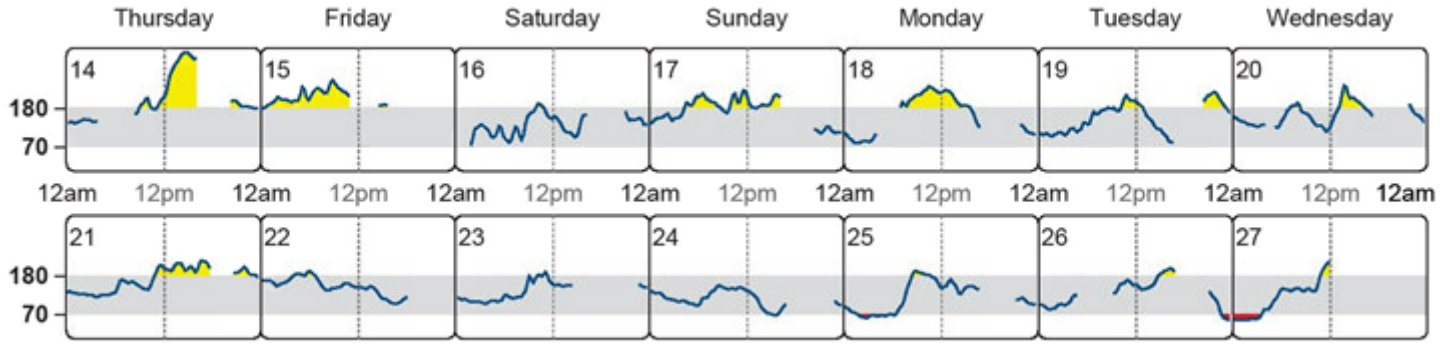
TIME IN RANGES

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

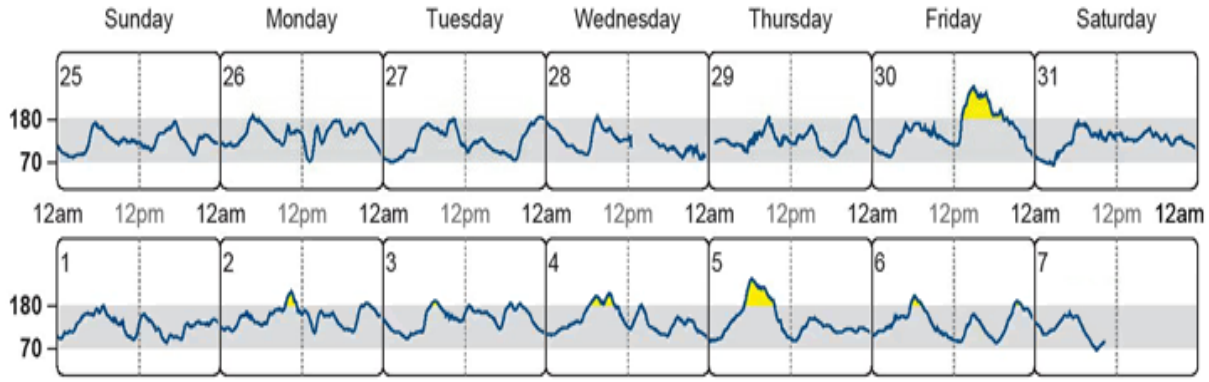


Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American

- Tresiba 70 units daily
- NovoLog averaging 10-13 units 2-3 times a day - takes when his BG's are greater than 120.
- Metformin 1000 mg BID
- Ozempic 0.5 mg once weekly and tolerating



ource: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American

- 78 yr Male
- PMHX: DM2, HLD< HTN, CKD 3, history of liraglutide increase lipase and RUQ 2019
- Weight: 94.8 KG BMI 35.94
- A1c 6.6%

- -Tresiba 58 units daily
- -Novolog 7-9 units once a day
- -Metformin 1000 MG BID
- Ozempic 1 mg weekly

GLUCOSE STATISTICS AND TARGETS

August 25, 2024 - September 7, 2024	14 Days
Time CGM Active:	96%

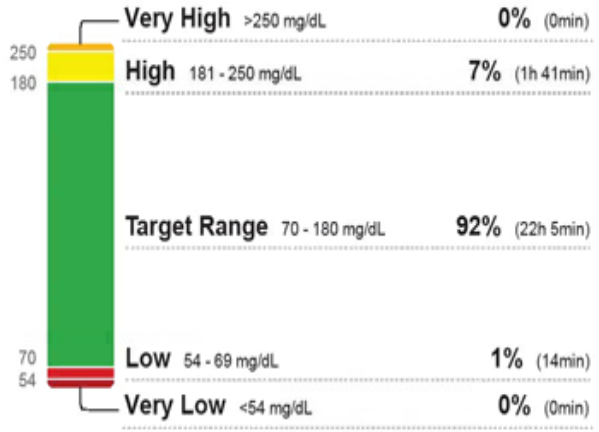
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	133 mg/dL
Glucose Management Indicator (GMI)	6.5%
Glucose Variability	24.5%

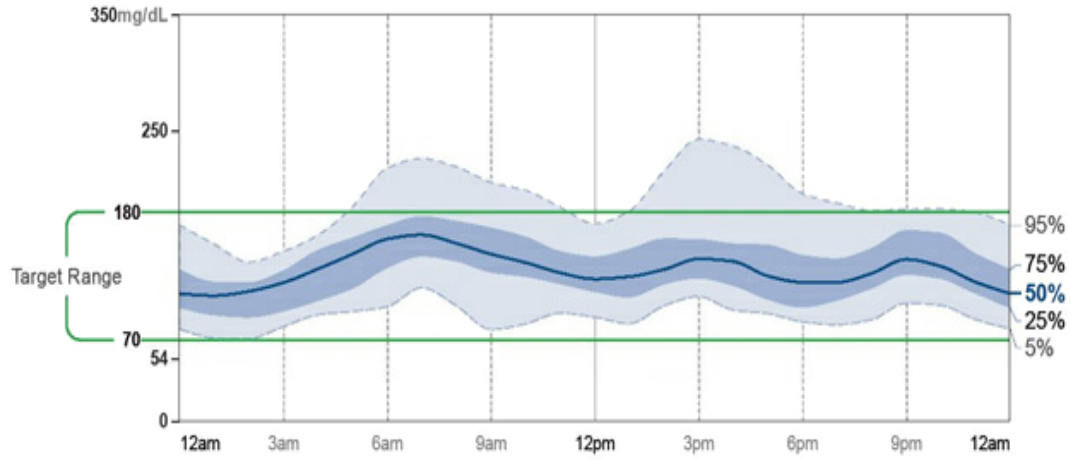
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



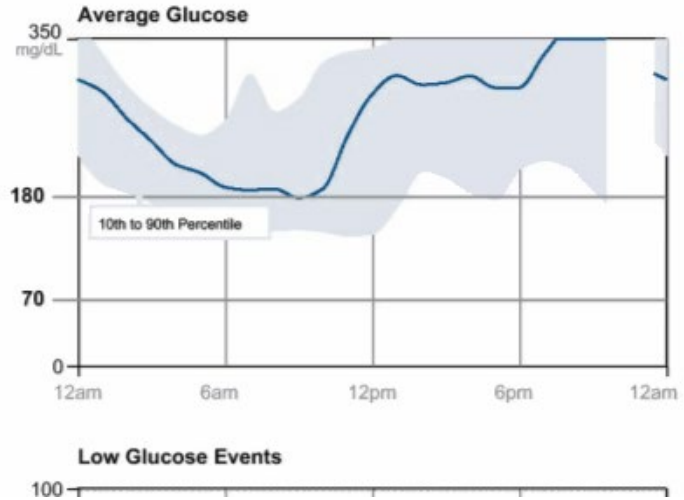
William: 54 yo male, PMHX of DM, CKD, HL, Cardiomyopathy
A1c 11.9% GFR 31

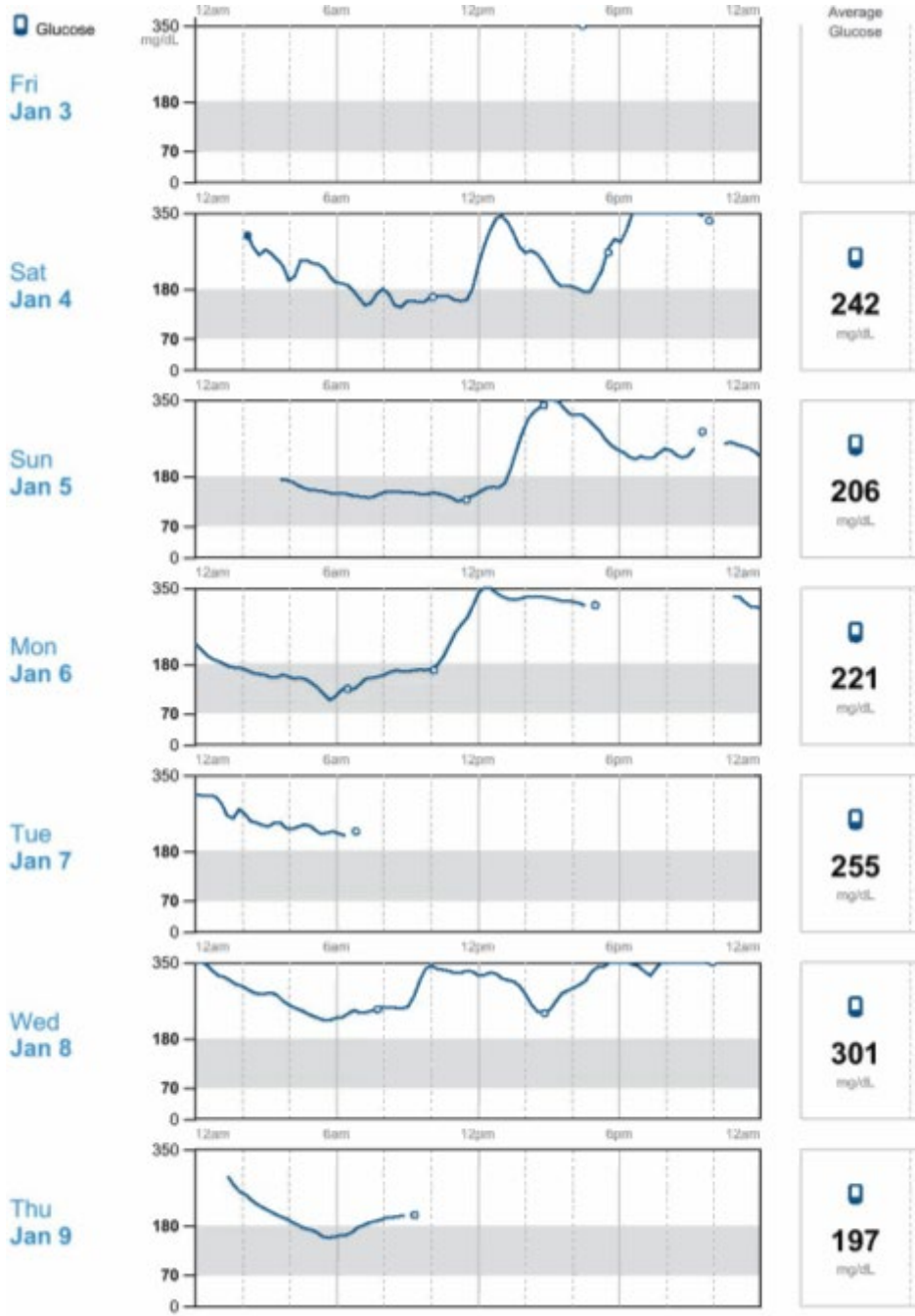
CURRENT LIST OF MEDICINES (pre Ozempic 2 mg):

1. Ozempic 1 mg weekly
2. Tresiba 80 units daily
3. Novolog 16 units with lunch and dinner
4. getting lunch Novolog in, but missing dinner novolog

Glucose

AVERAGE GLUCOSE	257 mg/dL
% above target	78 %
% in target	22 %
% below target	0 %

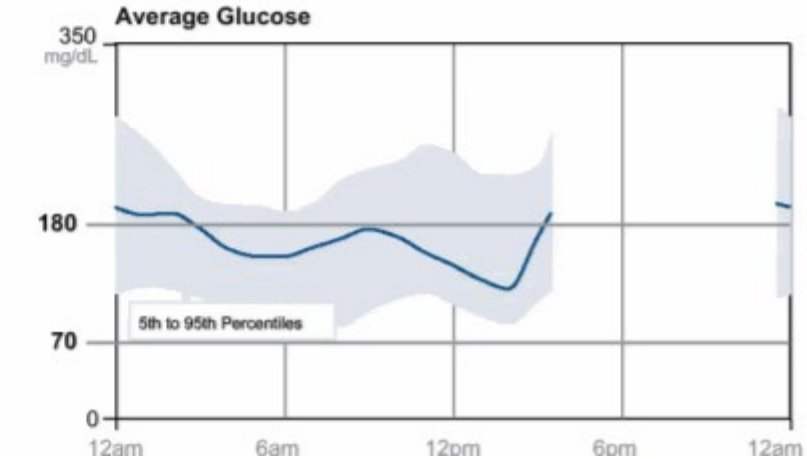


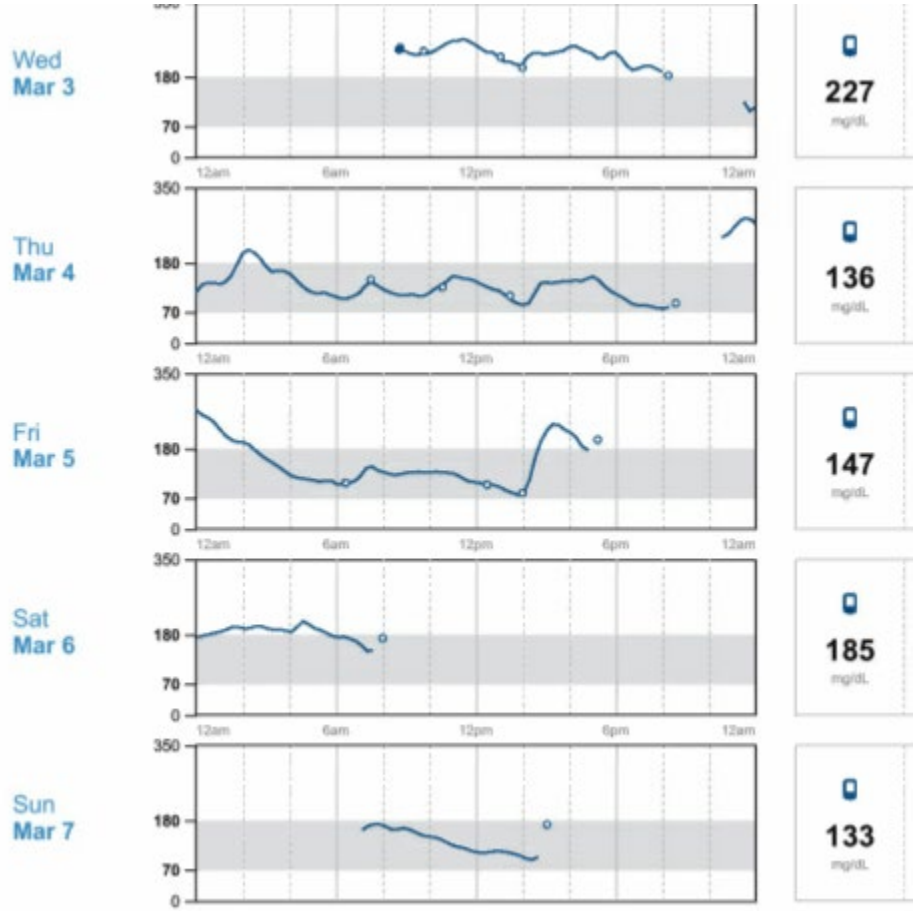


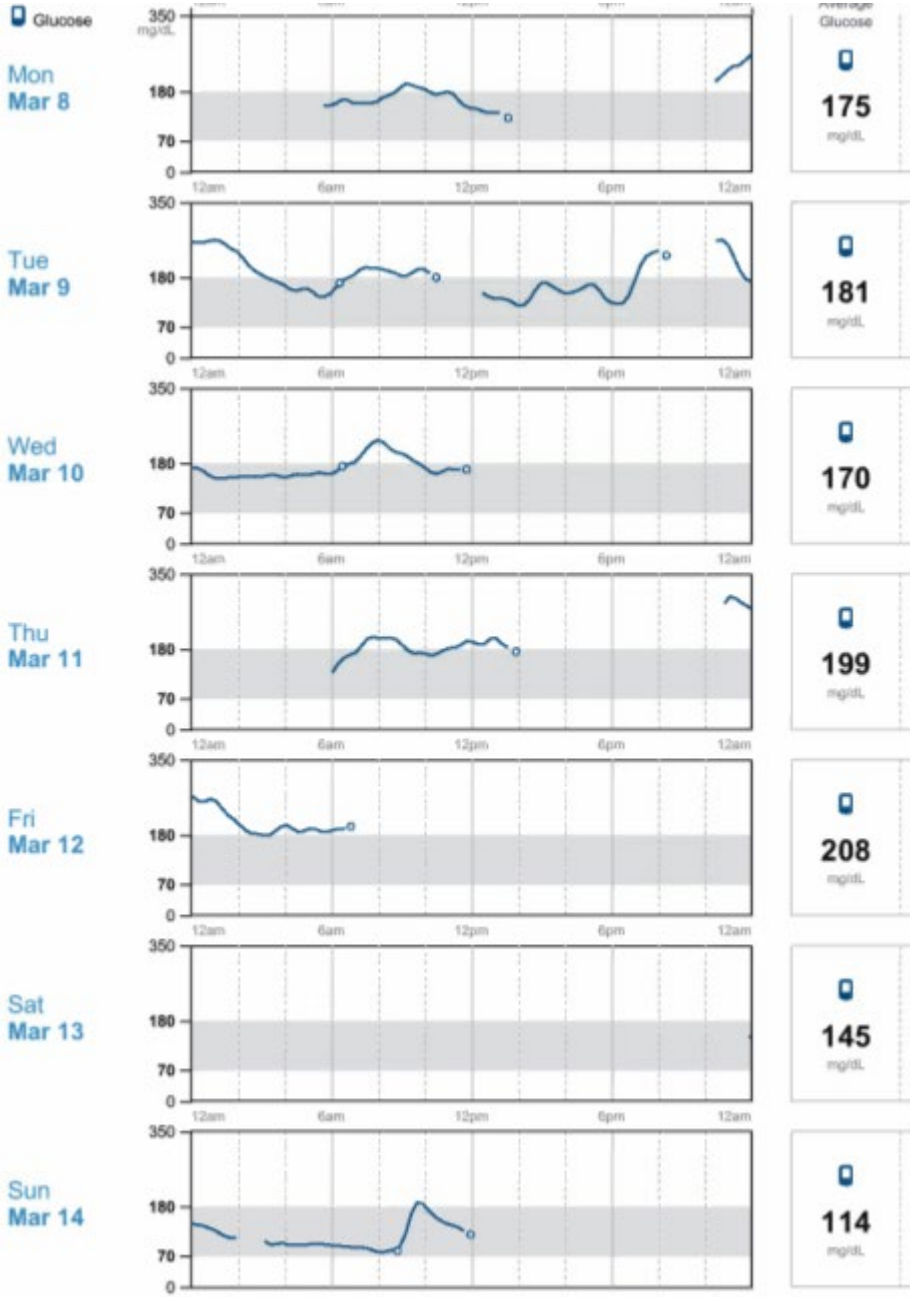
WILLIAM

- A1c 8.7%, previously 8.2%
- WT 113 KG
- BMI 34.37
- GFR 35
- Meds:
  - Ozempic 1mg weekly
  - Tresiba 80 units daily
  - Novolog 70/30 20 units takes about 2 times a week
  - Metformin 500 mg daily

AVERAGE GLUCOSE	167 mg/dL
% above target	38 %
% in target	62 %
% below target	0 %







THANK YOU

Christy Pierce

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