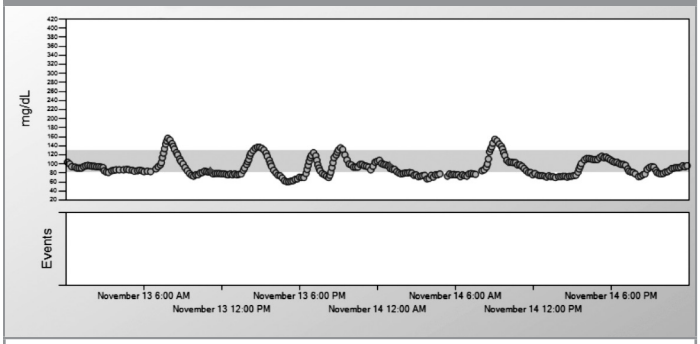
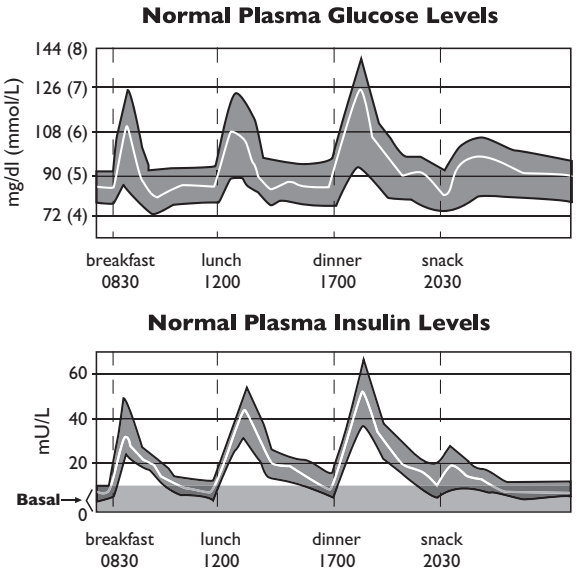
6.1 Glucose Levels in a Person without Diabetes



This graphic shows glucose levels without diabetes. The grey area shows glucose between 85 and 130 mg/dL.

6.2 Insulin Matches Glucose Intake

Post-meal glucose levels in the top graph are controlled by rapid releases of insulin, shown in the bottom graph. The grey area in the bottom graph represents basal insulin.



Adapted from BR J Diabetes Vasc Dis 4(1): 39-42, 2004

6.3 Glucose Values and Goals for Adults with Type 1 Diabetes

	Normal Glucose	ADA Goals[1]	AACE Goals[2]	Pregnancy Goals[3, 4]
Avg Meter BG:	<126 mg/dL <7 mmol/L	<154 mg/dL <8.6 mmol/L	<140 mg/dL <7.8 mmol/L	<140 mg/dL <7.8 mmol/L
A1c:	<5.7%	<7.0% without significant hypoglycemia	<6.5% for healthy individuals	<6.5%
Fasting BG	<100 mg/dL <5.6 mmol/L	70–130 mg/dL 4-7.2 mmol/L	<110 mg/dL <6.1 mmol/L	60-99 mg/dL 3.3-5.5 mmol/L
Before Meal BG	<110 mg/dL <6.1 mmol/L	70–130 mg/dL (4-7.2 mmol/L)	<110 mg/dL <6.1 mmol/L	<100 mg/dL <5.6 mmol/L
2 hr After Meal BG	70–140 mg/dL 4-7.8 mmol/L	180 mg/dL peak 10 mmol/l peak	<140 mg/dL <7.8 mmol/L	<120 mg/dL <6.7 mmol/L
Bedtime BG	<110 mg/dL <6.1 mmol/L	90-150 mg/dL 5-8.3 mmol/L	–	<100 mg/dL <5.6 mmol/L

1 Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes-2024. Diabetes Care. 2024 Jan 1;47(Suppl 1):S111-S125. doi: 10.2337/dc24-S006. 2 AACE/ACE Diabetes Guidelines, Endocrine Pract. 2015; 21 (Suppl 1)
3 Normal glucose levels in pregnancy range from 63 to 120 mg/dL. 4 Blum, A. K. Insulin use in pregnancy: an update. Diabetes Spectrum, 2016, 29(2), 92-97.

6.4 Steps to Better Glucose Readings

- **Set clear goals**, such as getting 5% more glucose readings inside your target range within 30 days.
- **Look at your CGM glucose reading 8 or more times a day.**
- **Use your bolus calculator** for all carb and manual correction boluses. Check the 3- and 6-hour windows later to see how each bolus worked.
- **Bolus early** for every meal and snack unless there's a good reason not to.
- **Match bolus doses** to a meal's carb count or size, current glucose, and IOB.
- **Wait to eat more than 15 grams of carbs** until below 140 mg/dL (7.8 mmol/L).
- **Don't overtreat** lows with carbs nor highs with insulin.

6.5 Estimated Average Glucose from A1c

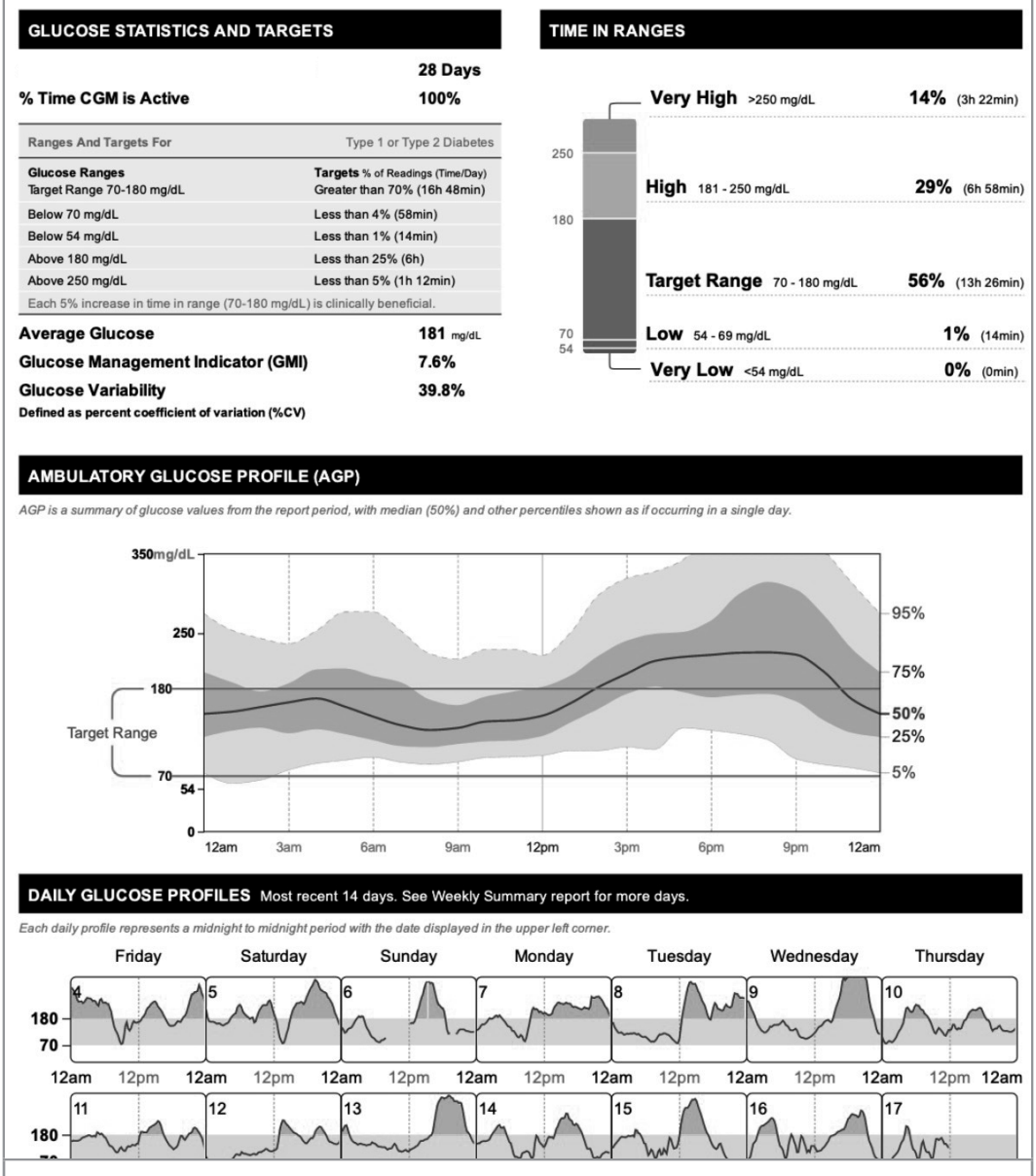
A1c	Est. Avg. Glucose mg/dL (95% range)	Est. Avg. Glucose mmol/L (95% range)
5.0%	97 (76–120)	5.4 (4.2–6.7)
5.5%	112 (88–136)	6.2 (4.9–7.6)
6.0%	126 (100–152)	7.0 (5.5–8.5)
6.5%	140 (112-168)	7.8 (6.2-9.4)
7.0%	154 (123–185)	8.6 (6.8–10.3)
7.5%	169 (135-201)	169 (7.5-11.2)
8.0%	183 (147–217)	10.2 (8.1–12.1)
8.5%	197 (159-233)	11-0 (8.8-13.0)
9.0%	212 (170–249)	11.8 (9.4–13.9)
10.0%	240 (193–282)	13.4 (10.7–15.7)
11.0%	269 (217–314)	14.9 (12.0–17.5)
12.0%	298 (240–347)	16.5 (13.3–19.3)

Based on ADAG data of 2,700 glucose measurements over 3 months per A1c measurement in 507 adults with type 1, type 2, or no diabetes. Adapted from Nathan et al. Diabetes 2014;63:282–290. Scan for conversion tool.

6.6 What the Sample AGP in Fig. 6.7 Shows

In the daily graphs visible at the bottom of Fig. 6.7, this individual's glucose often rises after lunch and stays high until after dinner. The glucose levels after lunch and dinner vary significantly from day to day. This suggests boluses were not adequately adjusted for meal size, boluses were missed or given late, or a weak (high) CarbF gave inadequate boluses. The mismatch between boluses and carbs creates a high glucose variability of 39.8%, shown by the wide light grey area that contains 90% of the glucose values.

6.7 Sample Ambulatory Glucose Profile Report



GLUCOSE STATISTICS AND TARGETS

	28 Days
% Time CGM is Active	100%

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	181 mg/dL
Glucose Management Indicator (GMI)	7.6%
Glucose Variability	39.8%
Defined as percent coefficient of variation (%CV)	

TIME IN RANGES

250
180
70
54

Very High	>250 mg/dL	14% (3h 22min)
High	181 - 250 mg/dL	29% (6h 58min)
Target Range	70 - 180 mg/dL	56% (13h 26min)
Low	54 - 69 mg/dL	1% (14min)
Very Low	<54 mg/dL	0% (0min)

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
95%
75%
50%
25%
5%
12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am

DAILY GLUCOSE PROFILES Most recent 14 days. See Weekly Summary report for more days.

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

Friday Saturday Sunday Monday Tuesday Wednesday Thursday

4 5 6 7 8 9 10

180
70
12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am 12pm 12am

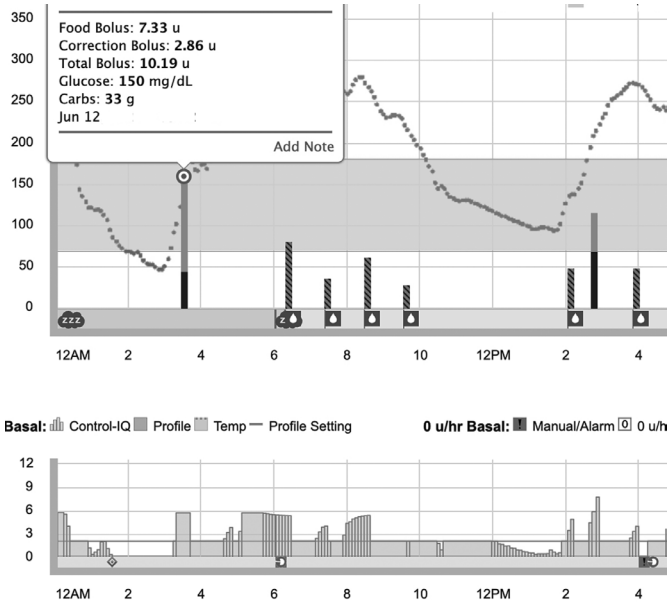
11 12 13 14 15 16 17

180

This AGP report summarizes glucose data over the last 14 days in four parts:

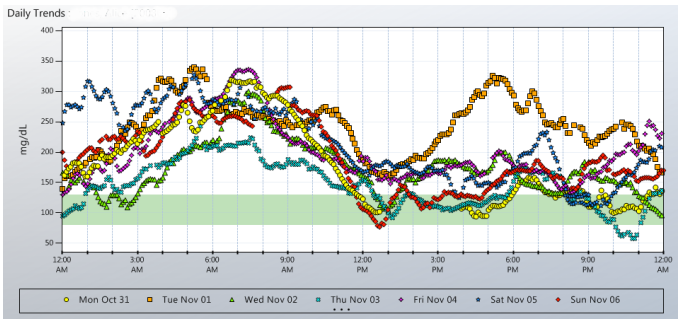
Top Left: shows the average glucose, GV, and GMI (estimated A1c). **Top Right:** time in different glucose ranges. **Middle:** AGP report with the average glucose (line), the middle 50% (darker grey) of glucose readings, and the middle 90% (lighter grey) of glucose readings. **Bottom:** daily glucose trend lines for the last 14 days.

6.8 Avoid Excess Basal Chatter on AID

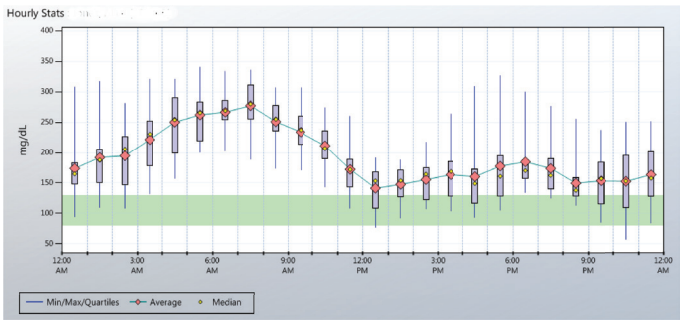


This example graph from midnight to 4 pm shows excessive "basal chatter" at the bottom with basal rates varying between 0 in the blank white areas to 6 units an hour when they spike. Although the average daily glucose is 150 mg/dL, glucose spiking occurs from late and missed boluses. Changes in basal and bolus settings and habit are required.

6.9 Daily and Hourly Trend Graphs



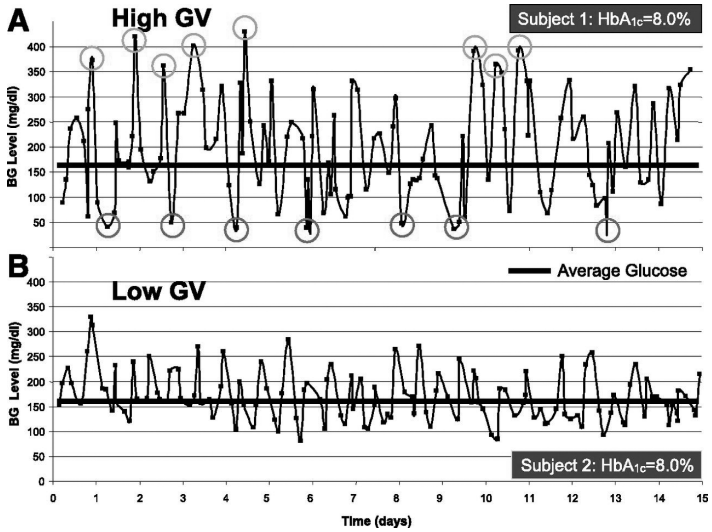
This **Daily Trend Graph** shows glucose readings with each 24-hour day as one of the lines across the graph. The consistent pattern in these high readings makes them relatively easier to correct.



Hourly Trend Graphs summarize the same data. The boxes show where 50% of the glucose readings land and the whiskers show 90% of readings. This person's glucose rises overnight after a 10 pm dinner. A higher basal between 7 pm and 7 am and a lower (stronger) dinner CarbF will help.

6.10 The Less Glucose Variability, the Better

These fifteen-day glucose tracks show two different people with an identical HbA1c of 8.0% but different degrees of GV.74



The same A1c or average CGM glucose can be deceptive. Over 15 days, person A has numerous lows below 50 mg/dL and highs above 350 mg/dL, marked by the circles. Their high GV comes from overtreating lows, skipping or delaying meal boluses when their glucose is lower, and then giving excessive boluses for the highs.

Person B has the same A1c, far less GV, no hypoglycemia, and can lower their A1c of 8.0% with a slight increase in their basal rates and a small reduction in their CarbF number.

Steady glucose readings make it easier to lower an average glucose with less risk of hypoglycemia.

6.11 Check These When You Want to Reduce Highs and Lows

Answer these questions and rank their importance on a 1 to 5 (low to high) scale regarding how much they are affecting your glucose variability:.

Are you:	Yes	No	Importance
• Missing meal boluses?	❑	❑	_____
• Bolusing just before or after eating?	❑	❑	_____
• Unclear about carb counts or meal sizes?	❑	❑	_____
• Having frequent or severe low glucoses?	❑	❑	_____
• Preferring lows because you fear complications?	❑	❑	_____
• Preferring to stay high to avoid lows?	❑	❑	_____
• Significantly differing bolus or basal doses day to day?	❑	❑	_____
• Having infusion set or pod failures?	❑	❑	_____
• Exercising at different times, intensities, or durations?	❑	❑	_____
• Sleeping irregularly or insufficiently?	❑	❑	_____
• Under stress, depressed, or lacking motivation?	❑	❑	_____
• In pain?	❑	❑	_____

6.12 Drinking and Diabetes

Take care when mixing alcohol and insulin. Hypoglycemia and intoxication symptoms are strikingly similar. If you go low after drinking, a police officer may not recognize the real problem when they smell alcohol. You may be placed in a drunk tank rather than receive the carbs you need. Excess alcohol impairs judgment and reduces attention and the accuracy of carb counts and bolus doses. Don't drink on an empty stomach or to excess!

Four standard drinks cut glucose production in the liver in half, making it a major cause of nighttime hypoglycemia. Excess alcohol blocks the liver from making glucose, and excess insulin stops it from releasing the glucose you need, making it difficult to raise it.

Make the best decisions about drinking:

- Know the laws in your state.
- Remember, you can say "No!"
- If you plan to drink, eat carbs first, and don't skip meals or snacks.
- Limit your intake: slowly drink one or two drinks or alternate with nonalcoholic drinks.
- Wine, beer, and straight alcohol like gin or tequila may not need a bolus. Mixed drinks, liqueurs, and marguerites with sugar usually do.
- Don't drink before you drive. Don't drive after drinking.
- Wear a diabetes medical ID.
- Let friends know: you have diabetes, hypoglycemia can make you look drunk, you can pass out from a low, and to encourage carb intake if you respond inappropriately.
- Check your glucose before going to sleep, and consider a larger bedtime snack.