

Sunscreen is NOT enough:  
*Patient engagement with technology for  
Pattern Management and  
Therapeutic Adjustments*

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# 5 Steps to Develop Meaningful Action Plans



# Collaboration

- People are the experts in their own lives
- Professionals are the experts in clinical aspects of diabetes
- 99% of diabetes care is *self care*
- Behavior change takes place as health professionals help people make informed decisions about their **self** care.
- Not all patients will be primary decision makers in their own care.

# Making a Difference with your Communication

*What will my patient hear? “We’ve got to go”*

- **Verbal/Voice and Tone (38%)**
  - Open ended questions
  - Friendly tone
- **Nonverbal/Body Language (55%)**
  - Open stance, lean forward, no crossed arms
  - Eye contact
- **Words (7%)**
  - Easy to understand and easy to remember
  - “We’ve got to go”

# Tipping Points

- Depression
- “No Big Deal”
- Inevitability
- Treatment Skepticism
- Unrealistic Plans for Action
- Poor Social Support
- Environmental Pressures

# To help Assess Tipping Points....

- No big Deal-Inevitability
  - What worries you about having diabetes?
- Treatment skepticism
  - Help the person see that their regimen is working....How does exercise affect your BG? Check blood sugars before and after starting GLP
- Unrealistic plans
  - Help pts select smaller achievable actions

# To Help Assess.....

- Poor Social Support
  - Who could you ask “for help”,
  - “to be your walking partner”?
  - What would you say?
- Environmental Pressures
  - Financial, Competing Demands,
  - It is *Hard* to change habits. Move your trash can....
  - What can you change in your environment that might make this easier for you?

# Behavior Styles

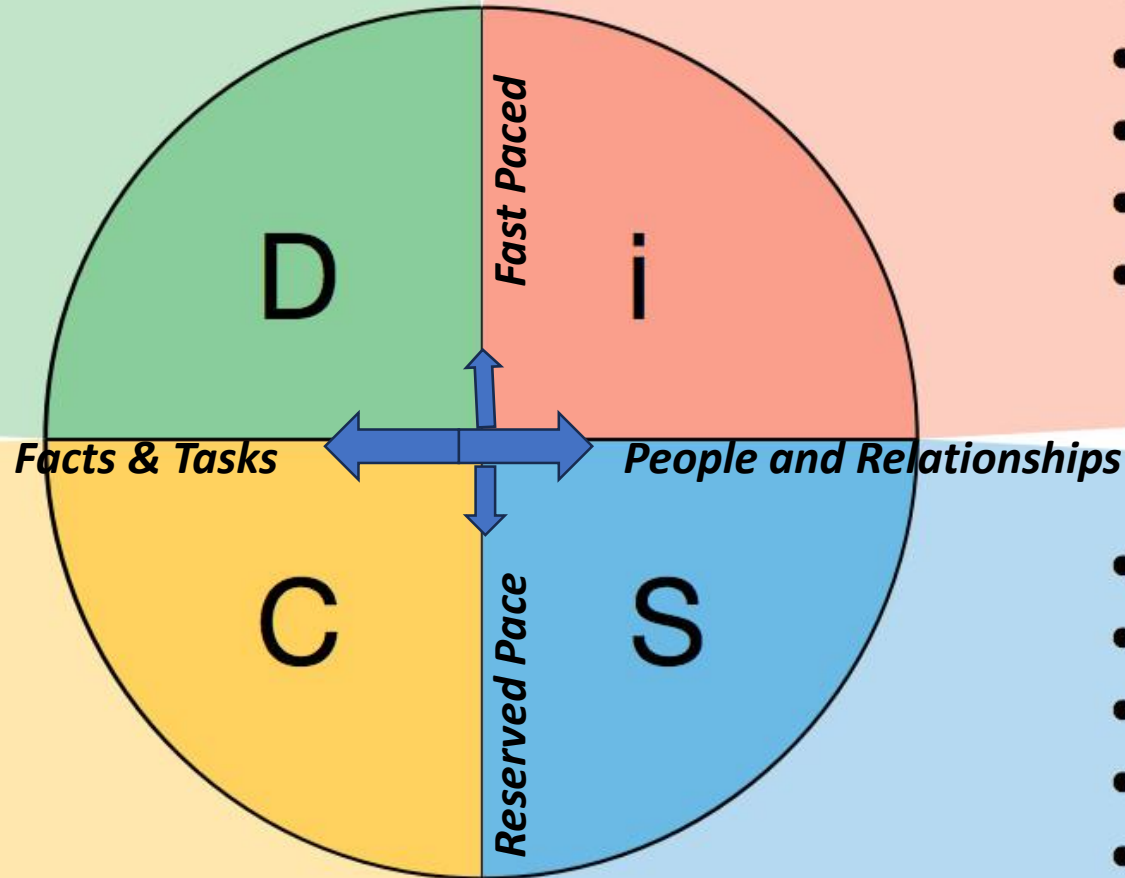
*Quickest Determination is to mirror your patient*

## DOMINANCE

- Direct
- Results-oriented
- Firm
- Strong-willed
- Forceful

## INFLUENCE

- Outgoing
- Enthusiastic
- Optimistic
- High-spirited
- Lively



- Analytical
- Reserved
- Precise
- Private
- Systematic

## CONSCIENTIOUSNESS

- Even-tempered
- Accommodating
- Patient
- Humble
- Tactful

## STEADINESS

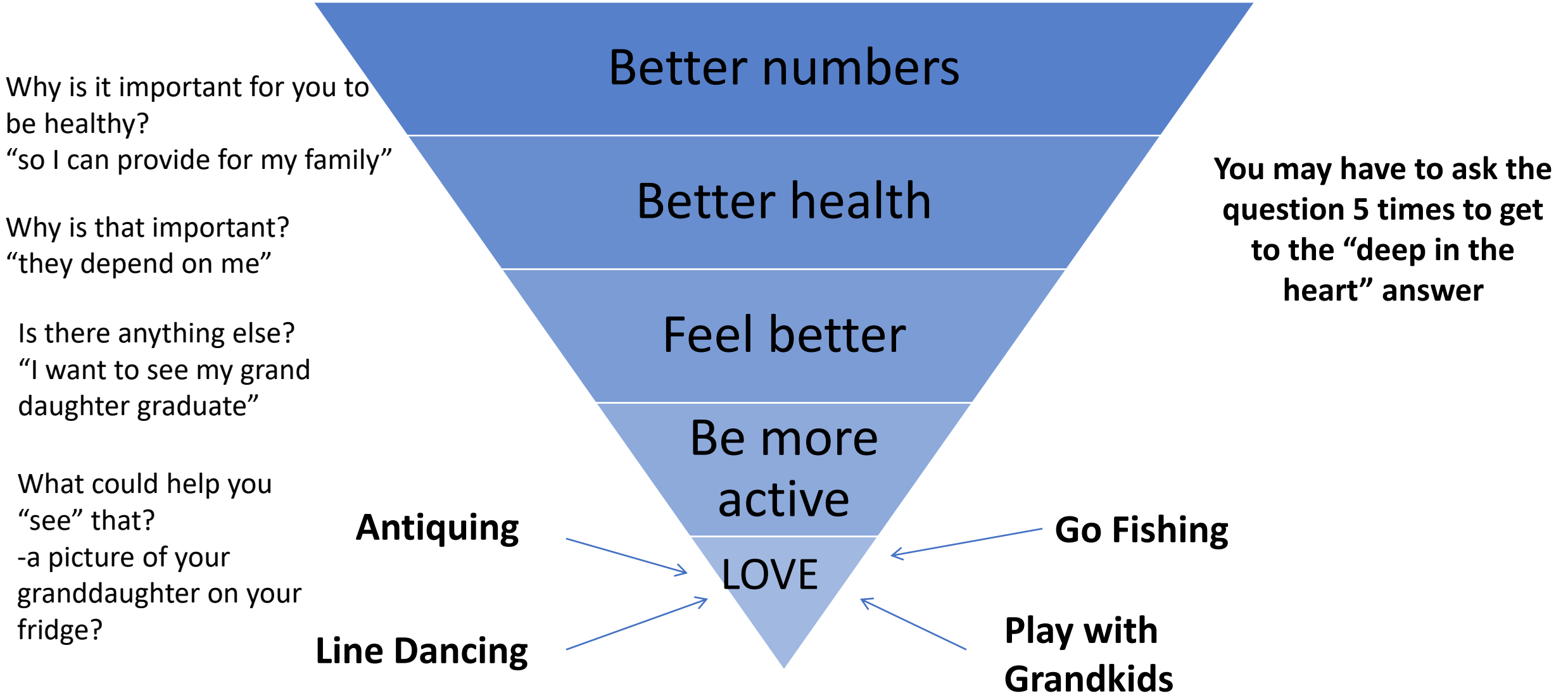


# To Get Good Outcomes....

- The D needs to set their own goals/deadlines. They may take on too much
- The I needs deadlines and accountability. Help them get to the goal/point
- The C will analyze for years....Set deadlines
- The S needs to care for themselves and know they are important. Give them permission to be the priority

# 5 Levels of Motivation

Using What, Why & How questions to identify significance.



# Educating to Empower

- Set the Goals and Give the Power to the PWD
  - Your A1C goal is <7%. I will help you get the information and skills to help you be independent.
- Self Care Skills: Verify knowledge and basic skills
  - Medication administration
  - Basic eating guidelines
  - Hypoglycemia: symptoms and treatment
  - SMBG and Goals
  - When to call the Dr. and,
  - Sick Days
    - *What would you prioritize in a 10 minute 1<sup>st</sup> visit?*

# Strategies to Empower

- Identify Learning style. *ex: If you set the demo pen on the desk.....*
  - Feeler: How does this apply to me?
  - Watcher: Show me
  - Thinker: I will read the instruction manual
  - Doer: Let me just figure it out
- Ask “How do you learn best”?
  - **Partner up.** Person with biggest jewelry is the Clinician
  - **In 1 minute.... Determine learning style**

# Strategies to Empower

- Employ Adult Teaching Principles
  - Use experiential-hands on tactics
  - Assess readiness to learn...Start there
  - Base info on what the learner already knows
  - Reinforce info and skills
  - Help clarify THEIR management goals
  - ***With your partner, use your pen/pencil to teach how to give a weekly GLP injection. (Semaglutide, Dulaglutide or Tirzepatide) 2 minutes***

# Coaching.....

- “Mrs Jackson, I would like to have your thoughts when we review your blood sugar records at your next visit.
- Would you bring your log book with the fastings and after meal blood sugars written down on this form?” AND would you write down notes about what you observed from doing the blood sugars?
  - *Verbal Contracting*

# Asking for input.....

- Mrs S, recent research shows high lipids and diabetes out of control speed up cardiac complications. I don't want you to have a heart attack. I suggest we consider specific steps to reduce your risk factors. Are you willing?
  - *Setting a plan with specific/doable steps*
- “Mr B, you said you wanted to get your A1c below 8. I agree. We definitely don't want you to have the neuropathy get worse. What is your toughest challenge? What can I do to help make things work better for you?”
  - *Treatment commitment/overcoming barriers*

# To Promote Behavior Change

- What part of diabetes is most difficult for you?
- How does that (situation) make you feel?
- How would this have to change to make you feel better about it?
- Are you willing to take action to improve the situation for yourself?
- What are some steps you could take to get you there?
- Is there *one thing* you will do when you leave here to improve things for yourself?
  - Switch roles with your partner. *The person with T2DM for 10 years has an LDL of 120 and needs to start a statin. **Be persuasive***



# Trouble shooting and Getting a Commitment....

- What questions would you like to ask about the new medicine?
- What will get in the way of you being able to take this?
- On a scale of 1-10 how confident are you that you can do this?  
(anything below 7-8 unlikely to be successful)
  - What would it take to make your answer a 7 instead of a 6?

# Clinical Inertia Sabotages Best Outcomes

- Defined as...”failure to intensify therapy when indicated”<sup>1</sup>
- People with Diabetes (PWD) failing to see themselves as partners in their own care<sup>1</sup>
- Worsened by...lack of meaningful data to take action in changing therapies or self-care behaviors<sup>1</sup>
- Poor self management behavior increase therapeutic clinical inertia<sup>2</sup>
- Pattern management is an important strategy to combat clinical inertia and promote self-management<sup>2</sup>

1. AADE's The Art & Science of DSME Desk Reference 2<sup>nd</sup> Ed., Chp 10, p 533

2. Grant R et al. Relationship between patient medication adherence and subsequent clinical inertia in type 2 diabetes glycemic management. Diabetes Care. 2007;30(4):807- 11

# There are a “few” glucose meters out there



# 6 steps for a accurate test

1 Wash your hands



2 Install the lancet



3 Insert the strip



4 Collect blood



5 Apply blood



6 Results in 7s



# Lancets vs Drums

## Lancets



# Pattern Recognition and Principles of Insulin Dose Adjustment

	BREAKFAST		LUNCH		DINNER		NIGHT
	PRE	POST	PRE	POST	PRE	POST	
MON	X						
TUES		X					
WED			X				
THUR				X			
FRI					X		
SAT						X	
SUN							X

	BREAKFAST		LUNCH		DINNER		NIGHT
	PRE	POST	PRE	POST	PRE	POST	
MON	X	X					
TUES			X	X			
WED					X	X	
THUR	X	X					
FRI			X	X			
SAT					X	X	
SUN	X	X					

	BREAKFAST		LUNCH		DINNER		NIGHT
	PRE	POST	PRE	POST	PRE	POST	
MON							
TUES							
WED							
THUR	X	X	X	X	X	X	X
FRI							
SAT							
SUN							

- SMBG schedules shown are for troubleshooting problematic glycemia—[not for routine use in patients with stable glycemic control](#)<sup>1-4</sup>
- There is no consensus on the optimal monitoring schedule for patients using basal insulin without prandial insulin<sup>1-4</sup>
- Very frequent monitoring is burdensome for patients—consider CGM instead of SMBG for these patients<sup>2</sup>

1. Klonoff DC, et al. *J Diabetes Sci Technol*. 2011;5:1529-1548; 2. Hinnen D, Tomky D. In: Mensing C, et al, eds. *The Art and Science of Diabetes Self-Management Desk Reference*. 2nd Ed. Arlington, VA: ADA; 2011:531-575; 3. Accu-Chek. <https://www.accu-chek.com/apps-and-software/360-view-tool/support>; 4. *Practical Insulin*. 3rd ed. Arlington, VA: ADA; 2011:1-68.

# How *Often* and *When* to test?

Name: \_\_\_\_\_  
 Date of Birth: \_\_\_\_\_

Phone: \_\_\_\_\_

- **Testing Patterns**
  - **Testing in pairs:**
    - Before Br & 2 hrs after
      - Skip a day
    - Before Lu & 2 hrs after
      - Skip a day
  - Before dinner & 2 hrs after

Year	Breakfast				Lunch				Dinner				Bedtime		Comments
	Fasting Blood Sugar	Carbs	Insulin Units	Blood Sugar 1 Hr After	Fast Blood Sugar	Carbs	Insulin Units	Blood Sugar 2 Hr After	Fast Blood Sugar	Carbs	Insulin Units	Blood Sugar 2 Hr After	Blood Sugar	Insulin Units	
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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31															



# BLOOD GLUCOSE RECORD

Patient Name: _____		<b>BLOOD GLUCOSE GOALS:</b> Fasting _____ 1 hour after meal _____ 2 hours after meal _____ Before meal _____
Date of Birth _____	Phone# _____	
Email Address _____		
Check your Physician/Provider: <input type="checkbox"/> Richard Guthrie, MD <input type="checkbox"/> Belinda Childs, ARNP <input type="checkbox"/> Phil Challans, MD <input type="checkbox"/> Jolene Grothe, ARNP <input type="checkbox"/> Jeremiah Nelson, MD <input type="checkbox"/> Diana Guthrie, ARNP <input type="checkbox"/> Debbie Hinnen, ARNP		

	Date:	Breakfast		Lunch		Dinner		bed time	Exercise time	Comments
		before	2 hrs after	before	2 hrs after	before	2 hrs after			
Blood Glucose										
Medication										
Blood Glucose										
Medication										
Blood Glucose										
Medication										
Blood Glucose										
Medication										
Blood Glucose										
Medication										
Blood Glucose										
Medication										



# Pattern Management Process

## Step 1 Identify the glycemic abnormality

-Look at 3+ days of glucose data

- **Priority 1** – Hypoglycemia
- **Priority 2** – Fasting Hyperglycemia
- **Priority 3** – Postprandial Hyperglycemia\*

## Step 2 Determine timing and frequency of occurrence

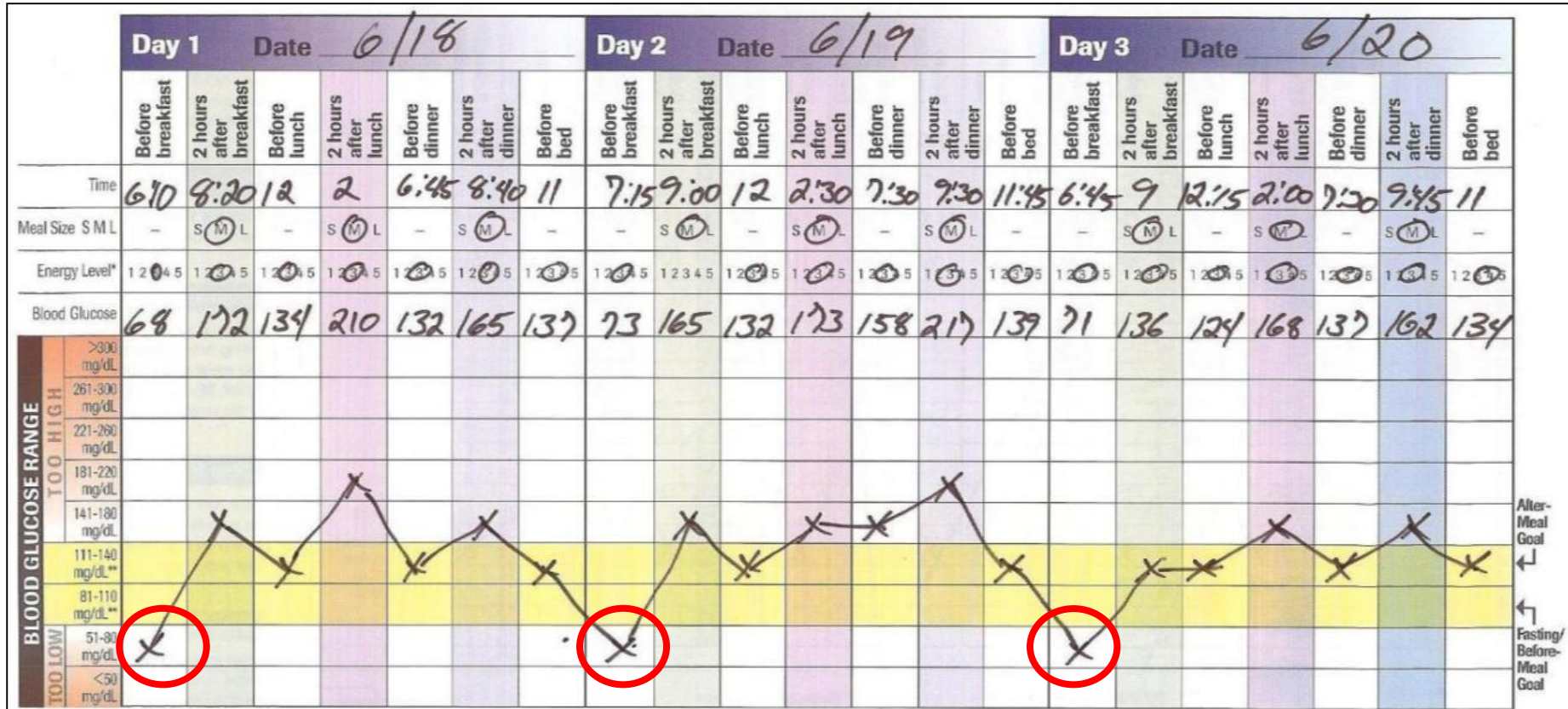
## Step 3 Investigate potential causes

## Step 4 Take action

*\*Results greater than 50 mg/dL higher than preprandial need attention*

# Step 1 – Identify the Glycemic Abnormality

## Priority 1 – Hypoglycemia



**\*ENERGY LEVEL**

What is your energy level?	1	2	3	4	5
	Very Low	Somewhat Low	Moderate	Somewhat High	Very High

**WARNING:** Do not adjust your prescribed oral medication or insulin therapy without first consulting your physician.

What did you learn from doing this analysis of your blood glucose results?

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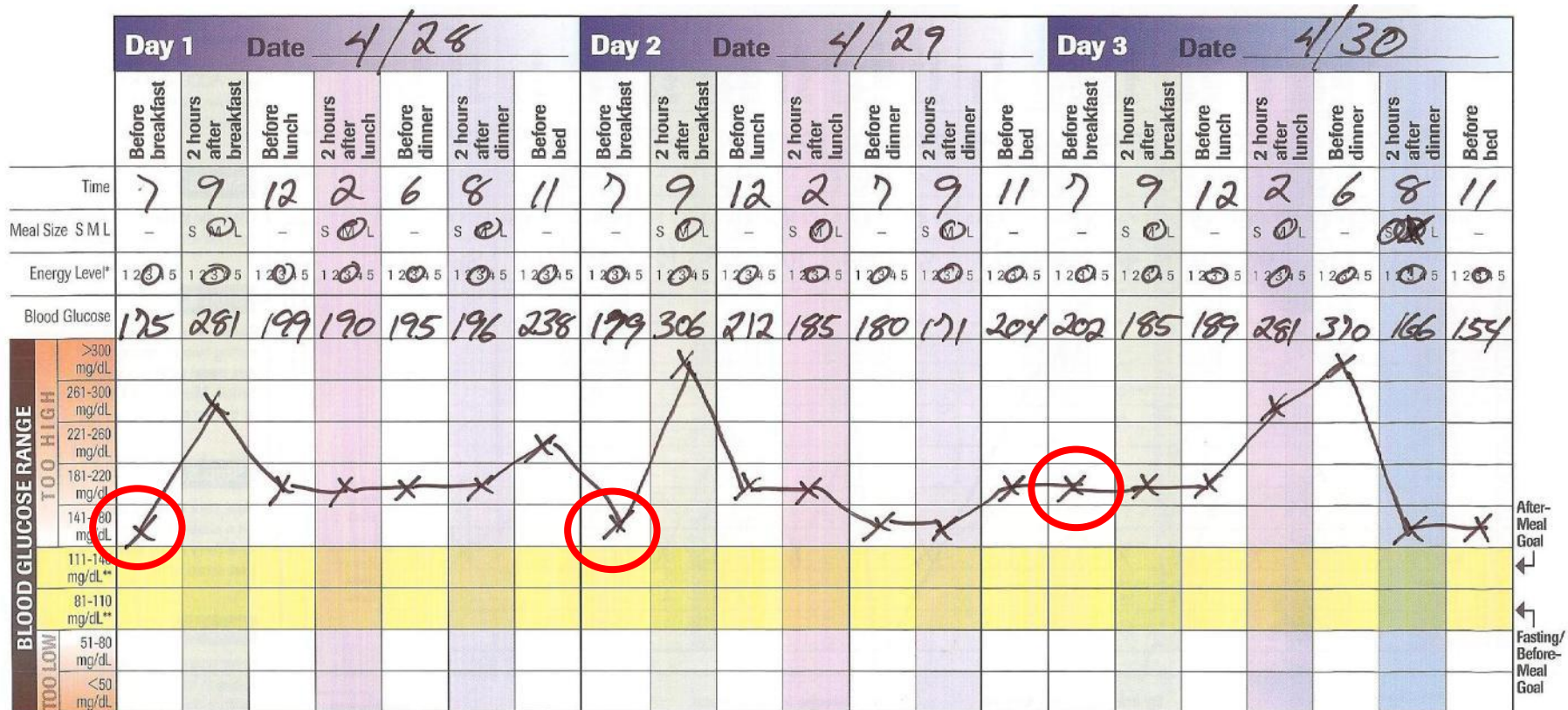
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Bring this form and your [REDACTED] blood glucose monitoring system to your next physician appointment.

\*\*American College of Endocrinology Consensus Statement on Guidelines for Glycemic Control, 2002.

# Priority 2.

## Fix the fastings (>110 mg/dL)



*ENERGY LEVEL					
What is your energy level?	1	2	3	4	5
	Very Low	Somewhat Low	Moderate	Somewhat High	Very High

**WARNING:** Do not adjust your prescribed oral medication or insulin therapy without first consulting your physician.

What did you learn from doing this analysis of your blood glucose results?

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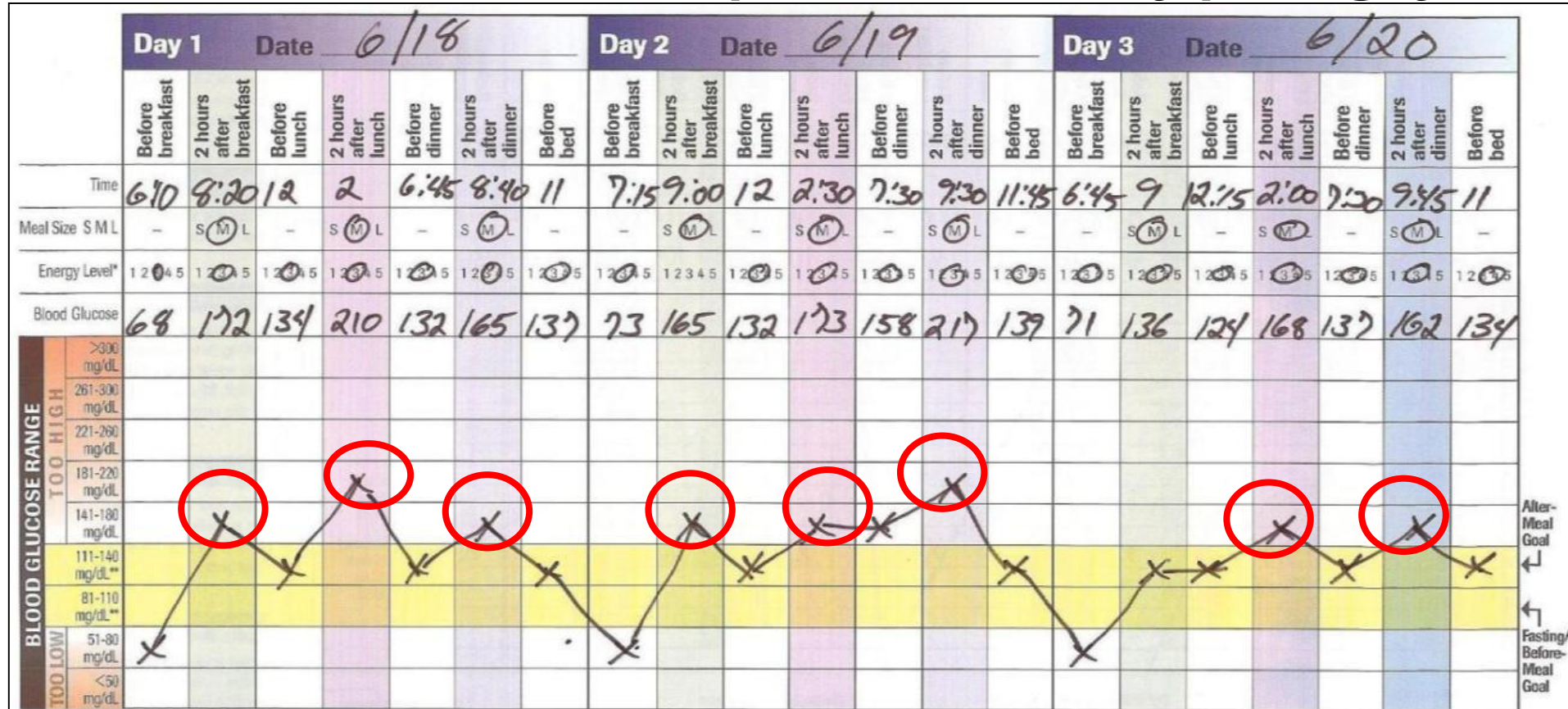
Bring this form and your [REDACTED] blood glucose monitoring system to your next physician appointment.

\*\*American College of Endocrinology Consensus Statement on Guidelines for Glycemic Control, 2002.



# Priority 3

## Postprandial hyperglycemia



*ENERGY LEVEL					
What is your energy level?	1	2	3	4	5
	Very Low	Somewhat Low	Moderate	Somewhat High	Very High

**WARNING:** Do not adjust your prescribed oral medication or insulin therapy without first consulting your physician.

What did you learn from doing this analysis of your blood glucose results?

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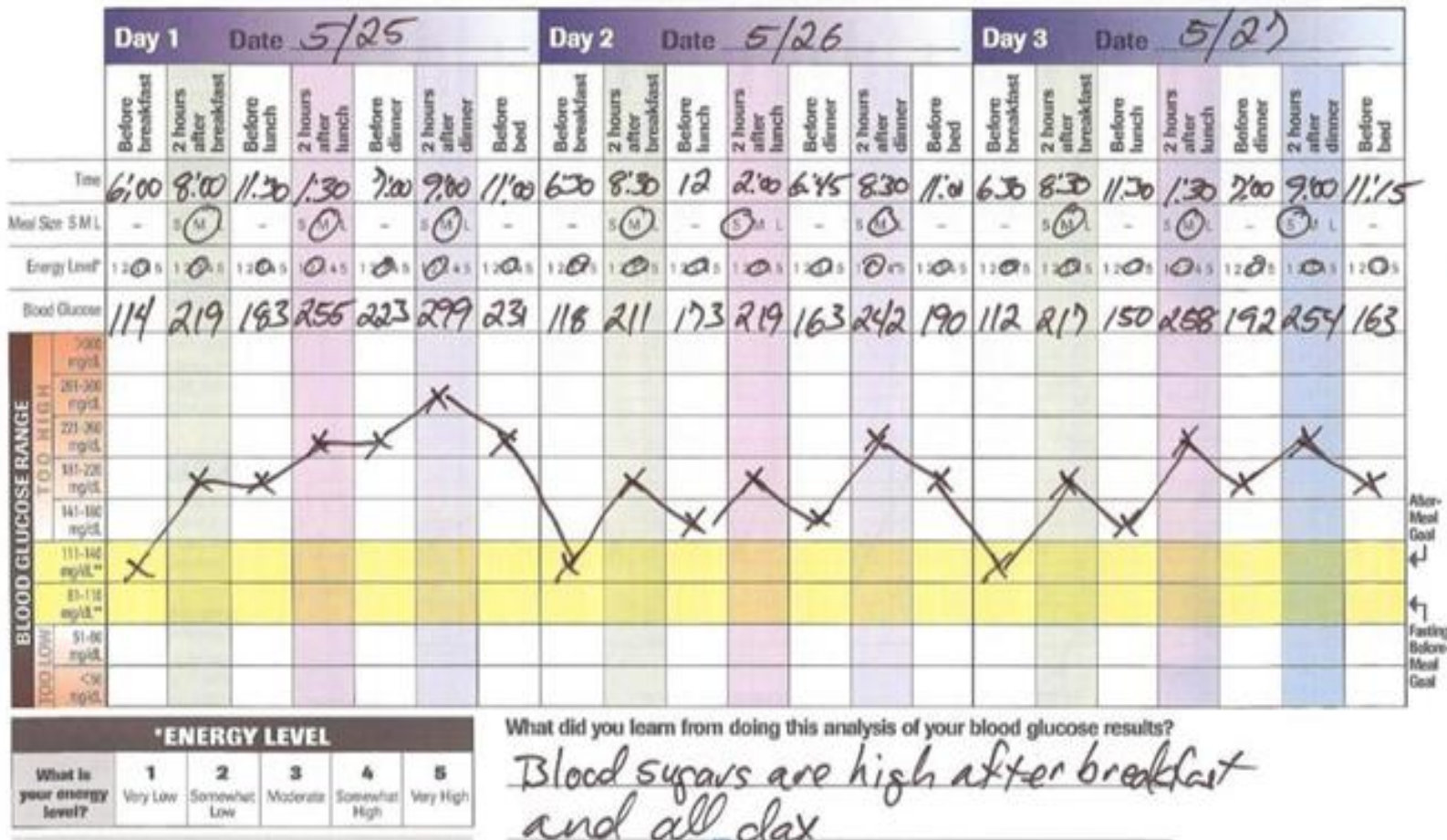
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Bring this form and your [REDACTED] blood glucose monitoring system to your next physician appointment.

\*\*American College of Endocrinology Consensus Statement on Guidelines for Glycemic Control, 2002.

# What Do You See?

## Case Study: Mary



A1C = 7.9%

Mean bG = 203

Biguinide  
1,000 mg BID



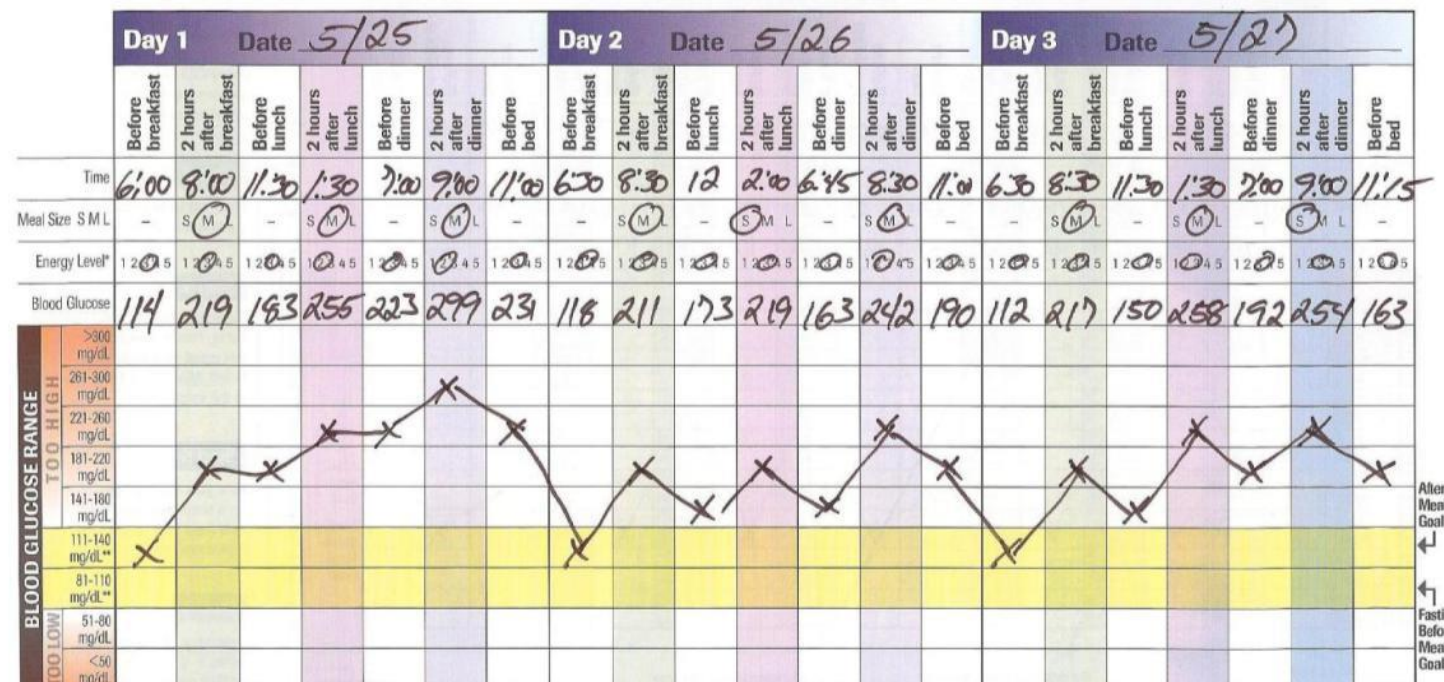
# What Do You See? Is there a pattern?

## Case Study: Ma

- Situation: High after meals
- Medications: Metformin, 1000 mg 2x/d
- A1C: 9.2%
- Although fastings are a little high, the main problem is elevated after meals. Breakfast shows very large excursions, but lunch & supper are also beyond the 50 mg/dL excursion cutpoint.
- Possible Tx Changes:
  - Start on GLP-1RA or GLP/GIP?
    - DPP4?
  - SGLT2 inhibitor
  - Basal insulin?

### ACCU-CHEK® 360° View Blood Glucose Analysis System

PATIENT NAME	INSULIN NAME	DOSE (UNITS)	SHOTS/DAY	ORAL DIABETES MEDICATIONS	DOSE	TIMES/DAY	PHYSICIAN NAME
				Metformin	1000	2X	
PATIENT PHONE							PHYSICIAN PHONE



*ENERGY LEVEL					
What is your energy level?	1	2	3	4	5
	Very Low	Somewhat Low	Moderate	Somewhat High	Very High

**WARNING:** Do not adjust your prescribed oral medication or insulin therapy without first consulting your physician.

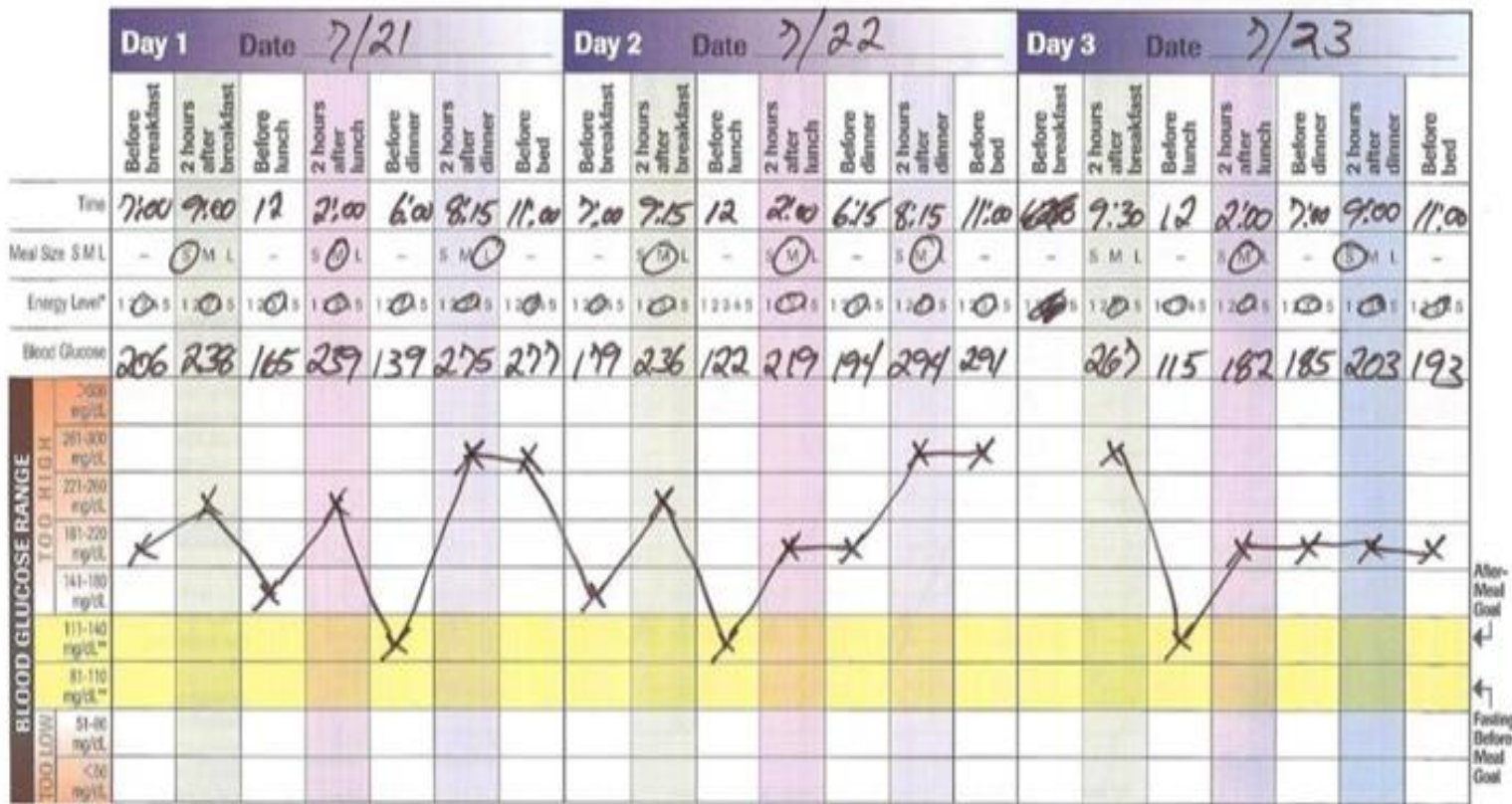
What did you learn from doing this analysis of your blood glucose results?  
*Blood sugars are high after breakfast and all day*

Bring this form and your ACCU-CHEK blood glucose monitoring system to your next physician appointment.

\*American College of Endocrinology Consensus Statement on Guidelines for Glycemic Control: 2002.

# What Do You See?

## Case Study: Bobby



A1C = 9.4%

Mean bG = 221

**Sulfonylurea**  
10 mg BID

**TZD**  
30 mg

**DPP-4 inhibitor**  
100 mg

*ENERGY LEVEL					
What is your energy level?	1	2	3	4	5
	Very Low	Somewhat Low	Moderate	Somewhat High	Very High

What did you learn from doing this analysis of your blood glucose results?

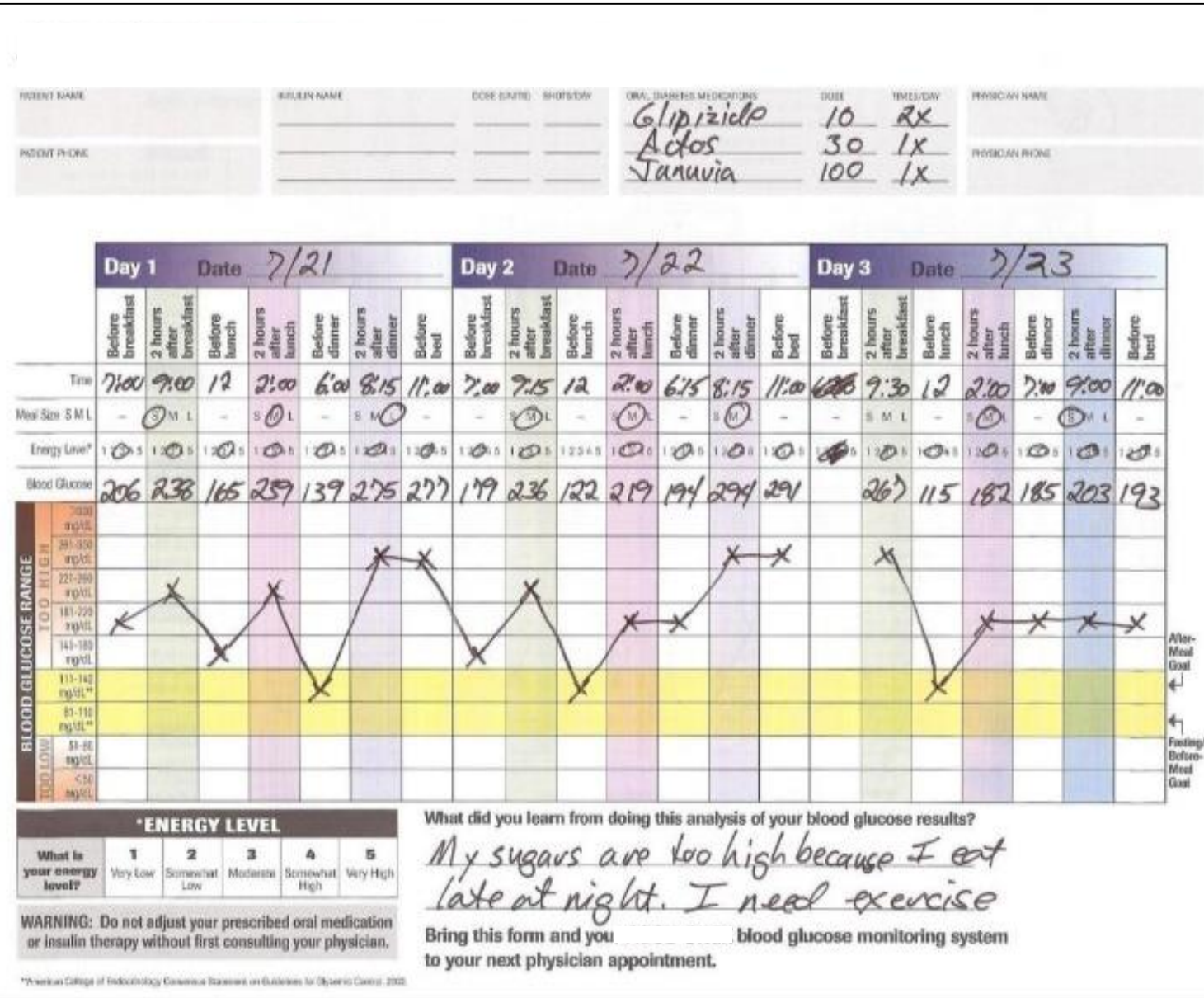
*My sugars are too high because I eat late at night. I need exercise*



# What Do You See?

## Case Study: Bobby

- Situation: Patient is on several oral agents, not at goal
- Medications:
  - Glipizide, 10 mg 2x daily
  - Actos (Pioglitazone), 15 mg 1x daily
  - Januvia, 100 mg 1x daily
- Bobby recognizes that lifestyle changes (eating, exercise) are needed.
- Possible Tx Changes
  - Discontinue glipizide and Januvia; start on GLP or GLP/GIP or Lantus 10u ?
  - Start metformin XR 500 mg 2x daily
  - Lifestyle counseling (diet, exercise)





# SELF MANAGEMENT RECORD

Name \_\_\_\_\_  
 Month \_\_\_\_\_ Wt. \_\_\_\_\_

Medication dose a.m. \_\_\_\_\_ (noon) \_\_\_\_\_

Calorie level \_\_\_\_\_

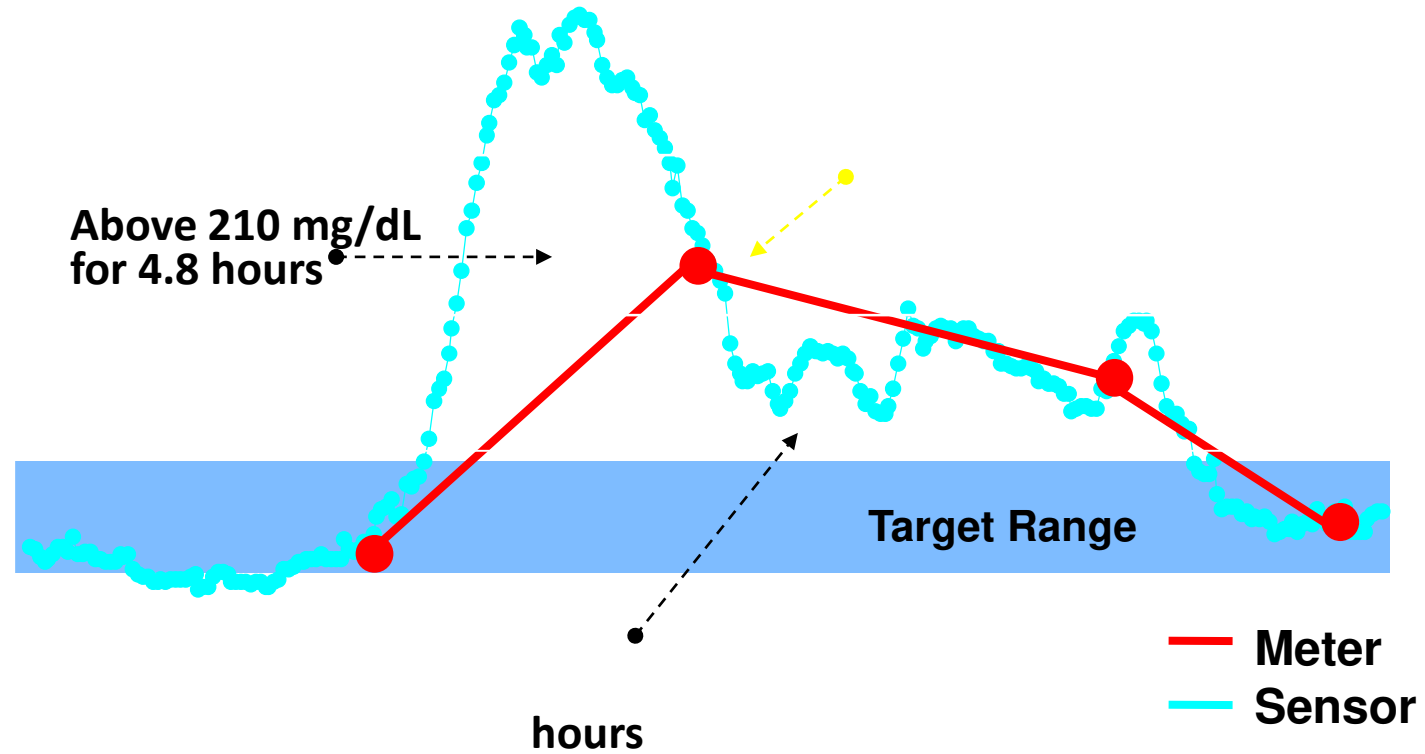
Activity level \_\_\_\_\_

Date Mon Thur Sun

	Mon	Thur	Sun	Example
Ketones (S) (M) (L)				
Time				
Fasting	100 mg/dl	110	103	
after breakfast	322	284	250	
before lunch				
after lunch	280	246	150	
before supper				
after supper	148	131	133	
B L O O D  G L U C O S E				<p><b>Problem:</b> Patterned High Blood Sugar-Mid Morning</p> <p><b>Cause:</b> 1. Too much CHO @ breakfast</p> <p>2. Not enough insulin or oral medication</p> <p><b>Solution:</b> 1. Evaluate breakfast content and amt</p> <p>2. Reduce CHO or points</p> <p>3. Increase activity after breakfast</p> <p>4. Increase Breakfast Oral agents-ie, prandin, starlix, or Increase insulin ie, Humalog/Novolog or mixed insulin.</p>
Time				
Changes				
Diet	+2 Milk	pancakes @ breakfast	as toast, cereal	
Insulin/Pills			↑ daytime ins.	
Reactions				
Activity	↑			
Remarks	7 PM Football			

KEY Diet changes/time Activity = ↑ increased activity Reaction M—mild

# Finger stick Testing Does Not Show the Whole Picture



# Continuous Glucose Monitoring

**CGM Catches Glycemic Excursions that BGM May Miss<sup>1,2</sup>**



**CGM Systems Replace BGM**



1. Devices@FDA. <https://www.accessdata.fda.gov/scripts/cdrh/devicesatfda/>.  
2. FDA. <https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm534056.htm>.

# Continuous Glucose Sensors: What Are The Options?

Freestyle Libre  
Plus Lingo **OTC**  
and Rio



DexCom G6  
and G7  
Stelo. **OTC**  
DexCom

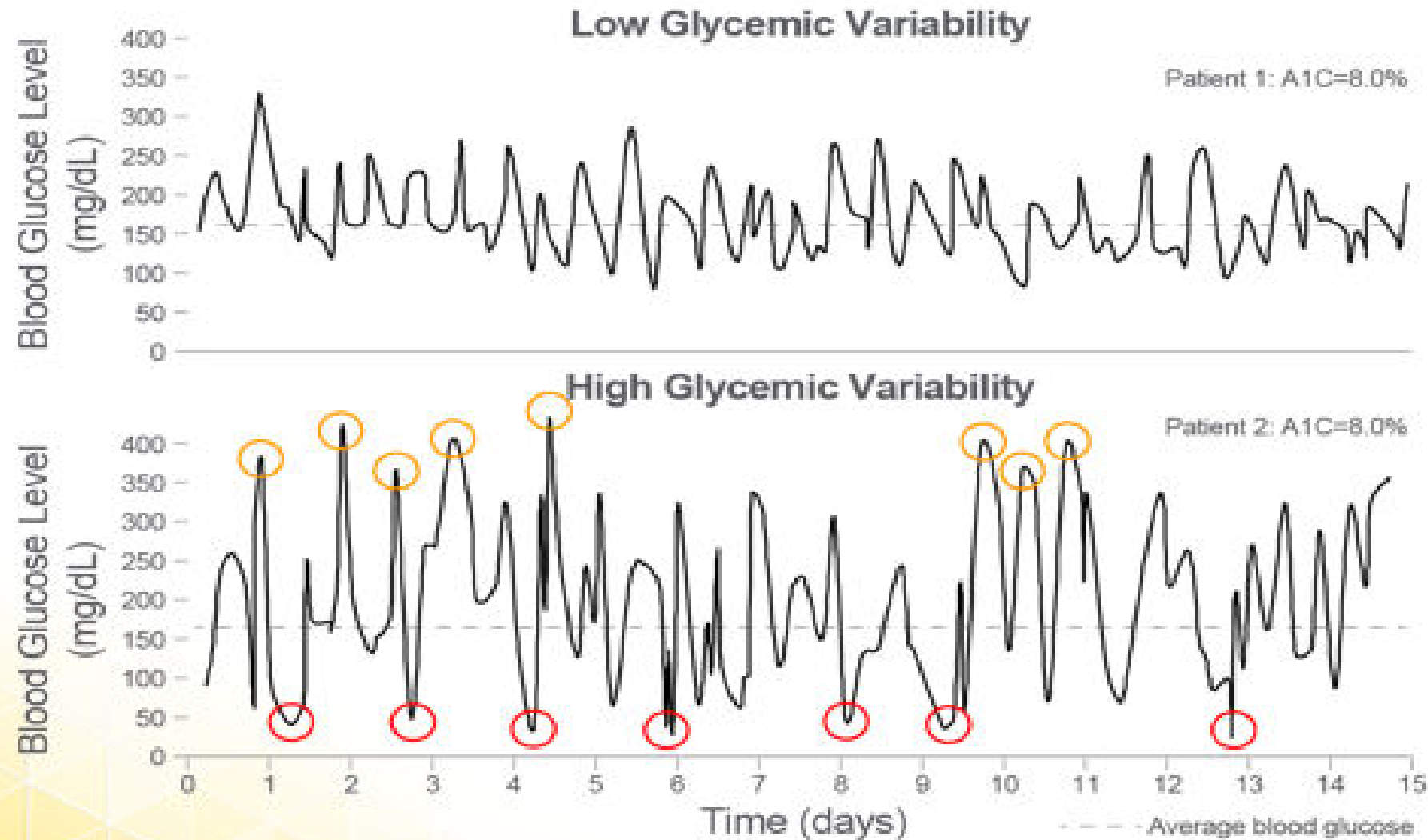
Eversense



Guardian 4  
Medtronic



# Fifteen-day glucose traces of two patients with identical A1C of 8.0%<sup>2</sup>



# AGP Report

Name \_\_\_\_\_

MRN \_\_\_\_\_

## GLUCOSE STATISTICS AND TARGETS

**26 Feb 2019–10 Mar 2019** **13 days**  
**% Time CGM is Active** **99.9%**

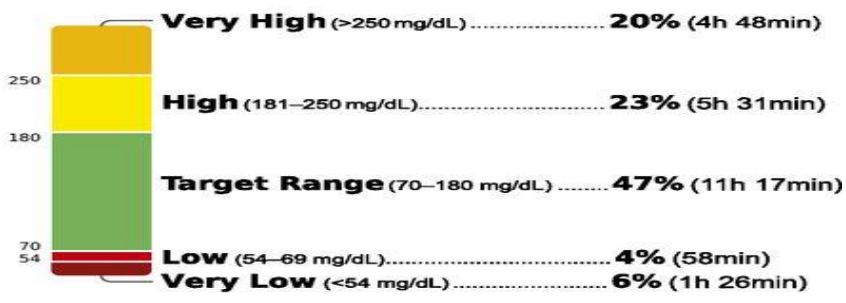
Glucose Ranges	Targets [% of Readings (Time/Day)]
Target Range 70–180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

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

**Average Glucose** **173 mg/dL**  
**Glucose Management Indicator (GMI)** **7.6%**  
**Glucose Variability** **49.5%**

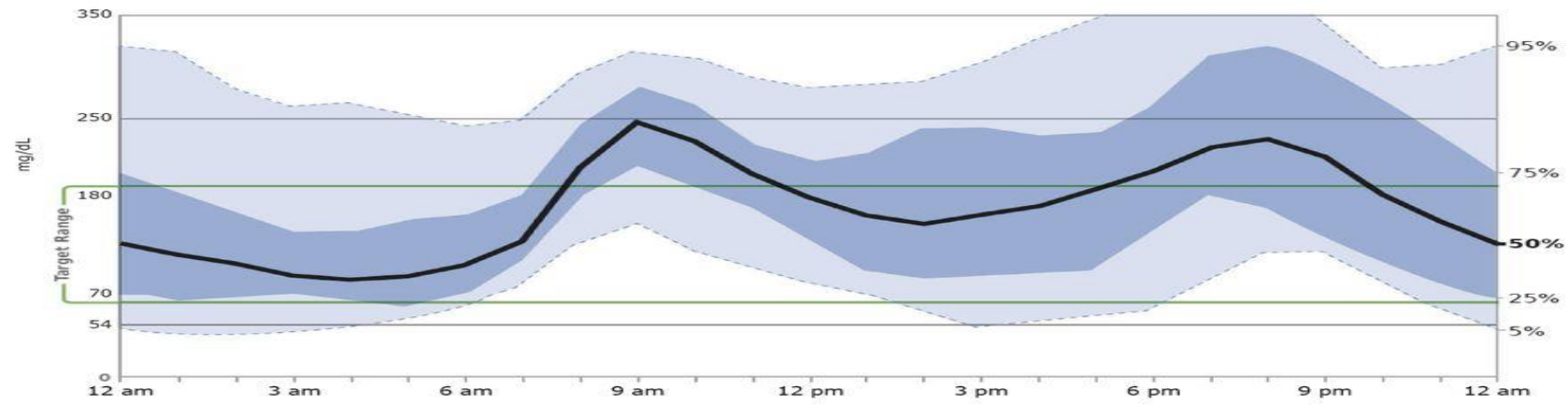
Defined as percent coefficient of variation (%CV); target ≤36%

## TIME IN RANGES

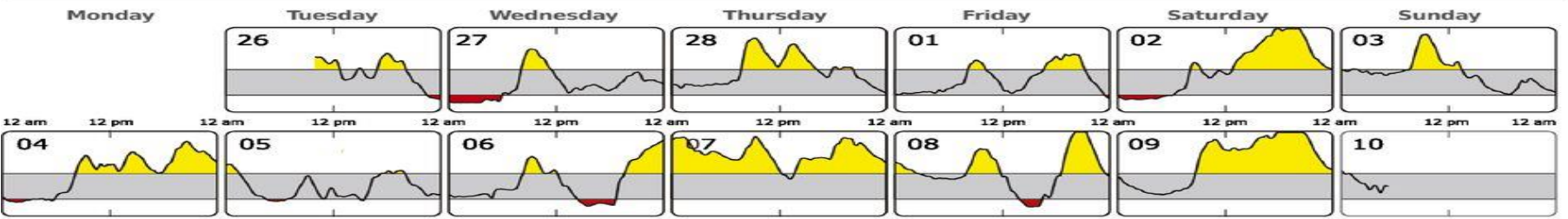


## AMBULATORY GLUCOSE PROFILE (AGP)

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.



## DAILY GLUCOSE PROFILES



Each daily profile represents a midnight-to-midnight period.



# PATTERN MANAGEMENT WITH THE AGP: AMBULATORY GLUCOSE PROFILE

## Summary

Average Glucose

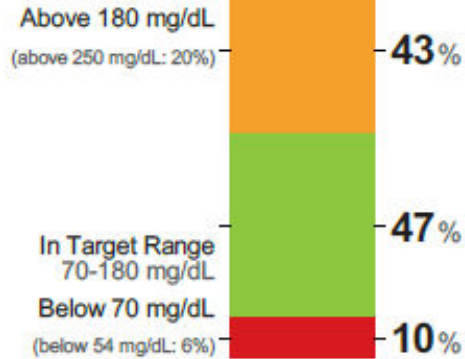
**173**  
mg/dL

88-116\*

Glucose Management Indicator (GMI) \*

**7.7%**

Time In Range



Coefficient of Variation (CV)

**49.4%**

19-25\*

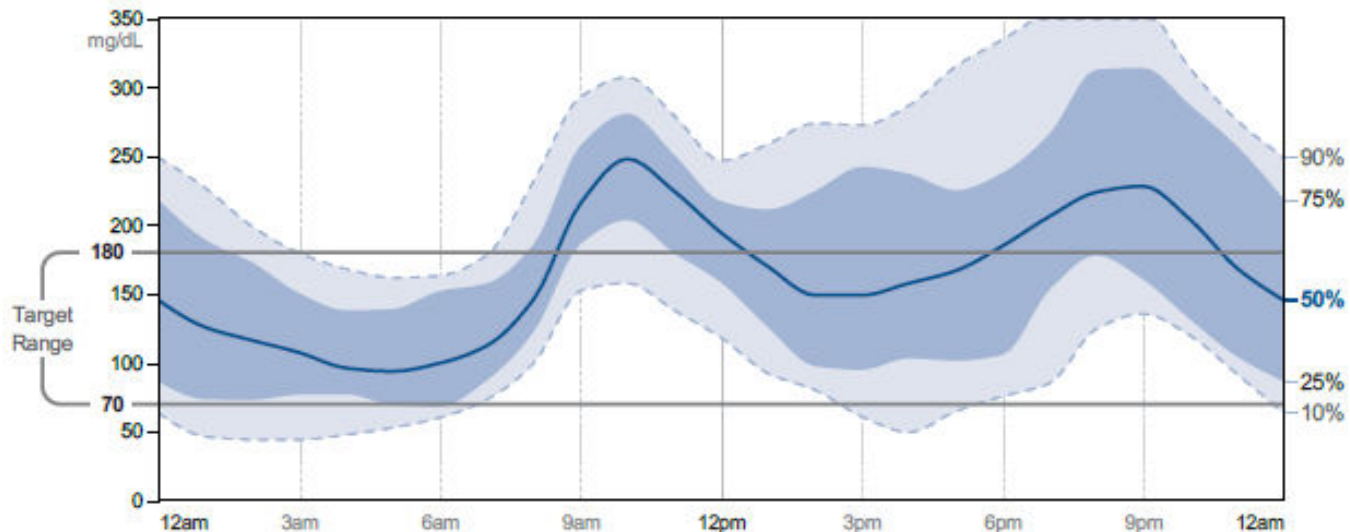
Standard Deviation (SD)

**85.4**  
mg/dL

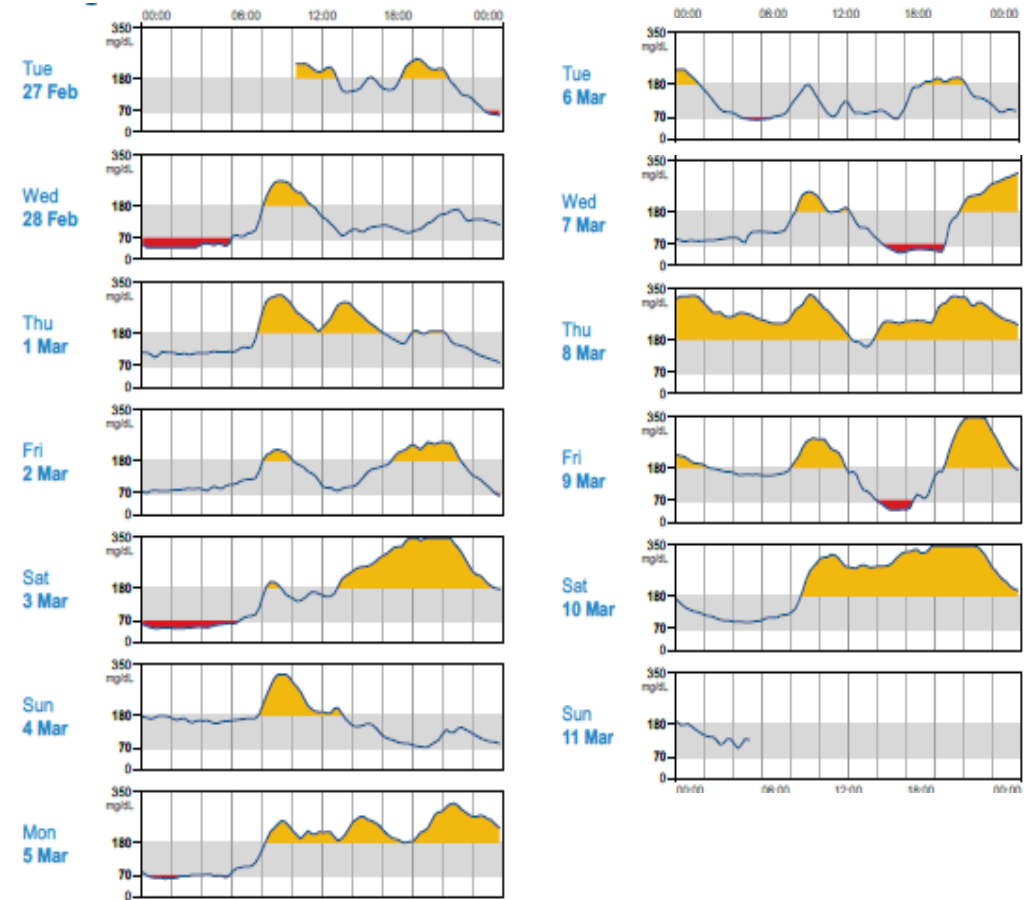
10-26\*

## Ambulatory Glucose Profile

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



## Daily Glucose Summary



Carlson AL, Mullen DM, Bergenstal RM. Clinical use of continuous glucose monitoring in adults with type 2 diabetes. *Diabetes Technol Ther.* 2017;19(Suppl. 2):S4-S11.

# AGP Report

October 18, 2021 - October 31, 2021 (14 Days)

LibreView

## GLUCOSE STATISTICS AND TARGETS

October 18, 2021 - October 31, 2021 **14 Days**  
**% Time CGM is Active** **93%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
<b>Glucose Ranges</b>	<b>Targets % of Readings (Time/Day)</b>
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.	

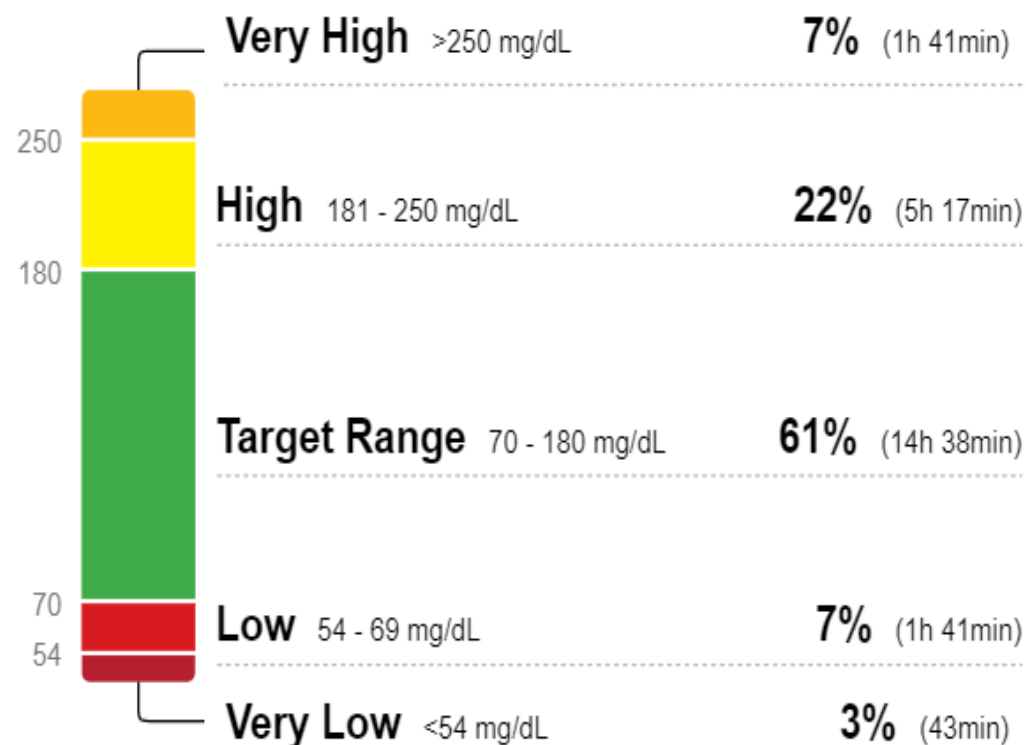
**Average Glucose** **147** mg/dL

**Glucose Management Indicator (GMI)** **6.8%**

**Glucose Variability** **42.2%**

Defined as percent coefficient of variation (%CV); target  $\leq 36\%$

## TIME IN RANGES





# Glucose

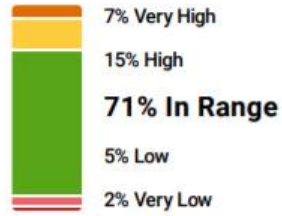
## Average Glucose

**143** mg/dL

Standard Deviation  
**62** mg/dL

GMI  
**6.7** %

## Time in Range



Target Range:  
70-180 mg/dL

## Sensor Usage

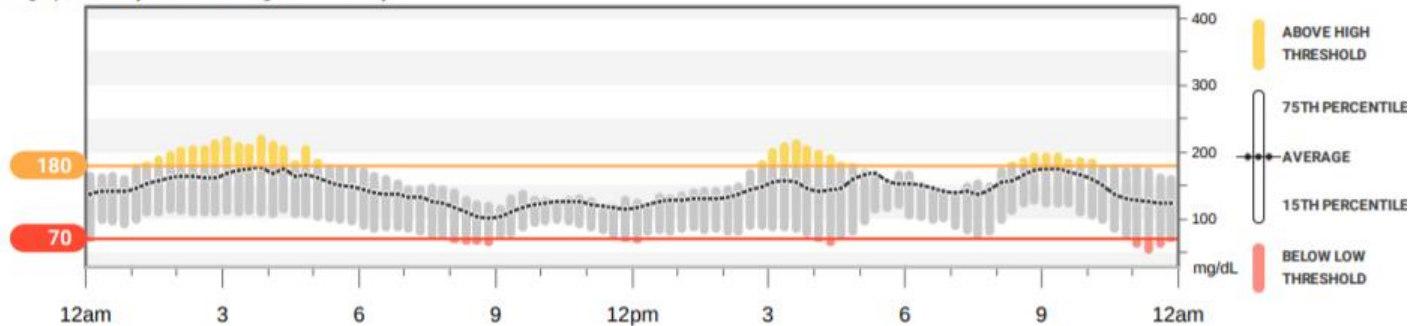
Days with CGM data  
**100%**  
14/14

Avg. calibrations per day  
**0.0**

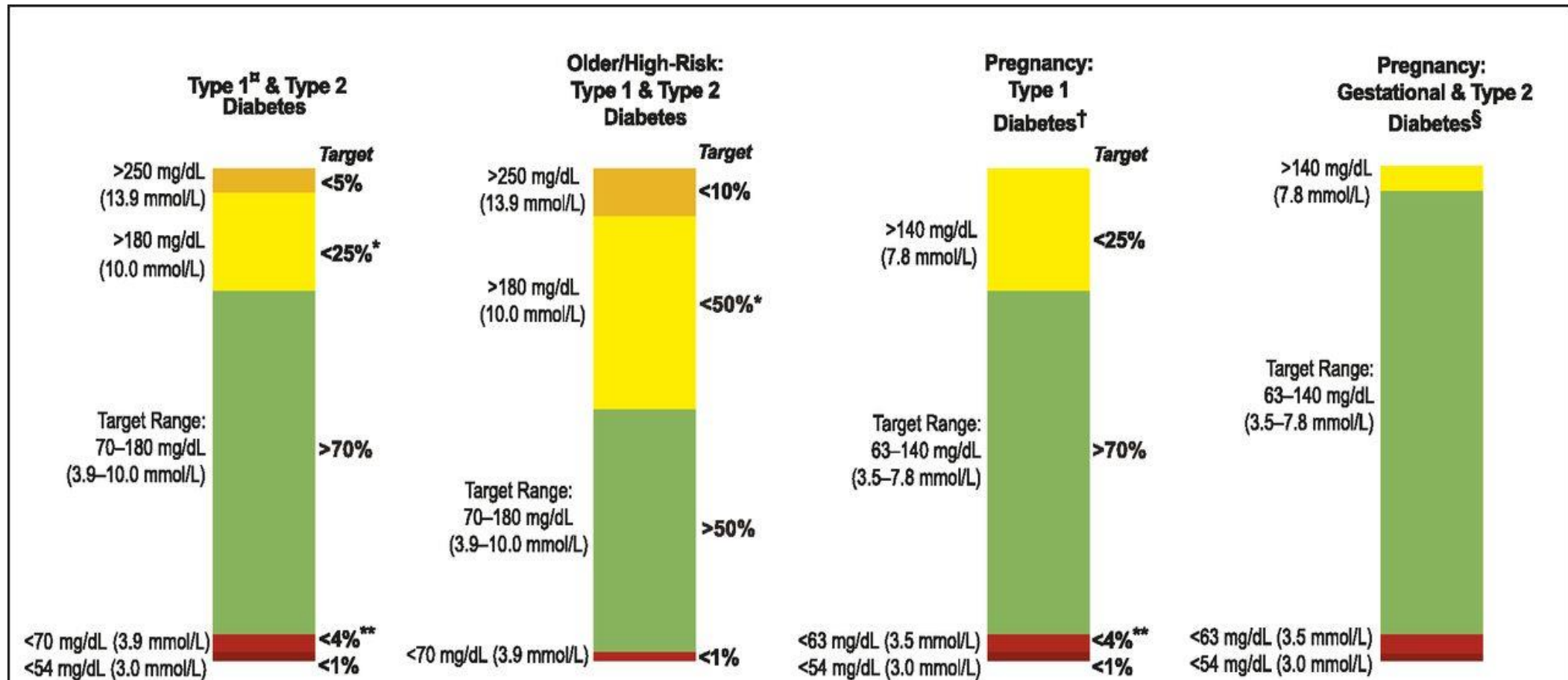
## Top Patterns

**1** Tracy's best glucose day was October 17, 2021  
Tracy's glucose data was in the target range about 90% of the day.

This graph shows your data averaged over 14 days



# Time in Target Recommendations



▣ For age <25 yr., if the A1C goal is 7.5%, then set TIR target to approximately 60%. (See *Clinical Applications of Time in Ranges* section in the text for additional information regarding target goal setting in pediatric management.)

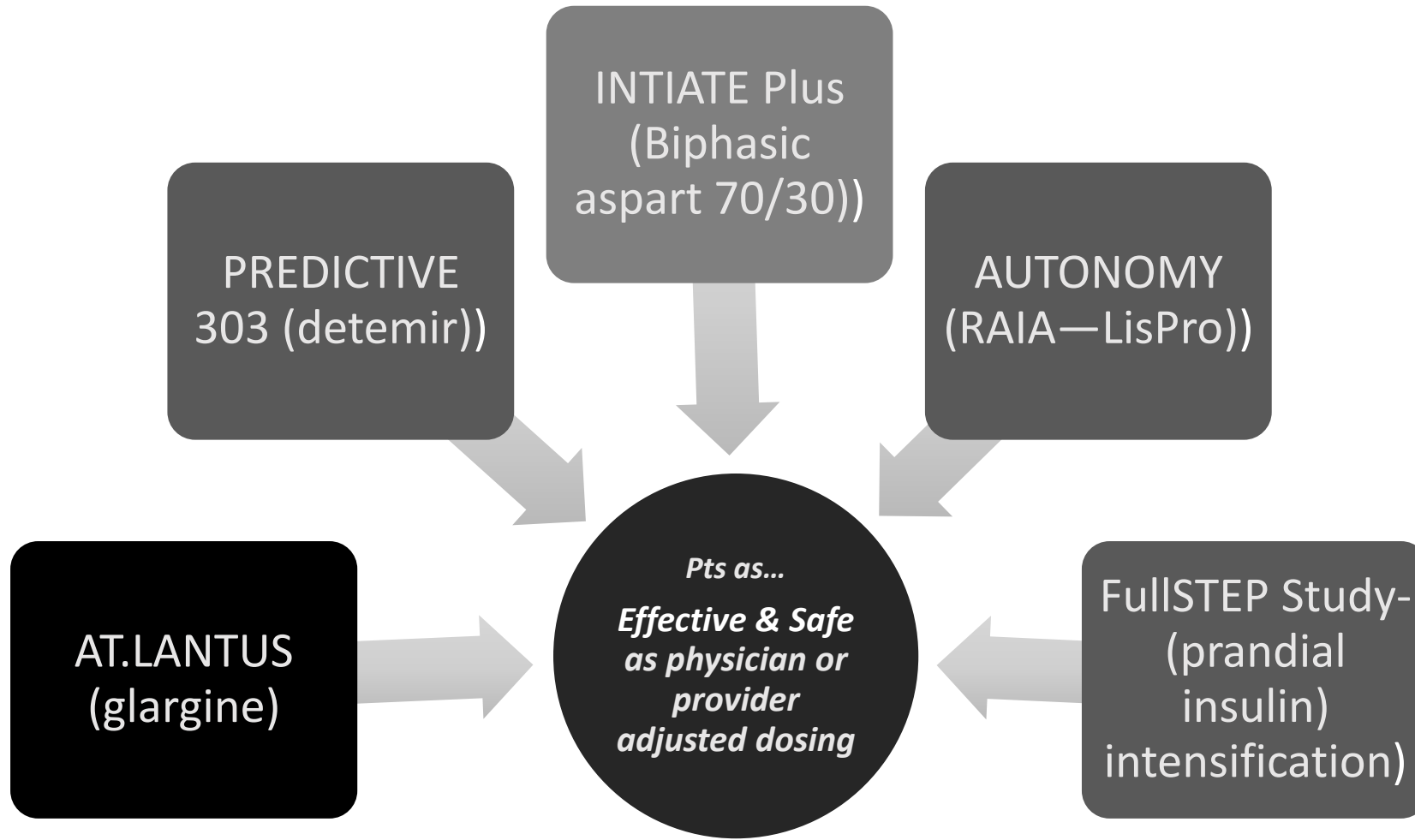
† Percentages of time in ranges are based on limited evidence. More research is needed.

§ Percentages of time in ranges have not been included because there is very limited evidence in this area. More research is needed. Please see *Pregnancy* section in text for more considerations on targets for these groups.

\* Includes percentage of values >250 mg/dL (13.9 mmol/L).

\*\* Includes percentage of values <54 mg/dL (3.0 mmol/L).

# Current Research Supports Patient Titration of insulin...



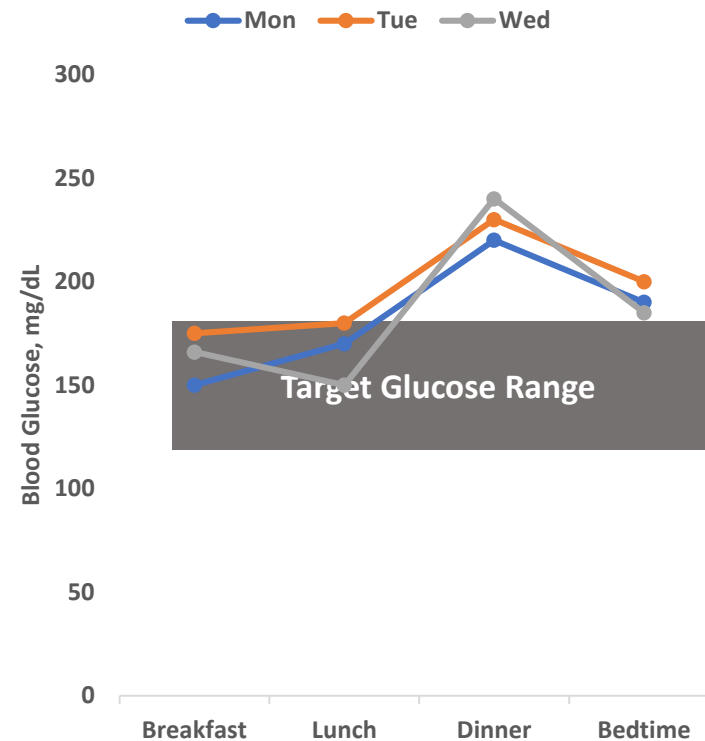
1. At Lantus; 2. PREDICTIVE 303; Helwick C and Meneghini L. Nov 2007; 3. Initiate Plus; 4. Autonomy: Edelman S, Liu R, Johnson J, and Glass L. **Diabetes Care**, Aug 2014 ; 5. Rodbard H et al. **Lancet Diabetes & Endocrin.** Vol 2, Jan 2014

# Recognizing the Need for Uptitration From Glucose Records

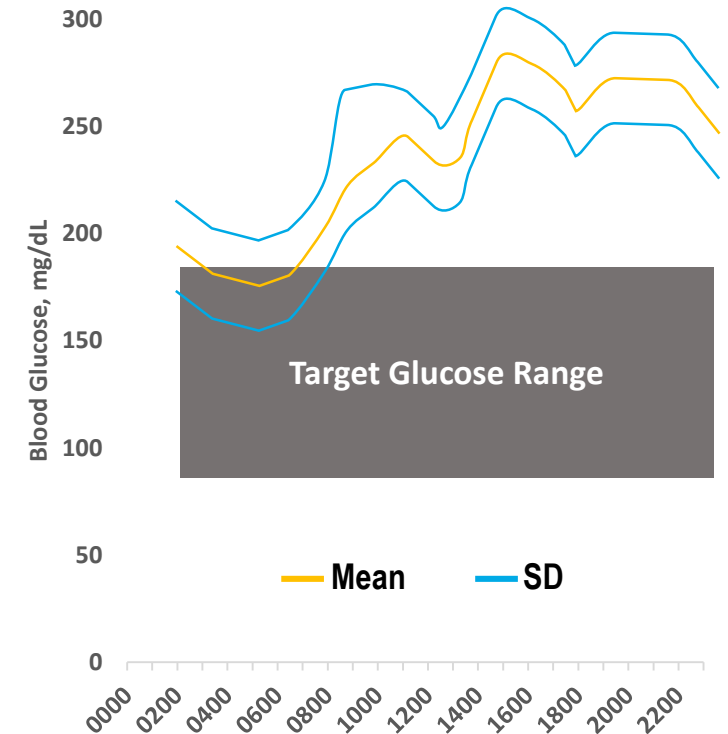
## Handwritten SMBG Diary

Date	Time	BG
Mon	6:00 AM	157
	6:00 PM	240
Tue	4:40 AM	145
	7:20 AM	192
	12:45 PM	210
	10:20 PM	187
Weds	6:00 AM	152

## Blood Glucose Graph



## CGM Output



All blood glucose measurements, before and after meals, are above target

# How to Use Pattern Management to Adjust Basal Insulin

Pattern Observed <sup>1-5</sup>	Action to Take <sup>1-5</sup>
All readings above targets	Increase basal dose
PPG readings above targets	<ul style="list-style-type: none"> <li>• Add GLP-1 RA, SGLT2i, or DPP-4i</li> <li>• Add/increase prandial insulin dose</li> </ul>
Hypoglycemia	Decrease basal dose
Frequent, unpredictable glycemic fluctuations	<ul style="list-style-type: none"> <li>• Investigate lifestyle, activity, and alcohol habits</li> <li>• Evaluate meal/carbohydrate intake</li> <li>• Look for hypertrophies</li> <li>• <i>May be a pump candidate</i></li> </ul>
Early morning glucose levels are not at target	Increase/decrease bedtime basal dose accordingly

1. Klonoff DC, et al. *J Diabetes Sci Technol*. 2011;5:1529-1548; 2. Hinnen D, Tomky D. In: Mensing C, et al, eds. *The Art and Science of Diabetes Self-Management Desk Reference*. Arlington, VA: ADA; 2011:531-575; 3. Accu-Chek. <https://www.accu-chek.com/apps-and-software/360-view-tool/support>; 4. *Practical Insulin*. Arlington, VA: ADA; 2011:1-68.

# Simple pumps focused on T2D



**CeQur Simplicity  
Patch pump  
delivers RAI in  
2u increments.**



**V-Go Patch pump. Zealand  
56, 66, 76 total u/ 24hr use**

# AUTOMATED INSULIN PUMPS

## OmniPod 5

Tubless patch pump with sensor



## Tandem X2

### Control IQ

Pump and sensor with screen like smart phone



## iLet by

### BetaBionics

Pump and sensor. Set up based on wt.



## Minimed 780G

Uses Guardian 3 or 4 sensor  
Can bolus q 5m. Detects missed/miscalculated carbs.

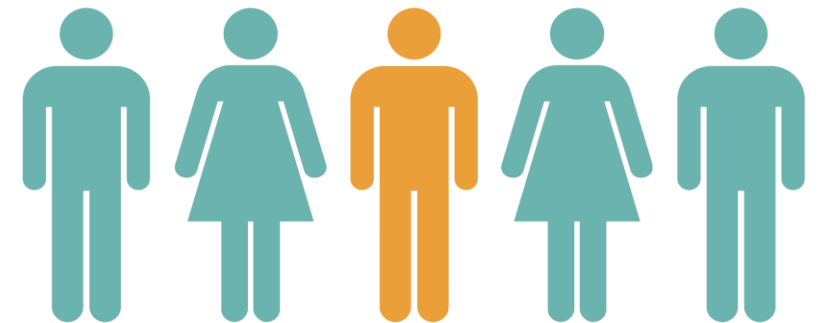


## Tandem Mobi

Based on Control IQ technology

# HYPOGLYCEMIA IS A COMMON COMPLICATION OF DIABETES MANAGEMENT

- ❑ **Most people** with T1D experience hypoglycemia<sup>1,2</sup>
- ❑ **30% to 40%** of people with T1D experience **1-3 severe** hypoglycemia events per year<sup>3</sup>
- ❑ **50 %** of people with T2 Diabetes experience hypoglycemia<sup>4</sup>
- ❑ **1 in 5** people with T2D experience **≥1 severe** hypoglycemic event per year<sup>5</sup>



T1D, Type 1 diabetes; T2D, Type 2 diabetes

1. Spanakis EK et al. *NCBI Bookshelf*. 2018.
2. Cryer PE. *Diabetes*. 2008;57:3169-3176.
3. International Hypoglycaemia Study Group. *Diabetes Care*. 2015; 38: 1583-1591.
4. Gehlert RR et al. *J Diabetes Sci and Technol*. 2015;9(5):999-1005.
5. Edrige CL et al. *PLOS One*. 2015.



# SEVERE HYPOGLYCEMIA OCCURS AT ALL LEVELS OF GLYCEMIC CONTROL AND ALL AGES

**% Persons With Type 1 Diabetes Experiencing  $\geq 1$  Severe Hypoglycemic Event<sup>a</sup> In Prior 3 Months By Recent HbA1C (N=11,060)<sup>b</sup>**

**The risk of severe hypoglycemia increases with age**

HbA1C-recent	6-12 years old N=1313	13-17 years old N=3183	18-25 years old N=2445	26-49 years old N=2143	>50 years old N=1976
<7%	4%	5%	4%	6%	10%
7.0-7.5%	3%	3%	4%	5%	11%
7.5-8%	4%	4%	4%	7%	8%
8-9%	5%	4%	6%	7%	9%
>9%	7%	6%	7%	14%	9%

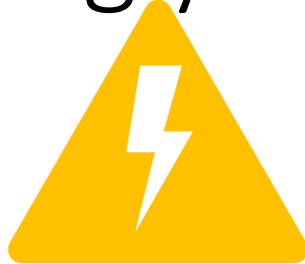
<sup>a</sup>Severe hypoglycemic event defined by loss of consciousness or seizure.

<sup>b</sup>Management practices and health outcomes were reported for 22,697 patients (ages 1 to 93 years) enrolled in the T1D Exchange Registry from 2016 to 2018. Foster NC et al. *Diabetes Technol & Ther.* 2019;21(2):66-72.

# Classification of Hypoglycemia



**BG  $\leq$  70 mg**



**BG  $<$  54 mg/dL**



**Assistance Required**

## Level 1<sup>1,2</sup>

- Hypoglycemia alert value
- Treat with fast-acting carbohydrate and insulin dose reduction
- Affects  $\approx$  50% of patients with T2DM per month who use insulin or secretagogues

## Level 2<sup>1</sup>

- Clinically significant hypoglycemia
- Indicates clinically important hypoglycemia

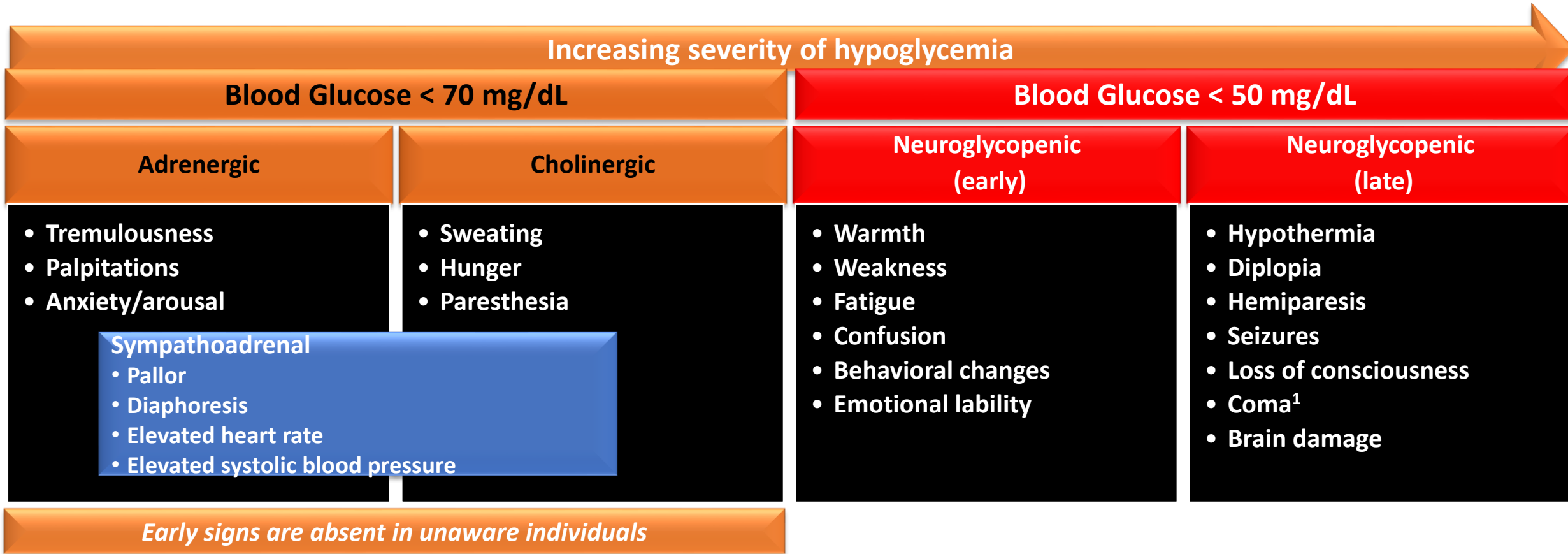
## Level 3<sup>1,3,4</sup>

- Severe hypoglycemia
- No specific glucose threshold
- Associated with severe cognitive impairment requiring external assistance for recovery
- Affects 1%-3% of patients with T2DM per year, regardless of medications used

**Hypoglycemia of any degree of severity is *serious*<sup>5</sup>**

1. ADA. *Diabetes Care*. 2018;41(suppl 1):S1-S159; 2. Ratzki-Leewing A, et al. *BMJ Open Diabetes Res Care*. 2018;6:e000503; 3. Lipska KJ, et al. *Diabetes Care*. 2017;40:468-475; 4. Karter AJ, et al. *J Diabetes Complications*. 2017;31:869-873; 5. Cryer PE, et al. *J Clin Endocrinol Metab*. 2009;94:709-728.

# Physiological Responses to Hypoglycemia



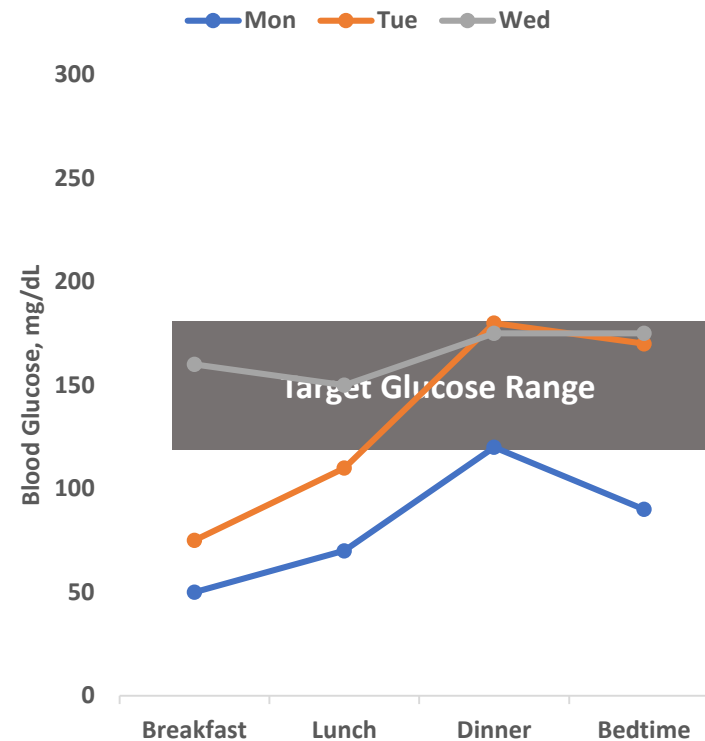
Individual symptoms may not match textbook descriptions and may change over time

# Recognizing Hypoglycemia From Blood Glucose Records

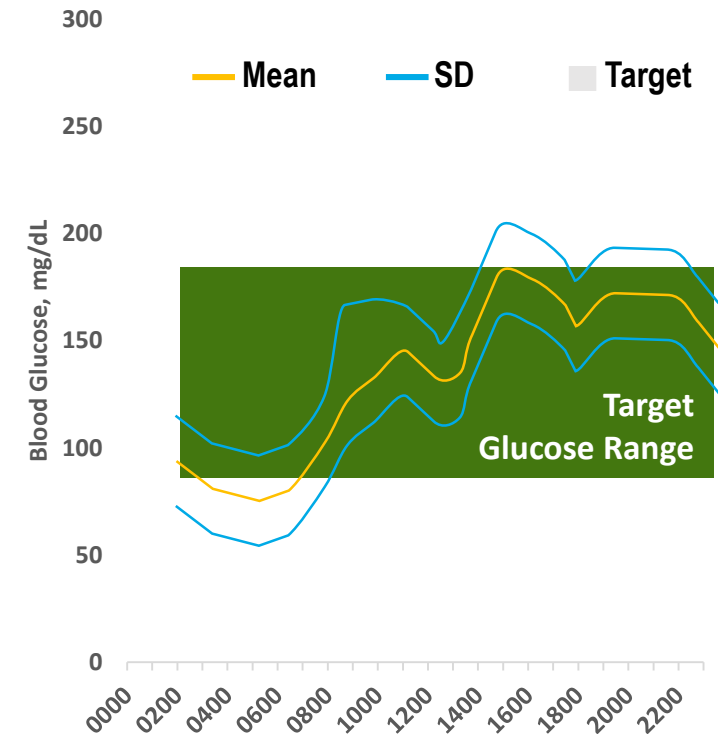
## Handwritten SMBG Diary

Date	Time	BG
Mon	6:00 AM	57
	6:00 PM	140
Tue	4:40 AM	45
	7:20 AM	92
	12:45 PM	110
	10:20 PM	87
Weds	6:00 AM	160

## Blood Glucose Graph



## CGM Output



Some (not necessarily all) blood glucose measurements are below target

# Hypoglycemia in CGM Downloads

## Summary

### Average Glucose

**151**  
mg/dL

88-116\*

### Time In Range

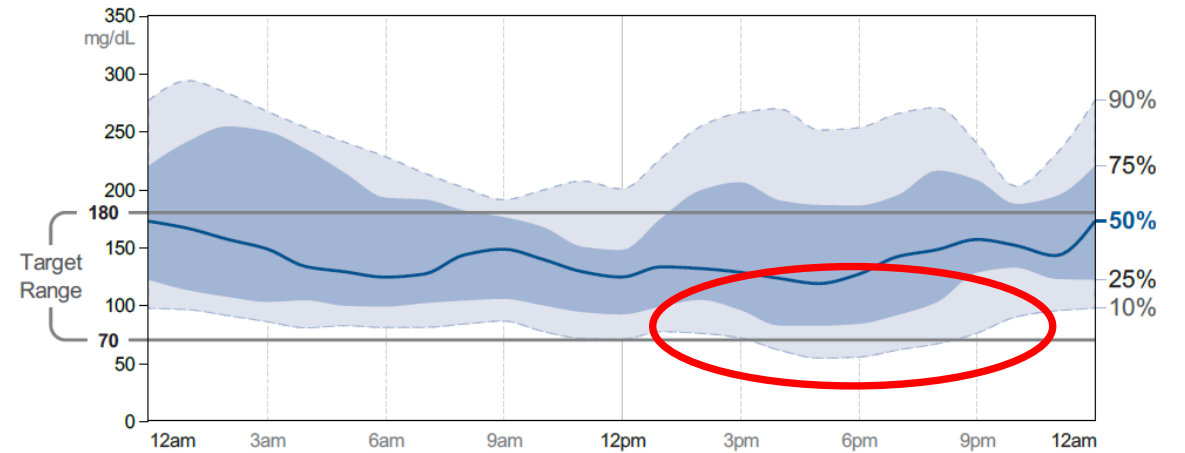
Above 180 mg/dL  
(above 250 mg/dL: 10%) **31%**

In Target Range  
70-180 mg/dL **62%**

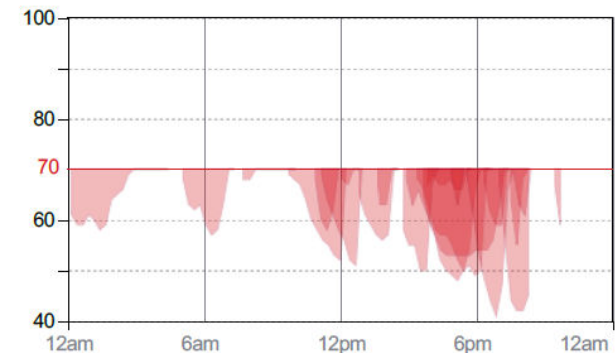
Below 70 mg/dL  
(below 54 mg/dL: 2%) **7%**

**LOW GLUCOSE EVENTS** **20**

Average duration **114** Min



### Low Glucose Events



# Hypoglycemia Treatment

-Sweet *Bite*...



1C. Milk



1/3-1/2 C. OJ



5-6  
lifesavers



4 glucose tabs

- Eat a Sweet Bite
- Wait 15 minutes
- Re-check glucose (goal: >100mg)
- Re-Treat if needed  
(try holding sweet in your mouth)
- Then have snack with solid protein
- Document it
- Carry a sweet bite with you all the time!*



# OTHER TREATMENT OPTIONS FOR HYPOGLYCEMIA

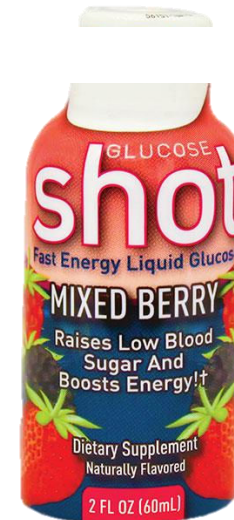
4 glucose tabs



1 tube gel



1/3 C



½ can  
soda





# ....New Glucagon Delivery

- Lilly: Nasal Glucagon (BAQSIMI) 3mg
  - Nasal glucagon, no reconstitution
  - >4y/o



- Xeris, Glucagon injection (G-Voke hypopen) 0.5mg and 1mg
  - Re-constituted. pre-filled (PFS) and
  - Hypo pen, Auto injector 2021



- Zeland: Dasiglucagon (Zegalogue), 0.6mg/0.6ml
  - Approved 3-22-21, available 6-21
  - Auto injector and prefilled >6 y/o



# Nasal Glucagon



- Nasal powder dosing: delivers into patient's nose by pushing bottom of dispenser
  - Nasal cavity has a large surface area and rich blood supply for absorption
- No need to inhale = consistent dosing
- Found to be non-inferior (works as well) to 1mg injectable glucagon in a cross-over study with 75 participants
  - Mean time to recovery: 16 min (IN) vs 13 min (IM) ( $P < 0.001$ )
- Studied in patients with nasal congestion: dosing found to be consistent
- Single-use dose 3mg

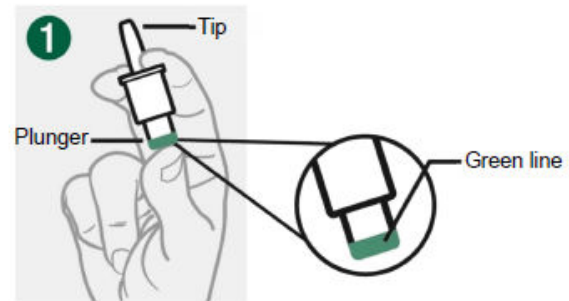
# Nasal Glucagon

- Indicated for severe hypoglycemia in PWD over 4 years old
- Can be carried in high and low temps
- Stable at room temp



[www.baqsimi.com](http://www.baqsimi.com)

## Giving the Dose



- Hold Device between fingers and thumb.
- Do not push Plunger yet.



- Insert Tip gently into one nostril until finger(s) touch the outside of the nose.



- Push Plunger firmly all the way in.
- Dose is complete when the Green Line disappears.

# Glucagon Hypo Pen (Gvoke)

- Room temperature stable, non-aqueous liquid form of glucagon
- Proprietary formulation technology (XeriSol™)
- Long-term stability at room temperature
- Pre-mixed solution in auto-injector
  - Doses: 0.5mg, 1mg
- Phase 2 trials for other indications
  - Post-bariatric hypoglycemia, exercise induced hypoglycemia



**Table 6.6—Median monthly (30-day) AWP and NADAC of glucagon formulations in the U.S.**

Product	Form(s)	Median AWP* (min, max)	Median NADAC* (min, max)	Dosage(s)
Glucagon	Injection powder with diluent for reconstitution	\$266 (\$194, \$369)	\$249 (\$225, \$273)	1 mg
Glucagon	Nasal powder	\$337	\$270	3 mg
Glucagon	Prefilled pen, prefilled syringe	\$368	\$285	0.5 mg, 1 mg
Dasiglucagon	Prefilled pen, prefilled syringe	\$371	NA	0.6 mg

AWP, average wholesale price; max, maximum; min, minimum; NA, data not available; NADAC, National Average Drug Acquisition Cost. AWP and NADAC prices are as of August 2023. \*Calculated per unit (AWP [147] or NADAC [148]; median AWP or NADAC is listed alone when only one product and/or price is described).

Glycemic Goals and Hypoglycemia:

*Standards of Care in Diabetes - 2024. Diabetes Care 2024;45(Suppl. 1):S111-S125*

# HYPOGLYCEMIA UNAWARENESS

- A major risk factor for severe hypoglycemic episodes involving seizures or coma<sup>1</sup>
- Occurs more often than you might expect, in approximately 40% of people with type 1 diabetes, and less often in type 2 diabetes
- Defined as the onset of neuroglycopenia before the appearance of autonomic warning symptoms<sup>2</sup>, or as the failure to sense a significant fall in blood glucose below normal levels<sup>3</sup>
- HU is multifactorial, possible mechanisms include chronic exposure to low blood glucose, antecedent hypoglycemia, recurrent severe hypoglycemia and the failure of counter-regulatory hormones<sup>4</sup>

1. Jancin, B, Detection and Reversal of Hypoglycemia Unawareness. Fam Prac News. 2006. Feb 2006.

2. de Galan BE, Schouwenberg BJ, Tack CJ, Smits P. Pathophysiology and management of recurrent hypoglycaemia and hypoglycaemia unawareness in diabetes. Neth J Med. 2006;64:269–279

3. Moghissi E, Ismail-Beigi F, Devine RC. Hypoglycemia: minimizing its impact in type 2 diabetes. Endocr Pract. 2013;19:526–535

4. Martín-Timón I, Javier del Cañizo-Gómez F, [World J Diabetes](#). 2015 Jul 10; 6(7): 912–926

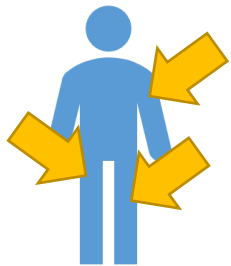
# NPH Requires Extra Precautions to Use Safely



**NPH-based insulins require thorough mixing before injection**



**Failure to resuspend NPH can cause doses that are double or half as much as intended**



**NPH absorption varies by injection site**



**With any insulin, HCPs should assess patient's injection technique regularly—errors are common**



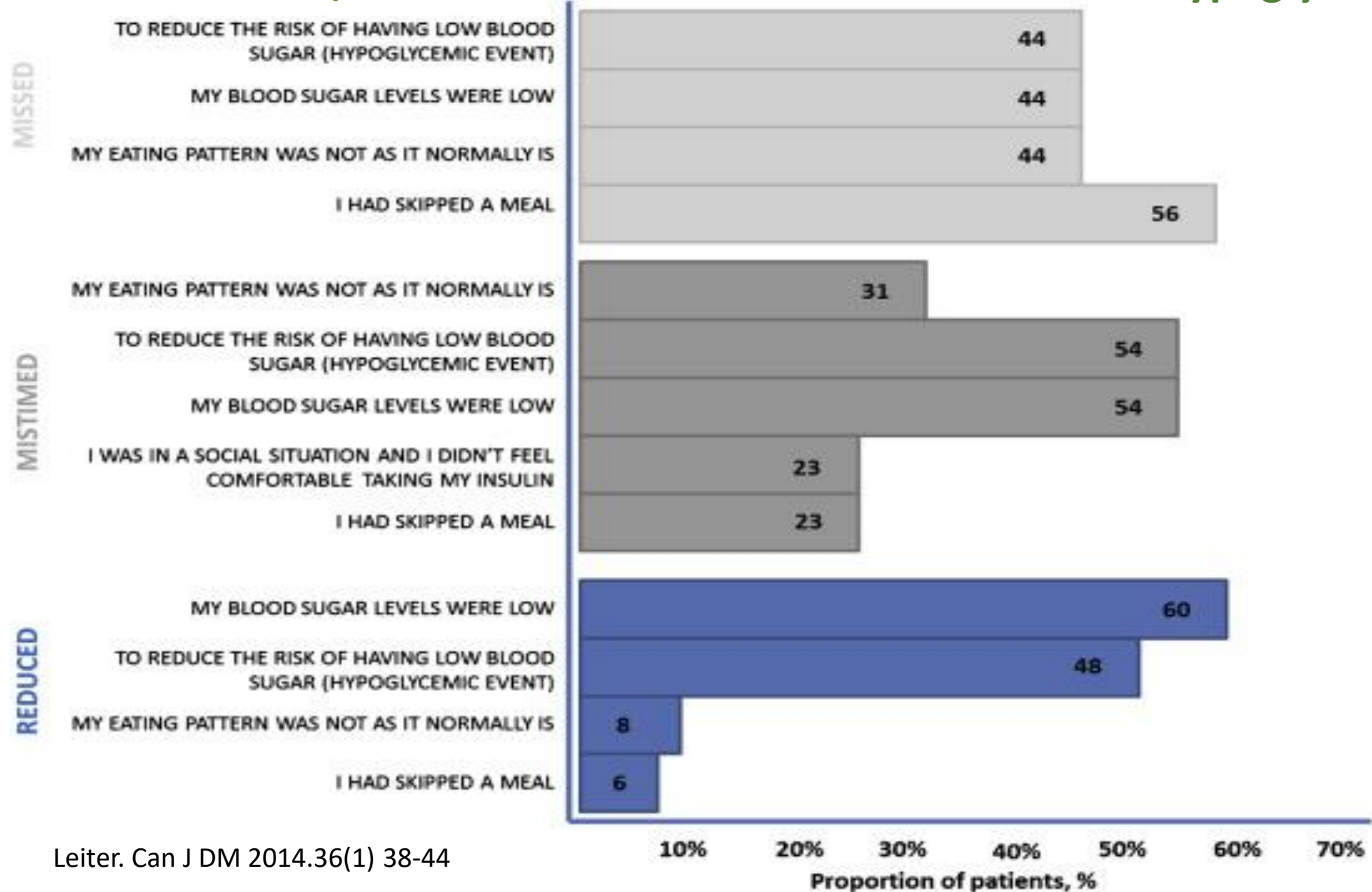
**The peak action of NPH varies from dose to dose**



**Patients need to *commit in advance* to the next meal in terms of content and timing**















# Patients Miss Doses, Mis-Time and Reduce Insulin to Reduce Hypoglycemia Risk



# Ask PWD about Hypoglycemia at Every Office Visit

*Consider these questions for your charting template*

HYPOGLYCEMIA SYMPTOMS	HYPERGLYCEMIA SYMPTOMS
 SWEATING	 PALLOR
 DRY MOUTH	 THIRST
 IRRITABILITY	 HUNGER
 WEAKNESS	 HEADACHE
 LACK OF COORDINATION	 FREQUENT URINATION
 SLEEPINESS	 BLURRED VISION

How many times have you had BG < 70 mg/dL in the past 2 weeks?

How low is your BG when you feel symptoms?

What symptoms let you know that your BG is low?  
Do they change?

How do you treat low BG?

What do you carry with you *at all times* in case you need to treat low BG?

What do you do to prevent low BG?

1. Seaquist ER, et al. *Diabetes Care*. 2013;36:1384-1395.  
2. Unger J. *Diabetes Metab Syndr Obes*. 2011;4:253-261.

# Meet Alex

- Alex is a 66 year old male with type 2 diabetes x 10 years, A1C=6.7%, BMI=33kg/m<sup>2</sup>, Scr=1.5mg/dL, eGFR=42
- Checks glucose 2x daily; FBG: 53-180, Bedtime: 110-175
- Comorbidities: Obesity, Hypertension, CKD
- Medications:
  - Lisinopril 40mg daily
  - Carvedilol 25mg BID
  - Metformin 500mg BID
  - Glipizide 10mg BID
  - Insulin glargine 60 units QPM
  - Atorvastatin 40mg daily
  - Aspirin 81mg ddaily

# Alex Case Questions

- Which of these medications could mask the symptoms of hypoglycemia?
- Which medications are most likely to contribute to hypoglycemia?
- What changes would you recommend?
- How would you counsel Alex about hypoglycemia?

# Patient Case Questions

- Which of these medications could mask the symptoms of hypoglycemia?
  - Carvedilol – Beta Blocker
- Which medications are most likely to contribute to hypoglycemia?
  - Glipizide, especially 6-8 hrs later. Glargine to some degree, ~4 hrs after injection
- What changes would you recommend?
  - Place a CGM for evaluation of hypoglycemia. Hypo unawareness?
  - Check MCare formulary and change to other meds with less hypoglycemic effect, ie, SGLT2, GLP. Stop glipizide (not renal friendly), reduce glargine 50%.
- How would you counsel Alex about hypoglycemia?
  - Signs and symptoms, advise to carry something sweet with him at all times

# Summary

- Figure out your patients Behavior Style. Try to mirror that
- Encourage independence through technology and shared decision making
- Hypoglycemia is a serious, life-threatening complication of diabetes treatment.
- Discuss hypoglycemia at every visit by asking questions and reviewing glucose data.
- New technology helps with prevention efforts. Ie, low glucose alerts
- Now glucagon formulations make treatment easier.
- Choose medications with lower hypoglycemia risks.

