Experiencing Technology

3rd Annual Sweet Science Conference

Myrtle Beach, SC

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Objectives

- Discuss what an insulin pump is and does.
- Identify and discuss helpful features on a pump.
- Correctly give a bolus by insulin pump.
- Correctly set & use a Temp Basal Rate
- Correctly find & check History Screens
- Trouble shoot an insulin pump.
- Verbalize who/how to call for assistance with a malfunctioning insulin pump
- Discuss what a CGM is and how it functions
- Correctly obtain a blood glucose from a CGM
- Understand arrows on a CGM
- Trouble shoot a CGM

How Pumps Work

-Use Rapid-Acting Insulin

-Individual Settings from HCP

-Basal/Bolus functions

-Require blood glucose number

    Needed for correction

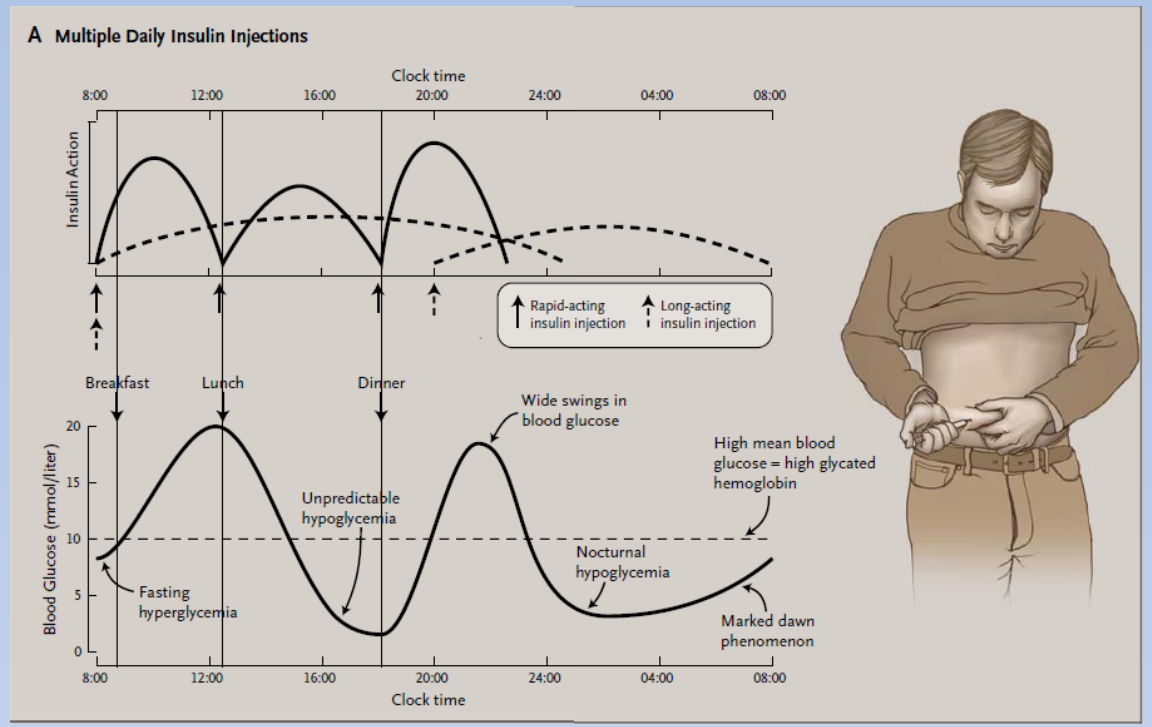
-Require carb count

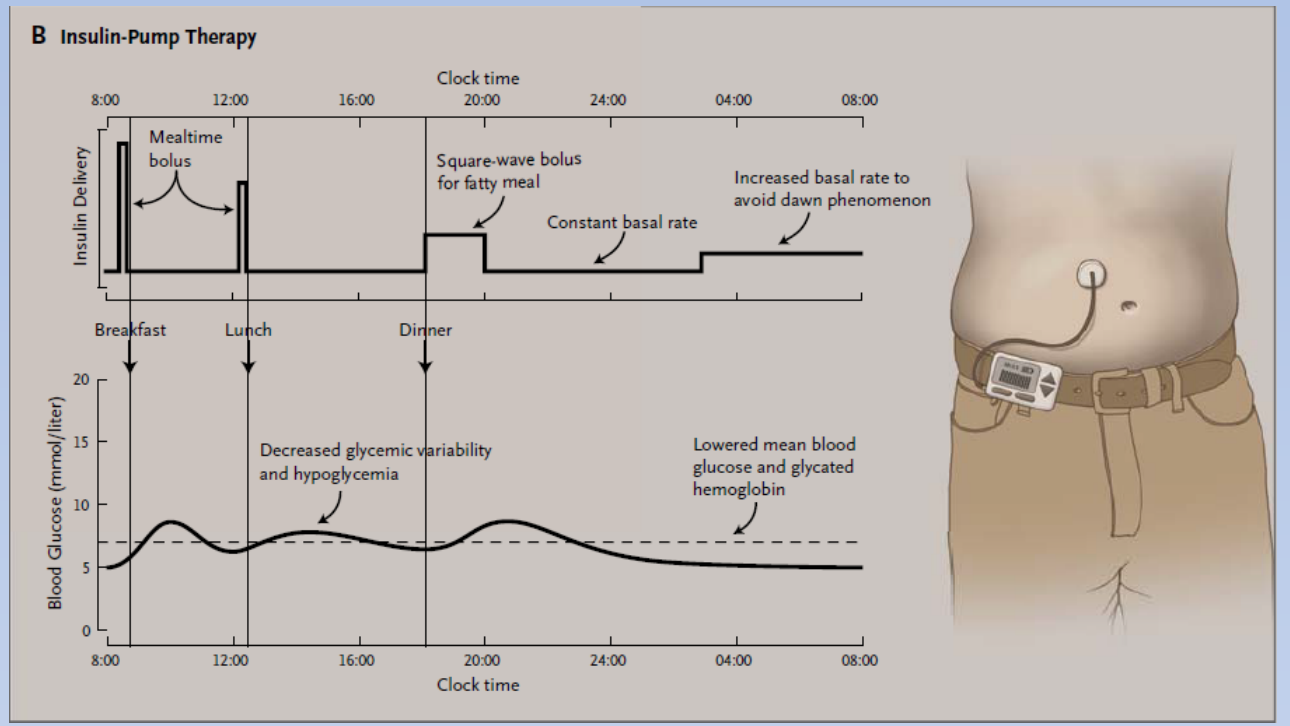
    Needed for accurate food coverage

-Require a “good” site

    Prevents DKA

MDI vs. Pump





NEJM 366;17. April 26, 2012.

How ~~a Pump~~ MDI Works

-Continuous supply of basal insulin independent of meals/blood sugar.

This is what prevents DKA

-Rapid acting insulin for meals

-A little extra if the sugar is high

-Always prepared to troubleshoot

How ~~a Pump~~ MDI Works

-Basal

-Carb Ratio

Carbs/CR = amount of insulin

-Correction Factor/Target

(Glucose-Target)/CF = amount of insulin

How a Pump Works

Same as MDI:

-Basal, CR, CF/Target

Unique to Pumps:

-Only uses rapid acting insulin

Good: Can use temp basal rates

Bad: Ever present risk of DKA if insulin interrupted

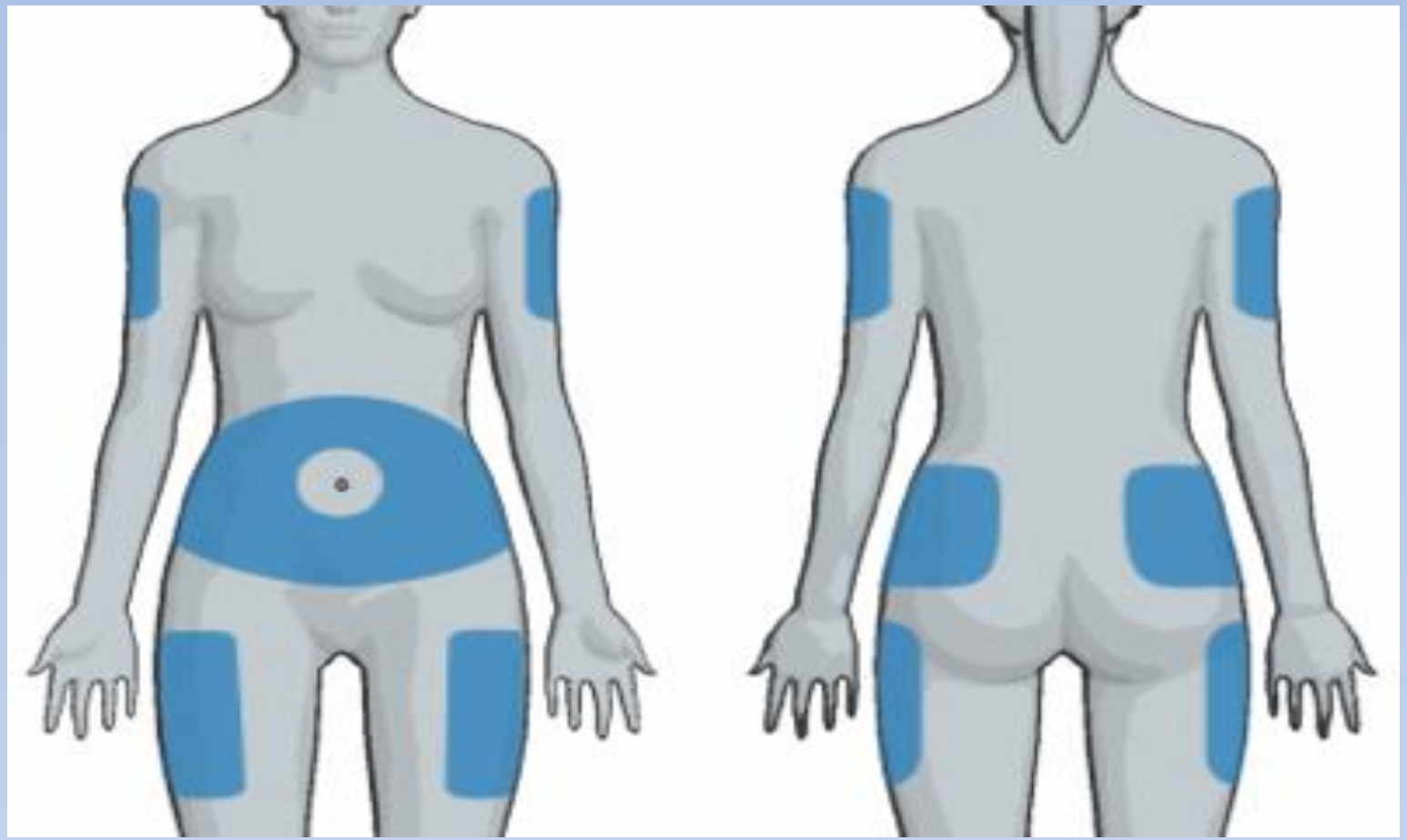
-An “active insulin time” that adjusts correction calculation as a defense against stacking

Pump Sites

- Tiny cannula inserted under skin
- Changed every 2-3 days
- Connected to insulin source-cartridge or pod

Pump Sites

Possible Site Placement



Infusion Site Management

- Can use any place that would normally put an injection
- Avoid lumpy/bumpy areas
- Avoid scars/tattoos
- Avoid areas that are rubbed by clothing
- New site should be an inch from old site
- New site should be at least an inch from umbilicus
- If blood is visible in tubing, change site
- If stinging continues more than an hour after insertion, change site.
- Best time to change site is after a bath, but NOT late at night, OR before a meal.

Insulin Pumps

- RIP: Cosmo, Animas, Spirit, etc

Helpful Features on a Pump

1. Main Screen
2. History Screen
3. Bolus Screen
4. Set Up
5. Customer Service Number (on back of pump)

Main Screen

First Screen seen on a pump. Features will see include:

-Date

-Time

-Battery life

-Insulin remaining

-Special option running

Bolus Screen

Can pick between several types of bolus—

1. normal, which is a set amount that basically requires little thought
2. BG, which covers just blood sugar correction
3. Carb, which covers food and can also cover blood sugar if entered
4. Can do combo bolus or extended bolus from carb bolus also. Allows to pick part of a bolus to be given immediately and remaining bolus to be given over a specified amount of time.

Giving a Bolus for meals:

- Go to Bolus Screen.
- Enter BG if giving for a meal
- Enter carbs
- Read Screen to make sure entered correctly
- Give bolus.

- IF BOLUS IS FOR SNACK, DO NOT NEED A BG UNLESS HAVE A REASON TO DO A BG. BG JUST BECAUSE THE STUDENT IS GOING TO EAT A SNACK IS NOT NECESSARY UNLESS ORDERED BY PHYSICIAN OR HAS OTHER CIRCUMSTANCES…FEELS LOW, EXTRA ACTIVITY, ETC.

History Screen

Will show basal history, bolus history, suspend, resume, prime, alarms, total daily dose.

Can see if bolus was missed, if cartridges are being changed greater than every 3 days, if insulin delivery was stopped.

Can see what kind of bolus was given and when---will be able to identify missed bolus, no blood sugar being entered for correction.

Will NOT show if pump was removed.

Temporary Basal Rate

- Useful for hypoglycemic episodes

  Set temp rate for off for 30min. to allow fast-acting carbs to increase BG

  Useful for hyperglycemic episodes with ketones

    Set temp rate for 10% increase x 2 hr. to help decrease BG and ketones

  Will return to normal basal rate when time frame up; does NOT require you to turn basal rate on again. Does it automatically.

Hybrid Closed-Loop System

- Medtronic 670G and Tandem Control IQ
- Increases/decreases basal rates based on cgm readings
- Wear 2 pieces: site and sensor

Safety Lock

All pumps have a lock for safety purposes. These are especially useful for young children.

Remember…

- No blood glucose entered…no correction given.
- No carbs entered…no accurate food bolus given.
- Entering a random number of units…random results.

- **Look at the History Screens.**

Insulin Pump Use is ONLY as Accurate as Person Operating It.

AND….

When in doubt, change it (site) out.

Trouble Shooting an Insulin Pump

1. Check INFUSION SITE for:
   -redness
   -rash
   -damp/leaking
   -odor (smell of insulin or infection)

2. Check INFUSION SET for
   -air bubbles in tubing
   -Leur lock is tight; no leaking

3. Check INSULIN PUMP for:

-status (pump is on)

-alarm message

-correct basal program running

-correct time displayed

-battery sign

-bolus history review

4. Call for help if needed. (Customer support phone number is on back of pumps.)

Unexplained High Sugar = Bad Site

-Although inspection of equipment should be done for obvious issues, the most common issue is a bad pump site and these most commonly look normal on inspection and don't have an alarm!

-If the sugar is high without a good explanation, and particularly if the sugar does not come down after a bolus, assume a bad site and

-Replace site +

-Give syringe injection

Scenarios That Come Up

-Transitioning off pump onto shots (vacation, waiting on replacement for broken pump to come in mail, etc)

-Programming a new pump to match old settings when a new one comes in the mail

-Taking basal insulin shot while on insulin pump

(But generally doesn’t make sense to take rapid acting insulin while on a pump unless changing bad pump site)

Customer Support Number

Found on BACK of pump:

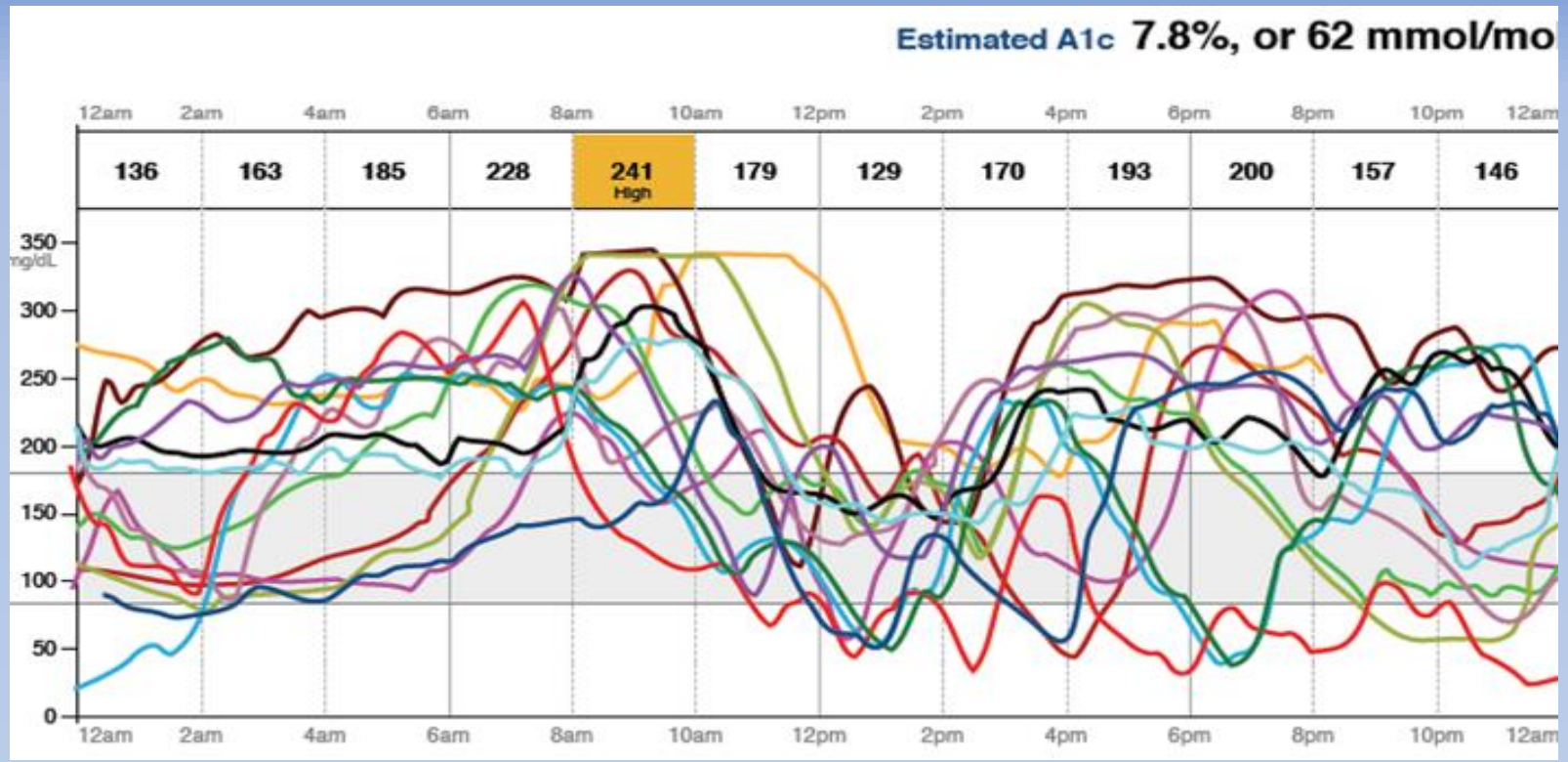
Medtronic (& Animas): 1 (800) 633-8766

Omnipod: 1 (800) 591-3455

Tandem: 1 (877) 801-6901

You can reach support for pump problems 24/7.

Continuous Glucose Monitors



How Do CGMs Work?

CGMs measure blood glucose in interstitial fluid just below the surface of the skin through a tiny sensor. Most CGMs consist of a sensor, transmitter, and receiver. The receiver could even be an insulin pump, cell phone, or Apple Watch depending on the system.

CGMs: help find trends, not just a single BG "snap shot". Helps make treatment decisions to promote more time in range.

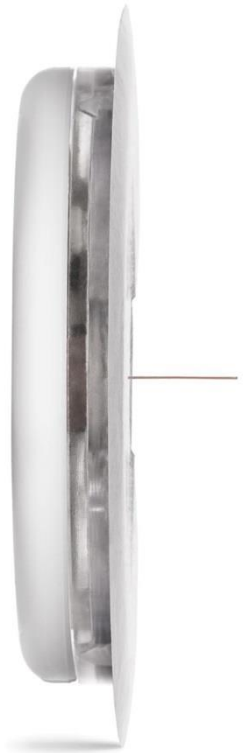
Libre
Change sensor every 14 days

Dexcom
Change sensor every 10 days

Medtronic
Guardain Sensor 3

Eversense
Change Implant every 3 months
Reattach patch daily

Sensors



Why Use a CGM?

Most obvious: less fingerstick!

Other good reasons:

- **Provide continuous glucose monitoring, day and night.**
- **Thought to lower HgbA1c**
- **Decrease hypoglycemia**
- **Decrease night monitoring**
- **Increase time in range**

Any Downsides to CGM?

-Effort spent troubleshooting device does not directly result in better glycemic control

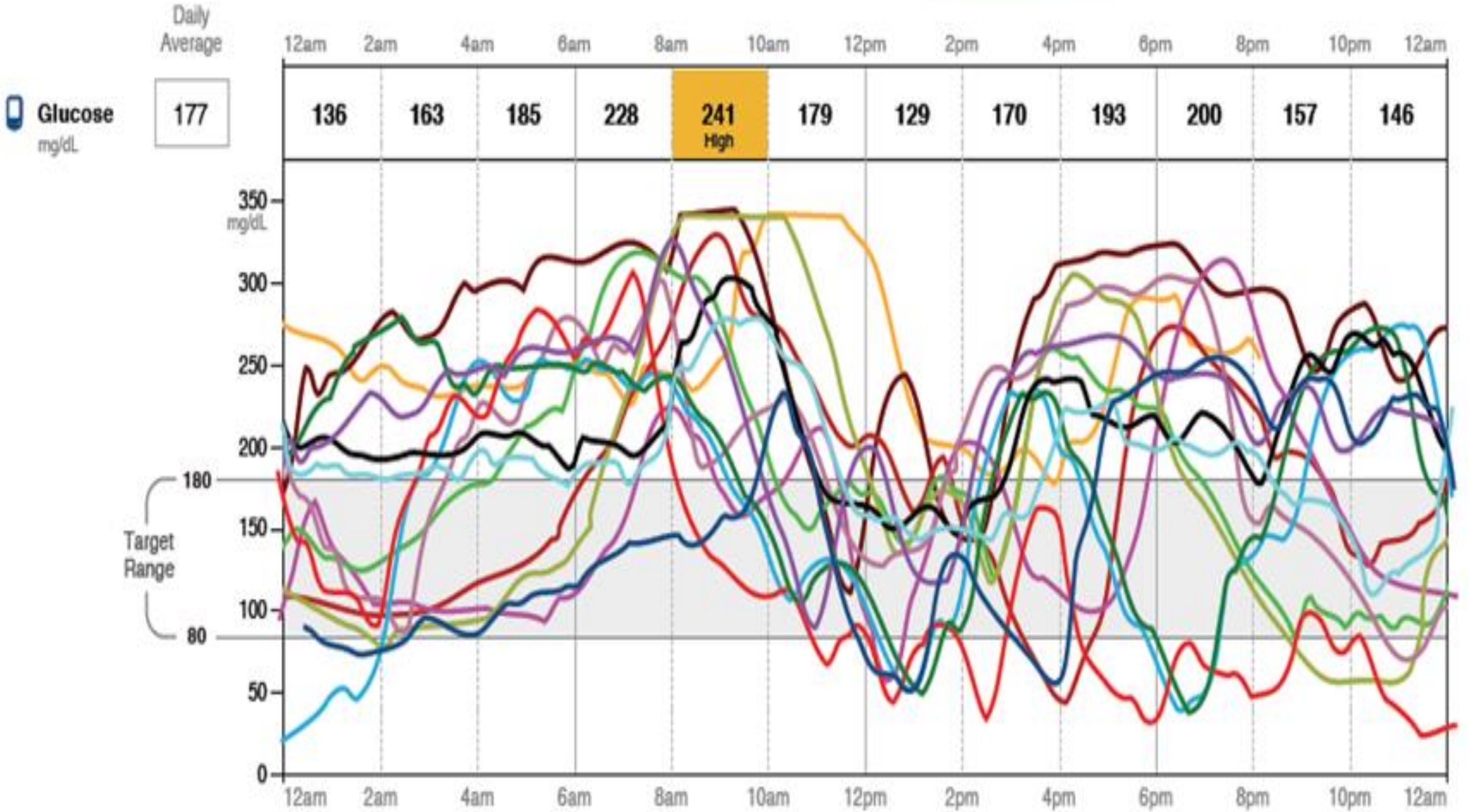
-Knowing the “reality” of blood sugar data can sometimes shift patient into an excessive “correction” mindset

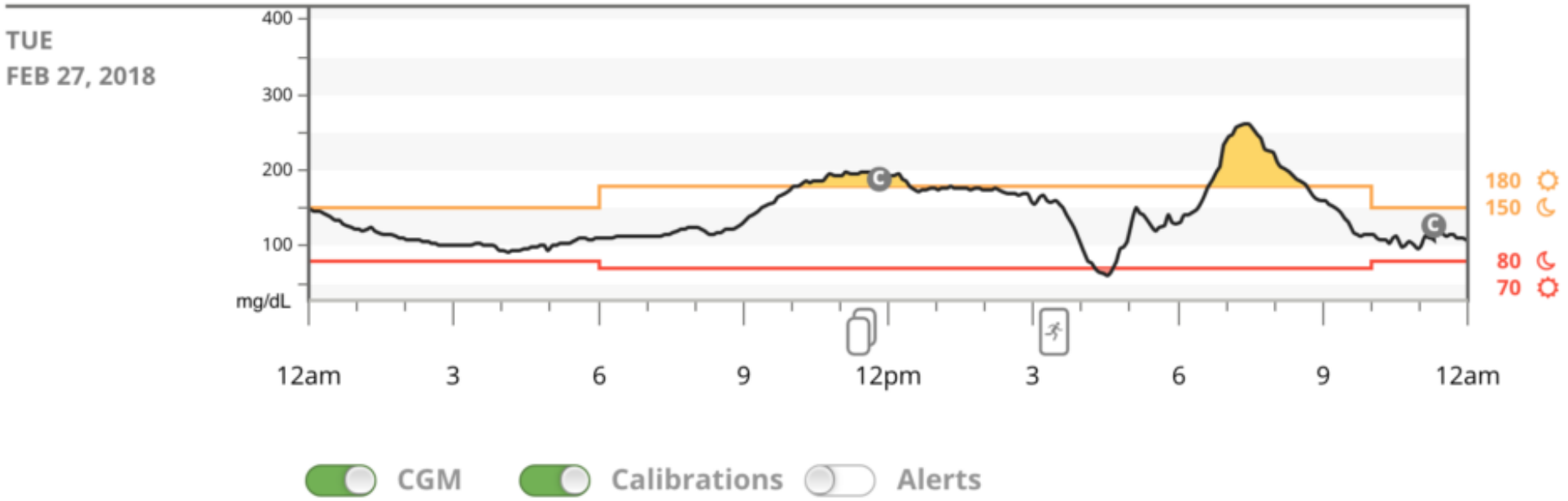
-Overall these systems remain imperfect and thus patient preferences are important

Still Need a Fingerstick?

- Suspect inaccurate readings
- Signs/symptoms don’t match number
- Symbol/system ask for fingerstick
- System requires calibration

- Evolving relationship between meter and sensor confirmation/calibration…important to recognize that neither technology is perfect.


Daily Average
12am 2am 4am 6am 8am 10am 12pm 2pm 4pm 6pm 8pm 10pm 12am
Glucose
mg/dL
177
136 163 185 228 241 High 179 129 170 193 200 157 146
350 mg/dL
300
250
200
180
150
100
80
50
0
Target Range
12am 2am 4am 6am 8am 10am 12pm 2pm 4pm 6pm 8pm 10pm 12am



Statistics for this day

141

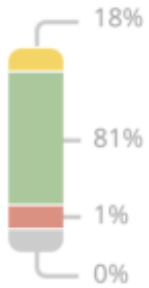
mg/dL

Average glucose (CGM)

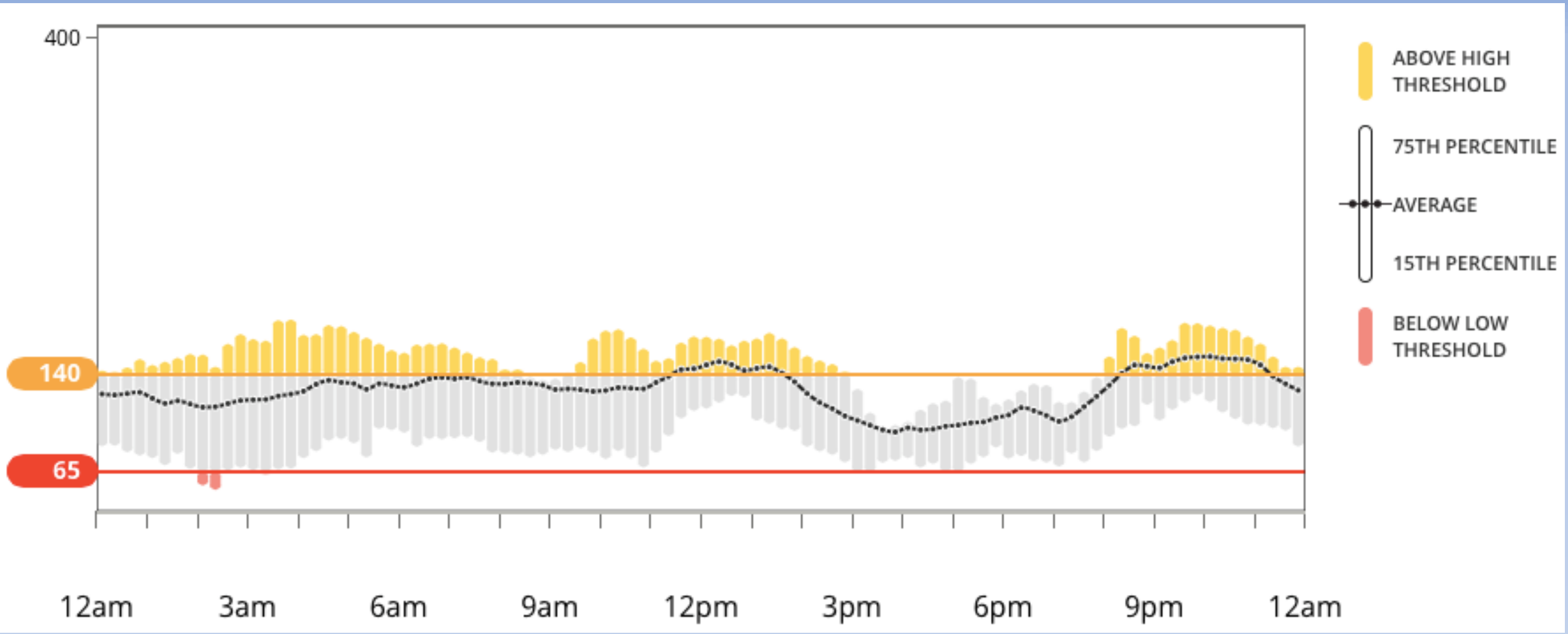
41

mg/dL

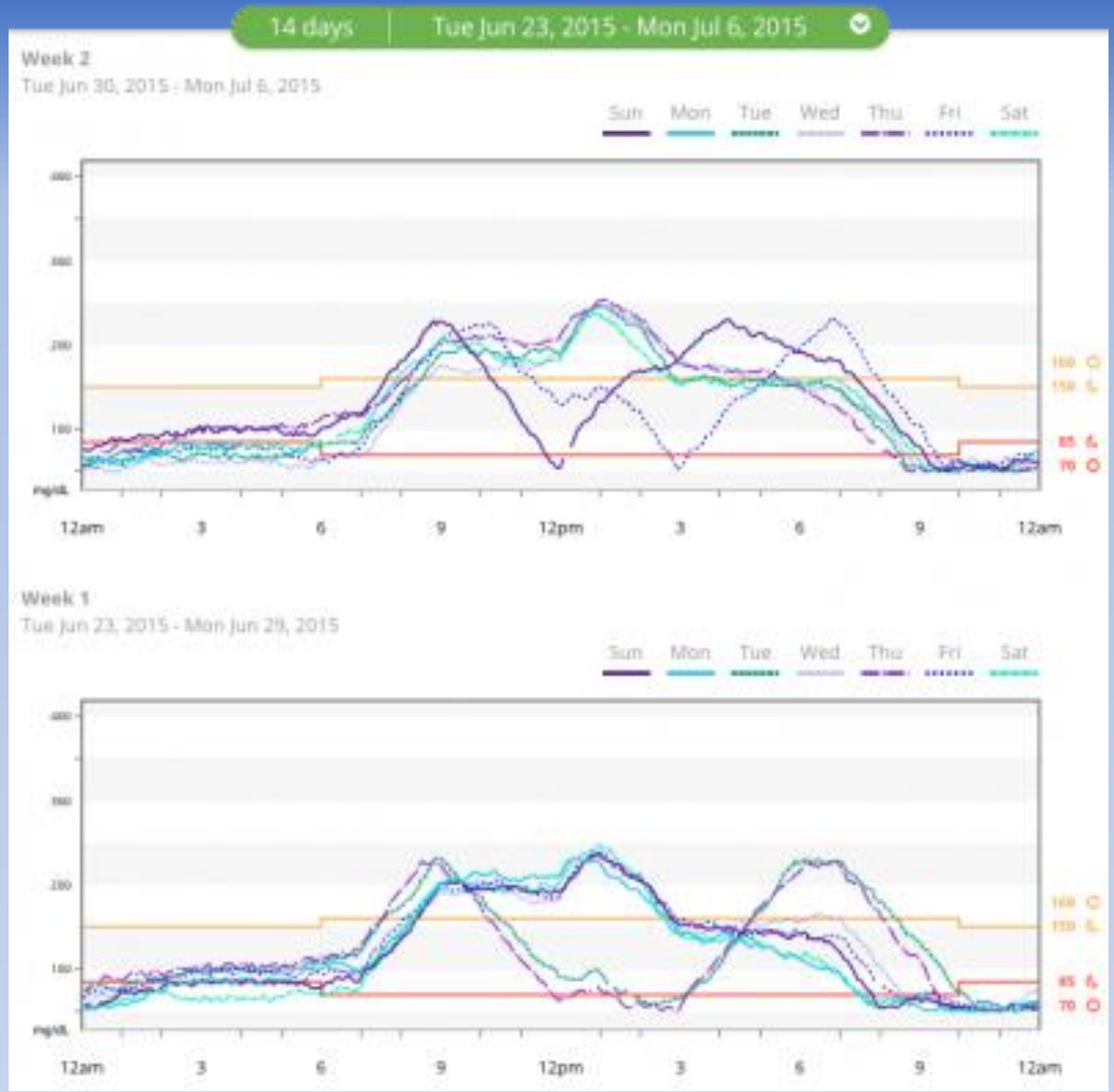
Standard deviation (CGM)



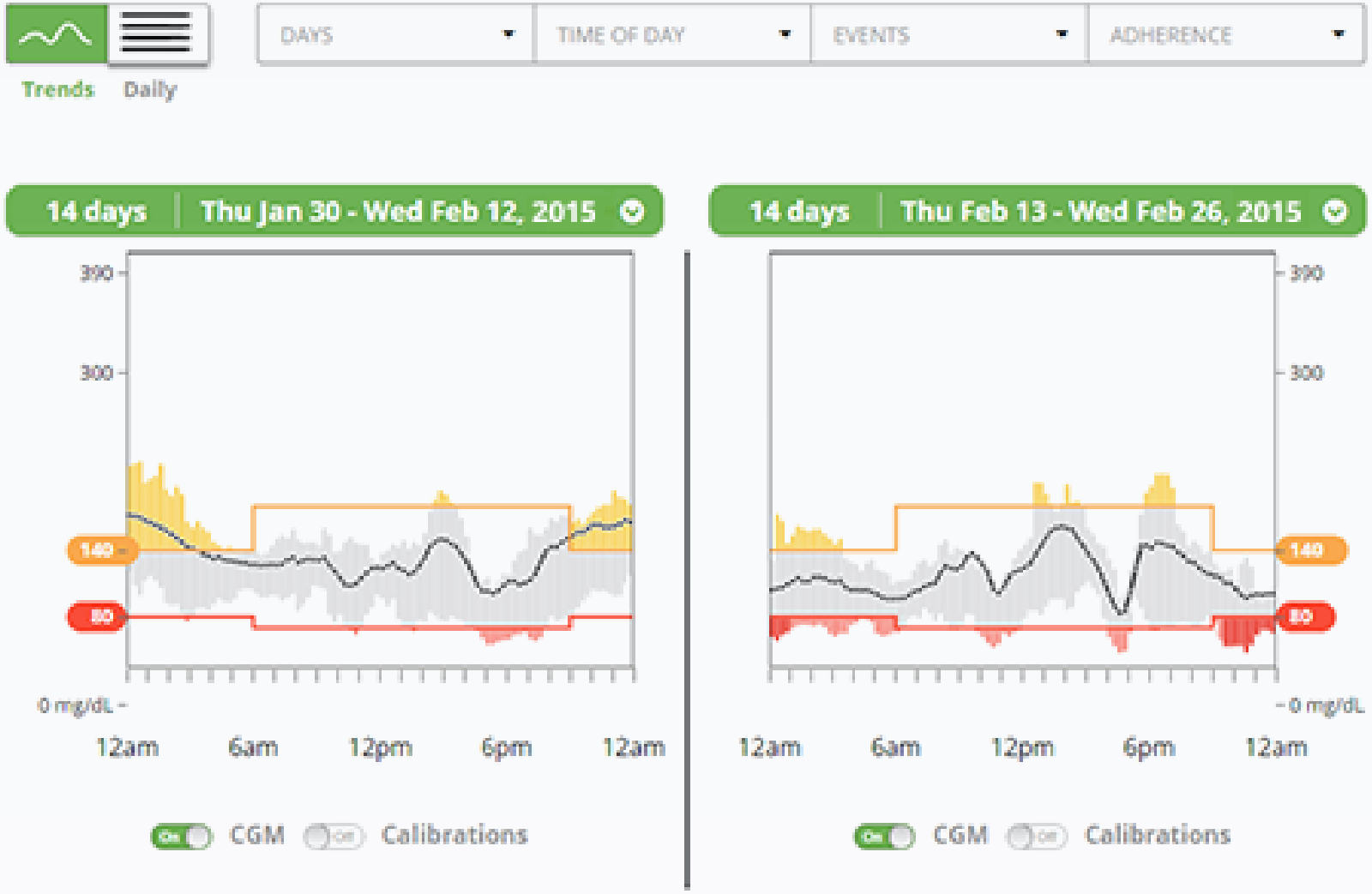
Time in range

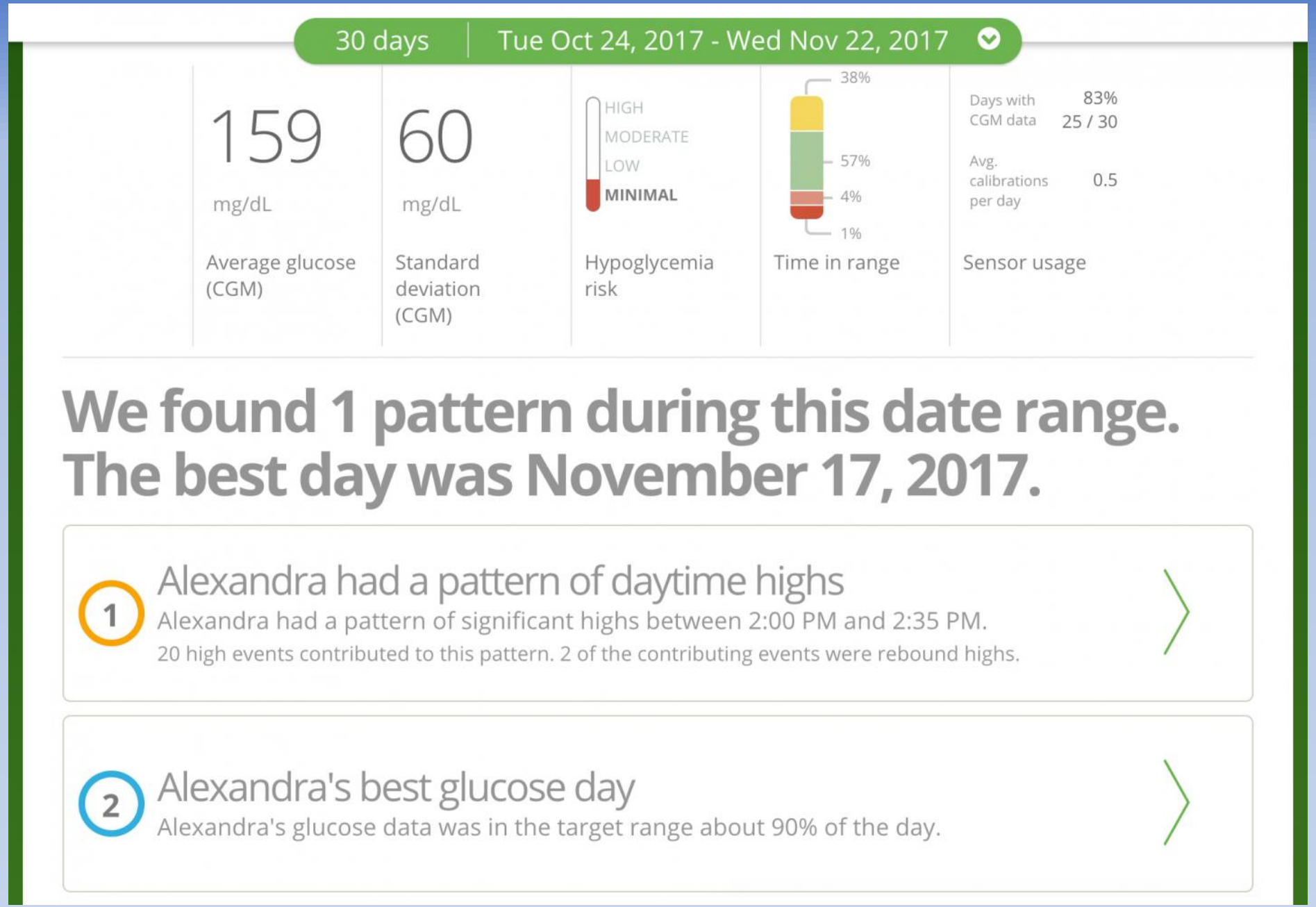

400
140
65
12am
3am
6am
9am
12pm
3pm
6pm
9pm
12am
ABOVE HIGH THRESHOLD
75TH PERCENTILE
AVERAGE
15TH PERCENTILE
BELOW LOW THRESHOLD

Arrows, Trends, & Patterns



Select two date ranges to compare side-by-side.




30 days
Tue Oct 24, 2017 - Wed Nov 22, 2017
159
mg/dL
Average glucose (CGM)
60
mg/dL
Standard deviation (CGM)
HIGH
MODERATE
LOW
MINIMAL
Hypoglycemia risk
38%
57%
4%
1%
Time in range
Days with CGM data
83%
25 / 30
Avg. calibrations per day
0.5
Sensor usage
We found 1 pattern during this date range. The best day was November 17, 2017.
1
Alexandra had a pattern of daytime highs
Alexandra had a pattern of significant highs between 2:00 PM and 2:35 PM.
20 high events contributed to this pattern. 2 of the contributing events were rebound highs.
2
Alexandra's best glucose day
Alexandra's glucose data was in the target range about 90% of the day.

Trouble Shooting a CGM

- Check Sensor/Transmitter
- Check distance of sensor to transmitter to receiver
- Be patient
- If in doubt, do fingerstick glucose
- Call CGM customer service.

  Dexcom: 1-888-738-3646

  Medtronic Guardian Connect:

  Abbott Freestyle Libre: 1-855-632-8658

Pump Emergencies

- Bad Site
- Pump Malfunction

If the pump malfunctions or the site is bad, the student gets NO basal insulin, which means that DKA can occur quickly (2-3hr) without this.

Student needs back up plan—refer call parent also.

When Diabetes Technology Fails:

Need available::

- Rapid acting insulin in pen/vial form
- Insulin syringes/pen needles
- Extra sites, cartridges available
- Ketone sticks or strips available
- Glucometer and strips available

High Blood Sugar

- Possible Causes:

  -bad site

  -carb counting inaccurate

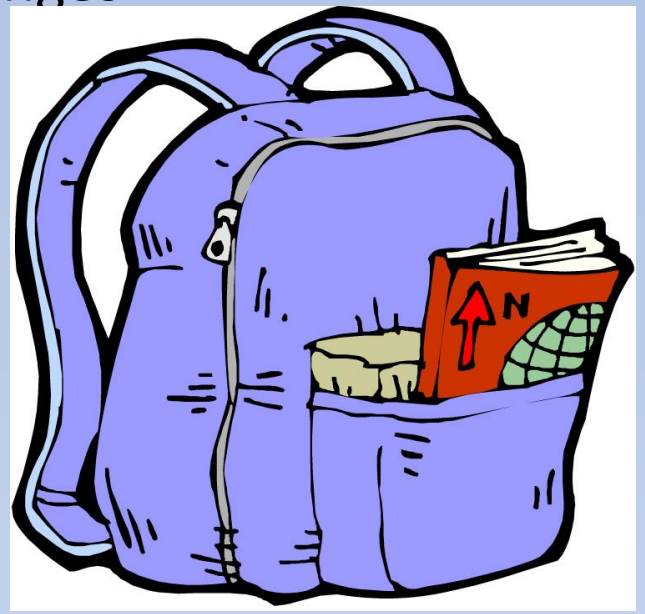
  -time on clock wrong

  -did not use blood sugar at last meal in calculation

  -missed bolus

Items to Keep at School

- Extra sites & cartridges
- Extra rapid acting insulin
- Rapid acting insulin pen or insulin & syringes
- Glucagon
- Glucometer strips
- Ketone sticks
- Fast acting carbs
- Snacks
- Water
- Batteries
- Pump batteries



Questions?