

Diabetes

2022 McLane School Nurse Conference



McLane Children's
BaylorScott&White

Ketone Testing: When and How

Test ketones for any BG >300 or ANY ILLNESS!

1. Inexpensive: Urine test strips. This is easily “misperformed” and misinterpreted. The best practice is to have then urinate in a cup and YOU dip/time it. The results are read EXACTLY 15 SECONDS after sampling. All that matters is POSITIVE or NEGATIVE, not quantity.
2. Expensive: Blood testing is precise and fast, hard to “mess it up” and misinterpret. NovaMax (Blue meter) and Precision Xtra (Purple strips).

Insurances typically don't cover either type of testing! Even Medicaid!



Pump Trouble Shooting

- Insulin pumps can indeed be a valuable tool, but can also be quite dangerous.
- There is no long acting insulin injected, there is only rapid/ultra rapid insulins in a pump (rare cases of Humulin R U-500)
- This means that if the flow gets interrupted for any reason, they WILL start making ketones within Two(2) hours.



Pump Trouble Shooting

- This is why insulin pumps are not easier, they are more complex and have more risks associated with them.
- Use CGM data and Ketone testing to troubleshoot the insulin pump is actively infusing insulin.



My Algorithm: Written for Teenagers!

Pump trouble shooting:

1. Using Ketones: If there are ketones, step 1 is to NOT trust the pump. 90% of the time, it is a bad infusion site.
2. Using CGM: If a bolus is administered and the CGM does NOT show a downward turn in 30-45 mins, it may be a bad site. The insulin probably isn't going in!



My Algorithm: Written for Teenagers!

- Corrective action:

1. Remove pump/infusion set (but don't deactivate it, yet)
 2. Calculate correction dose on the pump, press deliver. (This tracks the dose in the history/IOB)
 3. Give the calculated dose manually (syringe or pen) in an area not usually used.
 4. Perform a perfect site change in an area not regularly used (to rule out scar tissue interference)
 5. Bolus through pump at 2-hour recheck, watch the CGM for the bend.
- This will reestablish flow of insulin, but will not necessarily remove ketones. Only aggressive rehydration does that.



Managing Ketones in the School Setting

- DO NOT PANIC and send the kid home. That is nowhere in our care plan. The ONLY time I will recommend removal from the school setting is you can't stop the vomiting. Not Home, to the ED!
- You have three (3) tools at your disposal, the same tools the hospital uses: Insulin, Water (any fluids), and Zofran® (Ondansetron ODT).
 1. Insulin stops the formation of NEW ketones (Presses Pause)
 2. Fluids “flush” out the ketones already formed
 3. Zofran ODT remove barriers to rehydration

This begins the 2-hour cycle outlined in the care plan!





**A student arrives back
to school after winter
break with a 585 BG.
What do we do?**

Scenario

Three (3) non-accusatory questions need to be asked/answered:

1. Is that blood sugar reliable (could it be a dirty finger?) Wash hands with soap and water and retest to confirm.
2. Are there any ketones? (BG is >300 , should have been checked)
3. Is there any nausea or vomiting? Don't hesitate to give Zofran® early on.

These will be the first questions out of my mouth when you are on the phone with me. Why the ketones are there doesn't matter as much as knowing whether they are Positive or Negative.

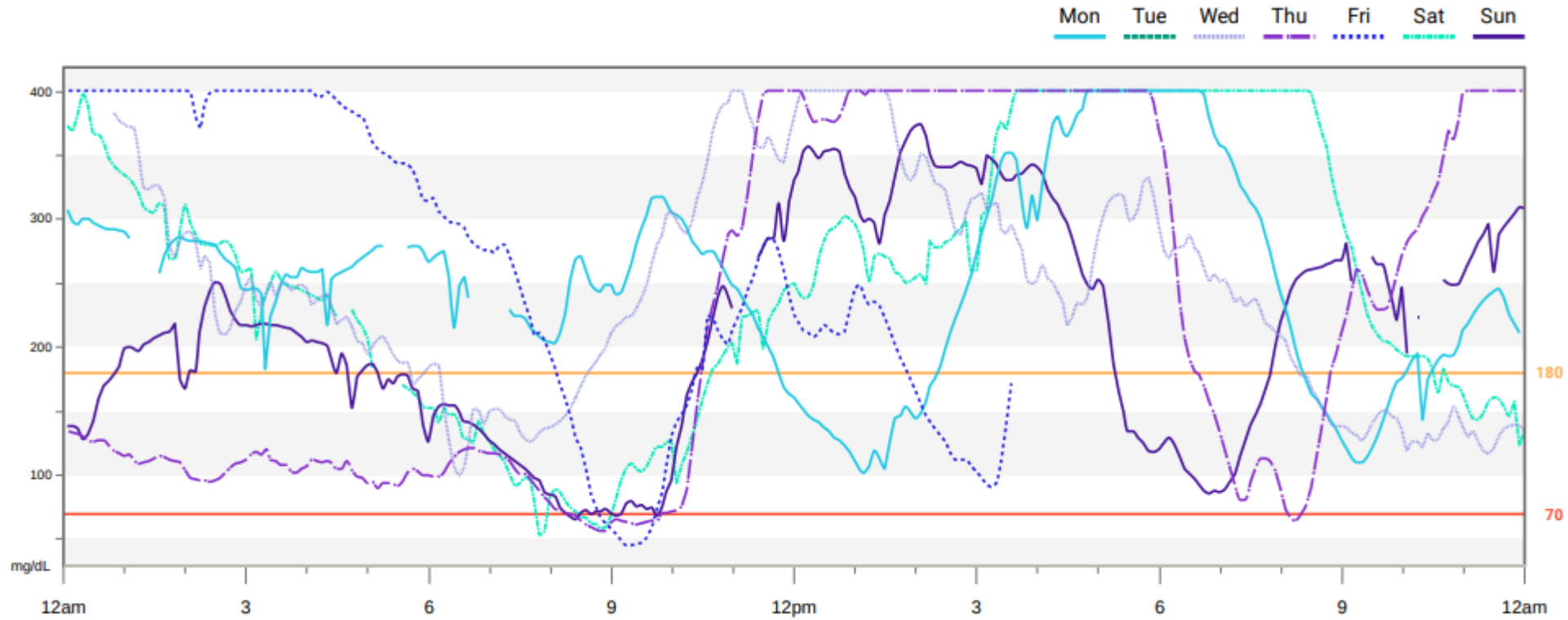


Preventing DKA

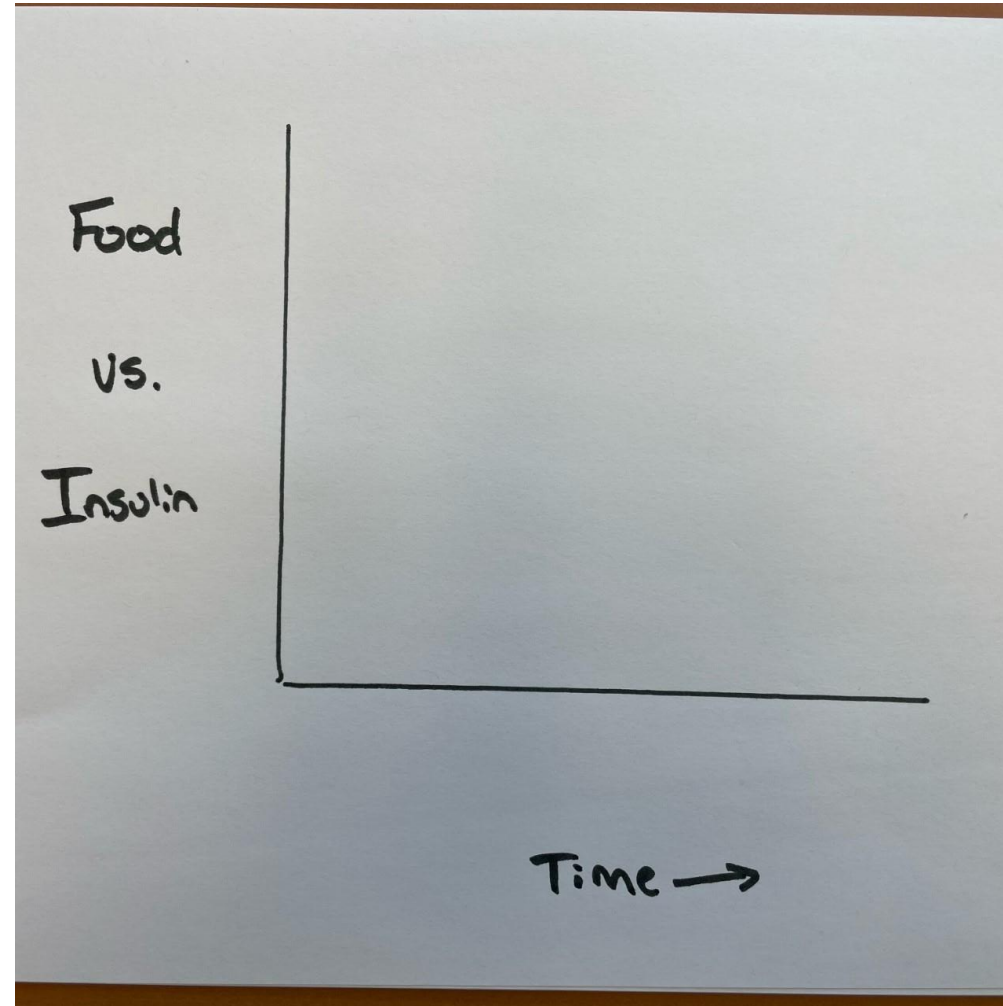
- Begin 2-hour cycle!
 1. Start off with Zofran® ODT. It will take 15-20 mins to start working. Zofran can be given every 12-hours or every 8-hours depending on body size.
 2. Correction dose of insulin using a fresh insulin pen and given by an adult in an area not regularly used. This rules out compromised insulin and scar tissue interference as the cause of ketone formation.
 3. Aggressive hydration. Keep in mind, we are not drinking to rehydrate them, we are drinking to force urination. Handing them a water bottle and sending them to class will NOT work.



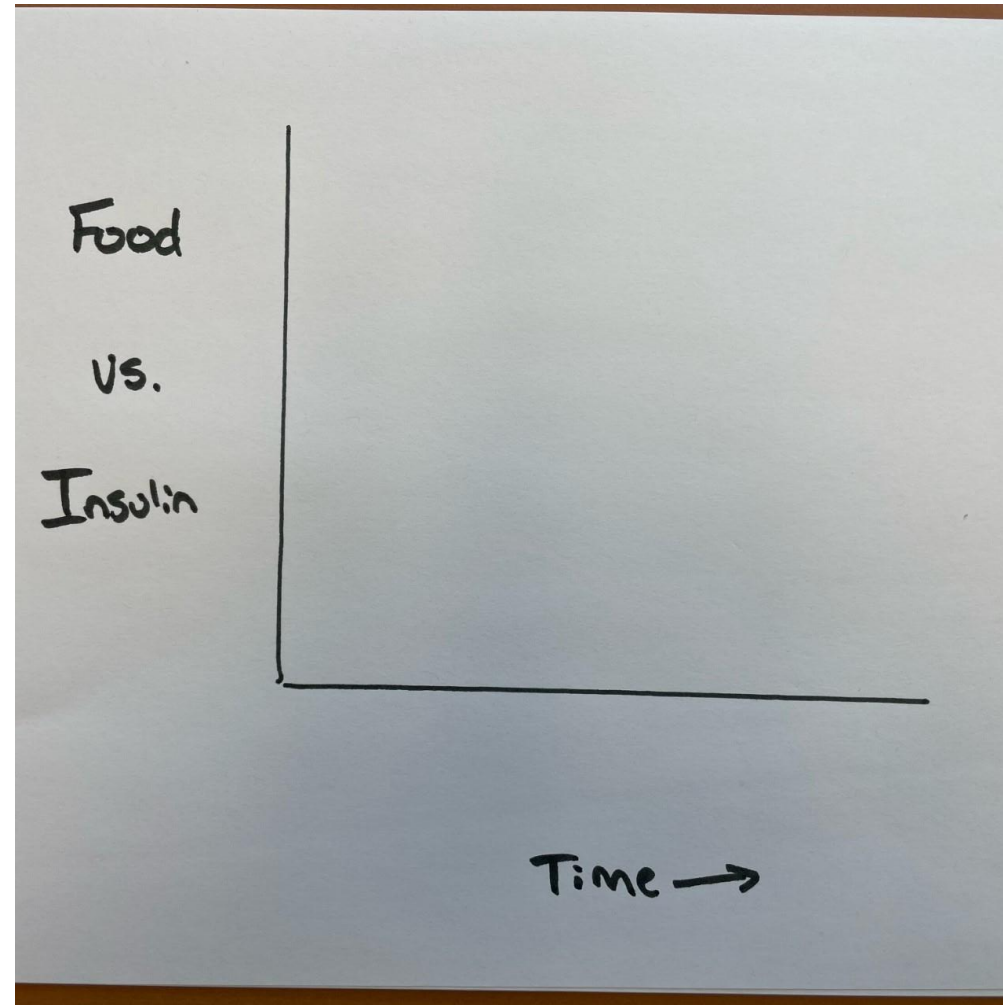
Late Bolusing Example



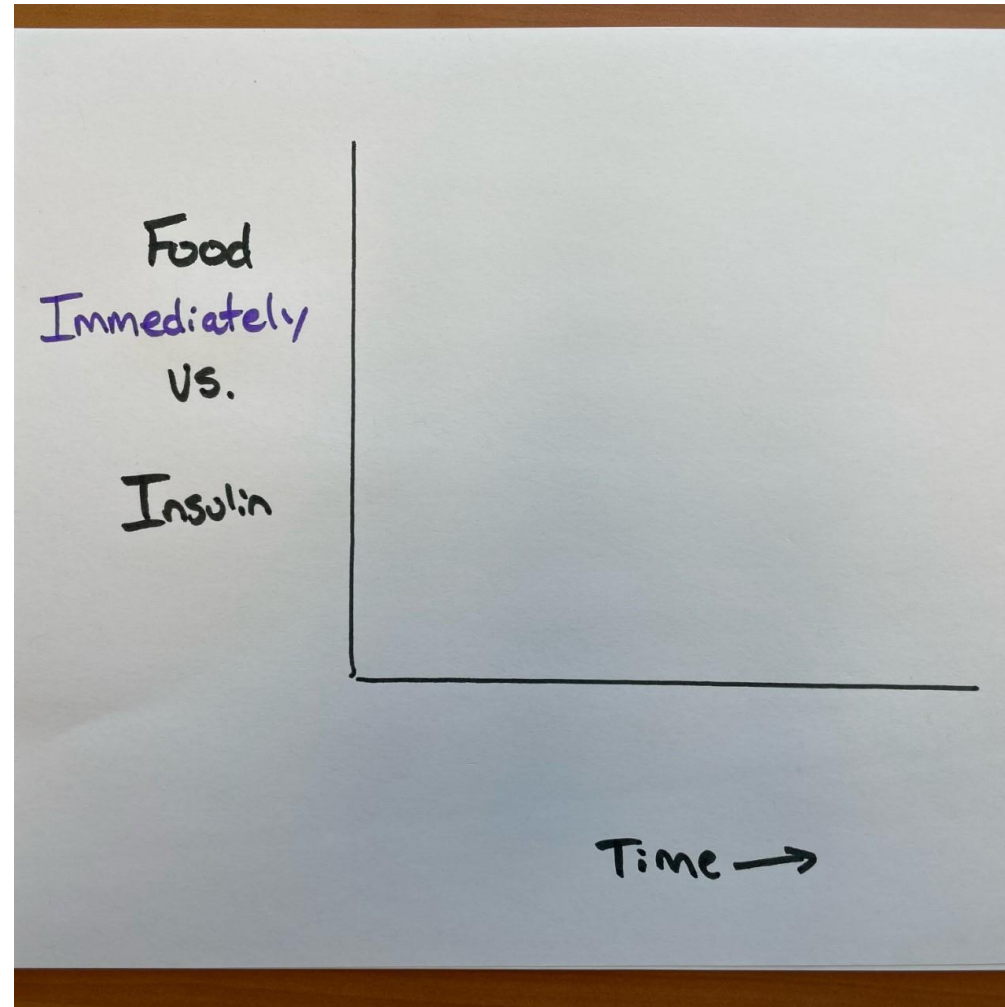
Insulin Timing- Cause and Effect



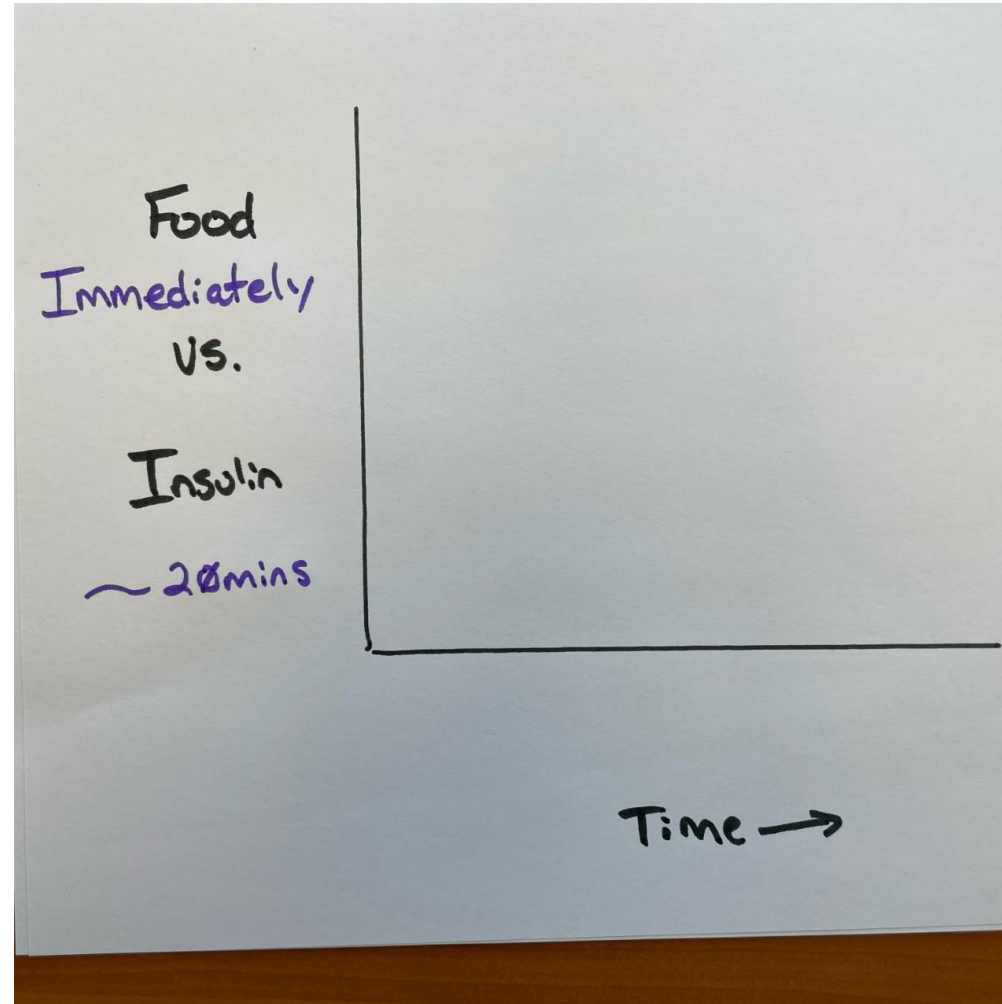
Insulin Timing- Cause and Effect



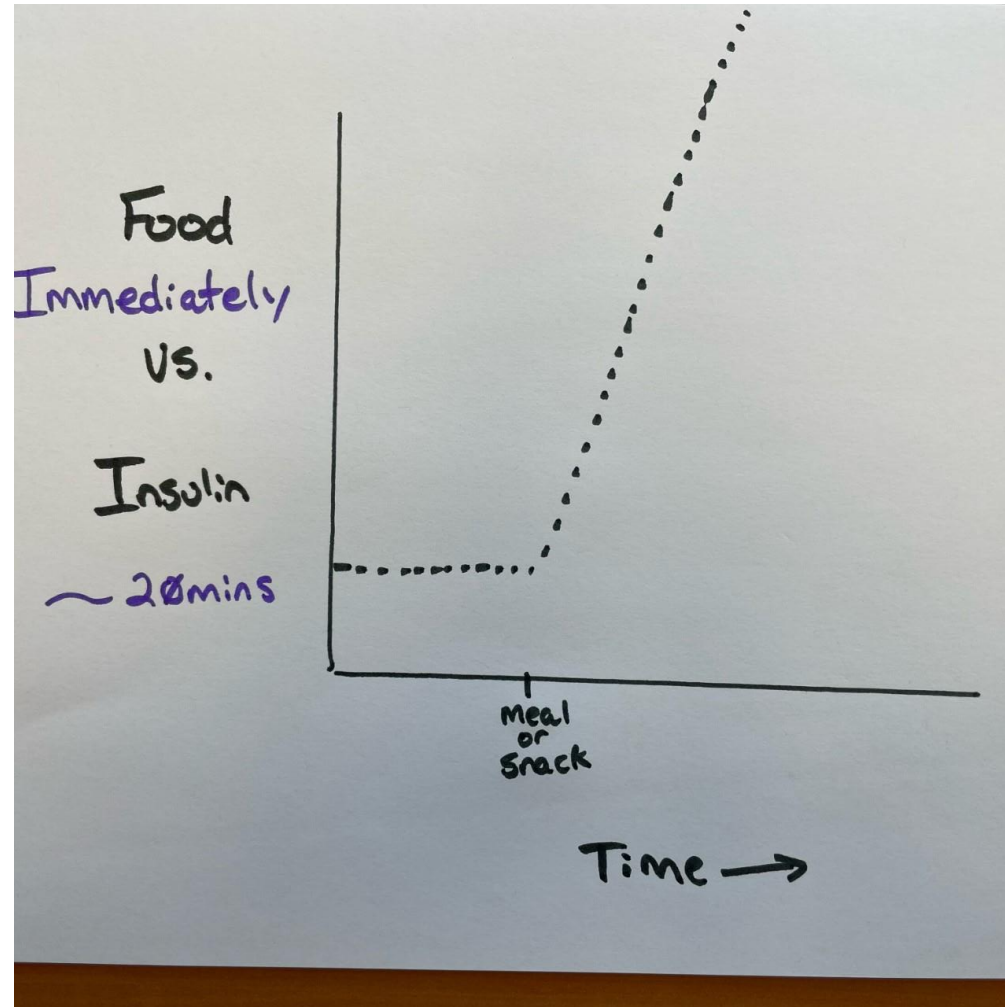
Onset of Food?



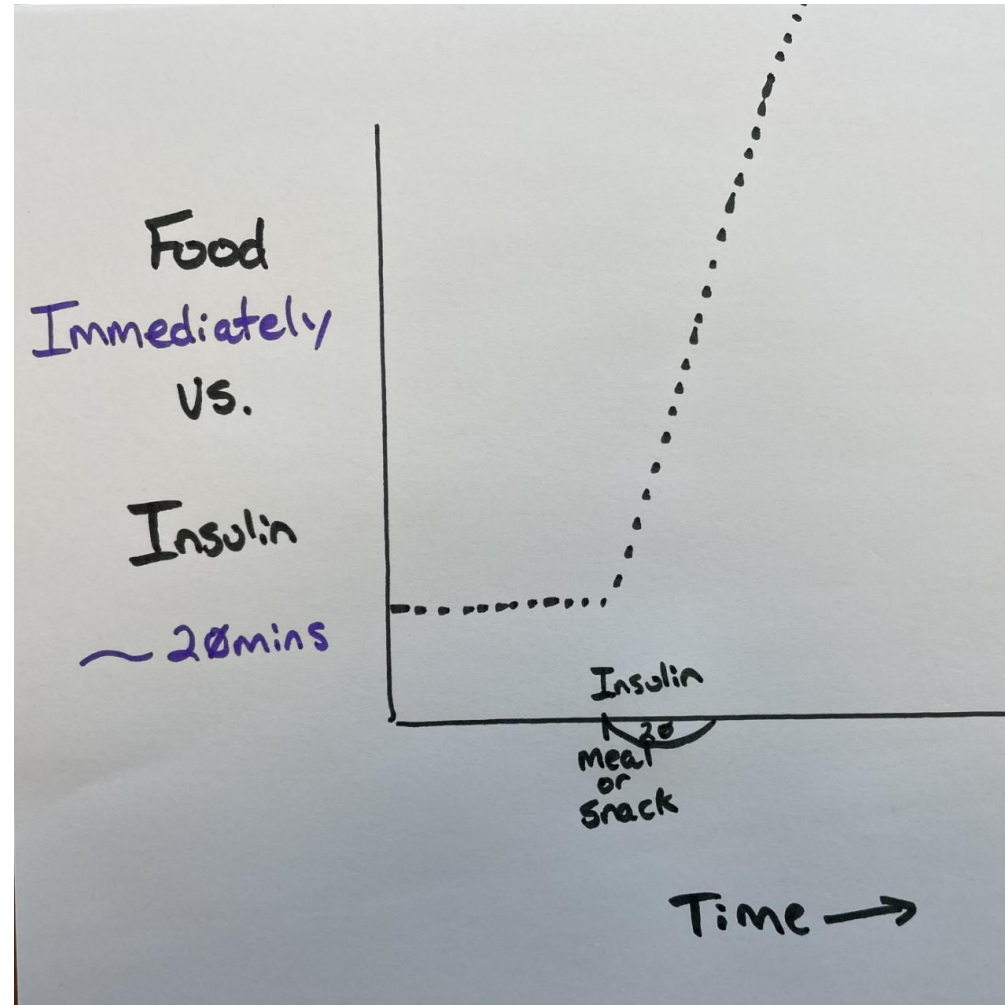
Onset of Insulin?



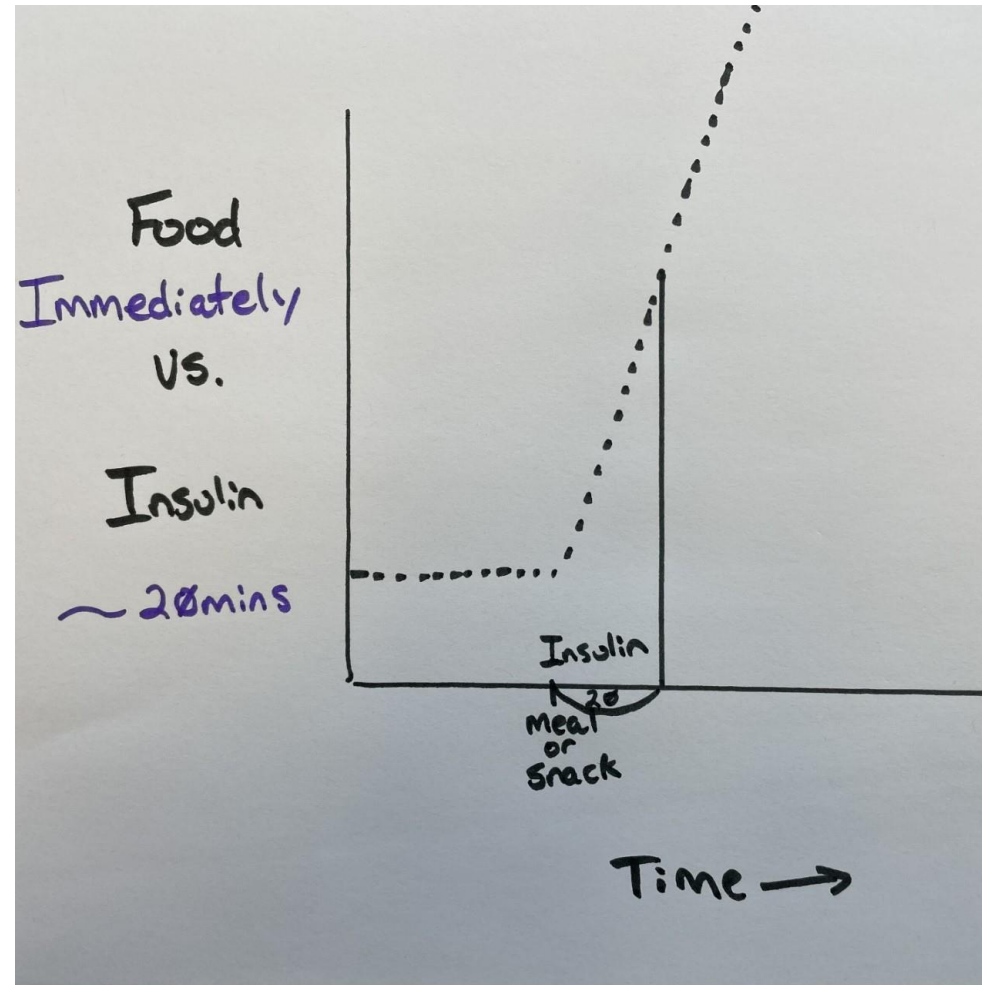
Blood Sugar Trends (CGM Graph)



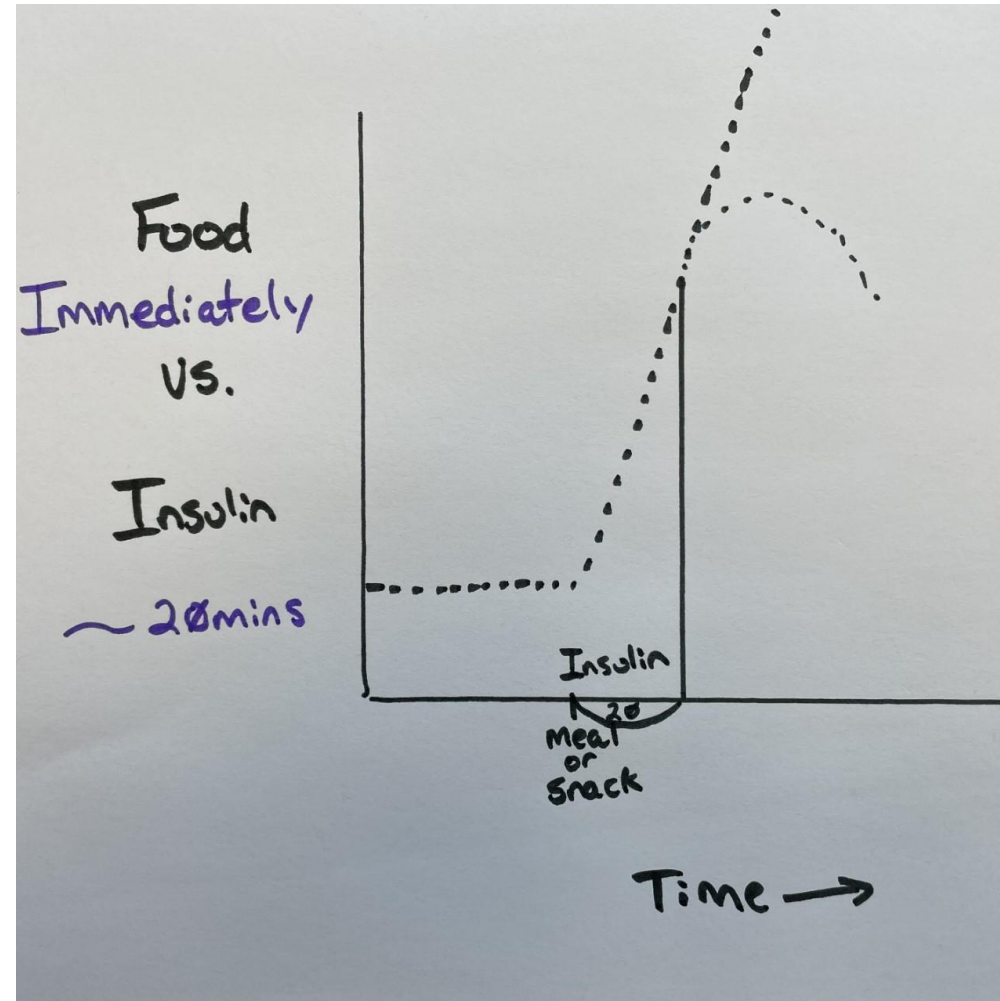
Mismatches can be Manipulated



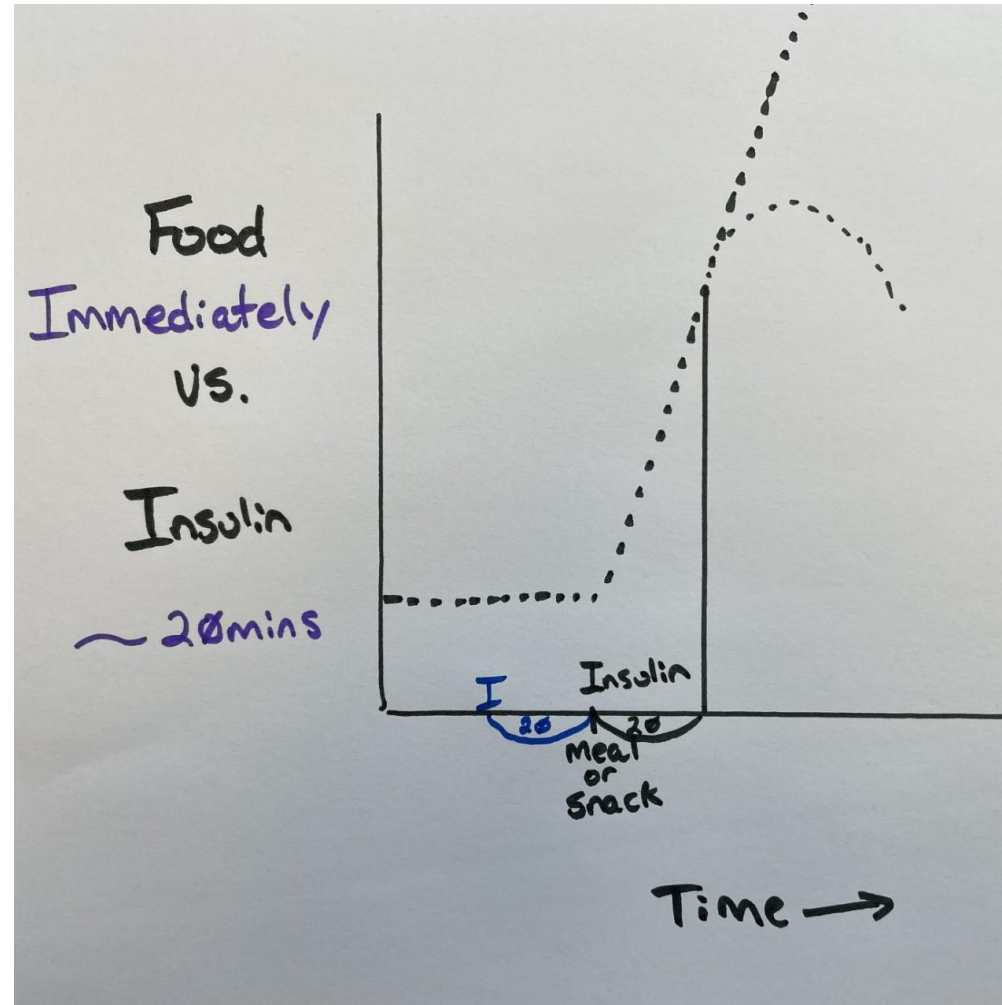
Insulin Catches Up Eventually



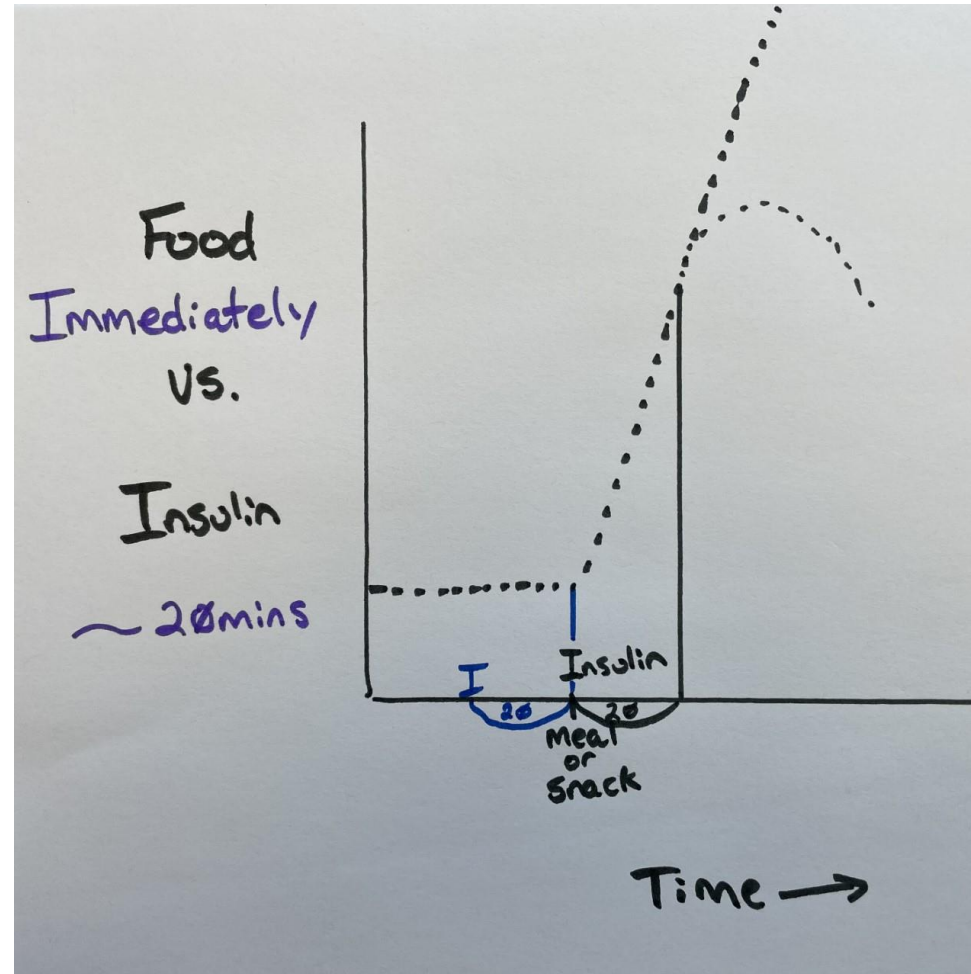
Then it Finally Starts Working!



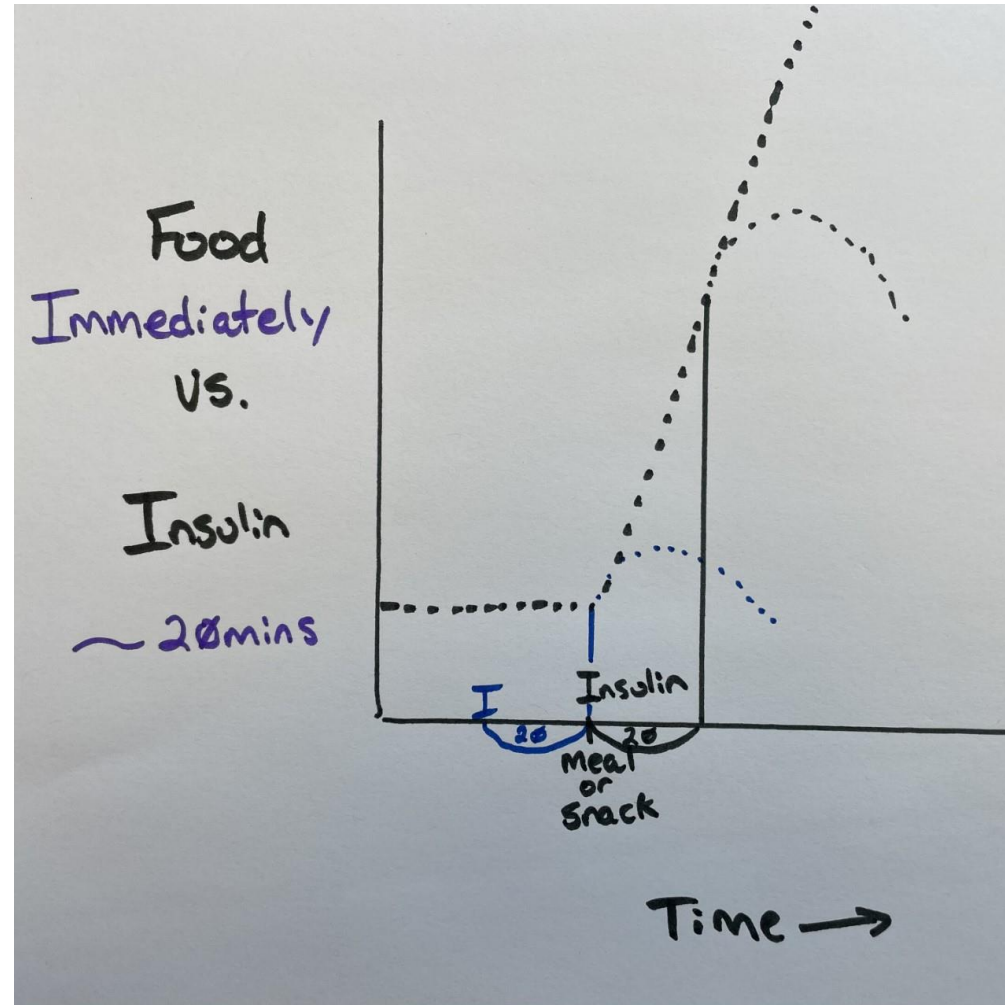
This is Why... Pre-Bolus



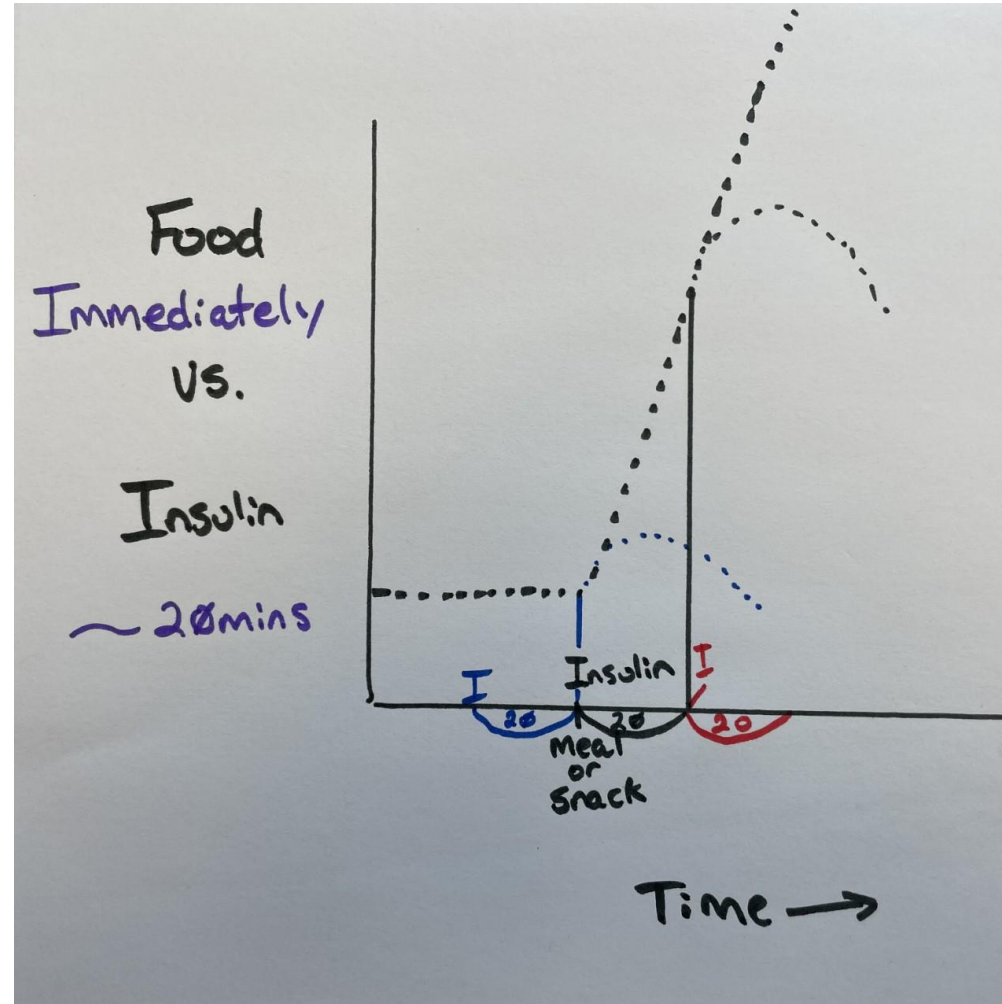
Insulin Hits the Same Time as the Food



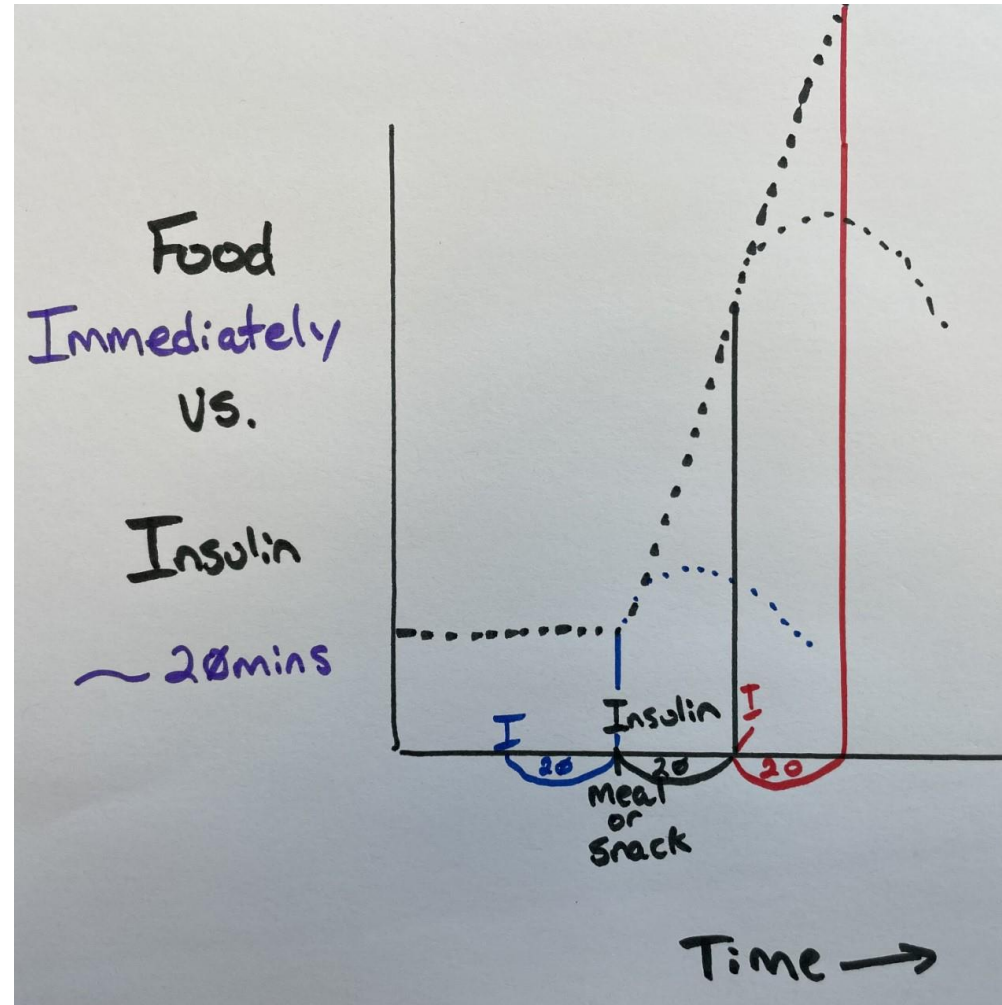
The Insulin Starts and Prevents the Spike



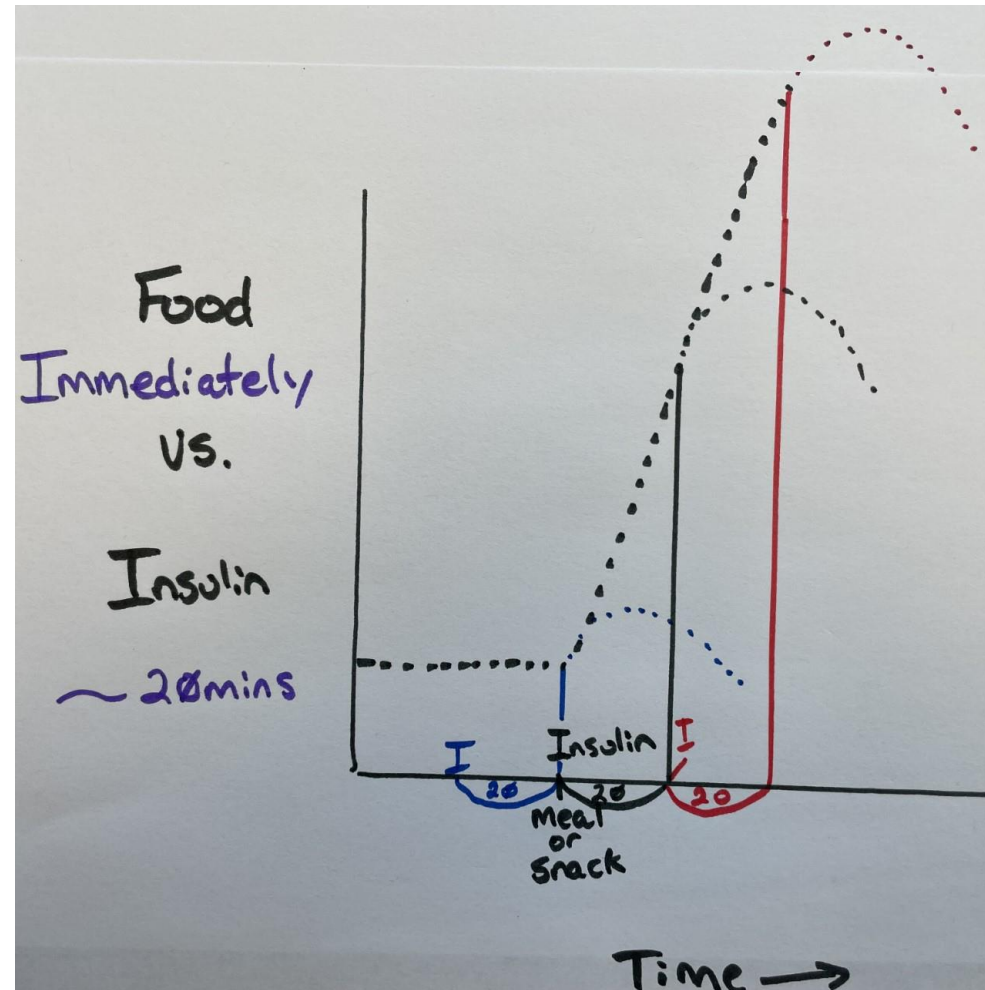
The Worst Case Scenario



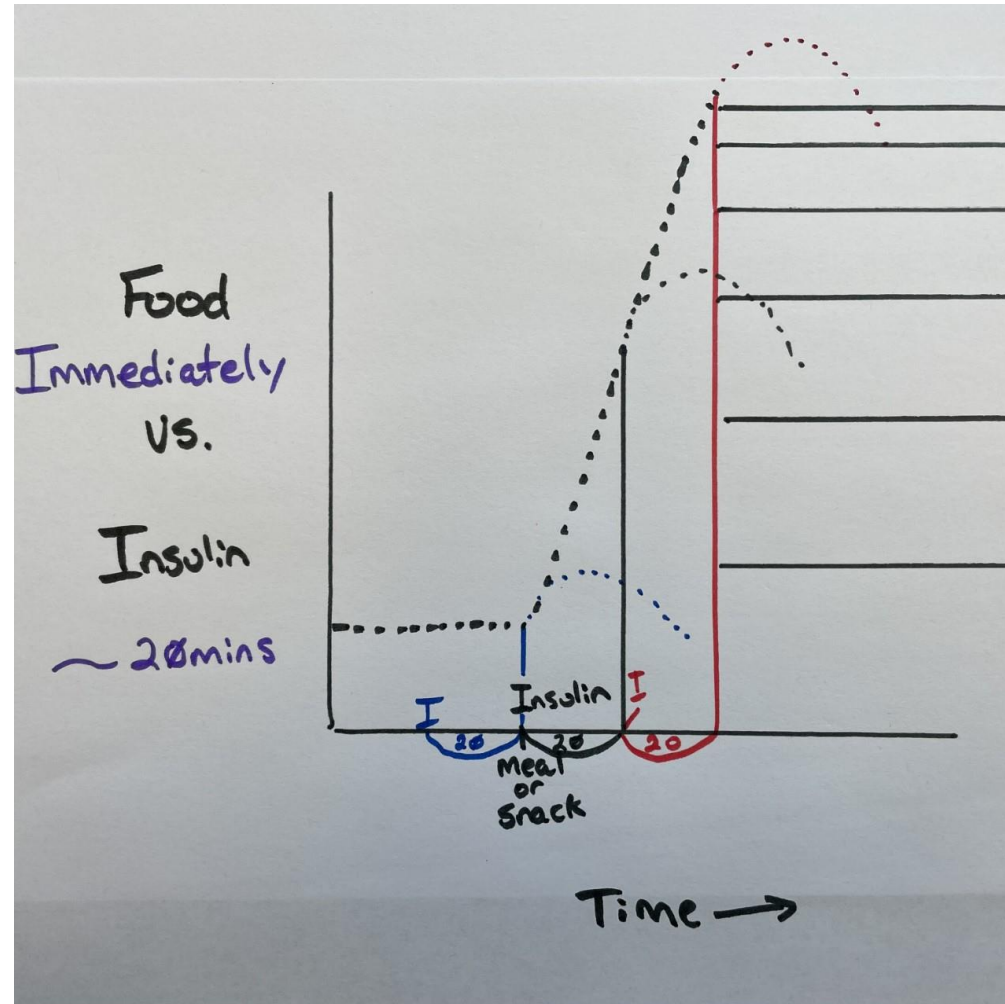
Insulin Has a Lot of Ground to Make Up



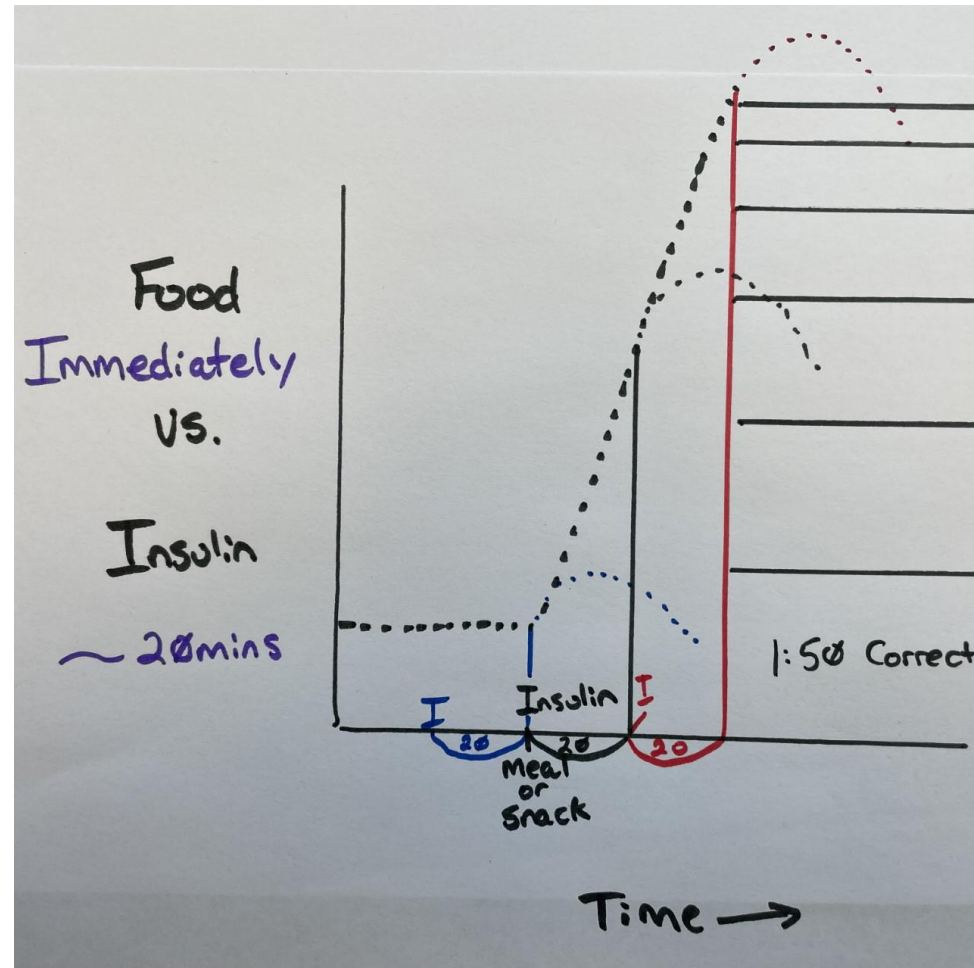
Eventually Catches Up... but There's a Problem



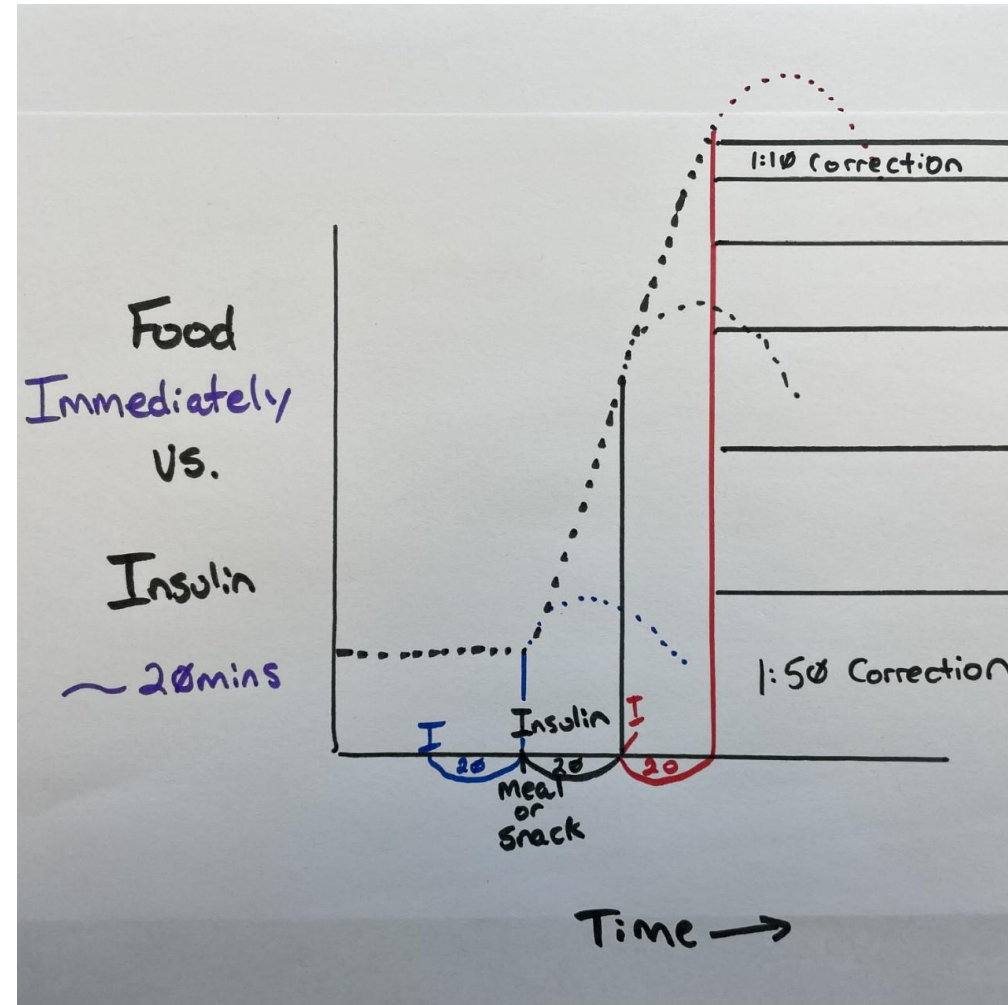
Who Remembers Graphing Algorithms?



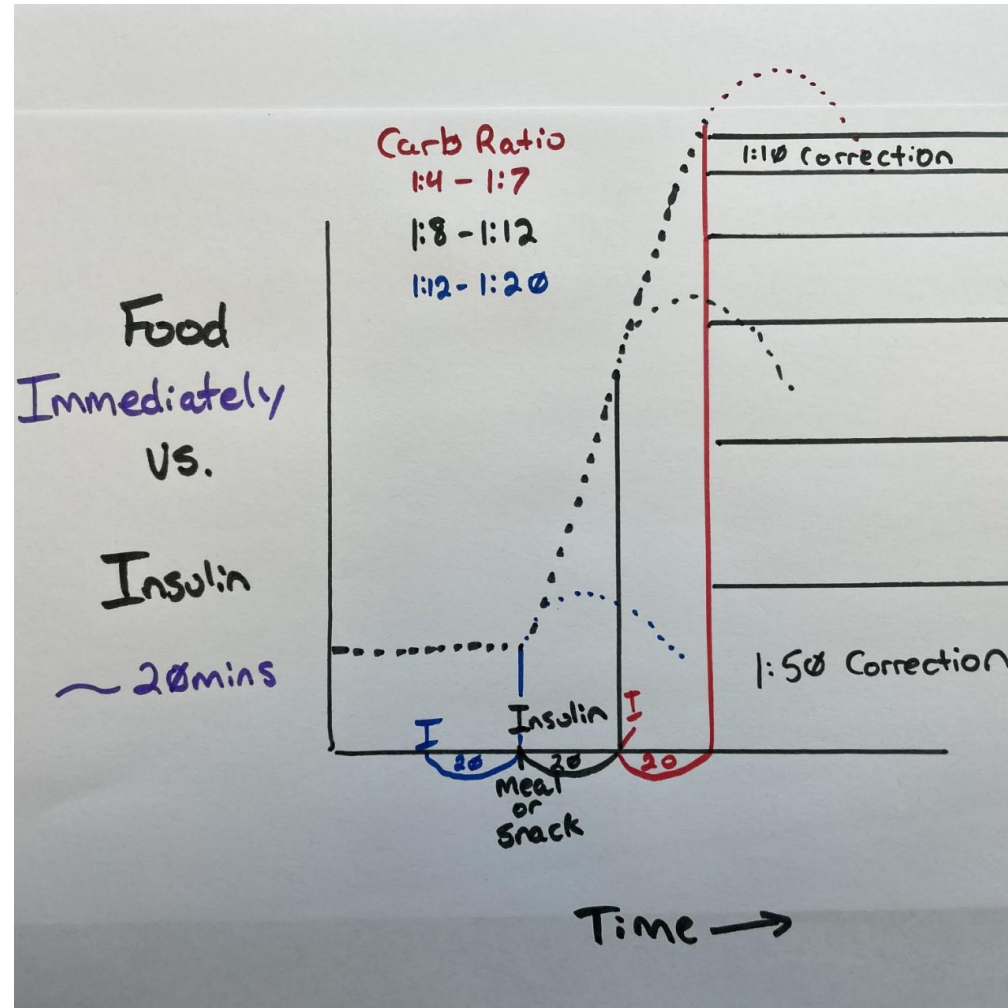
Insulin Resistance Increases as BGs Rise



It Takes Significantly More Insulin to Fix a High



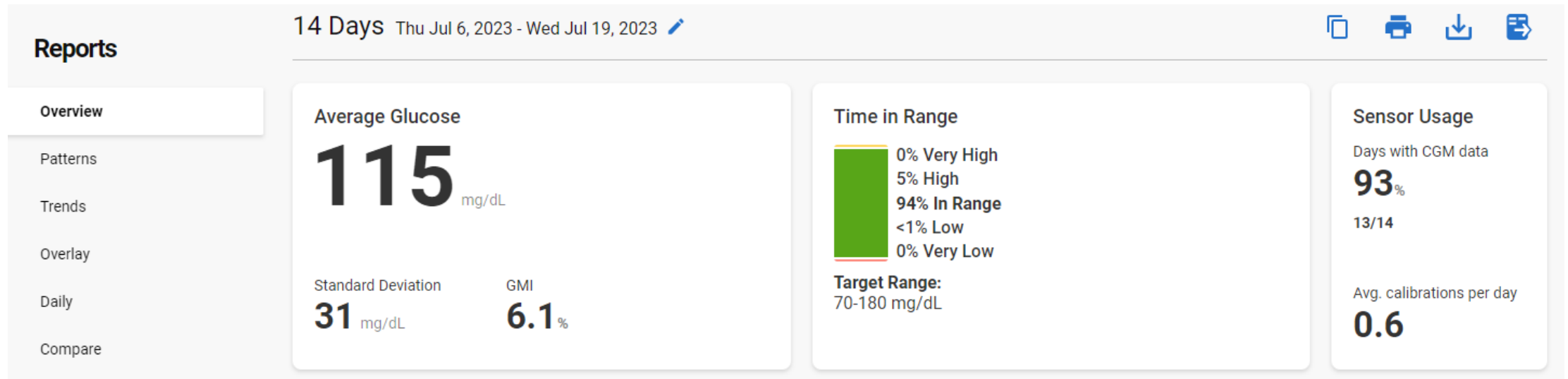
Inefficient Insulin Use



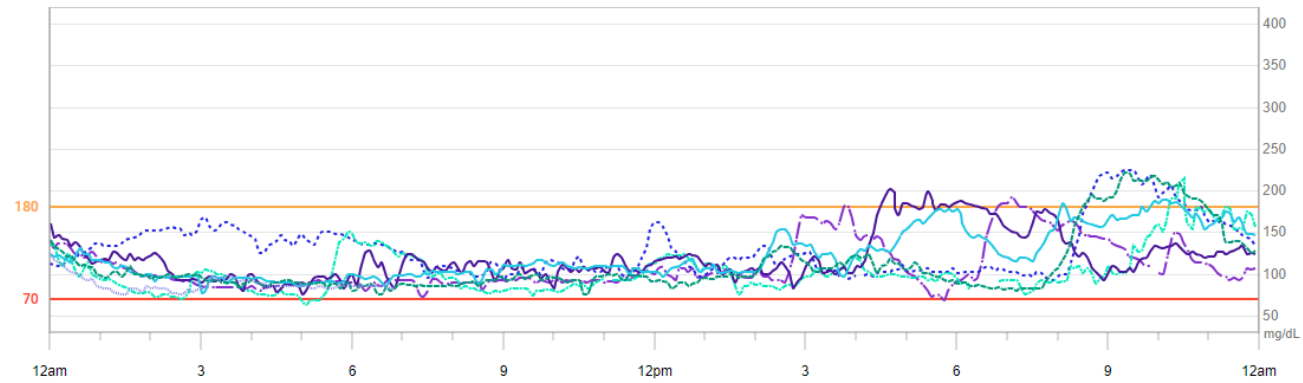
Real world examples

CGM and Pump data

Dexcom data (well controlled)

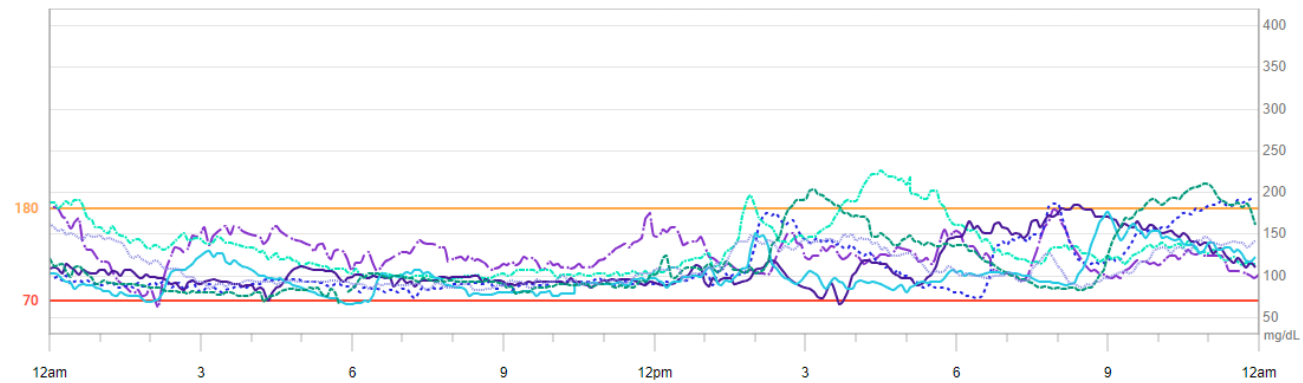


Well controlled (continued)



Week 1
Thu Jul 6, 2023 - Wed Jul 12, 2023

Mon Tue Wed Thu Fri Sat Sun



Dexcom Data (not well controlled)

Overview

Patterns

Trends

Overlay

Daily

Compare

Average Glucose

227 mg/dL

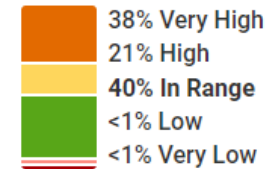
Standard Deviation

95 mg/dL

GMI

8.7 %

Time in Range



Target Range:
70-180 mg/dL

Sensor Usage

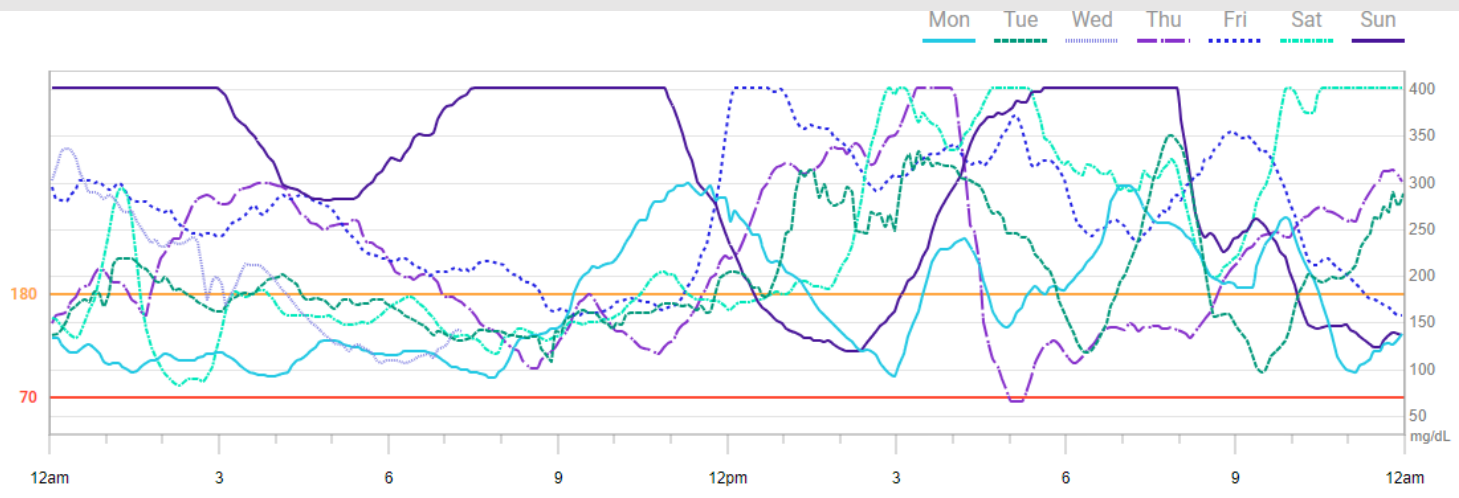
Days with CGM data

93%

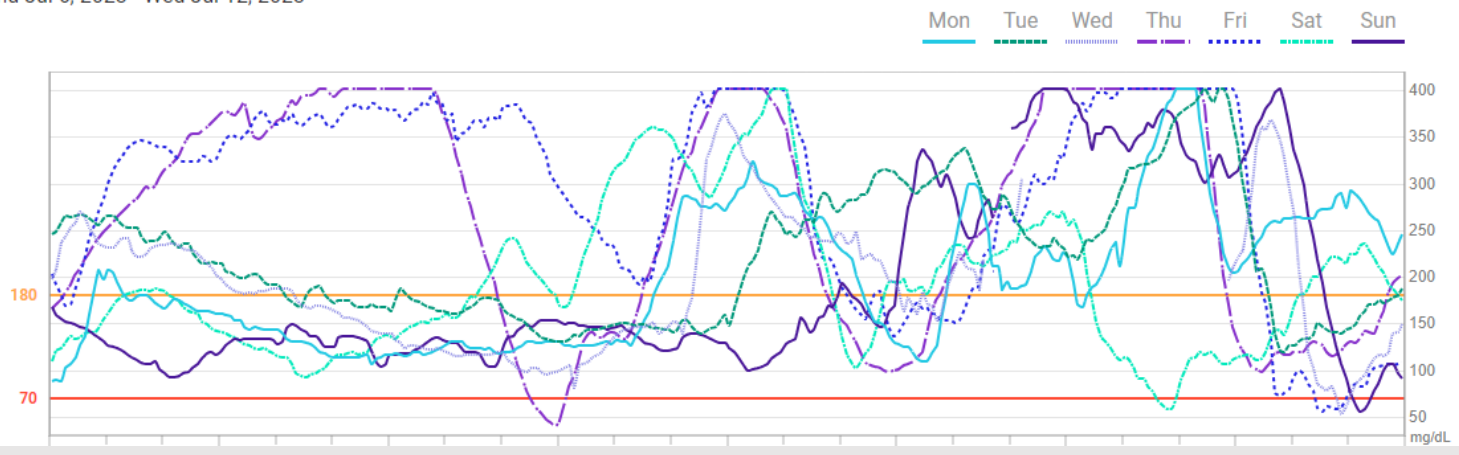
13/14

Avg. calibrations per day

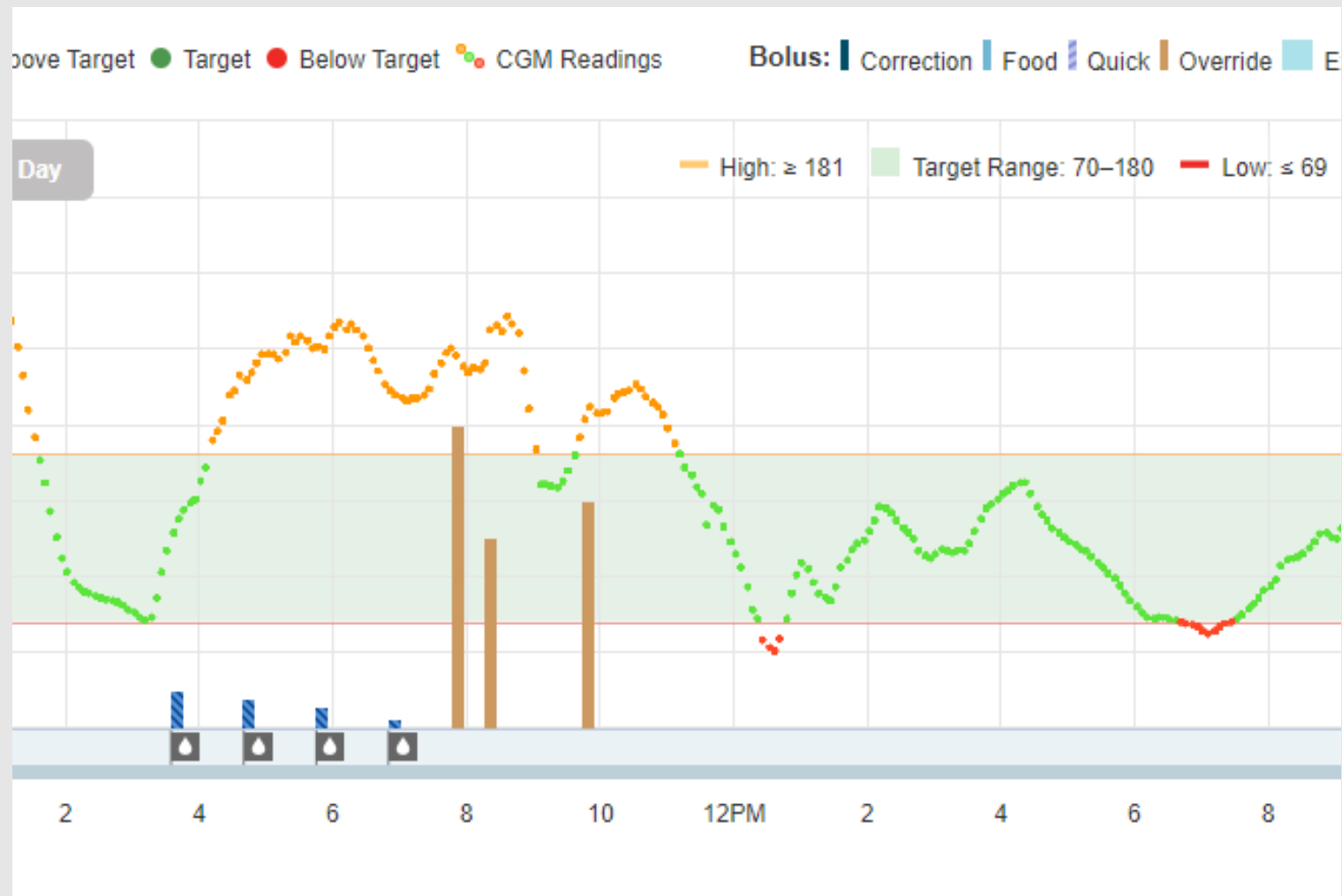
0.0



Week 1
Thu Jul 6, 2023 - Wed Jul 12, 2023



Not well
controlled
(continued
)



Pump Data
(Tandem
t:slim)



Insulin



Daily Dose	66.6 units
Overrides (%)	4.8% (2 boluses)
# Bolus/Day	3

System Details

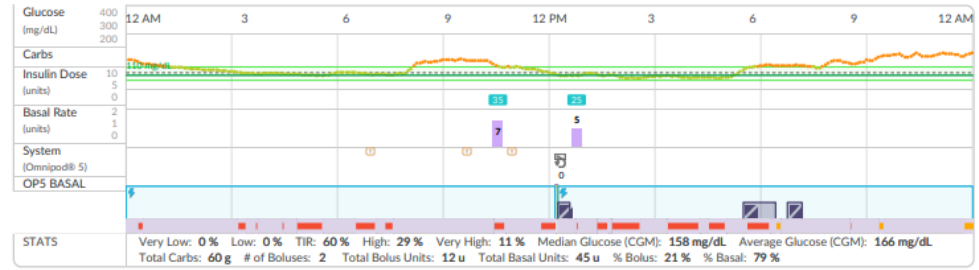
Insulet Omnipod® 5 (13d 1h)



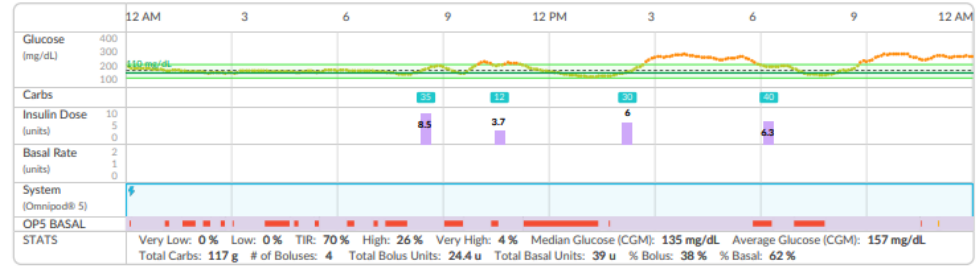
Automated Mode	70%	(9d 4h)
Automated: Limited	7%	(22h)
Automated: Activity	0%	
Manual Mode	30%	(3d 21h)

Diet

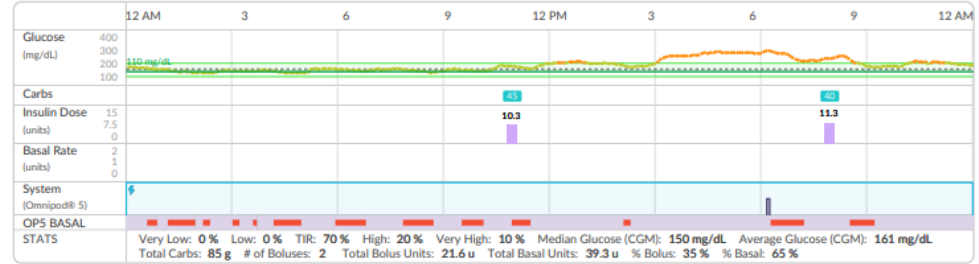
Carbs/Day	93.5 g
Entries/Day	2.5



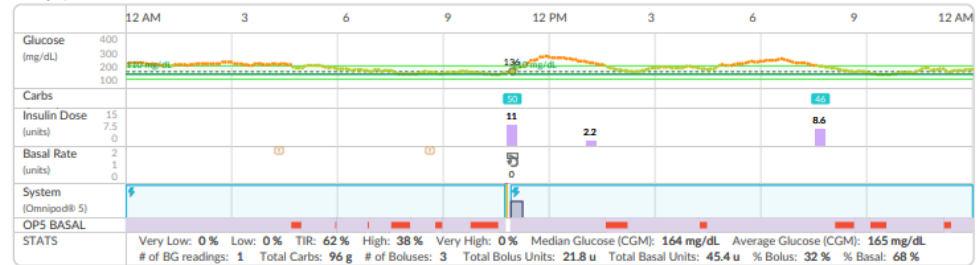
July 10, 2023



July 9, 2023



July 8, 2023



BSW Pedi Endo Care Plans

- Very thorough by school nurse request, can be very long depending on the individual
- Includes technology clauses (cell phone, receiver, pumps, InPen, etc.)
- Dosing calculations or pump settings
- Sick day management (ketones in the school setting)
- Do NOT send the child home for high BG's or Ketones.

Take Home Points

- Inefficient use of insulin leads to unnecessary weight gain, that leads to the need for more insulin (if there is more of you, it takes more insulin). Feed forward loop.
- Dosing late causes more after meal lows 1.5-2 hours after the meal. When is the child's PE/Recess?



Take Home Points

- Delivering insulin sufficiently before carb intake enables the use of weaker ratios. This means a more efficient delivery uses less insulin and causes less after meal lows.
- Work together with family, clinic, coaches, teachers to get insulin on board earlier (pumps deliver slower than injections).



Contact Information

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