

# Modeling and simulating uncertainty in type 1 diabetes

Máté Siket

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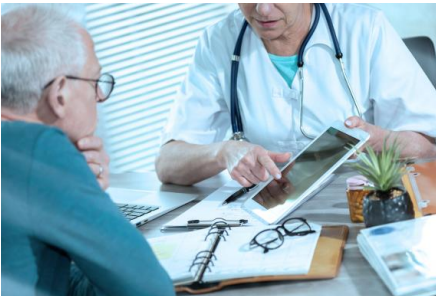
# What models can be used for, and what are their limitations?



Develop and test  
automated insulin delivery  
systems



Bolus recommendation



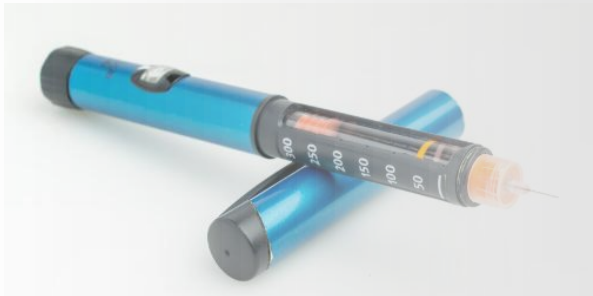
Education

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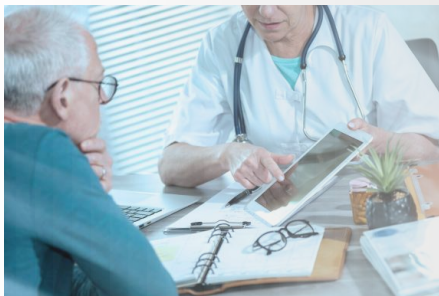


Develop and test  
automated insulin delivery  
systems

- Real-world data is messy
- Variabilities on multiple levels
- Complex disturbances



Bolus re

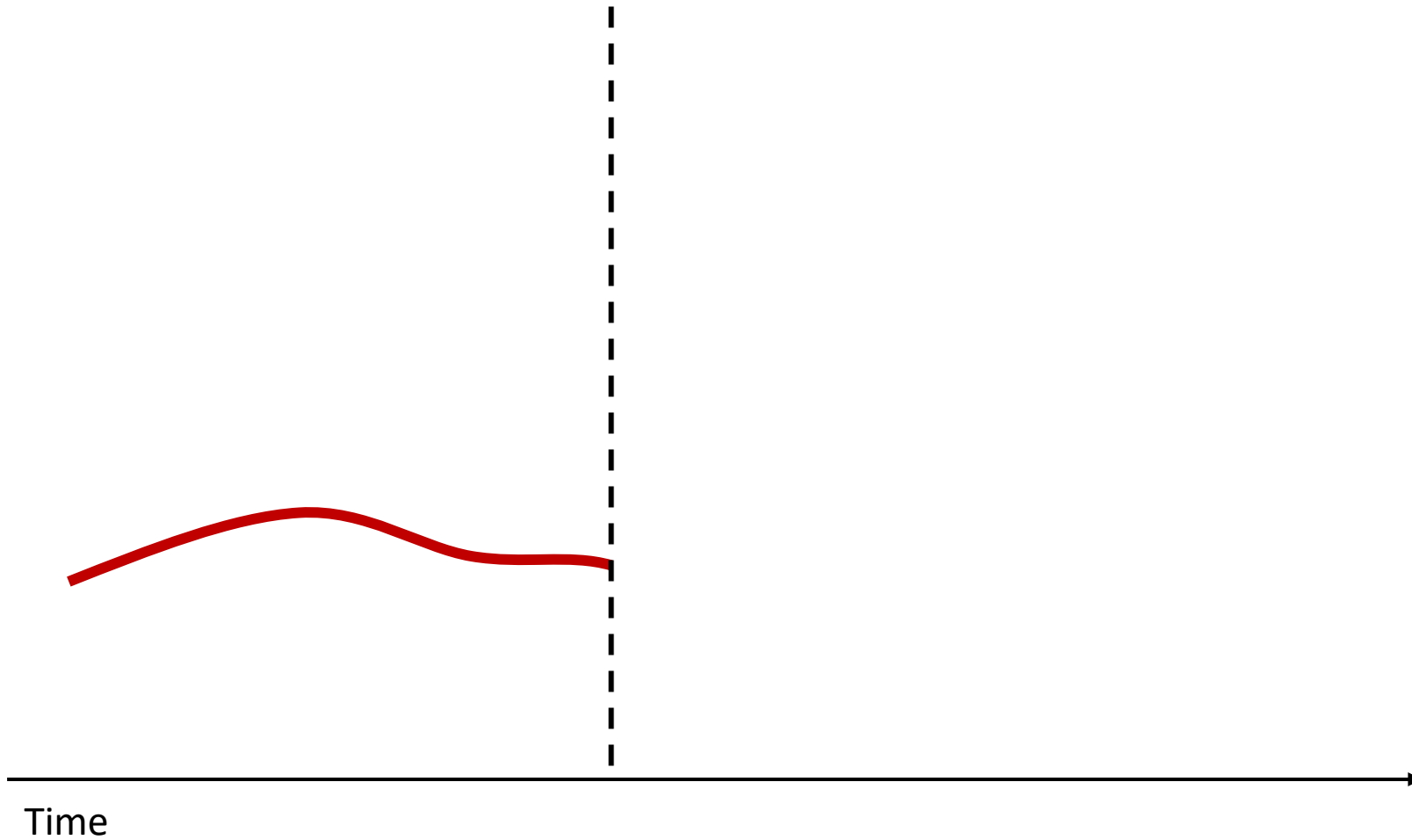


Education

# Prediction

Past glucose trends

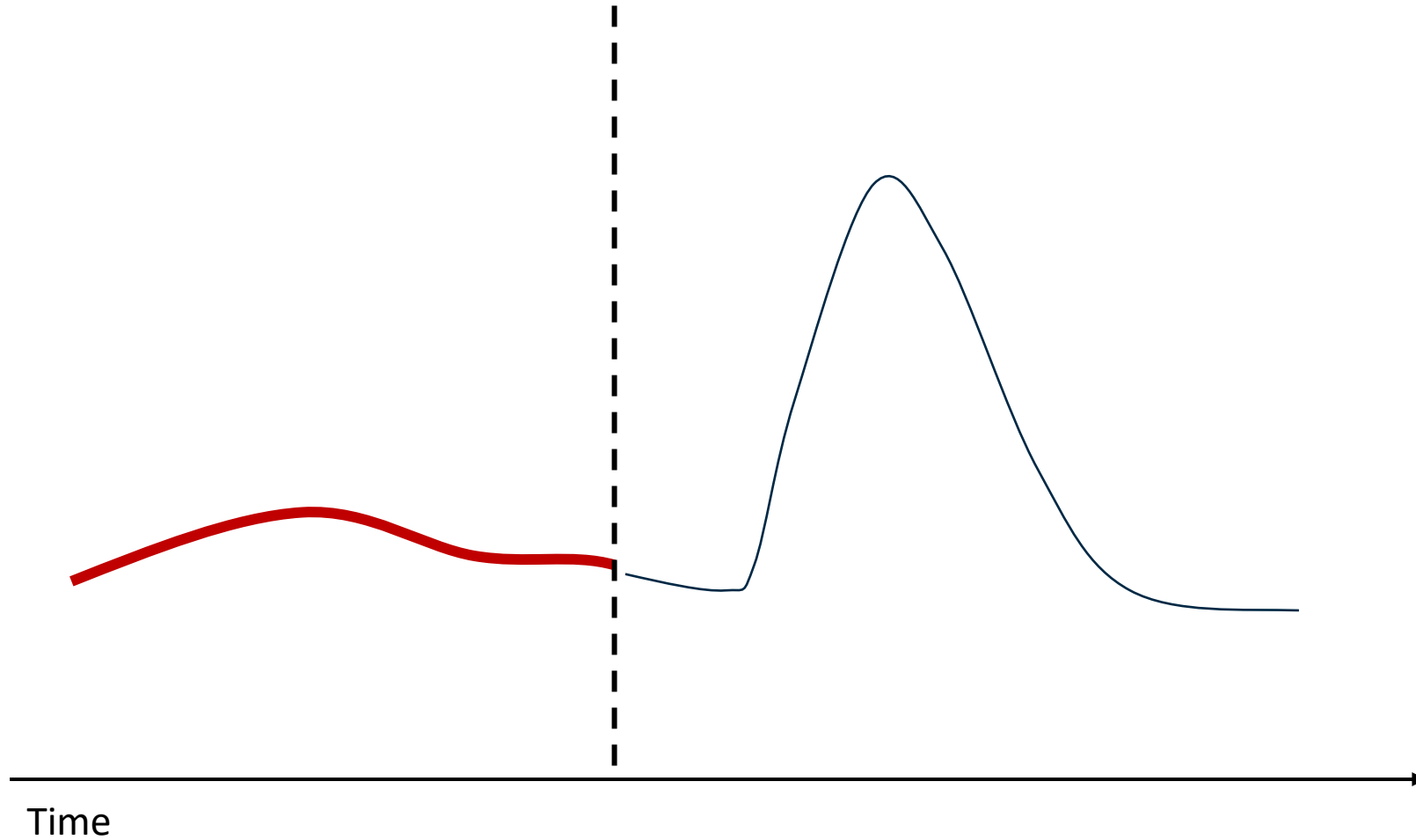
Unobserved future



# Prediction

Past glucose trends

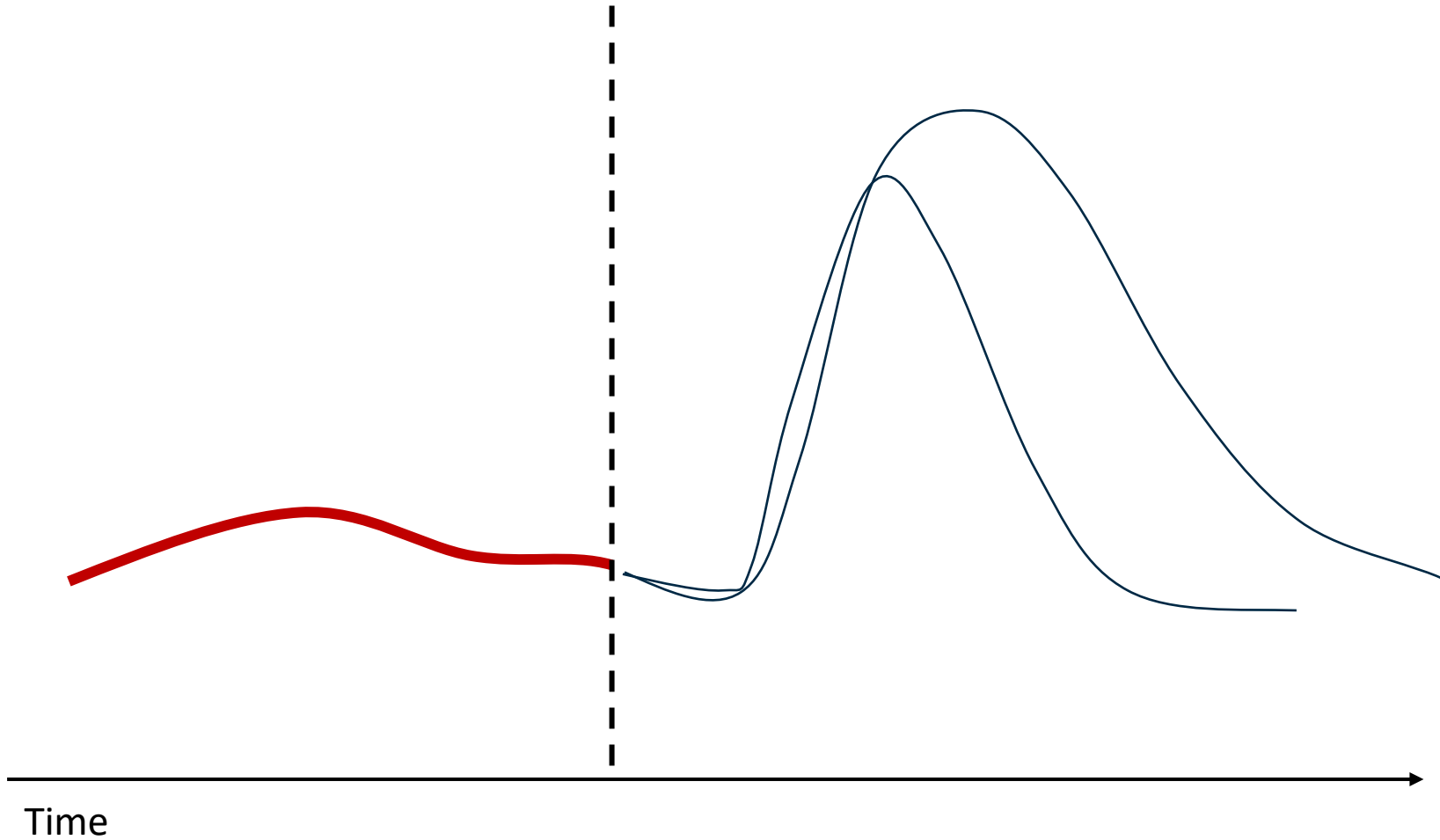
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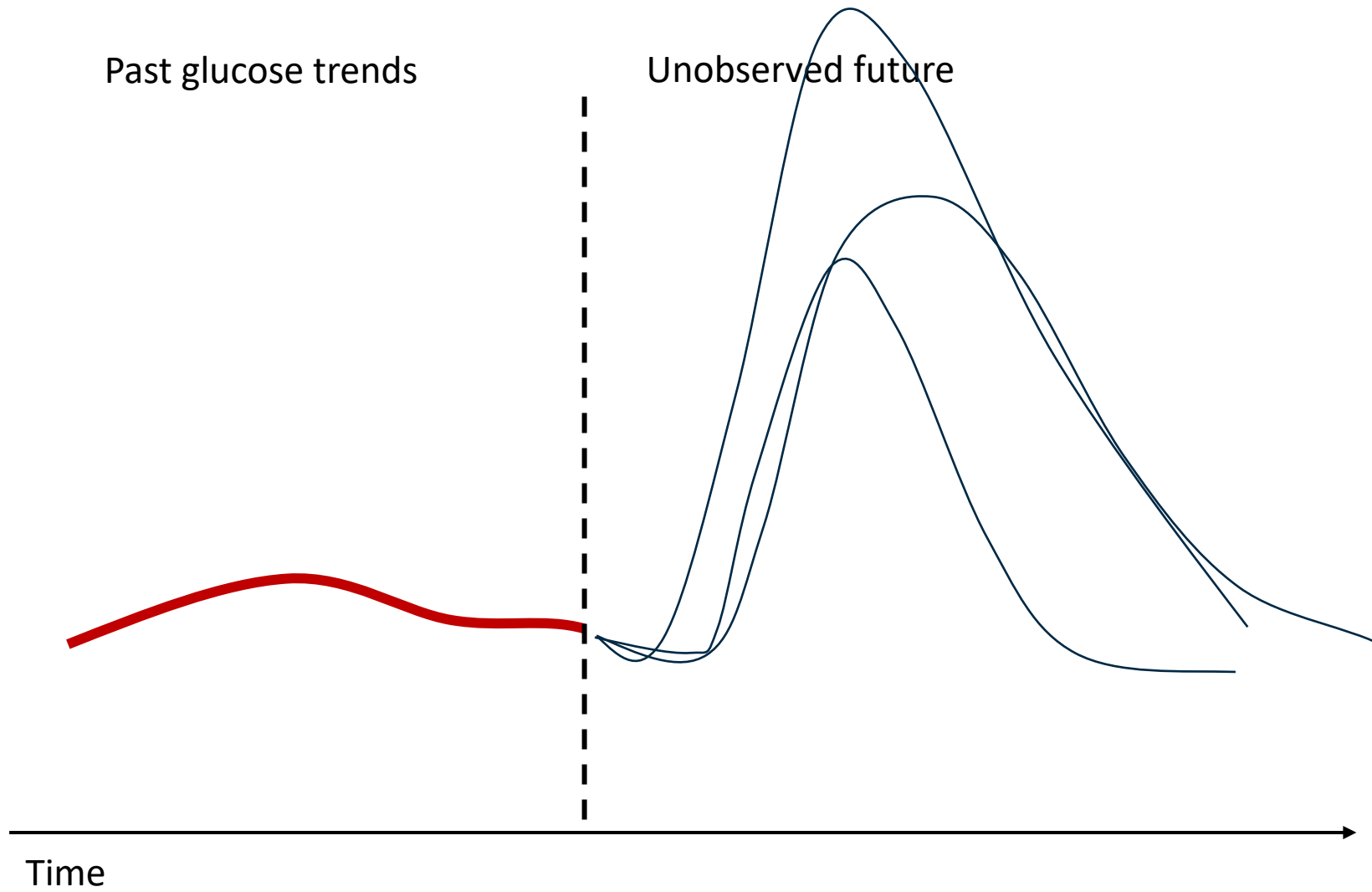


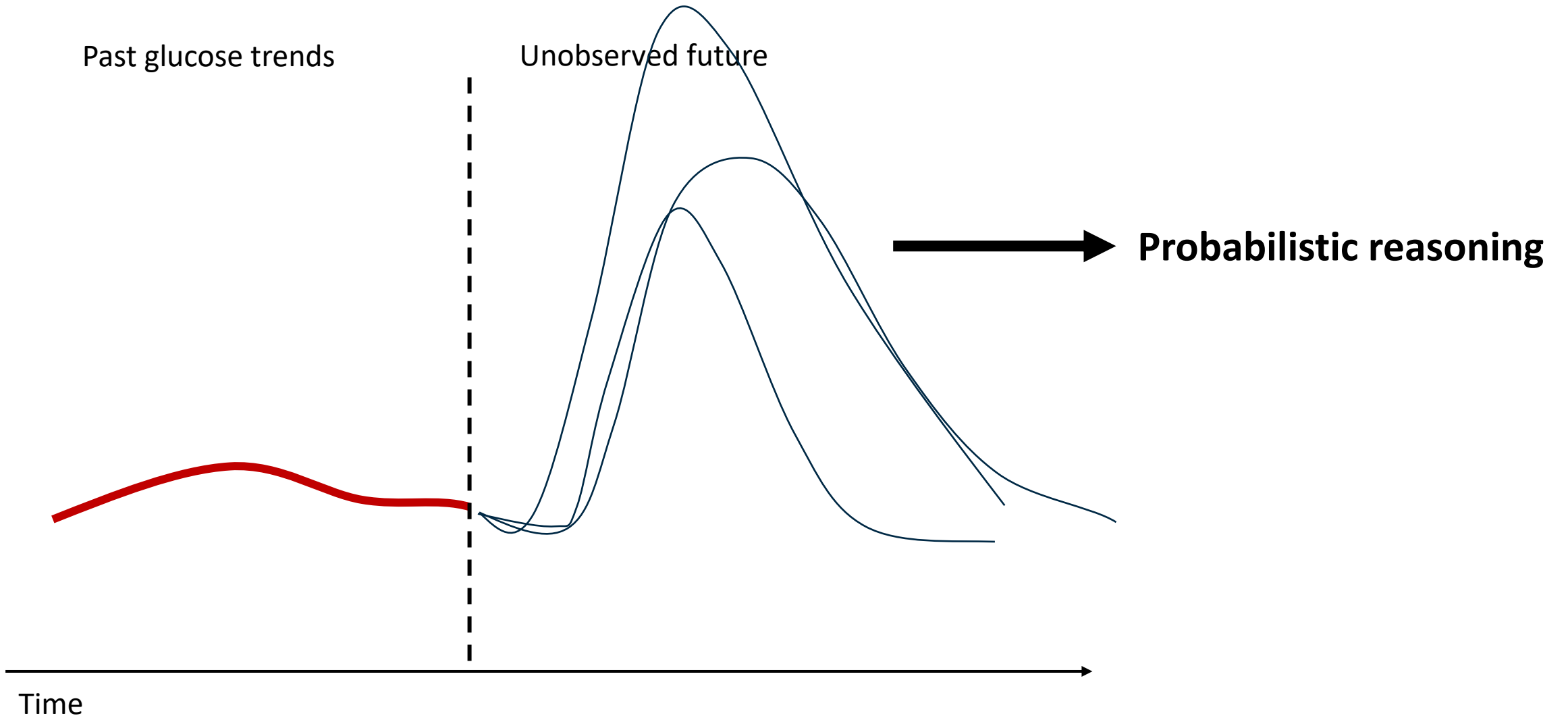
# Prediction

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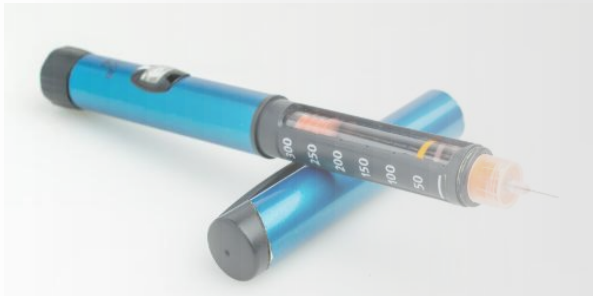


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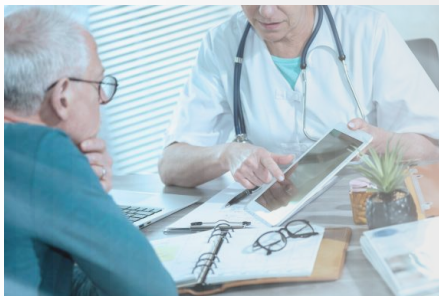


Develop and test automated insulin delivery systems

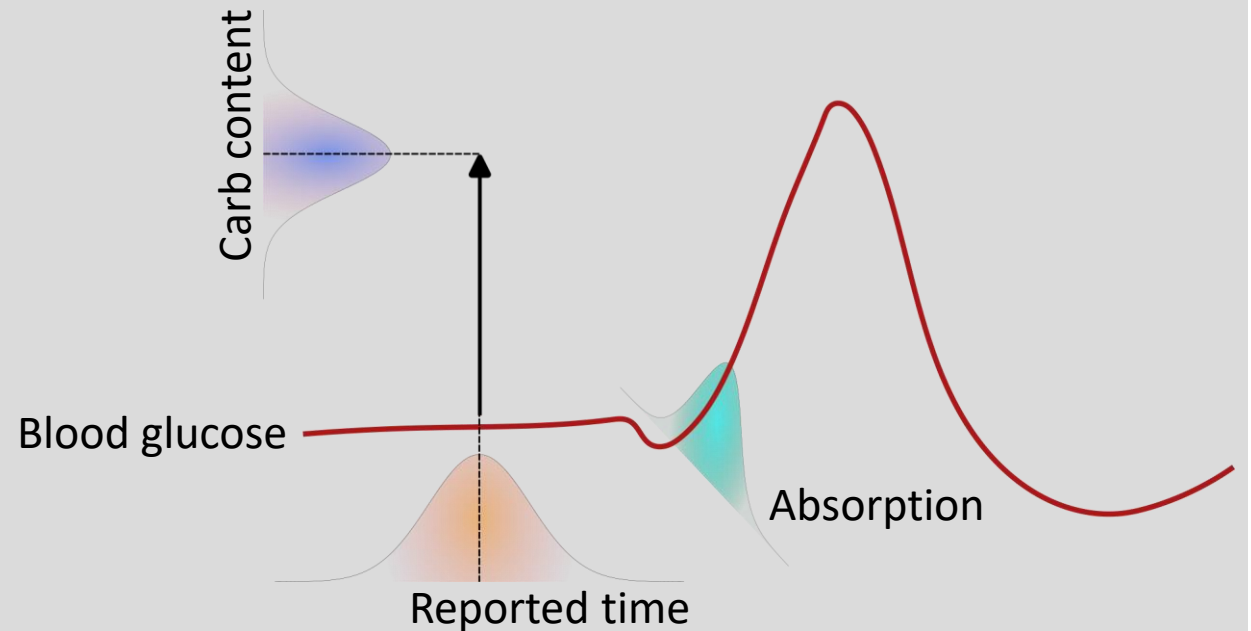
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Bolus rec



Education



## Dataset

<b>Demographics</b>	<b>Description</b>
Number of Participants	10
Condition	Type 1 Diabetes
Age	$35 \pm 7.1$ years
Body Weight	$73 \pm 9.4$ kg
HbA1c	$7.1 \pm 0.6\%$
Therapy	MDI (Multiple Daily Injections)
<b>Data sources, variables</b>	<b>Description</b>
CGM	Medtronic Guardian 3
Activity Tracker	Xiaomi MiBand 6 (for heart rate)
Data Logging Application	Diabtrend (for insulin, meals, activity)
Meal Data	From database or manual entry
Insulin Data	Fast-acting and basal injections
Physical Activity	Self-reported by user
Heart Rate	Measured by activity tracker
<b>Statistics</b>	<b>Description</b>
Sample Length	24 hours
Total Number of Samples	500 (10 patients, 50 samples/patient)
Total Meal Intakes	1349
Total Fast-acting Injections	931
Total Physical Activities	164



RESEARCH ARTICLE

## Stochastic virtual population in type 1 diabetes

Mate Siket<sup>1,2,3\*</sup>, Levente Kovacs<sup>2</sup>, Gyorgy Eigner<sup>1,2,3</sup>

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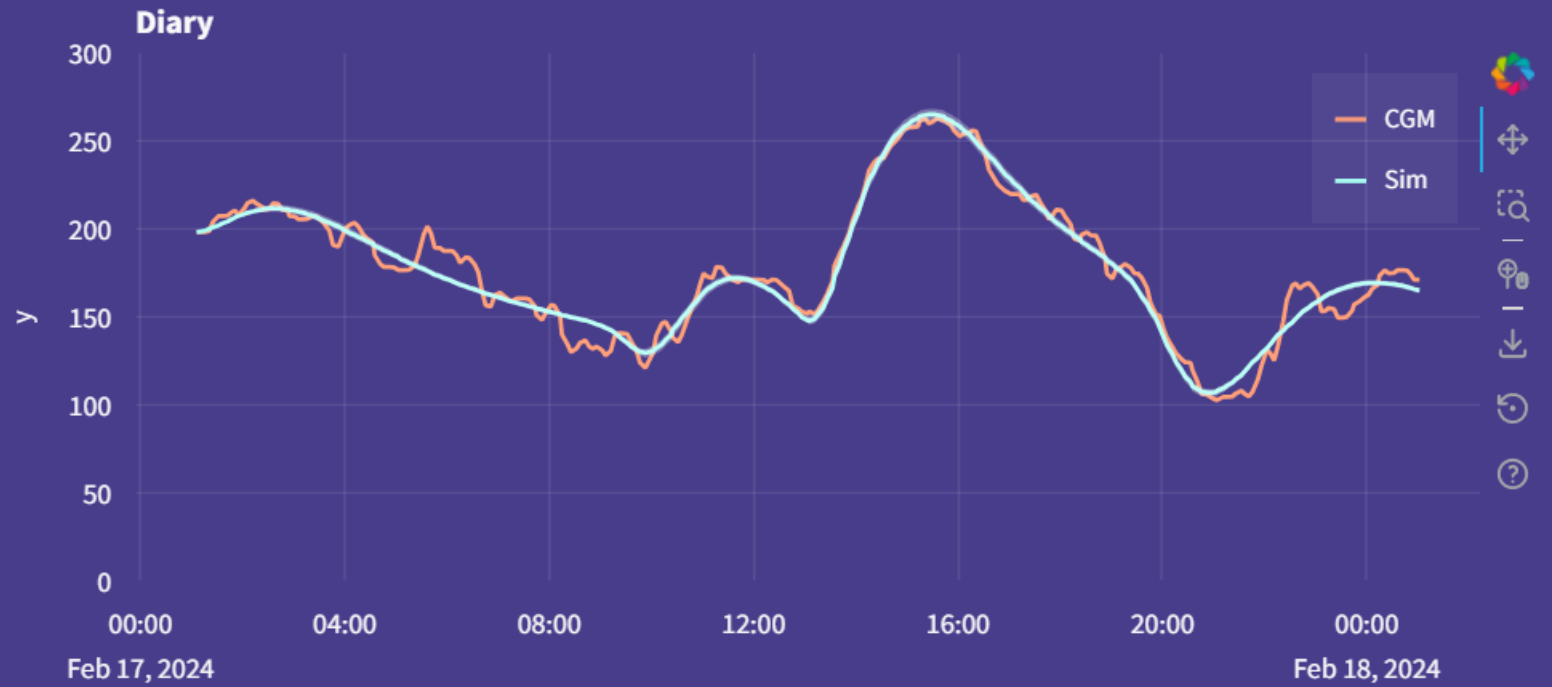
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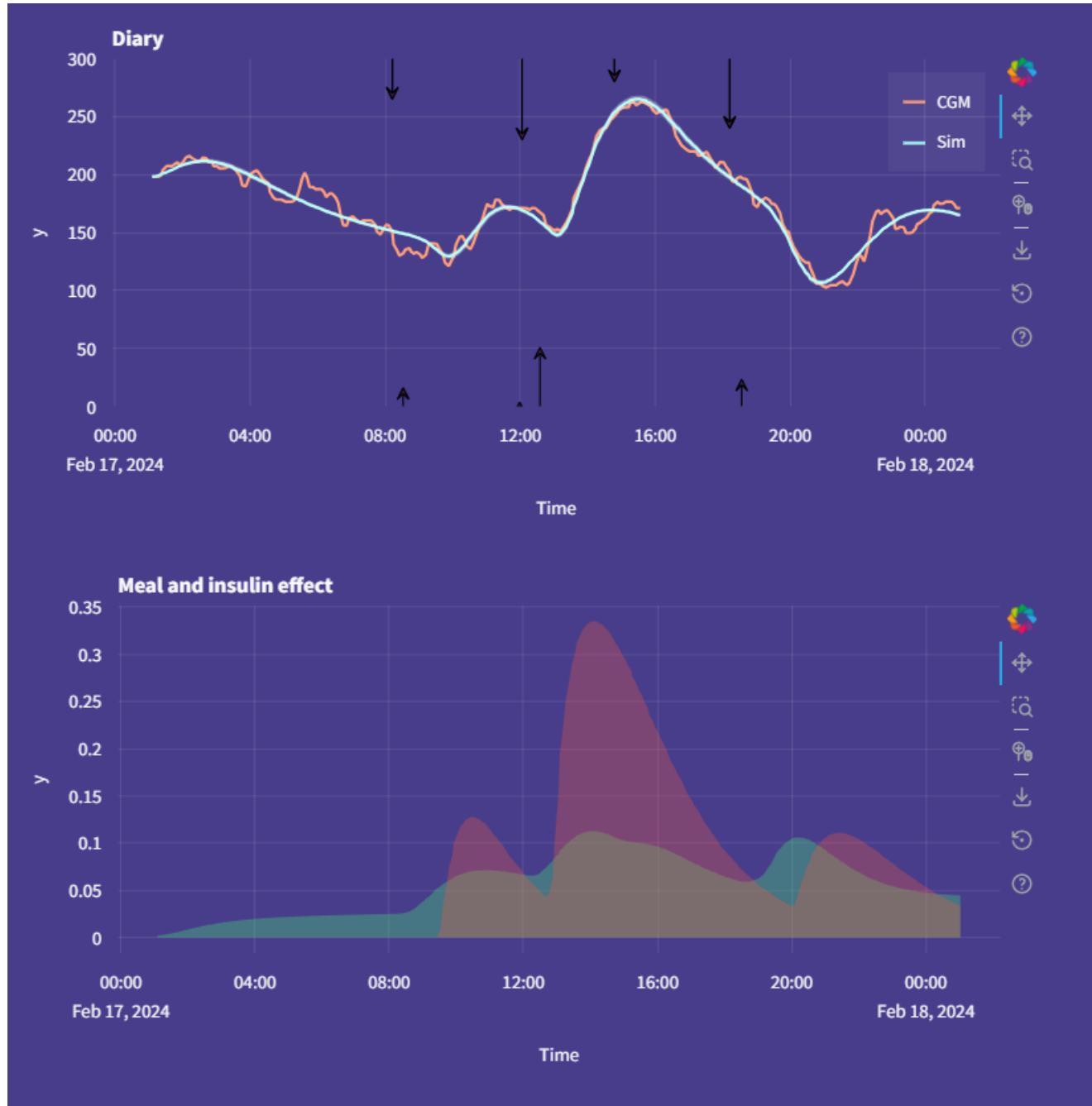
Select segment

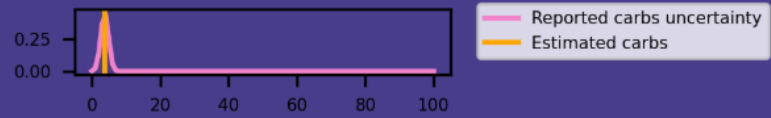
2024-02-17 02:06 - 2024-02-18 02:06

> Meals

> Boluses

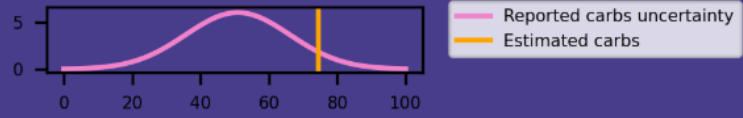






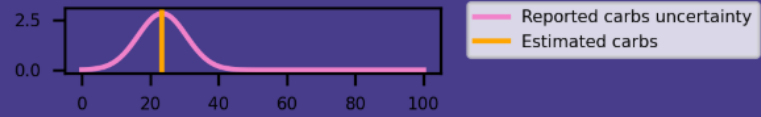
2024-02-17 11:58: reported carbs: 3 g, estimated carbs: 3 g

3.85



2024-02-17 12:35: reported carbs: 50 g, estimated carbs: 74 g

60.00

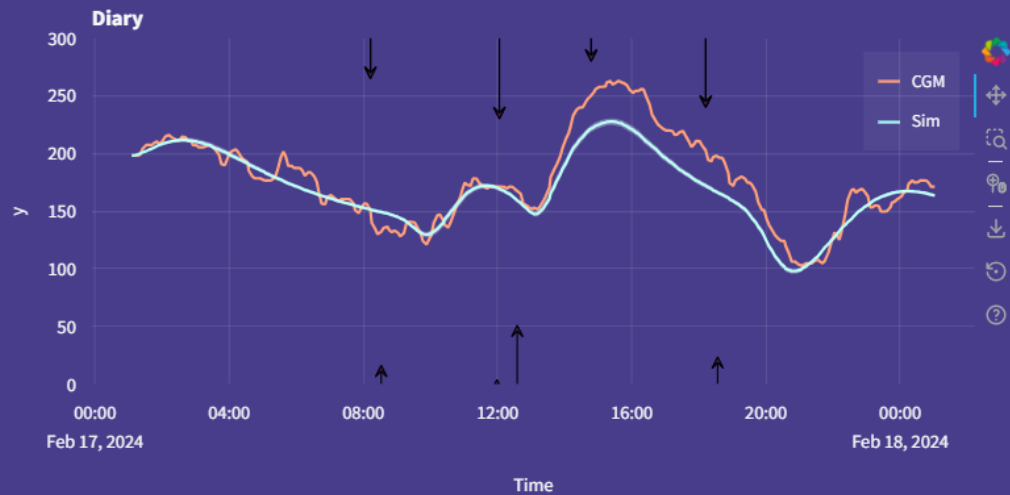


2024-02-17 18:33: reported carbs: 23 g, estimated carbs: 23 g

23.41



> Boluses



▼ Physiology

Physiology

As it happened

Circadian variability

Overall variability

This models observed changes in insulin sensitivity across different times of day, based on patterns observed over multiple days.

> Meals

> Boluses

