

Glucose predictions can improve glycemic control: A digital twin evaluation

Advanced glucose predictions have the potential to empower continuous glucose monitoring (CGM) users by enabling preventive actions to improve glycemic control.

Background & aim

The Accu-Chek® SmartGuide CGM solution facilitates proactive diabetes self-management via three predictive functionalities (Figure 1).¹

This study quantified the potential glycemic benefits of using the three predictive features in an adult population with type 1 diabetes (T1D) through a rigorous *in silico* evaluation.

Methods

The study was conducted using the next-generation, clinically backed University of Virginia Replay digital twin simulator.²

- Can be personalized using an individual's own CGM, insulin and carbohydrate data
- A powerful tool to model real-life treatment scenarios and evaluate therapeutic strategies



A control arm, simulating standard CGM with guideline-driven strategies for managing hypoglycemia and hyperglycemia,³ was compared with an intervention arm that incorporated probabilistic user behavior models responding to the CGM with predictive features.

A total of 204 digital twins were evaluated, representing 29,929 days of data taken from the REPLACE-BG clinical trial dataset.⁴

The Accu-Chek SmartGuide CGM solution offers AI-enabled prediction features:

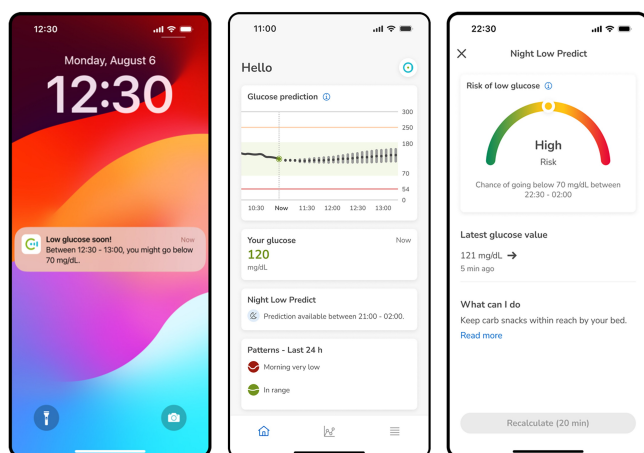


Figure 1. User interface of the predictive features.

Left: Low Glucose Predict (LGP)

- A low glucose notification that informs the user of a high risk of hypoglycemia within 30 minutes.

Middle: Glucose Predict (GP)

- A 2-hour glucose forecast, displayed with its confidence interval.

Right: Night Low Predict (NLP)

- A risk gauge indicating the likelihood of nocturnal hypoglycemia.

The predictive features are designed to improve glycemic control, reduce the burden of intrusive alarms, and enhance quality of life.⁵

Consuming 10 g of fast-acting carbohydrates in response to LGP notifications provided an optimal balance between hypoglycemia prevention and overall glycemic levels.

Glycemic outcomes with different carbohydrate doses

Intervention	% TBR (<70 mg/dL)	Mean CGM
Control	4.0±1.4	151.6±12.2
Predictive features (5 g)	2.1±0.9*	149.1±11.6*
Predictive features (10 g)	1.1±0.5*	153.4±11.0*
Predictive features (15 g)	0.8±0.4*	159.6±11.4*

Table 1. Comparison of 24-hour mean (±standard deviation) glycemic outcomes. *p<0.001 compared with the control arm. TBR, time below range.

- To identify an optimal intervention, the model was evaluated using three fast-acting carbohydrate doses ingested in response to a LGP notification: 5, 10, and 15 g.
- TBR (<70 mg/dL) was reduced with all interventions; however, the dose had a notable effect on mean CGM, highlighting a trade-off between hypoglycemia prevention and overall glycemic levels.
- 10 g provided an optimal balance.

Combined use of the predictive features led to a 2.9% reduction in TBR (<70 mg/dL), a 3.6% increase in TIR (70–180 mg/dL), and a 67% reduction in daily hypoglycemia alarms.

- The predictive features were evaluated together. Data presented here use the 10 g intervention in response to a LGP notification.
- Simulated use of the predictive features led to reduced TBR (<70 mg/dL) and a clinically meaningful increase (>3%)⁶ in TIR (70–180 mg/dL) without increasing TAR (>180 mg/dL).
- Reduced daily hypoglycemia alarms suggests potential to lessen the psychosocial burden of diabetes by mitigating stress and alarm fatigue.

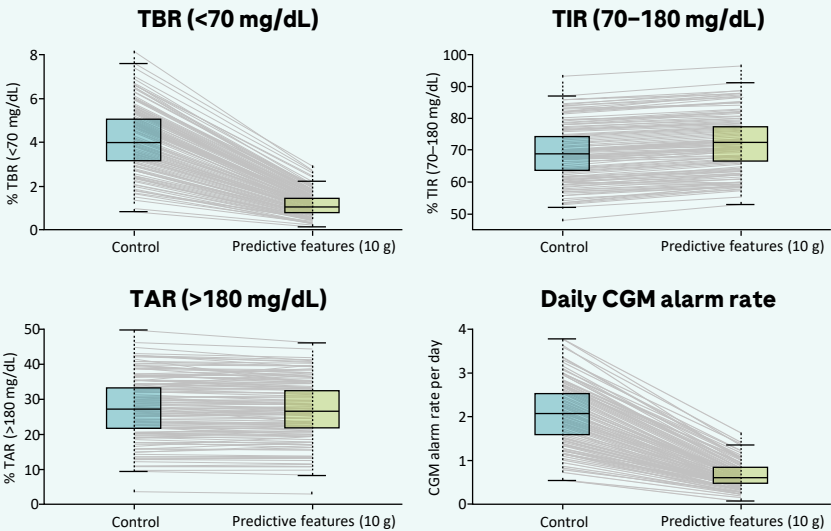


Figure 2. Box plots comparing glycemic outcomes between control and intervention arms. Data presented here use the 10 g intervention in response to a LGP notification. Plots show median (central line), interquartile range (box), and minimum/maximum values (whiskers). TAR, time above range; TBR, time below range; TIR, time in range.

Conclusions

- This robust *in silico* evaluation provides strong evidence supporting the potential clinical utility of the Accu-Chek SmartGuide CGM solution predictive features.
- Use of the features led to a reduction in the number of daily hypoglycemia alarms, a reduction in TBR, and increased TIR, without increasing TAR.

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This summary is based on the publication ‘Herrero P, et al. Glucose Predictions Improve Glycemic Control: A Digital Twin Evaluation. Diabetes Technol Ther 2026. doi:10.1177/15209156261432144.’ All unreferenced statements and figures are attributable to this publication.
1. Herrero P, et al. J Diabetes Sci Technol 2024;18:1014–26; 2. Villa-Tamayo MF, et al. Diabetes Technol Ther 2024;26:720–7; 3. American Diabetes Association Professional Practice Committee 2025; 48 (Suppl 1):S128–S45; 4. Aleppo G, et al. Diabetes Care 2017;40:538–45; 5. Glatzer T, et al. J Diabetes Sci Technol 2024;18:1004–8. 6. Battelino T, et al. Lancet Diabetes Endocrinol 2023;11:42–57.

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