# Evaluating Perplexity and Glucose Level Impact on State-Of-The-Art Generative Pre-trained Transformer (GPT) Model to Predict Glucose Values at Different Time Intervals

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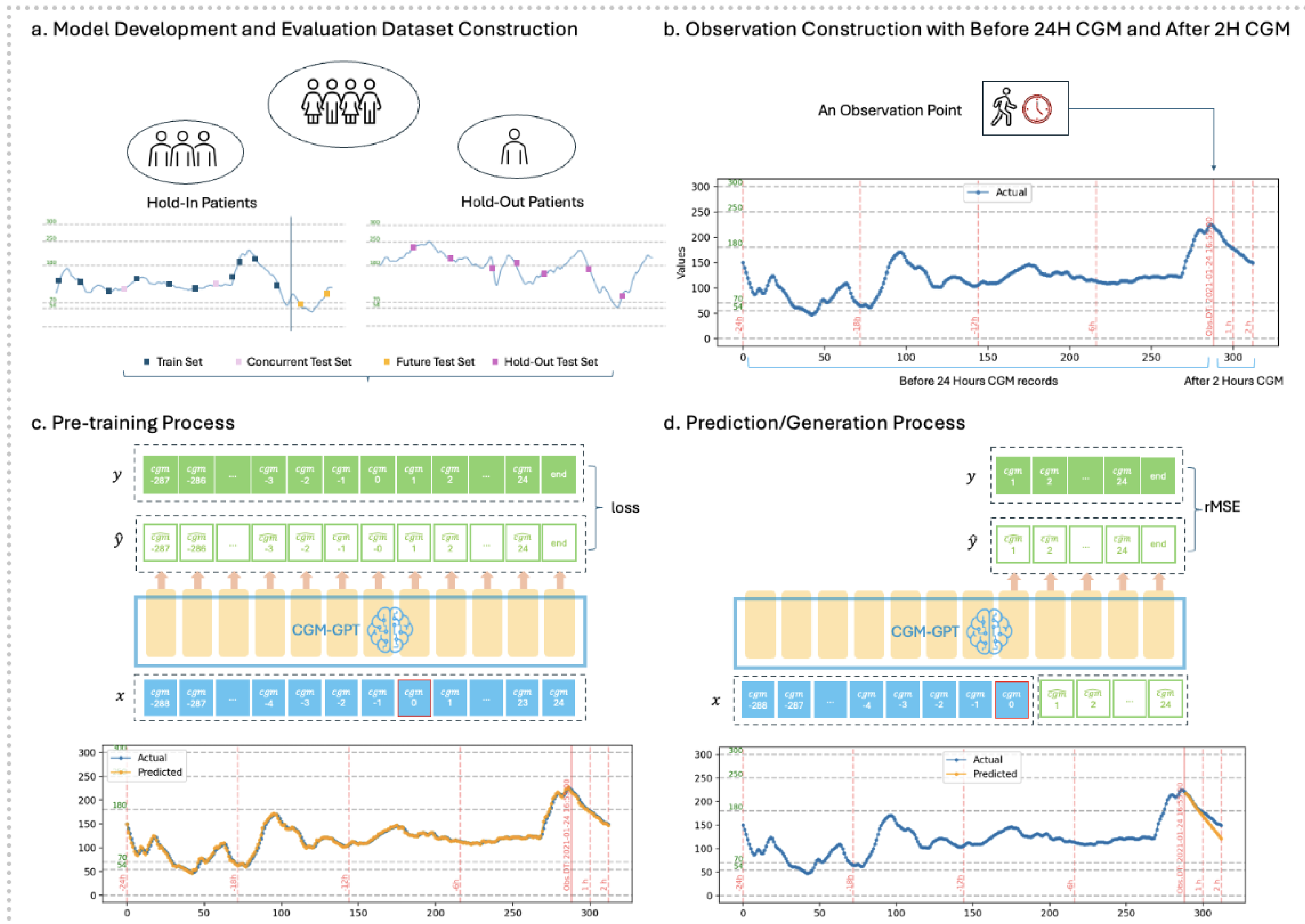
## BACKGROUND AND AIMS

The application of AI in cardiometabolic health is rapidly expanding[1], particularly in line with advancements in real-time sensor technology and data. Specific to diabetes management, the uptake of CGM continues to rise. Globally, CGM devices have been used by over 9 million individuals with diabetes.[2] The need for solutions that make CGM data more interpretable and meaningful to users is increasingly paramount for behavior modification and outcomes optimization. AI modeling, when applied to dense CGM data, can be used to predict the near-future glucose trajectory, which can then be used by a digital health platform to translate these predicted trajectories into actionable steps for users to optimize glycemia.

Welldoc has been developing GPT models (see Figure 1) to predict CGM trajectory at different time horizons.[3] In this study, we evaluated the performance of our GPT model across two prediction contexts: (a) the prior 24 hours glucose out-of-range frequency and (b) model perplexity. Perplexity is a measure of prediction uncertainty, and in this context. denotes how "surprised" a model is by a given glucose value input, based on the data on which the model was trained

**Figure 1: Design of the GPT Model**




## MATERIALS AND METHODS

A GPT model to generate CGM trajectories at 30-minute, 60-minute, and 2-hour time intervals was created using a real-world data set from 592 CGM users. Glucose out-of-range frequency was then classified into 5 categories of out-of-range glucose values: very low (<50 mg/dL), low (50-69 mg/dL), medium (180-249 mg/dL), high (250-300 mg/dL), and very high (>300 mg/dL). A perplexity score, along with the root-mean-square-error (RMSE) of the predicted glucose value vs. the actual value, were calculated.

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## RESULTS

As the prior 24-hour glucose out-of-range frequency increased, our model's root mean square error (RMSE) also increased. The largest increase in RMSE was noted when going from the medium out-of-range category to the high out-of-range category, with RMSE for 2-hour CGM generation increasing from 28 mg/dL to 33 mg/dL respectively. The 2-hour CGM generation RMSE also increased as the model perplexity increased from very low to very high.

**Figure 2: Prediction Performance by Prior 24 Hours Glucose Level**

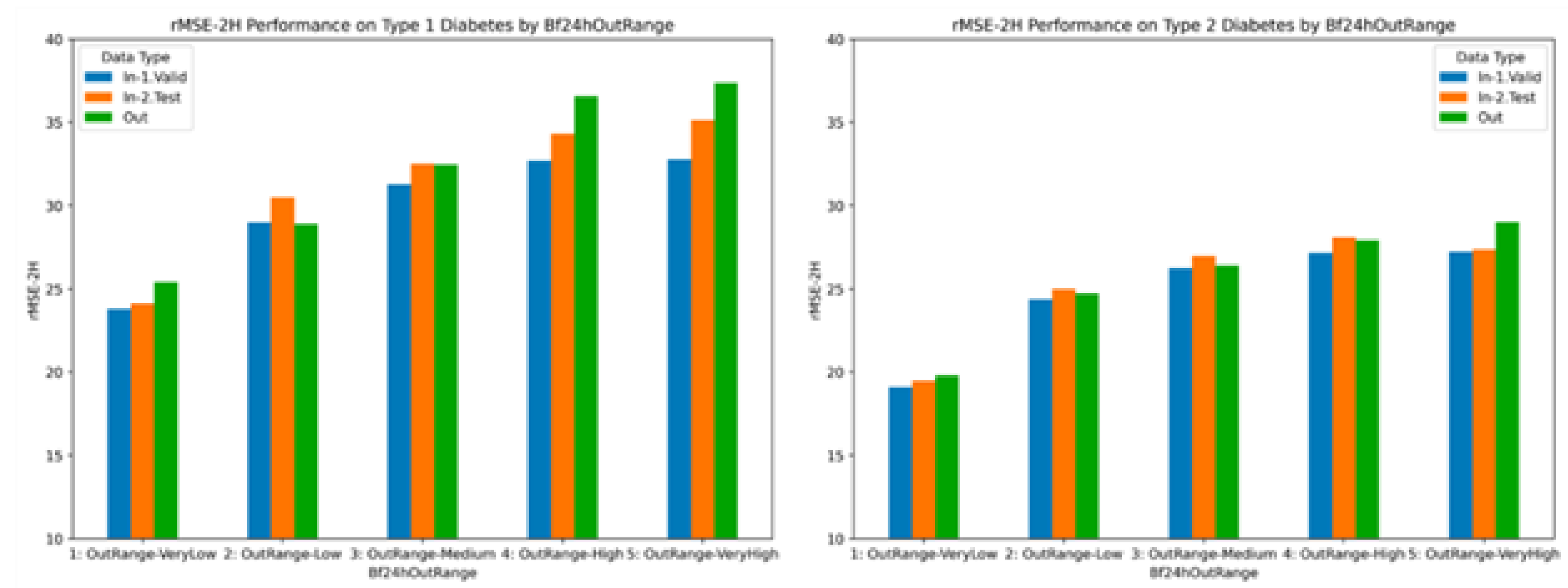
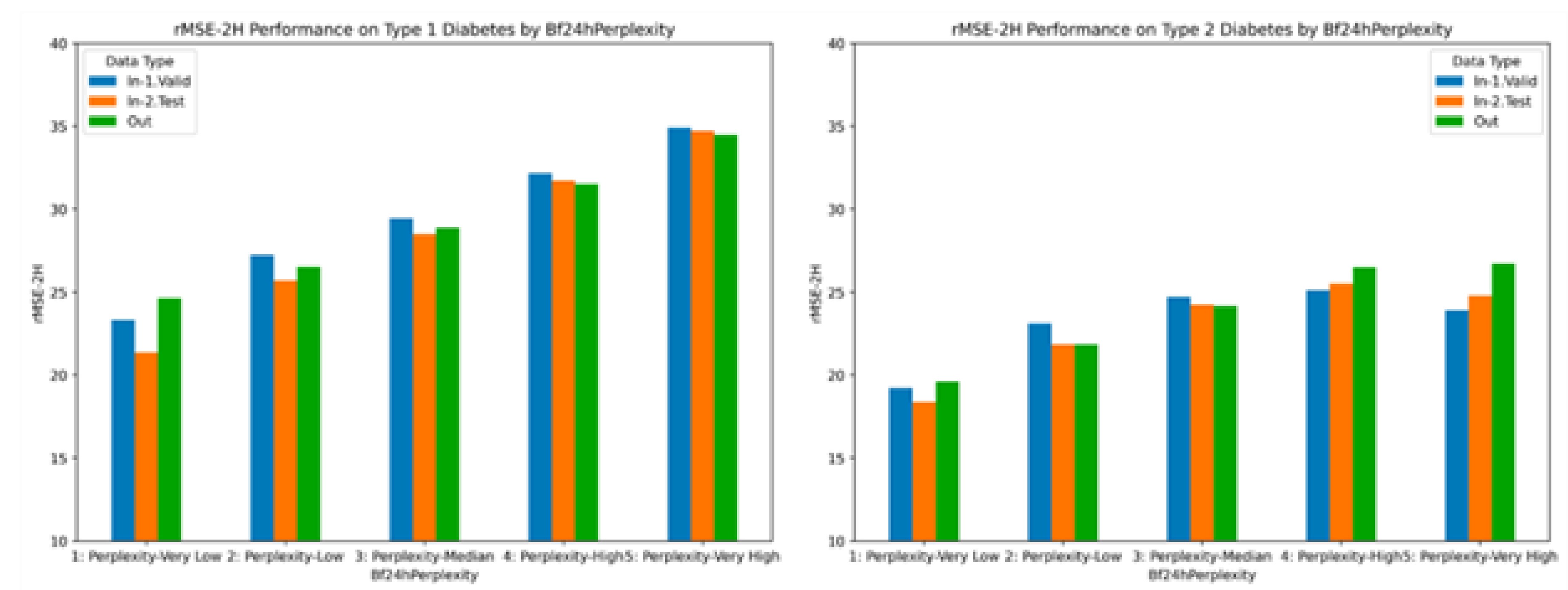



**Figure 3: Prediction Performance by Prior 24 Hours Perplexity Level**




## CONCLUSIONS

Our findings highlight the importance of fine-tuning GPT models for accurate glucose trajectory generation based on specific segments of populations. By tailoring these models, we can enhance the performance of AI-based CGM prediction, potentially enabling more optimal feedback to individuals in monitoring their glucose levels as well as their overall health. Additionally, such capabilities can also enable different models for CGM usage, including intermittent sensor wear. This could lead to significant cost savings for individuals and their healthcare providers in optimizing comprehensive diabetes management programs.

## REFERENCES

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