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Identifying Patterns in Long Term CGM and Insulin Data - An Explorative Study

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Abstract. The increased utilization of continuous glucose monitors (CGM) and smart insulin pens (SIP) among people with type 2 diabetes generates significant health data. This study explored possible patterns in long term CGM and SIP data.

Keywords. Long term data, patterns, continuous glucose monitor, smart insulin pen

1. Introduction

The increased utilization of continuous glucose monitoring (CGM) and smart insulin pens (SIP) creates an abundance of personal health data [1]. Current recommendations advise health care professionals (HCPs) to focus on the last 14 days of data despite often having three to six months of available data [2]. However, short term data focus eliminates identification of crucial daily patterns in the glycemic control [3]. Hence, the aim of this study was to explore possible patterns in long term CGM and SIP data.

2. Methods

Relevant patterns for long term CGM and SIP data analysis were identified through a comprehensive systematic literature search in PubMed, Embase and Scopus, and participant observations with three medical laboratory technicians working with CGM and SIP data at Aalborg University Hospital.

Three months of CGM and SIP data from a telemonitoring trial (NCT04981808) was used. The dataset included CGM data and insulin injections data (dosage, timing, and insulin type) from people with type 2 diabetes (T2D). Data from 10 randomly chosen participants were processed and visualized using MatLab R2023a. To identify daily patterns for one participant, the three-month data were visualized for each weekday. To identify patterns in overall change of glycemic control, fasting blood glucose (FBG) and

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basal insulin dosages from each day of the three-month period were visualized. All figures were analyzed through visual inspection.

3. Results

Daily patterns and patterns in overall change in glycemic control were detected. Figure 1 illustrates a recurring hyperglycemia pattern every Tuesday from 8 pm to midnight, with 95% of values surpassing 10 mmol/L. This pattern shows an injection of bolus insulin in the hours before the hyperglycemia episodes, but no prevention of those are observed.

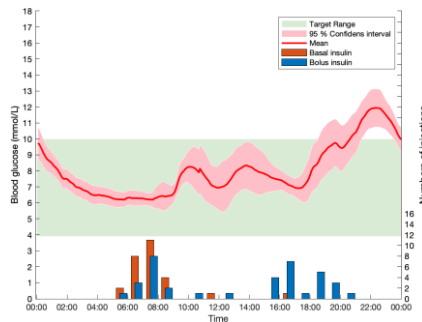


Figure 1. Long term CGM and SIP data from one patient - Tuesday.

4. Discussion

We identified daily patterns of undesirable deviations in blood glucose resulting in hyperglycemia. People with diabetes should aim to be “in range” >70 % of the time to prevent diabetes complications like cardiovascular diseases[1]. Deviations in injection of basal insulin were also identified, despite recommendation on consistent timing[2]. Identifying this pattern may assist HCPs tailor education based on personal data contributing to improved blood glucose levels [3]. The findings suggest the potential use of machine learning for analyzing long-term CGM and SIP data.

This study has methodical limitations, primarily due to the reliance on subjective visual inspection. In conclusion, identifying daily patterns in long term CGM and SIP data appears possible and may improve diabetes management, but future research is needed.

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