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Glucose Control in the First Years After Type 1 Diabetes Diagnosis: The Feasibility Study

Introduction

- Type 1 Diabetes (T1D) is characterized by the chronic dysregulation of blood glucose due to the destruction of insulin-producing beta cells, usually early in life.
- The therapeutic goal in T1D is to maintain strict blood glucose control through intensive insulin therapy. However, the effectiveness of this approach varies among individuals.
- Initiating intensive glucose control early in the disease course may reduce the risk of long-term complications, a phenomenon referred to as 'metabolic memory'.

Aims

- To describe changes in glucose control within five years after T1D diagnosis, using data from Continuous Glucose Monitoring (CGM) systems alongside glycated hemoglobin (HbA1c) levels.

Methods

I collected data from three cohorts:

- A retrospective cohort covered the period from 2016 to 2019 and was previously described in Chrzanowski (2021).
- A prospective cohort, based on the SWEET Registry Data Harmonization Initiative, began in January 2020 and is ongoing.
- An international cohort based on open-access patient-level data from the Jaeb Centre for Health Research and Zenodo.

Inclusion criteria were: confirmed Type 1 Diabetes (T1D), age at enrollment under 18 years old, diabetes duration less than five years, and at least three periods (years) of data available.

Data processing and analysis were conducted using GlyCulator 3.0, adhering to the established protocol for center benchmarking (Chrzanowski, 2023). The consistency of glucose control across periods was tested with Levene's test for homogeneity of variance. Subgroup classification was achieved through K-means clustering, identifying distinct trajectories in glucose control across the patient data.

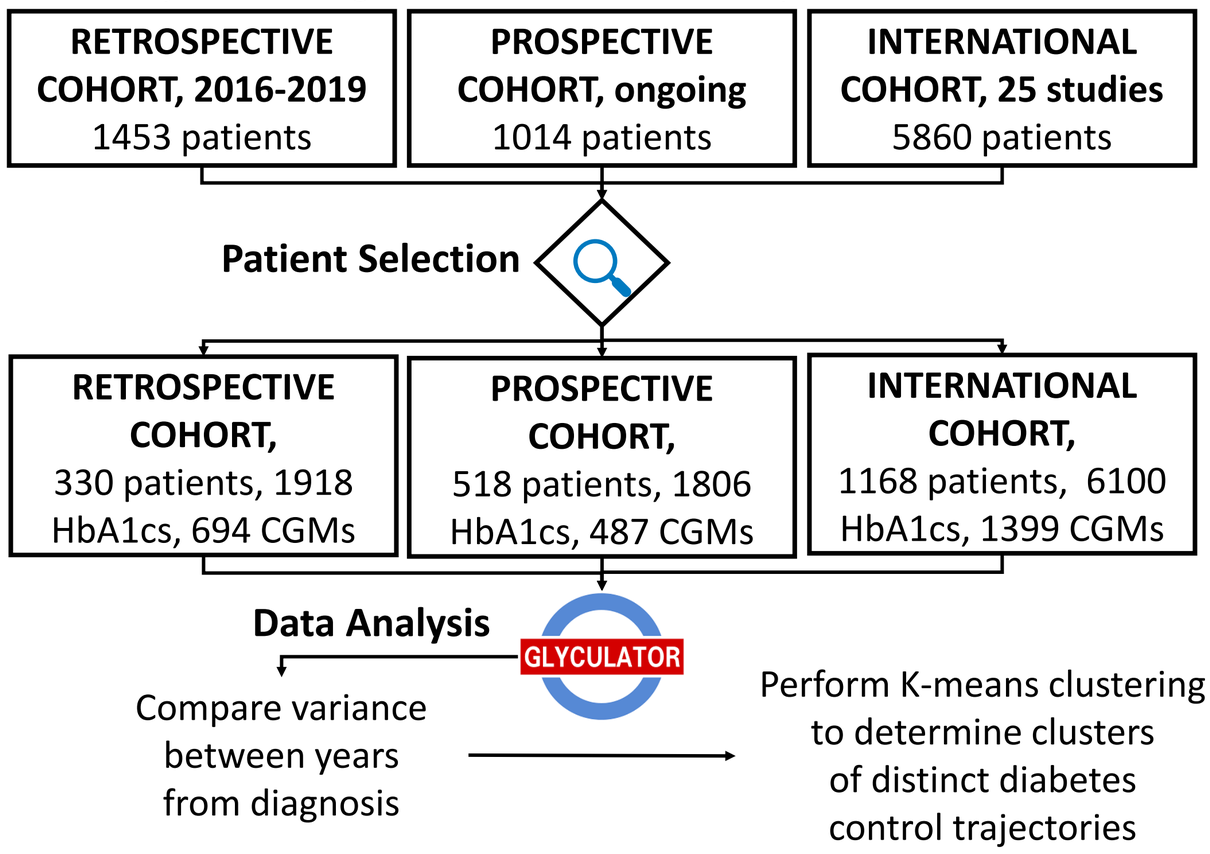

Figure 1. Patient Selection and Data Analysis Flowchart.

Abbreviations: CGM – Continuous Glucose Monitoring, HbA1c – Glycated Hemoglobin.

Results

- Altogether, 2,016 pediatric patients with T1D were included in the analysis (Figure 1). Detailed group characteristics and showcase of glucose control are presented in Table 1 and Figure 2.
- K-means clustering revealed a distinct subgroup with high variance in glycemic control trajectories during the first three years post-diagnosis (Figure 3), indicating a need for personalized management strategies.

Table 1. Clinical characteristics of cohorts and summary of available data.

Cohorts	Retrospective	Prospective	International
Patients number	330	518	1168
Age [years]	8.13±3.41	7.64±3.95	10.24±5.09
T1D duration [years]	0.85±1.48	0.13±1.01	2.16±1.51
HbA1c/CGM periods (measurements)	587 (1918) / 512 (6575)	1149 (1806) / 1309 (15704)	2031 (6100) / 627 (1476)
Mean HbA1c [%]	7.37±1.04	8.36±2.58	7.83±1.24
Mean TIR [%]	71.78±12.83	64.37±15.41	61.96±17.13

Abbreviations: CGM – Continuous Glucose Monitoring, HbA1c – Glycated Hemoglobin, TIR – Time in Target Range (70-180 mg/dL), T1D – Type 1 Diabetes.

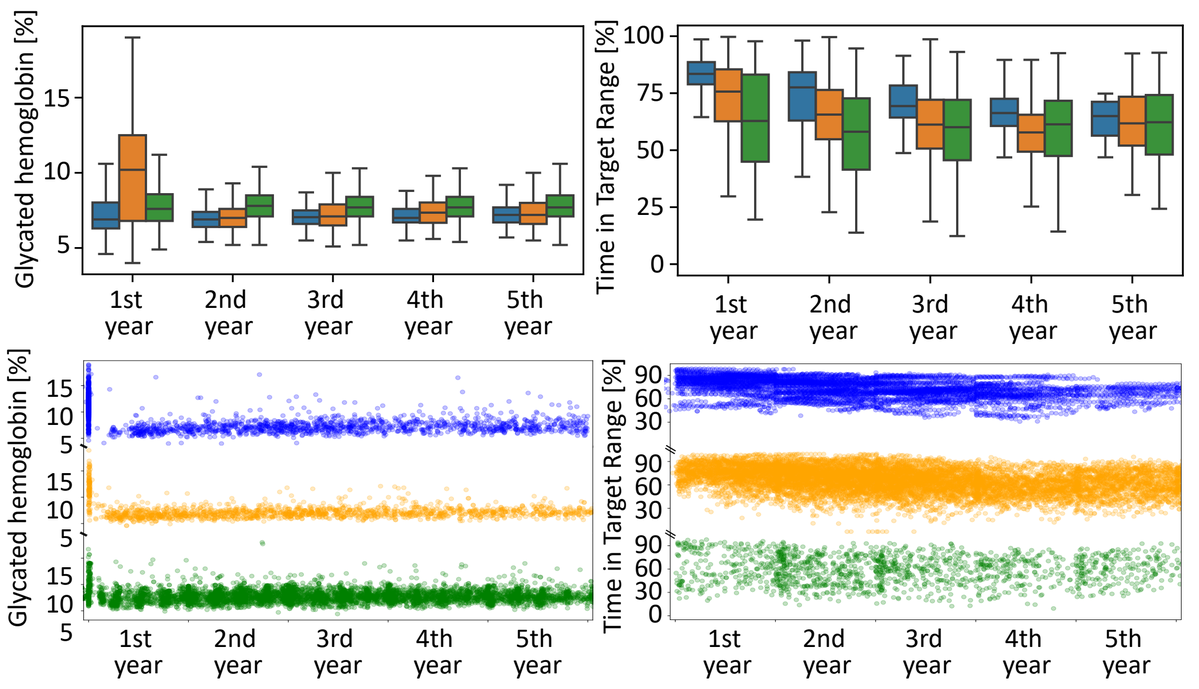

Figure 2. Glucose control measured by glycated hemoglobin and Time in Target Range (70-180 mg/dL). Upper: Box plots for each cohort and year. Lower: Scatter plots – each dot represents a measurement. Blue represents the retrospective cohort, orange the prospective cohort, and green the international cohort.

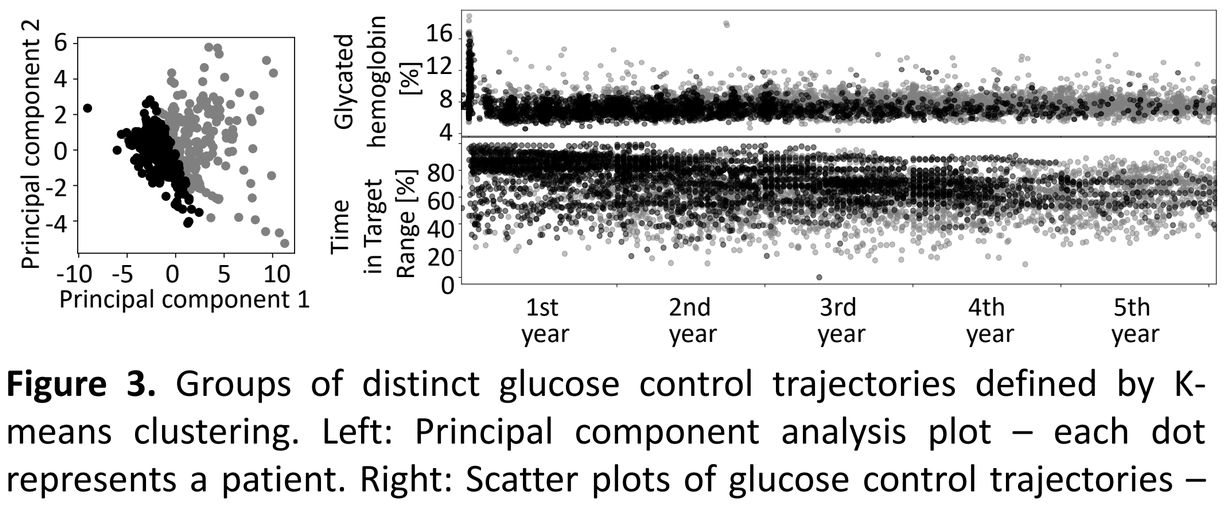

Figure 3. Groups of distinct glucose control trajectories defined by K-means clustering. Left: Principal component analysis plot – each dot represents a patient. Right: Scatter plots of glucose control trajectories – each dot represents a measurement. Black represents the low variance group, grey the high variance group.

Ongoing tasks

Ongoing tasks include: patient recruitment for epigenetic study (RNN/236/23/KE), lab method standardization, funding applications (BRAIN PI, ISPAD-JDRF), registration of systematic reviews (PROSPERO 536700, 540302) and planned participation in the ISPAD Summer Science School (September 2024).

References and Acknowledgements

1. Chrzanowski J et al. GlyCulator 3.0: A Fast, Easy-to-Use Analytical Tool for CGM Data Analysis, Aggregation, Center Benchmarking, and Data Sharing. Diabetes Care; 46 (1): e3–e5 (2023).
2. Chrzanowski J et al. Improved Estimation of Glycated Hemoglobin from Continuous Glucose Monitoring and Past Glycated Hemoglobin Data. Diabetes Technol Ther. 2021;

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