ECRONICON OPEN ACCESS

EC DIABETES AND METABOLIC RESEARCH
Research Article

A Case Study of Investigation and Prediction of A1C Variances Over Five Periods Using GH-Method: Math-Physical Medicine

Gerald C Hsu*

eclaireMD Foundation, USA

***Corresponding Author**: Gerald C Hsu, eclaireMD Foundation, USA.

Received: April 09, 2020; **Published:** May 29, 2020

Abstract

The author developed his GH-Method: math-physical medicine (MPM) by applying mathematics, physics, engineering modeling, and computer science such as big data analytics and artificial intelligence to derive the mathematical metabolism model and three prediction tools for weight, FPG, and PPG with >30 input elements. In this research paper based on a collection of big data, he analyzed, predicted, and interpreted his hemoglobin A1C variances over five periods utilizing the MPM approach.

Keywords: *Type 2 Diabetes; Fasting Plasma Glucose; Postprandial Plasma Glucose; Hemoglobin A1C; Artificial Intelligence; Math-Physical Medicine*

Introduction

The dataset is provided by the author, who uses his own type 2 diabetes (T2D) metabolic conditions control, as a case study via the "math-physical medicine" approach of a non-traditional methodology in medical research.

Math-physical medicine starts with the observation of the human body's physical phenomena (not biological or chemical characteristics), collecting elements of the disease related data (preferring big data), utilizing applicable engineering modeling techniques, developing appropriate mathematical equations (not just statistical analysis) and finally predicting the direction of the development and control mechanism of the disease.

In this case study, the author analyzed, predicted, and interpreted his hemoglobin A1C variances based on five periods data utilizing the GH-Method: math-physical medicine (MPM) approach [1-5].

Method

There are six hemoglobin A1C checkup results at the same hospital:

- 6.7% on 4/9/2017
- 6.1% on 9/12/2017
- 6.9% on 1/26/2018

- 6.5% on 6/29/2018
- 6.6% on 10/22/2018
- 6.8% on 4/4/2019.

The author selected five periods of almost equal length with five months each and then observed their measured A1C changes (variances) as follows:

- Period A (4/1/2017 - 8/31/2017): -0.6%
- Period B (9/1/2017 - 1/31/2018): +0.8%
- Period C (2/1/2018 - 6/30/2018): -0.4%
- Period D (6/29/2018 - 10/22/2018): +0.1%
- Period E (10/22/2018 - 4/4/2019): +0.2%.

He applied his developed MPM approach to analyze five A1C variances contributed by:

1. A1C variances contributed by FPG
2. FPG variance due to weight change
3. Colder weather impact on FPG
4. A1C variances contributed by PPG
5. PPG variance due to carbs/sugar intake
6. PPG variance due to post-meal walking
7. Warm weather impact on PPG.

Results

Based on the author's previous numerous publications of HbA1C contributions by fasting plasma glucose (FPG) and postprandial plasma glucose (PPG), along with the prediction models of glucose and A1C. Table 1 displays a step-by-step calculation on how to derive and interpret the causes of the these A1C variances.

Period	Date: From	Date: To	Weight Change	FPG: From	FPG: To	FPG Change	Glucose dueto FPG (25%)	A1C (due to FPG) @ 12.5
A	4/1/17	8/31/17	9	131	107	-24	-6	-0.48
B	9/1/17	1/31/18	-5	109	125	16	4	0.32
C	2/1/18	6/30/18	4	124	113	-11	-3	-0.22
D	6/29/18	10/22/18	2	113	108	-5	-1	-0.10
E	10/23/18	4/4/19	0	107	119	12	3	0.24
Period	Date: From	Date: To	Carbs/Sugar (gram) / Walking (steps)	PPG: From	PPG: To	PPG Change	Glucose due to PPG (75%)	A1C (due to PPG) @ 12.5
A	4/1/17	8/31/17	-1 / 400	121	119	-2	-1.5	-0.12
B	9/1/17	1/31/18	+3 / -300	112	120	8	6	0.48
C	2/1/18	6/30/18	-2 / +200	119	116	-3	-2	-0.18
D	6/29/18	10/22/18	+6 / -800	115	119	4	3	0.24
E	10/23/18	4/4/19	-1 / -540	118	117	-0.9	-0.7	-0.05
Period	Lab Dates	Lab Results	Lab (A1C Change)	A1C due to FPG	A1C due to PPG	Predicted A1C Variance	eclaireMD Predicted A1C %	
	10/31/16	6.6%						
A	4/9/17	6.7%	0.1%	-0.48	-0.12	-0.60	6.1%	
B	9/12/17	6.1%	-0.6%	0.32	0.48	0.80	6.9%	
C	1/26/18	6.9%	0.8%	-0.22	-0.18	-0.40	6.5%	
D	6/29/18	6.5%	-0.4%	-0.10	0.24	0.14	6.6%	
E	10/22/18	6.6%	0.1%	0.24	-0.054	0.19	6.8%	
	4/4/19	6.8%						

Table 1: *Calculation of A1C variances (five periods).*

As shown, his eclaireMD predicted A1C variances completely match the test results from the laboratory.

Conclusion

The A1C case study focused on five periods within 733 days. It contains 2,199 meals data, including carbs/sugar intake, exercise, weather, etc. This study has demonstrated a high degree of accuracy on calculating the patient's A1C variance by using the GH-Method: math-physical medicine approach. Once the medical professionals or T2D patients understand and learn this skill for the HbA1C prediction method, the patient's overall T2D condition can then be under control more easily prior to the available lab-tested results. The reason for the author's research is to prevent further damage to the patient's body, while waiting for the laboratory test results.

Bibliography

1. Hsu Gerald C. "Using Math-Physical Medicine to Control T2D via Metabolism Monitoring and Glucose Predictions". *Journal of Endocrinology and Diabetes* 1.1 (2018): 1-6.

2. Hsu Gerald C. "Using Math-Physical Medicine to Analyze Metabolism and Improve Health Conditions". Video presented at the meeting of the 3rd International Conference on Endocrinology and Metabolic Syndrome, Amsterdam, Netherlands (2018).

3. Hsu Gerald C. "Using Signal Processing Techniques to Predict PPG for T2D". *International Journal of Diabetes and Metabolic Disorders* 3.2 (2018): 1-3.

4. Hsu Gerald C. "Using Math-Physical Medicine and Artificial Intelligence Technology to Manage Lifestyle and Control Metabolic Conditions of T2D". *International Journal of Diabetes and its Complications* 2.3 (2018): 1-7.

5. Hsu Gerald C. "A Clinic Case of Using Math-Physical Medicine to Study the Probability of Having a Heart Attack or Stroke Based on Combination of Metabolic Conditions, Lifestyle, and Metabolism Index". *Journal of Clinical Review and Case Reports* 3.5 (2018): 1-2.

Volume 4 Issue 6 June 2020