The GH-Method

Comparison of Two Clinic Cases Using Big Data Analytics and Spatial Analysis to Investigate the Relationships Among Weight, Glucose, Blood Pressure (Math-Physical Medicine)

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Abbreviations: BP: blood pressure; FPG: fasting plasma glucose; PPG: postprandial plasma glucose

1. INTRODUCTION

The author uses math-physical medicine approach to investigate three pairs of relationship between:

(1) weight vs blood pressure (BP)
(2) weight vs glucose (daily averaged glucose, including both FPG and PPG)
(3) glucose and BP

There are two clinic cases to be presented here. Case A uses lifestyle management to control his metabolic disorders while Case B uses both medications and lifestyle management to control the same three chronic diseases.

2. METHODS

Both cases selected the same time periods for results comparison: 1,770 days (1/1/2014 - 11/6/2018) with big data of 17,700 metabolic syndrome (weight, BP, glucose) each. This paper utilized two statistical tools, i.e. time-series (x or y vs time, similar to EKG charts) and spatial analysis (in a two-dimensional x and y space, without "time" factor).

In time-series graphs, if the correlation coefficient (R) is greater than 50%, then these two sets of data (or curves) are highly correlated to each other (i.e. strong). If R is smaller than 30%, then considered as weak-correlated. Since R can only be calculated for two sets of data (or curves), therefore, this paper investigated 3 separate sets of pair inter-relationships among these three metabolic elements.

In spatial analysis, if the "data cloud" is concentrated within a long and narrow band and also skewed with an angle (i.e. slope is much greater than zero), then these two sets of data are highly correlated. On the other hand, if the angle of the plotted point cloud is either flat or vertical, then there is a very weak correlation between them.

3. RESULTS

For Case A, the highly correlated results are observed in attached figures, and also listed as follows:

(1) weight vs BP: 68%
(2) weight vs glucose: 78%
(3) glucose vs BP: 85%

The Case A patient is a male with 25-year history of 3 chronic diseases, including diabetes, hypertension, and hyperlipidemia. His BMI was dropped from 32 to 24 over 8 years and maintains around 25 during this data period. He doesn't take any medication for his metabolic disorders during this data period and depends solely on his strong determination and discipline on managing his lifestyle details.

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However, for Case B, both visual perception and data reality are very different from Case A. This patient is an "overweight" female with BMI bumping between 26 and 29 during this data period. Her calculated R in time-series Analysis and data cloud's shape and orientation in spatial Analysis have shown weak correlations among these three metabolic conditions (Figures 1-5).

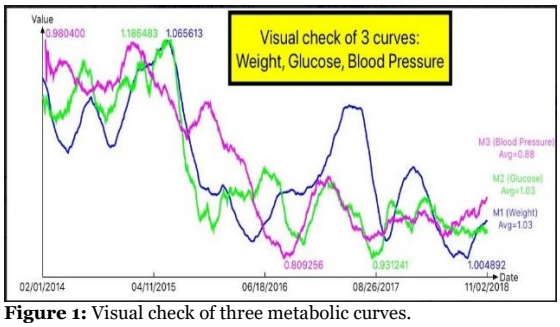

Figure 1: Visual check of three metabolic curves.

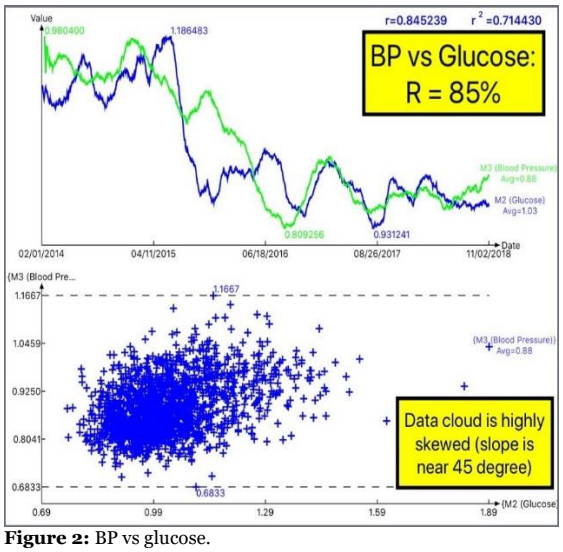

Figure 2: BP vs glucose.

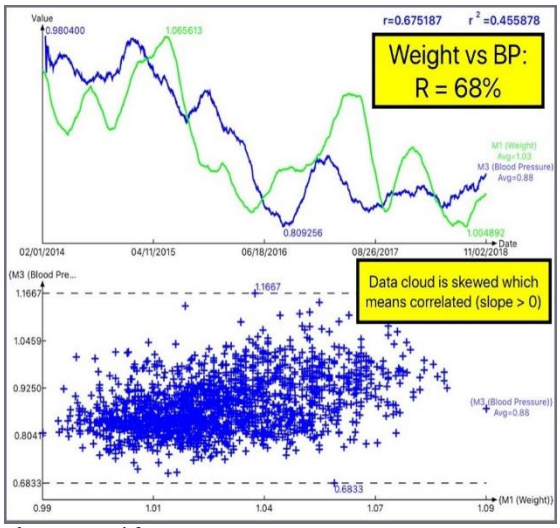

Figure 3: Weight vs BP.

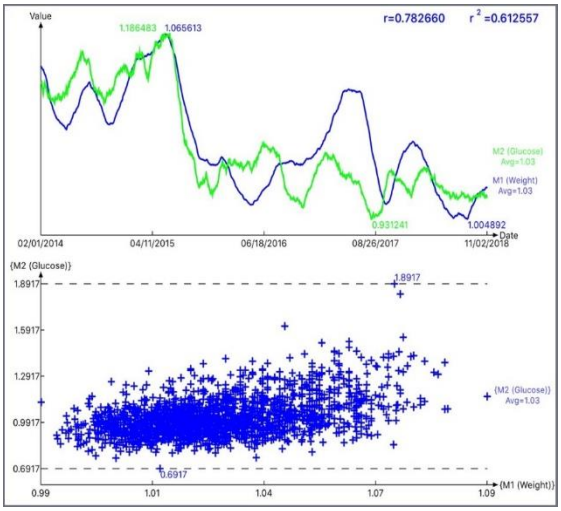

Figure 4: Weight vs glucose.

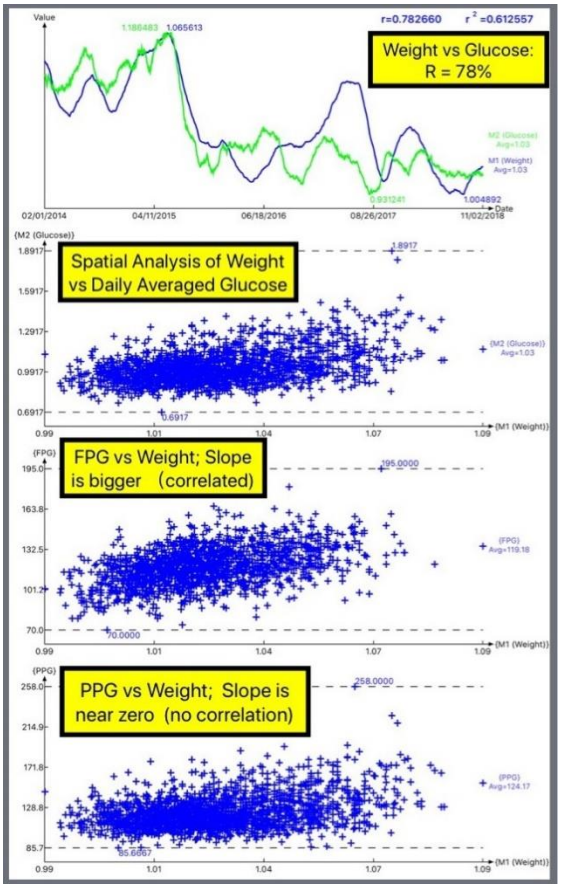

Figure 5: Weight vs FPG & weight vs PPG.

The author observed the following facts by digging the background of her data deeper:

(1) Her overweight situation is obvious and stubbornly persisted.

(2) She has 3 metabolic disorders over 20 years, including diabetes, hypertension, and hyperlipidemia.

(3) She has taken medications for 3 metabolic conditions.

(4) During this data period, she has been careful about her carbs/sugar intake and post-meal exercise. However, she has ignored her food portion, particularly eating various snacks between meals. This is the main source of her overweight problem.

(5) Her data in spatial analysis between glucose and BP is much more concentrated than the other two graphs. Data are clustered into a football shape. This graphic phenomenon indicated most of her glucose and BP data are confined in a narrow range which is due to her effective medication treatment. This is quite different from Case A where his graphs demonstrate his natural biological rhythms without chemical compound intervention.

4. CONCLUSION

Clinic case A has three strong R values existing among weight, BP, and glucose. That means his three metabolic syndromes are related to each other in a natural way without medication intervention.

Clinic case B demonstrates medications are quite effective to control her chronicle conditions in combination with her partial effort of lifestyle management. However, her overweight still represents a risk to her overall health.

The author did not discover any new findings, by using the math-physical medicine approach, he was able to offer additional mathematical proof and quantitative evidence of metabolic disorder control via both lifestyle management and medication treatment.