Progressive Behavior Modification for Diabetes Patients Based on the GH-Math-Physical Medicine Method Along with the Psychological and Physiological Linkage Pattern Analysis

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Introduction
The author self-studied abnormal (traumatized) and behavior psychology for nine years and he also conducted his own research on endocrinology including chronic diseases, especially diabetes, for another nine years.

He has contemplated a specific question
“Why do some type 2 diabetes (T2D) patients choose to face serious complications, including death, rather than change their lifestyle in order to control their diabetic conditions?”

T2D patients have faced three major challenges
1. Availability of accurate disease information with either physical evidence or quantitative proof, not just some general qualitative descriptions that may include either false or commercial driven purpose over the internet (knowledge issue).
2. Awareness of disease status and then be able to overcome “self-denial” to move onto “psychological acceptance” state in order to take effective action. The most difficult barriers are having willpower, determination, and persistence on lifestyle change (psychology issue).
3. A non-invasive, effective, and ease-of-use artificial intelligence technology (AI) based tool to accurately predict outcomes and also guide patients (technology issue).

His previous three specific papers in this area have already addressed the general understanding of the possible reasoning from a behavior psychology viewpoint by using wave theory, energy theory, frequency domain analysis (Fourier Transform), and segmentation pattern analysis. In those papers he also linked the patient’s psychological issues and diabetes physiological characteristics together in a mathematical and quantitative manner.

From his T2D clinical cases, he was able to identify some of those patients’ key personality traits and psychological behavior patterns. In this paper, he further tries to offer a few practical “tips” in order to help diabetes patients to control their disease. He named his approach as the “Progressive Behavior Modification” which is also a part of the generalized “MPM: Mentality-Personality Modeling”.

Method
The author collected 23,975 glucose data for a period of 330 days from 5/5/2018 to 3/30/2019. Initially, he decomposed and segregated these data into 990 Postprandial Plasma Glucose (PPG) waveforms, and then re-integrated them into three distinctive general patterns based on wave characters and waveform patterns. The analysis results can be seen in Reference 1, 2, and 3.

These three distinctive general wave patterns in time domain (Figures 1, 2 & 3) are able to reveal the individual patient’s specific behavior weakness in the areas of diet and/or exercise. From analyzing different waveform contribution percentages, each patient’s personality traits and behavior psychology profile can be identified evidently.

Figure 1: Pattern distribution (%) and daily glucose candlestick chart of continuous glucose monitoring data
Figure 2: Three distinctive PPG waveforms shapes with average and peak glucose values (mg/dL)

Figure 3: Relative energy level created by three distinctive PPG waveform patterns
Furthermore, the author developed a special graphical diagram with x-axis as diet strength, y-axis as exercise strength, and a 45-degree directional wave axis as glucose strength which can depict the combined effect of lifestyle, disease condition, and behavior psychological state clearly (Figure 4). He named this special diagram as “PPD: Psychological-Physiological Diagram”. In this diagram, the trend of the patient’s glucose movement can be predicted via lifestyle management (diet and exercise), then re-directed, and even possibly modified for correcting future movement direction as well.

**Results**

The detailed analysis can be found in references 1, 2, and 3. Therefore, this paper only addresses the following practical tips for progressive behavior modification.

1. Through social media to form multiple patient groups and provide them with accurate and ease-of-implement action steps. For severe patients, an AI-based tool can be taught and used to control their individual diabetes conditions. This approach helps to address both Knowledge and Technology issues.

2. Form a pairing team between a “senior” and a “junior” patient. The senior partners could be a patient with additional knowledge, more experiences, stronger self-control, or caring personality. A dietitian, nurse, spouse, or even a medical doctor who is willing to provide extra help can form a pair team with patients. Through this paring approach, plus peer-pressure and emotional support, there will be higher probability to get positive results.

3. The patients indeed can modify their behavior “one step at a time”, i.e. taking a little step on a smaller scale during a period of time. This is what the author defined as a “progressive” behavior modification. For example, setting up an initial target of 500 post-meal walking steps and reducing post-meal glucose by 2 or 3 mg/dL only. After achieving this goal, then increase the target to 1,000 steps and 5 mg/dL glucose reduction etc.

**Conclusion**

The patient’s psychological resistance on food craving and/or laziness with exercise is a well-known issue. Even with the three tips mentioned above are not new ideas. However, the author’s scientific research method on identifying patient’s psychological shortcomings and finding of their mathematical connection with diabetes physiology are more of a “forward-thinking” scientific approach. He developed the necessary computer programs with machine learning capabilities to assist with this approach. Furthermore, he believes that the continuous glucose monitoring sensor devices will become popular in the near future and a big glucose data will be easily collected and processed. Therefore, he is trying to lay the necessary groundwork and needed high-tech tools for a future endeavor.

**References**
