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A practical clinic case of using quantitative lifestyle management and glucose predictions to control chronic metabolic conditions (part of math-physical medicine)

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Background and Aim: The author has spent seven years to monitor and research medical conditions and lifestyle details (~1.5 M data) of a patient who has chronic diseases. This paper provides concrete results and practical ways of controlling the metabolic diseases via quantitative lifestyle management and glucose prediction technology.

Material and Method: The patient has been diagnosed with type 2 diabetes (T2D), hypertension, hyperlipidemia for a period of 20 years. He has experienced many complications from diabetes such as kidney, bladder, foot ulcers, cardiovascular issues, etc. His medical data during 2000-2010 were:

BMI: 31 (210 lbs., 44" waistline), Glucose: 280 mg/dL, A1C: 10%, ACR: 116 mg/mmol and Triglycerides: 1161 mg/dL

In 2014, the author developed a metabolism index model which defines multiple interactions of four disease outputs and six lifestyle inputs. During 2015 - 2016, he developed four prediction tools, including Weight, fasting plasma glucose (FPG), postprandial plasma glucose (PPG), and hemoglobin A1C based on his various knowledge such as signal processing, optical physics, statistics, mathematics, engineering modeling, machine learning, and artificial intelligence (AI).

He utilized 1,570 days' data (1/1/2014 - 4/20/2018) to study FPG and 1,054 days' data (6/1/2015 - 4/20/2018) to study PPG. He used time-series, spatial, and frequency domain to analyze these big data to extract valuable information.

Results: *Lifestyle and Metabolic Diseases Quantitative Guide:*

FPG (15% - 25% of A1C): Weight has >85% contribution to FPG. Correlation between FPG and Weight is >70%. Patient has reduced his food quantity to 85% of normal intake and walked ~18,000 steps (7 miles or 11 km) per day. Combining these two efforts, he reduced his weight from 210 lbs. to 169 lbs. The consequence of the weight reduction lead into a healthy range of FPG (< 120 mg/dL).

PPG (75% - 85% of A1C): PPG's contributing factors are carbs & sugar intake, post-meal exercise, weather, and others. His average carbs & sugar intake is ~15 gram per meal, and post-meal walking is ~4,400 steps. The combination of these two factors contributes ~80% to PPG (<120 mg/dL). Weather/temperature alone contributes ~10%. His glucose prediction tools have reached to 99% linear accuracy. His A1C prediction tool has ~97% due to build-in safety margin. As of now, his chronic diseases are completely under controlled via a quantitative lifestyle management and three glucose prediction tools.

His current health data are: BMI: 24.95 (169 lbs., 34" waistline), Glucose: 119 mg/dL, A1C: 6.4%, ACR: 15 mg/mmol and Triglycerides: 85 mg/dL.

Conclusion: The patient's "nearly-collapsed" health condition has been turned into a "nearly-perfect-controlled" situation. Furthermore, four useful prediction tools were developed via math-physical medicine. This case report has also provided concrete data and practical guidance on food, exercise, weight, and glucose for other patients to follow numerically.

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Page 42