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## Methodology of math-physical medicine (GH-Method)

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This paper describes the math-physical medicine approach (MPM) of medical research utilizing mathematics, physics, engineering models, and computer science, instead of the current biochemical medicine approach (BCM) that mainly utilizes biology and chemistry. Methodology of MPM on Diabetes Research: Initially, the author spent four years of self-studying six chronic diseases and food nutrition to gain in-depth medical domain knowledge. During 2014, he defined metabolism as a nonlinear, dynamic, and organic mathematical system having 10 categories with ~500 elements. He then applied topology concept with partial differential equation and nonlinear algebra to construct a metabolism equation. He further defined and calculated two variables, metabolism index and general health status unit. During the past 8.5 years, he has collected and processed 1.5 million data. Since 2015, he developed prediction models, i.e. equations, for both postprandial plasma glucose (PPG) and fasting plasma glucose (FPG). He identified 19 influential factors for PPG and five both wave and energy theories, he extended his research into the risk probability of heart attack or stroke. In this risk assessment, he applied structural mechanics concepts, including elasticity, dynamic plastic, and fracture mechanics, to simulate artery rupture and applied fluid dynamics concepts to simulate artery blockage. He further decomposed 1,200 glucose waveforms with 21,000 data and then re-integrated them into 3 distinctive PPG waveform types which revealed different personality traits and psychological behaviors of type 2 diabetes patients between two variables, he used spatial analysis. Furthermore, he also applied Fourier Transform to conduct frequency domain analyses to discover some hidden characteristics of glucose waves. He then developed an AI Glucometer tool for patients to predict their weight, FPG, PPG, and A1C. It uses various computer science tools, including big data analytics, machine learning (self-learning, correction, and simplification), and artificial intelligence to achieve very high accuracy (95% to 99%) mg/dL and A1C is 6.5%. Since his health condition is stable, he no longer suffers from repetitive cardiovascular episodes.

### Recent Publications

1. Hsu, Gerald C. Using Math-Physical Medicine to Control T2D via Metabolism Monitoring and Glucose Predictions. Journal of Endocrinology and Diabetes. 2018;1(1):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 2018, Amsterdam, Netherlands.

| Comparison of Methodology | Bio-Chemical Medicine (BCM) | Math-Physical Medicine (MPM) |
|---|---|---|
| Academic Foundation | Based on both Biology and Chemistry, which are both based on Physics and Math | Based on Engineering and Physics, which are both based on Mathematics |
| Precision and Accuracy of Results | It appears that more likely the results are less precise and less accurate than MPM | More likely more precise and accurate than BCM due to mathematics and physics |
| Data Size | It seems that most of the data size is smaller (hundreds to thousands) | Most of the data sizes are larger (thousands to millions) |
| Application of Mathematics | It appears that mostly utilizing statistics (an extension of mathematics) | Mostly utilizing mathematical equations, including many branches of mathematics |
| Distinguish by Importance Level (Weighting Factors) | It appears that mostly no weighting factors are considered before analysis | Figuring out various weighting factors and then assigned to key influential factors (Engineering Concept for approximation) |
| Data Collection and Cleaning | It seems that most of work spends 70% to 80% on data collection, cleaning, and organization | Spend only 10% or 30% on data collection, cleaning, and organization by utilizing computer technology, including AI |

3. Hsu, Gerald C. Using Signal Processing Techniques to Predict PPG for T2D. International Journal of Diabetes & Metabolic Disorders. 2018;3(2):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 & Its Complications. 2018;2(3):1–7.

## Biography

Gerald C Hsu has received his PhD in Mathematics and majored in Engineering at MIT. He has attended different universities over 17 years and studied seven academic disciplines. He has spent a huge time research in T2D research. His approach is "Math-Physics and Quantitative Medicine" based on mathematics, physics, engineering modeling, signal processing, computer science, big data analytics, statistics, machine learning and AI. His research focus is on preventive medicine using prediction tools. He believes that the better the prediction, the more control you have.

**Notes:**