Gerald C. Hsu

Eclaire MD Foundation, USA

Methodology of math-physical medicine

Math-physical medicine approach (MPM) utilizes mathematics, physics, engineering models, and computer science in medical 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 factors for FPG. He developed the PPG model using optical physics and signal processing. Furthermore, by using 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 12,000 glucose waveforms with 21,000 data and then re-integrated them into three distinctive PPG waveform types which revealed different personality traits and psychological behaviors of type 2 diabetes patients. 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, and artificial intelligence to achieve very high accuracy (95% to 99%).

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	Based on Engineering and Physics, which are both based on Mathematics
Precision and Accuracy of Results	Most likely the results are less precise and less accurate than MPM	Most likely to be more precise and more accurate than BCM due to mathematics and physics
Data Size	Most of the data size is smaller (hundreds to thousands)	Most of the data size is larger (thousands to millions)
Application of Mathematics	Mostly utilizing statistics (an extension of mathematics)	Mostly utilizing mathematical equations
Distinguish by Importance Level (Weighing Factors)	Mostly no weighing factors are considered before analysis	Mostly there are weighing factors assigned to influential factors (Engineering Concept)
Data Collection and Cleaning	Mostly spend 50% to 80% on data collection, cleaning, and organization	Spend 10% to 30% on data collection, cleaning, and organization using computer technology

Table: Comparison of BCM vs. MPM

Recent Publications

1. Hsu, Gerald C. (2018). Using Math-Physical Medicine to Control T2D via Metabolism Monitoring and Glucose Predictions. Journal of Endocrinology and Diabetes, 1(1), 1-6.
2. Hsu, Gerald C. (2018). Using Math-Physical Medicine and Artificial Intelligence Technology to Manage Lifestyle and Control Metabolic Conditions of T2D. International Journal of Diabetes & Its Complications, 2(3),1-7.
3. Hsu, Gerald C. (2018). Using Signal Processing Techniques to Predict PPG for T2D. International Journal of Diabetes & Metabolic Disorders, 3(2),1-3.
4. Hsu, Gerald C. (2018). Using Math-Physical Medicine to Study the Risk Probability of having a Heart Attack or Stroke Based on 3 Approaches, Medical Conditions, Lifestyle Management Details, and Metabolic Index. EC Cardiology, 5(12), 1-9.

Biography

The author received an honorable PhD in mathematics and majored in engineering at MIT. He attended different universities over 17 years and studied seven academic disciplines. He has spent 20,000 hours in T2D research. First, he studied six metabolic diseases and food nutrition during 2010-2013, then conducted research during 2014-2018. 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 main focus is on preventive medicine using prediction tools. He believes that the better the prediction, the more control you have.

g.hsu@eclariemd.com

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