Gerald C Hsu, J Diabetol 2019, Volume 3

Gerald C Hsu

EclaireMD Foundation, USA

BIOGRAPHY

Gerald C Hsu has completed his PhD in Mathematics and has been majored in Engineering at MIT. He has 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@eclairemd.com

GH-METHOD: METHODOLOGY OF MATH-PHYSICAL MEDICINE USING DIABETES RESEARCH AS AN EXAMPLE

Introduction: 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: 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. Then he applied topology concept with partial differential equation and nonlinear algebra to construct a metabolism equation. Further he 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. Each factor has a different contribution margin to the glucose formation. He developed 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. For single time-stamped variables, he used traditional time-series analysis. For interactions 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%).

Results: In 2010, his average glucose was 280 mg/dL and A1C was >10%. Now, his glucose value is 116 mg/dL and A1C is 6.5%. Since his health condition is stable, he no longer suffers from repetitive cardiovascular episodes.

Conclusion: Instead of utilizing traditional biology, chemistry and statistics, the methodology of GH-Method: math-physical medicine uses advanced mathematics, physics concept, engineering modeling and computer science tools (big data analytics, artificial intelligence), which can be applied to other branches of medical research in order to achieve a higher precision and deeper insight.

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 most likely the results are less precise and less accurate than MPM	Most 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 size 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 50% to 80% on data collection, cleaning, and organization	Spend only 10% to 30% on data collection, cleaning, and organization by utilizing computer technology, including AI

Fig.1. Comparison of MPM vs. BCM