The GH-Method

Relationship between Metabolism and Probability Risks of Having Cardiovascular Diseases or Renal Complications Using GH-Method: Math-Physical Medicine (No. 258)

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Abbreviations: CVD: cardiovascular disease; CKD: chronic kidney disease; MI: metabolism index; GHSU: general health status unit; HbA1C: hemoglobin A1C; FPG: fasting plasma glucose; PPG: postprandial plasma glucose; MPM: math-physical medicine

1. INTRODUCTION

The author uses the GH-Method: math-physical medicine (MPM) approach to investigate the risk probability of metabolic disorders-induced cardiovascular disease (CVD), stroke, or chronic kidney disease (CKD). He addresses the damages caused by metabolic disorders affecting arteries and micro-vessels, even nerves, in the forms of blockage, rupture, or leakage. Furthermore, he uses mathematical correlations to distinguish the weighted impact on the heart, brain, and kidney via metabolism status.

2. METHODS

In 2014, the author applied the topology concept, finite-element engineering technique, and nonlinear algebra operations to develop a mathematical metabolism model which contains ten categories, including four basic output categories (weight, glucose, BP, other lab-tested data including lipid profile, ACR, and TSH), and six basic input categories (food, water drinking, exercise, sleep, stress, routine life patterns, and safety measures), with approximately 500 detailed elements. For example, the category of stress includes a total of 42 elements where 21 of which are applied to psychologically traumatized patients in stressful situations. The author has spent 9 years from 2002 through 2010 self-study and researching the subject of "abnormal psychology", especially borderline personality disorders (BPD).

He further defined a new parameter, metabolism index (MI), as the combined score of the above 10 metabolism categories and 500 elements. He also defined another term, general health status unit (GHSU), as the 90-day moving average value of MI for indicating the trend of metabolism. This MI value is continuously and dynamically calculated whenever the patient has encountered some condition changes and those relevant data were collected regarding his medical conditions and lifestyle details. He also identified a mathematical normalized "break-even line" at 0.735 (73.5%) to separate his metabolism conditions between healthy (below 0.735) and unhealthy (above 0.735).

He started to collect his detailed personal data on 1/1/2012. Thus far, he has collected and stored ~2 million data on his body health and personal lifestyle.

It should be noted that, through his developed four weight and glucose (FPG, PPG, and A1C) prediction models, he has successfully reduced his glucose level from 280 mg/dL (A1C 10%) in 2010 to 113 mg/dL (A1C 6.4%) in 2020. It should be noted that, from 2016 to 2020, he did not take any diabetes drugs or insulin injections.

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In 2017-2018, he developed two similar but rather different mathematical models to calculate his risk probability of having CVD/Stroke and CKD, respectively.

At first, he built a baseline model, including genetic factors such as steady state and unchangeable conditions (race, gender, family history, and personal medical history), semi-permanent factors such as weight and waistline, and bad habits such as hard-to-change conditions (smoking, alcohol drinking, and illicit drugs).

Next, he developed a risk probability calculation model for estimating the following two scenarios:

(1) For CVD & Stroke: blood flow blockage of arteries due to diabetes and hyperlipidemia; and blood vessel rupture of arteries due to diabetes and hypertension.

(2) For CKD: leakage from micro-blood vessels due to diabetes and hypertension.

Finally, he applied his collected several hundred thousand data on medical conditions regarding four basic chronic diseases and more than 1 million data on lifestyle details, from the past eight and a half years (2012-2020), to calculate their combined contribution to the following situations related to CVD, Stroke, and CKD:

(1) Blockage and rupture of arteries in the heart or brain, including situations of CVD, CAD, and CHD due to diabetes, hypertension, and hyperlipidemia, more than 50% of heart disease or stroke patients also have different chronic diseases due to their metabolic disorders.

(2) Kidney complications, including glucose, blood pressure, glomeruli, bladder, and urinary tract, the two main causes of chronic kidney disease are diabetes and hypertension which are responsible for up to two-thirds of CKD cases.

His calculation results are further divided into the following three groups:

(1) Medical conditions (individual M1 through M4: i.e. weight, glucose, blood pressure, lipid, and ACR).

(2) Lifestyle details (individual M5 through M10).

(3) MI scores (a combined score of M1 through M10).

With these mathematical risk probability assessment models, he can obtain three separate percentages of risk probability (i.e. medical-based, lifestyle-based, and MI-based, but these three results are quite close to each other) to offer a range of the risk prediction of having CVD, stroke, or CKD resulting from metabolic disorders, unhealthy lifestyles, and their combined impact on the human body.

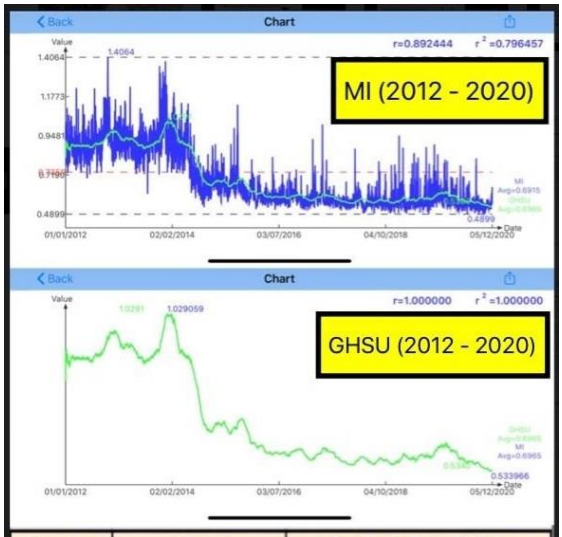
Regarding these three prominent influential biomarkers, i.e. MI %, CVD risk %, and CKD risk %, he further calculated their separated correlation coefficients using the time-series method. Due to the small data volume of these "annualized" average data, he cannot apply the spatial analysis method. The spatial analysis method can provide an accurate and clear picture of the data relationship pattern and moving trend; however, it requires a larger size of collected data to conduct its analysis.

During the past 8+ years, all of his measurements of weight, glucose, and blood pressure were performed using home-based devices. However, to obtain his tested data of HbA1C, albumin, creatinine, and albumin-creatinine ratio (ACR), these were done in a laboratory or hospital[1-4].

Finally, it should be noted here that the risk probability percentages are expressed on a "relative" scale, not on an "absolute" scale.

3. RESULTS

Figure 1 demonstrates the author's overall metabolic conditions, including both MI and GHSU for the past eight and one-half years (2012-2020), along with detailed descriptions of the MI category's measurement standards. Both his MI and GHSU were >73.5% during 2012-2014 (unhealthy) and <73.5% during 2014-2020 (healthy). In 2014, his health was greatly improved due to the knowledge gained from his development work on the metabolism model and his discipline in implementing the lifestyle management program.



Disease	Item	Perfect Condition
M1	Weight	170 lbs
M2	Glucose	120 mg/dL
M3	Blood Presuure	120/80
M4	Lipd	130/40/150
Lifestyle	Item	Worst / Best Condition
M5	Exercise	1.5 / 0.5
M6	Water	1.5 / 0.7
M7	Sleep	1.5 / 0.5
M8	Stress	1.5 / 0.5
M9	Food & Meal	1.5 / 0.5
M10	Daily Routine	1.5 / 0.7

Figure 1: Metabolism index (2012-2020) & measurement standards (M1-M10).

Figure 2 shows his risk probability % of having a CVD or stroke (heart or brain). It is obvious that his CVD risk % is decreasing from 82% in 2012 gradually down to 51% in 2020 with a linear decreasing speed of 4.3% per year. The year 2014 is the turning point.

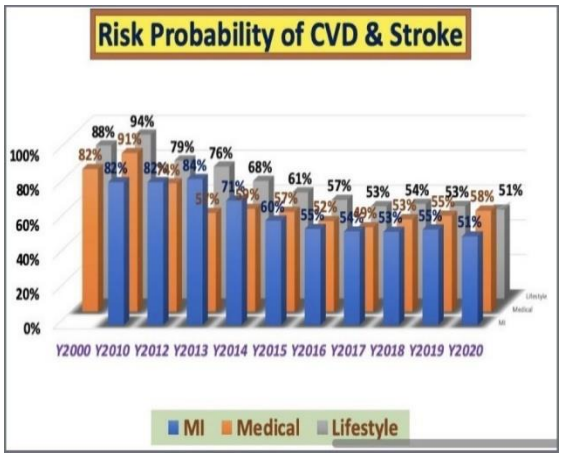


Figure 2: Probability risk% of having a CVD or stroke (2012-2020).

Figure 3 depicts his risk probability % of having a CKD (kidney). His CKD risk % is decreasing from 69% in 2012 gradually down to 35% in 2018 through 2020 with a linear decreasing speed of 5.8% per year. The year 2013 was the turning point.

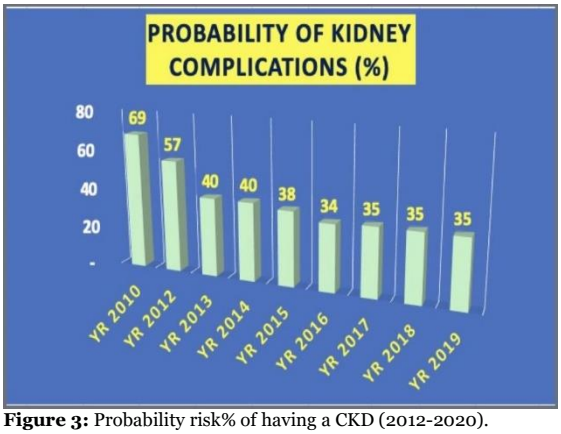


Figure 3: Probability risk% of having a CKD (2012-2020).

Figure 4 depicts a table that lists all of the numerical values of MI %, CVD risk %, and CKD risk %. The combined curves of these three % values are shown in the top portion of Figure 5 and Figure 6.

Year	MI %	CVD risk %	CKD risk %
Y2012	91	82	57
Y2013	94	84	40
Y2014	78	71	40
Y2015	64	60	38
Y2016	59	55	34
Y2017	57	54	35
Y2018	57	53	35
Y2019	58	55	35
Y2020	54	51	33

Figure 4: Table of MI%, CVD risk% and CKD risk% (2012-2020).

In Figure 5, two more interesting discoveries are observed:

(1) The correlation between MI % and CVD % is 99.9% while the correlation between MI % and CKD % is 78.2%. Both correlations are quite high (greater than 50%) which indicates that metabolism conditions are causing the risk probabilities of having heart/brain and kidney problems.

(2) He further delves into the question of why there is a gap between these two correlation coefficients. It is obvious that 99.9% of the damage to the heart and brain's arteries is 21.7% higher than the 78.2% for damage to the kidney's micro-vessels. This difference probably indicates a closer and stronger relationship between MI and CVD than MI and CKD. Of course, to confirm this

hypothesis, more clinical data needs to be collected and analyzed.

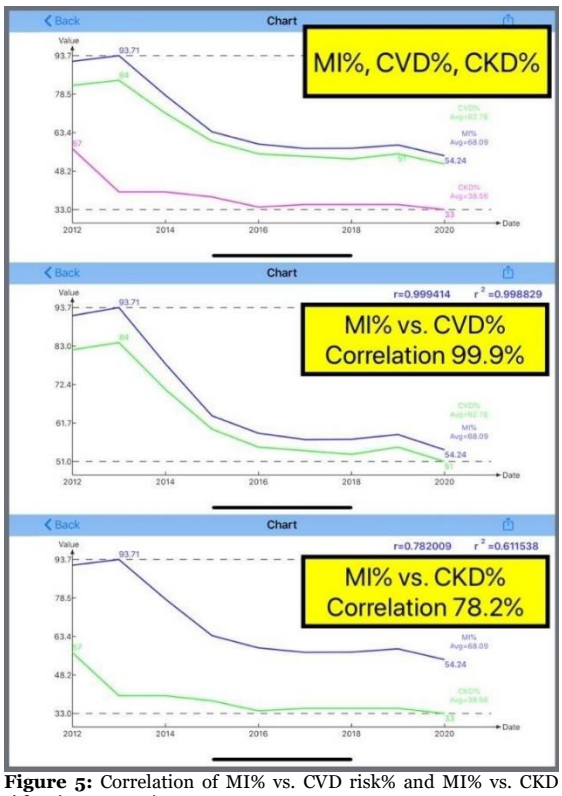


Figure 5: Correlation of MI% vs. CVD risk% and MI% vs. CKD risk% (2012-2020).

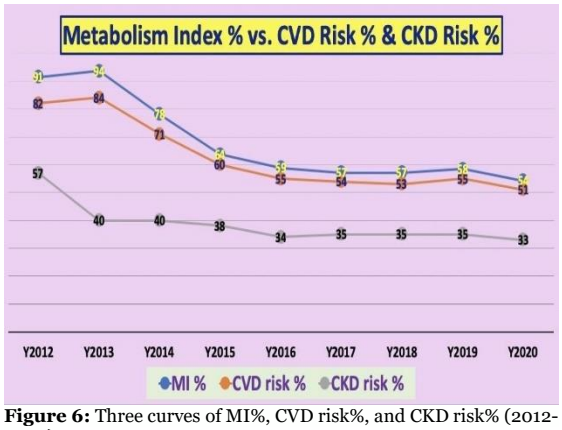


Figure 6: Three curves of MI%, CVD risk%, and CKD risk% (2012-2020).

4. CONCLUSION

These annualized big data analytics using three different sophisticated mathematical models for MI, CVD, and CKD have demonstrated the close relationships between metabolism and two major chronic disease-induced complications, CVD/Stroke (heart/brain) and CKD (kidney). By using the GH-Method: MPM math-physical medicine approach (mathematics, physics, engineering modeling, and computer science), the same conclusion can be reached. This research methodology has not been seen before.

5. REFERENCES

1) Hsu, Gerald C., eclaireMD Foundation, USA, No.225 "Health improvements using Metabolism Indexes of four different periods (2012-2019)."

2) Hsu, Gerald C., eclaireMD Foundation, USA, No.256 "How to reverse chronic disease induced heart conditions using a simple and effective "cookbook of quantitative formulas" (GH-Method: math-physical medicine)."

3) Hsu, Gerald C., eclaireMD Foundation, USA, No.257 "Risk Probability of having chronic kidney disease over the past ten years using GH-Method: Math-Physical Medicine."

4) Hsu, Gerald C., eclaireMD Foundation, USA, No. 115 "Using GH-Method: math-physical medicine to investigate the risk probability of metabolic disorders induced cardiovascular diseases or stroke".