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The GH-Method

Viscoelastic Medicine Theory (VMT #303): Pathophysiological Qualitative Explanations and Math-Physical Quantitative Analysis Results of Metabolism Index versus 5 Mortality Diseases Using Data Collected Within a Period of 12 Years from 2012 to 2023 and Applying Space-Domain Viscoplastic Energy Model of GH-Method: Math-Physical Medicine (No. 903)

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Abstract

Excluding infectious diseases, accidental deaths, and suicides, the remaining nearly 80% of annual fatalities in the US stem from internal organ failures, primarily attributed to metabolic disorders. Beyond genetic and environmental influences, a significant portion of fatal ailments arise from unhealthy lifestyle choices. The author of the article highlights his obesity as the initial catalyst for a majority of his health problems. This spanned from 1994 to 1999, during which his body weight peaked at 220 lbs with a BMI of 32.5. Coupled with an inadequate diet and lack of exercise, his obesity exacerbated the situation, leading to elevated glucose levels indicated by an HbA1C level of 11% in 2010. Alongside type 2 diabetes, he faced hypertension and dyslipidemia. These metabolic disorders resulted in various medical complications, including cardiovascular incidents, kidney issues, retinopathy, neuropathy, and foot ulcers. Thankfully, he has not been diagnosed with dementia or cancer thus far. In 2014, he devised a metabolism index (MI) model, encompassing ten categories comprising four metabolic conditions and six lifestyle aspects, incorporating over 500 intricate biomedical components. Throughout the past 14 years, he has amassed and meticulously processed over three million data. The objective of this article is to delve into the intricate interplay between the author's MI and five specific diseases: type 2 diabetes, cardiovascular diseases, chronic kidney diseases, dementia, and cancers. This paper elucidates these associations through a blend of qualitative pathophysiological explanations and quantitative analysis results derived from the GH-Method: Math-Physical Medicine. Utilizing data amassed over a span of 12 years, it employs a space-domain viscoplastic energy model to dissect the interrelationships among diverse factors. The author further quantitatively distinguishes the degrees of association or connectivity by leveraging his computed energies between the metabolism index and the aforementioned five chosen mortality diseases. Two notable discoveries emerge from this study: Firstly, concerning the nexus between the metabolism index and the author's selected five mortality diseases, the most substantial association is apparent between his MI and T2D (30%). This is succeeded by CKD (20%), likely attributable to the author's CKD development in 2010. The association with CVD stands at 18%, occurring in earlier years, between 1994 and 2004. However, the susceptibilities to dementia (24%) and cancer (14%) are relatively lower for him. Secondly, the Pre-COVID era spanning from 2012 to 2019 constitutes a significant majority of the total contribution (98%), with the COVID era from 2020-2023 contributing a mere 2%. This underscores that the majority of the harm transpired during the Pre-COVID years of 2012-2019.

Keywords: Viscoelastic; Viscoplastic; Metabolism index; Mortality diseases; Glucose; Diabetes

Abbreviations: BMI: body mass index; MI: metabolism index; CVD: cardiovascular disease; CKD: chronic kidney disease; T2D: type 2 diabetes; PPG: postprandial plasma glucose; FPG: fasting plasma glucose

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1. INTRODUCTION

Apart from infectious diseases, accidental deaths, and suicides, nearly 80% of annual deaths in the US are caused by internal organ failures, primarily resulting from metabolic disorders. Poor lifestyle choices are a major factor contributing to the majority of mortality diseases, alongside environmental and genetic factors.

The author of this article identifies his obesity as the initial trigger for most of his health issues, which occurred between 1994 and 1999 when his body weight reached 220 lbs with a BMI of 32.5. With a combination of poor diet and a lack of exercise, his obesity further exacerbated the problem, leading to elevated glucose levels and an HbA1C level of 11% in 2010. In addition to type 2 diabetes, he also suffered from hypertension and dyslipidemia. These metabolic disorders resulted in various medical complications such as cardiovascular episodes, kidney problems, neuropathy, retinopathy, and foot ulcers. Fortunately, he has not been diagnosed with dementia or cancer to date.

In 2014, the author developed a metabolism index (MI) model that consists of 10 categories, including four metabolic conditions and six lifestyle details, encompassing over 500 detailed biomedical elements. Over the past 14 years, he has collected and processed more than three million data points for his research.

The aim of this article is to delve into the intricate relationship between the author's metabolism index (MI) and five specific diseases: type 2 diabetes, cardiovascular diseases, chronic kidney diseases, dementia, and cancers. This study presents these various associations through a combination of qualitative pathophysiological explanations and quantitative analysis results based on the GH-Method: Math-Physical Medicine. Utilizing data collected over a span of 12 years, the study utilizes a space-domain viscoplastic energy model to analyze the interplay among various factors. The author further quantifies the degrees of association using calculated energies between the MI and the selected mortality diseases.

1.1 Biomedical information

The following sections contain condensed information sourced from various published medical articles that the author has reviewed. It is important to acknowledge that these sections are not the original work or creation of the author of this specific article. They have been included for the purpose of later review by the author and to provide useful information to other readers interested in this topic.

Pathophysiological explanations and statistical information of relationship between metabolism versus 5 diseases, diabetes, CVD, CKD, dementia and cancers:

The metabolic index (MI) is a measure used to evaluate an individual's metabolic state. This index is typically calculated based on various physiological markers and measurements. Examples of these markers include basal metabolic rate (BMR), body weight, blood glucose levels, blood cholesterol levels, blood pressure, body fat percentage, muscle mass, and visceral fat percentage (a measure of fat accumulation around abdominal organs), etc.

The purpose of the metabolic index is to help individuals understand their metabolic level and take steps towards managing and improving their health. The author has developed a MI model in 2014 for measuring his own metabolic index, which takes into account four basic metabolic conditions (weight, glucose, blood pressure, and lipids) and six lifestyle details (diet, water hydration, exercise, sleep, stress, and daily routines). Generally, a higher metabolic index suggests a more active metabolism, while a lower index may indicate a slower metabolism requiring less energy intake for bodily functions. However, the author has aimed to align with biomedical standards, where a lower number is considered better. Therefore, he has set 0.735 or 73.5% as the "break-even line" for his MI score, with values below this line considered healthy.

It is important to note that the metabolic index and MI score are relative assessments, and what is considered normal may vary among different populations and age groups.

Metabolism Index and certain important lifestyle details:

The metabolism index takes into consideration certain important lifestyle details that can impact an individual's metabolic state. These lifestyle details may include:

1. Diet and nutrition
The types of food consumed, portion sizes, and nutrient intake play a significant role in metabolism. A balanced diet with appropriate macronutrient ratios can support a healthy metabolic rate.

2. Physical activity
Regular exercise and physical activity can boost metabolism. Both aerobic exercises and strength training can help increase muscle mass, which in turn can enhance metabolic rate.

3. Sleep patterns
Sufficient sleep and quality rest are crucial for optimal metabolic function. Lack of sleep or poor sleep habits can disrupt hormonal balance and negatively impact metabolism.

4. Stress levels
Chronic stress can affect metabolism by altering hormone levels such as cortisol. High levels of stress can lead to metabolic complications, such as weight gain or difficulty in losing weight.

5. Hydration of water drinking
Staying adequately hydrated is important for a healthy metabolism. Water plays a role in various metabolic processes and aids in digestion, energy production, and nutrient absorption.

6. Lifestyle habits
Consistency is a key factor in developing and maintaining healthy lifestyle habits. Just as with stress management, these habits are closely tied to an individual's physiological characteristics. Establishing and adhering to beneficial habits for an extended period of time is crucial for enhancing an individual's overall metabolic state.

7. Alcohol and drug use
Alcohol and certain drugs can affect metabolism and interfere with the body's ability to process nutrients and eliminate toxins. Excessive alcohol consumption can lead to weight gain and other metabolic disorders.

It is worth noting that while these lifestyle factors can influence metabolism, the exact impact and interactions may vary between individuals. Understanding and addressing these lifestyle details can help individuals optimize their metabolism and overall health.

Metabolism index including basic medical conditions and important lifestyle details:

The metabolism index takes into account certain basic medical conditions and important lifestyle details that can impact an individual's metabolic state. These factors include:

1. Medical conditions
Certain medical conditions can influence metabolism. For example, thyroid disorders can cause an imbalance in thyroid hormone production, leading to changes in metabolism. Diabetes, insulin resistance, and metabolic syndrome can also affect metabolic function.

2. Medications
Some medications, such as certain antidepressants or steroids, can impact metabolism. They may affect hormone levels, appetite, or energy expenditure, resulting in changes to the metabolic rate.

3. Age and gender
Age and gender can affect metabolism. Metabolic rate tends to decline naturally with age, primarily due to a decrease in muscle mass. Men generally tend to have a higher metabolic rate than women due to differences in body composition and hormonal influences.

4. Body composition
The proportion of body fat and muscle mass can impact metabolism. Muscle tissue is generally more metabolically active than fat tissue, so individuals with higher muscle mass may have a higher metabolic rate.

5. Smoking and alcohol consumption
Smoking and excessive alcohol consumption can negatively impact metabolism. They can affect nutrient absorption, disrupt hormonal balance, and lead to various health issues that can influence metabolic function.

6. Nutritional intake and meal patterns
The quality and quantity of food intake, as well as meal frequency and timing, can affect metabolism. Balanced meals with appropriate macronutrient distribution and consistent meal patterns can support a healthy metabolic rate.

7. Stress levels
Chronic stress can significantly impact metabolism. Stress hormones like cortisol can affect nutrient metabolism and contribute to weight gain or difficulty in losing weight.

Understanding these basic medical conditions and lifestyle details can help individuals and healthcare professionals assess and manage metabolic health effectively.

Pathophysiological explanations of the metabolism index:

The metabolism index is a measurement that reflects an individual's metabolic state. There are several pathophysiological explanations for variations in the metabolism index, including:

1. Insulin resistance
Insulin resistance occurs when cells become less responsive to the effects of insulin, leading to elevated blood sugar levels. This can contribute to a lower metabolism index as cells have difficulty efficiently utilizing glucose for energy.

2. Thyroid dysfunction
The thyroid gland produces hormones that regulate metabolism. Hypothyroidism, a condition where the thyroid gland does not produce enough thyroid hormones, can lead to a lower metabolism index due to a decrease in the basal metabolic rate.

3. Obesity
Excessive body fat can contribute to metabolic abnormalities. Adipose tissue secretes several hormones and inflammatory molecules that can disrupt metabolic processes, leading to a lower metabolism index.

4. Cushing's syndrome
Cushing's syndrome is characterized by excessive production of cortisol, a stress hormone. Elevated cortisol levels can increase insulin resistance and promote the breakdown of muscle tissue, leading to a lower metabolism index.

5. Metabolic disorders
Certain inherited metabolic disorders, such as phenylketonuria or mitochondrial disorders, can impair metabolic processes and lead to variations in the metabolism index.

6. Hormonal imbalances
Imbalances in hormones, such as leptin (a hormone involved in appetite regulation) or ghrelin (a hormone that stimulates hunger), can affect metabolic function and contribute to variations in the metabolism index.

7. Inflammation
Chronic low-grade inflammation, often associated with conditions like metabolic syndrome or autoimmune diseases, can impact metabolic processes. Inflammatory molecules can interfere with insulin signaling and disrupt metabolic rate, affecting the metabolism index.

8. Medications and treatments
Certain medications, such as corticosteroids or antipsychotics, can affect metabolism and contribute to variations in the metabolism index. Additionally, treatments like chemotherapy or radiation therapy may impact metabolic rate.

It is important to note that variations in the metabolism index can have multiple underlying causes and may not be solely attributed to a single pathophysiological explanation. Accurate diagnosis and evaluation by healthcare professionals are essential to understand and address the specific factors affecting an individual's metabolism index.

Pathophysiological explanations and statistical information regarding metabolism versus type 2 diabetes, CVD, CKD, dementia and cancers:

Metabolism plays a crucial role in the development and progression of various diseases, including diabetes, cardiovascular disease (CVD), chronic kidney disease (CKD), dementia, and cancers. Here are some pathophysiological explanations and statistical information regarding the relationship between metabolism and these diseases:

1. Diabetes
-Pathophysiological explanation: In diabetes, there is a disruption in the body's ability to regulate blood sugar levels due to impaired insulin function or production. This impacts carbohydrate metabolism, leading to elevated blood glucose levels.

-Statistical information: According to the International Diabetes Federation, approximately 463 million adults were living with diabetes worldwide in 2019, with the number expected to rise to 700 million by 2045.

2. Cardiovascular disease (CVD)
-Pathophysiological explanation: Metabolic disorders, such as obesity, insulin resistance, and dyslipidemia, can contribute to the development of CVD. These conditions often lead to atherosclerosis, a build-up of plaque in the arteries, increasing the risk of heart attacks and strokes.

-Statistical information: According to the World Health Organization, CVD is the leading cause of death globally, accounting for nearly 18 million deaths each year.

3. Chronic kidney disease (CKD)
-Pathophysiological explanation: Metabolic abnormalities like diabetes, hypertension, and obesity are major risk factors for developing CKD. These conditions can impair kidney function and lead to the accumulation of waste products and fluid imbalances in the body.

-Statistical information: The National Kidney Foundation estimates that over 10% of the global population has CKD, and it is responsible for approximately 1.5 million deaths per year.

4. Dementia
-Pathophysiological explanation: Metabolic disorders, such as diabetes and obesity, have been linked to an increased risk of dementia. These conditions can cause chronic inflammation, oxidative stress, and vascular damage, which can contribute to brain dysfunction and cognitive decline.

-Statistical information: The World Alzheimer Report 2019 estimated that around 50 million people worldwide were living with dementia, with Alzheimer's disease being the most common type.

5. Cancers
-Pathophysiological explanation: Metabolic abnormalities, including obesity and altered glucose metabolism, are associated with an increased risk of various cancers. These conditions can create an inflammatory environment, hormone imbalances, and DNA damage, promoting the development and progression of cancer cells.

-Statistical information: The International Agency for Research on Cancer estimates that there were approximately 18.1 million new cancer cases and 9.6 million cancer deaths globally in 2018.

These statistical figures and pathophysiological explanations highlight the significant impact of metabolism on the development and outcomes of diabetes, CVD, CKD, dementia, and cancers. Managing metabolic health through lifestyle modifications, proper nutrition, regular exercise, and medical interventions can contribute to the prevention and management of these diseases.

2. METHODS

2.1 MPM background

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 describes his MPM methodology in a general conceptual format. The second paper, No. 387 outlines the history of his personalized diabetes research, various application tools, and the differences between biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 depicts a general flow diagram containing ~10 key MPM research methods and different tools.

2.2 The author's diabetes history

The author was a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with an average daily glucose of 250 mg/dL

(HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 to develop a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average finger-piercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes-related medications since 12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period, including both 2018 and 2019, he traveled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his glucose control was somewhat affected during the two-year traveling period of 2018-2019.

He started his COVID-19 self-quarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lbs. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-traveling, low-stress, and regular daily life routines. Of course, his in-depth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his own developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checks his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5-minute intervals from every 15-minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work over 40,000 hours and read over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with well-balanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time-length depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

2.3 Energy theory

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells; and energy consumption from labor-work or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucoses are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g. diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For an example, the combination of hyperglycemia and hypertension would cause micro-blood vessel's leakage in kidney systems which is one of the major cause of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. Both output symptom value (i.e. strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) are influencing the energy level (i.e. the Y-amplitude in the frequency domain).

Currently, many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deform; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, the carbohydrates and sugar function as the energy supply. After having labor work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both processes of energy influx and energy dissipation take some time which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviors are "dynamic" in nature, i.e. time-dependent. This time-dependent nature leads to a "viscoelastic or viscoplastic" situation. For the author's case, it is "viscoplastic" since most of his biomarkers are continuously improved during the past 13-year time window.

2.4 Time-dependent output strain and stress of (viscous input*output rate)

Hooke's law of linear elasticity is expressed as:

Strain (ε: epsilon)
= Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:

PPG (strain)
= carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking k-steps * GH.w-Modulus (a negative number)

Where GH.p-Modulus is reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:

Stress
= viscosity factor (η: eta) * strain rate (dε/dt)

Where strain is expressed as Greek epsilon or ε.

In this article, in order to construct an "ellipse-like" diagram in a stress-strain space domain (e.g. "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain
= (body weight at certain specific time instant)

He also calculates his strain rate using the following formula:

Strain rate
= (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorder-induced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of explored deadly diseases and longevity characteristics using the viscoplastic medicine theory (VMT) include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect based on time-dependent stress and strain which are different from his previous research findings using linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).

Note: For a more detailed description, please refer to the "consolidated method" section which is given at the beginning of the special issue.

3. RESULTS

Figure 1 shows the data table, TD curves, and SD-VMT analysis results.

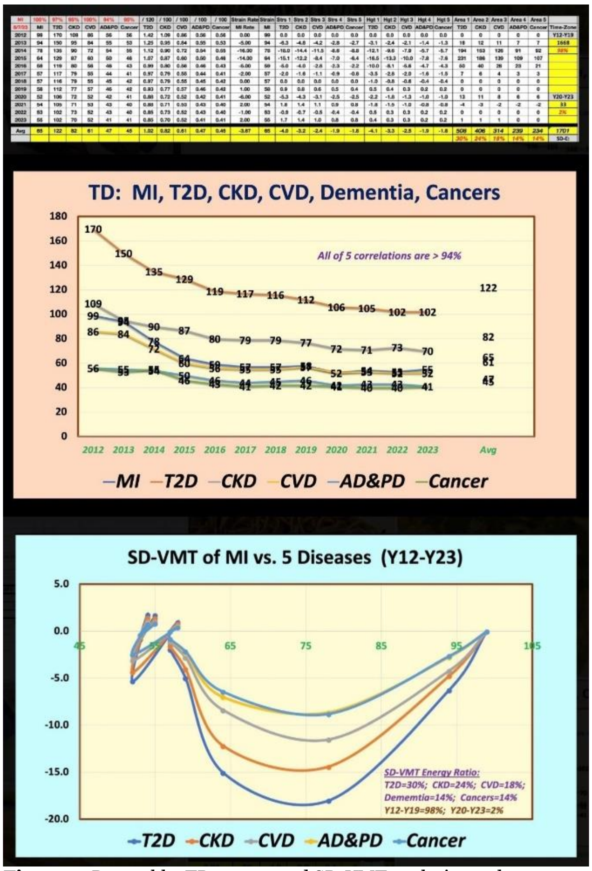

Figure 1: Data table, TD curves, and SD-VMT analysis results.

4. CONCLUSION

In summary, this study reveals two key findings:

Firstly, regarding the relationship between the MI and the author's chosen mortality diseases, the highest association is observed between the MI and T2D (30%). This is followed by CKD (20%), most likely due to the author developing CKD in 2010. The association with CVD is 18%, which occurred in earlier years between 1994 and 2004. Fortunately, the risks of dementia (24%) and cancer (14%) are relatively low for the author.

Secondly, this study highlights that the majority of the total contribution (98%) comes from the Pre-COVID period spanning from 2012 to 2019, while the COVID period from 2020-2023 only accounts for 2% of the total contribution. This indicates that the majority of the damage was incurred in the Pre-COVID period of 2012-2019.

5. REFERENCES

For editing purposes, majority of the references in this paper, which are self-references, have been removed for this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

Readers may use this article as long as the work is properly cited, and their use is educational and not for profit, and the author's original work is not altered.

For reading more of the author's published VGT or FD analysis results on medical applications, please locate them through three published special editions from the following three specific journals:

(1) Special Issue. The GH-Method. (https://www.theghmethod.com).

(2) Journal of Applied Material Science & Engineering Research (contact: Catherine).

(3) Advances in Bioengineering and Biomedical Science Research (contact: Sony Hazi).

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