ISSN: 2689-1204

Research Article

Journal of Applied Material Science & Engineering Research

Relative Risk Probability of a Female Patient with 3 Chronic Diseases having a Stroke or CVD/CHD using the Metabolism Index Model and her 8.5 Years Data based on GH-Method: Math-Physical Medicine (No. 491)

Gerald C Hsu

EclaireMD Foundation, USA

***Corresponding author**
Gerald C Hsu, EclaireMD Foundation, USA

Submitted: 01 Aug 2021; **Accepted**: 06 Aug 2021; **Published**: 18 Aug 2021

Citation: *Gerald C Hsu (2021) Relative Risk Probability of a Female Patient with 3 Chronic Diseases having a Stroke or CVD/CHD using the Metabolism Index Model and her 8.5 Years Data based on GH-Method: Math-Physical Medicine (No. 491). J App Mat Sci & Engg Res, 5(2), 1-8.*

Abstract

The author was professionally trained as a mathematician and an engineer. His view of health and medicine is similar to his past experience on designing and building a structure or a machine which he calls an "object". The expected strength or useful lifespan of an object is similar to the health and longevity of a human being based on the following three factors:

1. The availability of good and strong building materials that are similar to the genetic factors of a human body.
2. The engineering design and site construction of this object are comparable to the lifestyle, life-long habits, and environmental factors which are related to the health of the human body.
3. The object suffers from different operational problems due to external forces that is similar to the human body is affected by various diseases. After the object suffering from external impacts, using structural reinforcements to fix the building's damaged cracks or replacing the malfunctioning part of the machine are equivalent to diagnosing disease symptoms and then conducting various medical treatments of those human diseases. The medical treatments including medication interventions (oral drugs or biochemical injections), necessary surgeries, or certain organ transplants which are similar to engineering fix of the damaged object.

Once the author understood the analogy and similarity between an engineering object and a human body, he can then distinguish the differences among genetic reason, lifestyle maintenance, disease control, and medical treatments. It is extremely difficult, almost impossible, to change our genes because we cannot select our biological parents; however, we can focus on our daily lifestyle management to either prevent from having diseases or controlling the progression of existing diseases.

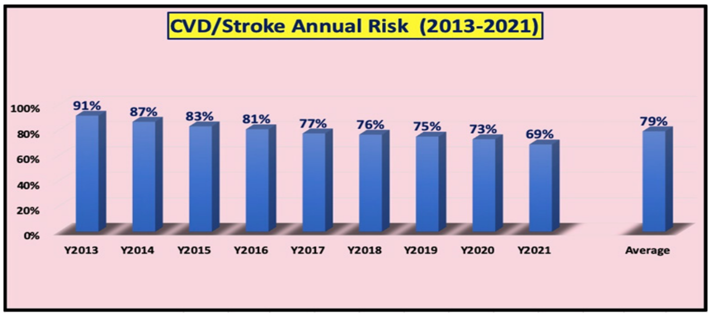
In the US, approximately 10% among the total deaths each year, (~2.85 million deaths occurred in 2019), are caused by infectious diseases, while another 12% involved injuries or suicide. The remaining 78% of deaths are due to various diseases associated with internal organs, particularly cardiovascular diseases (CVD), coronary heart diseases (CHD), or stroke. A large percentage of heart diseases and stroke are directly related to metabolism and chronic diseases.

However, among the 80% disease deaths, there is about 10% of deaths related to malpractice of medical treatments - "195,000 patients die in hospitals each year because of preventable medical mistakes", from the national trial law, medical malpractice statistics, Dr. George Stanislaw, 2019". Generally speaking, genetic factors only contributes around 20% or less to various diseases while lifestyle management and health maintenance cause approximately 80% of deaths. The following simple calculation can draw a conclusive fact that about 54% (0.8*(0.78-0.1)) of deaths caused by diseases are preventable through lifestyle management or improvements.

This article discusses the clinical case of a female patient's risk probability of having a stroke or CVD/CHD, known as the "CVD Risk" during the past 8.5 years. Her CVD Risk is closely related to the subjects on metabolism, medical conditions, disease prevention or control, and lifestyle management. From this case study, we can clearly observe that, despite the patient's "near-constant" state of her three chronic diseases (diabetes, hypertension and hyperlipidemia which are under medication interventions), her continuous improving lifestyle details has brought her "CVD risk" on a consistent downward trend. This means that she has been lowering her relative risk probability of having a CVD/CHD or stroke each year regardless of her increasing age.

In order to look into this particular study deeper, the author also conducts a *"**what-if" analysis***. *He made an assumption that if the patient reduces 10% of her average food consumptions quantity, improves 10% of her daily meal's quality by reducing red meat along with her between-meal snacks, and increasing her daily walking steps by 20%, then what would to happen about her overall CVD risks? This what-if analysis finds that* ***her CVD risks would be reduced by 3%*** *if she makes above-mentioned lifestyle improvements on her diet and her exercise.*

Life is precious and health is important where a long and healthy life is a desirable goal for everyone. Both of heart diseases and brain stroke cause a high percentage of death and disability. In order to avoid these health hazards, chronic disease conditions must be avoided or at least under control. As a result, lifestyle management is the crucial tool for achieving these health goals. This article provides a logical and practical way to lower risk probabilities of having a stroke or CVD/CHD.



Introduction

The author was professionally trained as a mathematician and an engineer. His view of health and medicine is similar to his past experience on designing and building a structure or a machine which he calls an "object". The expected strength or useful lifespan of an object is similar to the health and longevity of a human being based on the following three factors:

1. The availability of good and strong building materials that are similar to the genetic factors of a human body.
2. The engineering design and site construction of this object are comparable to the lifestyle, life-long habits, and environmental factors which are related to the health of the human body.
3. The object suffers from different operational problems due to external forces that is similar to the human body is affected by various diseases. After the object suffering from external impacts, using structural reinforcements to fix the building's damaged cracks or replacing the malfunctioning part of the machine are equivalent to diagnosing disease symptoms and then conducting various medical treatments of those human diseases. The medical treatments including medication interventions (oral drugs or biochemical injections), necessary surgeries, or certain organ transplants which are similar to engineering fix of the damaged object.

Once the author understood the analogy and similarity between an engineering object and a human body, he can then distinguish the differences among genetic reason, lifestyle maintenance, disease control, and medical treatments. It is extremely difficult, almost impossible, to change our genes because we cannot select our biological parents; however, we can focus on our daily lifestyle management to either prevent from having diseases or controlling the progression of existing diseases.

In the US, approximately 10% among the total deaths each year, (~2.85 million deaths occurred in 2019), are caused by infectious diseases, while another 12% involved injuries or suicide. The remaining 78% of deaths are due to various diseases associated with internal organs, particularly cardiovascular diseases (CVD), coronary heart diseases (CHD), or stroke. A large percentage of heart diseases and stroke are directly related to metabolism and chronic diseases.

However, among the 80% disease deaths, there is about 10% of deaths related to malpractice of medical treatments - *"195,000 patients die in hospitals each year because of preventable medical mistakes", from the national trial law, medical malpractice statistics, Dr. George Stanislaw, 2019"*. Generally speaking, genetic factors only contributes around 20% or less to various diseases while lifestyle management and health maintenance cause approximately 80% of deaths. The following simple calculation can draw a conclusive fact that ***about 54% (0.8*(0.78-0.1)) of deaths caused by diseases are preventable through lifestyle management or improvements.***

Methods

Death Caused By Diseases

As shown in Figure 1, approximately 2.85 million people died in 2019 from multiple causes of death in the United States. Among them, the first and largest group, ~1.4 million deaths or 50% of the total were directly related to metabolic disorders and their various complications. The second group, ~800,000 deaths or 28% were caused by a variety of cancers. Furthermore, within the cancer cases, at least about 45% of them were directly related to metabolic disorders. The third group, ~275,000 deaths or ~10% of the total deaths were caused by various infectious diseases (not including COVID-19 data). This group of infectious diseases requires excellent medical treatments and a strong body immunity to fight against infections from different virus or bacteria. The medical community has already proven that immunity and metabolism are closely related to each other, like two sides of the same coin. In summary, 88% of the total death cases are related, either directly or indirectly, to metabolism. The final remaining 12% of death cases are accident, injury, and suicide which are not related to diseases, except suicides may be related to psychological diseases.

Research Method in this Article

In this paper, the author described how to apply his engineering science background, including mathematics, physics, and computer science to conduct his medical research on the subject of "risk probability of having a stroke or CVD/CHD". He has reviewed 8.5-years of data from 1/1/2013 through 8/5/2021 belonging to a clinical case of a female patient with three chronic diseases, where he focused on both of her chronic disease's medical conditions and her general health lifestyle details. It should be pointed out that this patient's annual lifestyle scores were estimated by the author through an interview with the patient. After the initial data collection, he then applied the same mathematical risk model developed by the author ~4 years ago based on the GH-Method: math-physical medicine approach.

As a part of his medical research, he applied the acquired mechanical and structural engineering knowledge to develop several biomedical models to research three chronic diseases and their complications. They include cardiac vascular disease (CVD), coronary heart disease (CHD), stroke, chronic kidney disease (CKD), diabetic retinopathy (DR), pancreatic beta cells impairment, and even risk probabilities of having cancer or dementia in order to estimate the impact on human lives. In the worst case scenario, deaths caused by diseases are often triggered by a single disease or a combination of various diseases.

The engineering analogy of deaths caused by disease and human expected lifespan can be explained simply by using an example of a new machine or a new bridge. If we develop a monitoring system to continuously measure, record, and analyze the external forces, material strength and damages of material of a machine or a bridge, as well as the relationship between force/stress (causes of disease such as lifestyle details) and deformation/strain (symptoms of disease such as medical conditions), we can then have a clear idea how severe the damages are and how long this machine or bridge will last which is their useful life or expected lifespan.

The author self-studied chronic diseases, metabolism, and food nutrition for 4-years from 2010 to 2013. He started his medical research work by building a mathematical metabolism model in 2014. He named his research methodology as the "GH-method: math-physical medicine (MPM approach)".

Over the past 11 years of his MPM research, he has learned that the most important factor is knowing how to apply physics principles and engineering modeling techniques to various biomedical problems. This is different from inserting your biomedical data into some existing mathematical equations extended from physical theories and engineering models. The reason for doing this is that the original mathematical equations associated with the inventors' theories or models usually come along with their original boundary conditions. This may or may not be perfectly fit into your biomedical situations directly; therefore, you must understand the scope and applicability of these physical theories and engineering models first, and then find a suitable way to apply them. In other words, by learning other people's wisdom first and then find a way to apply their wisdom to your own biomedical problem is the most practical way to solve these biomedical problems.

The author's simple numerical calculation of CVD risk for this female patient is based on his knowledge and applications of physics law/concept and engineering modeling, big data analytics, and his developed mathematical metabolism model. It has depicted a possible way to extend lowering the risk probability of having CVD risks via an effective metabolic condition improvement and lifestyle maintenance program. This practical method has already been applied and proven effectively in the author's own case of control of his diabetes and complications without taking medications over the past 6 years.

The author hopes that this method can also be easily applied to other patients who face the risks of having strokes or CVD/CHD. Although he has already collected 2+ million data of his own health data using a customized computer software, the methodology and risk prediction tool are equally applicable and useful for other patients. For example, if patients are able to collect sufficient data regarding their routine check-ups on chronic disease conditions from a hospital or laboratory, then they can directly plug the input data of M1 through M4 into the risk prediction model. They can also utilize the same approach to deal with their own guesstimated lifestyle data of M5 through M10, which is the case in this article about the female patient.

Math-Physical Medicine

Topology is a newer branch of mathematics which was created around 1900. It studies key properties of "spaces", such as metabolism of the human body space, which are invariant under any continuous deformation happened during the lifespan. A few key properties or characteristics are not going to change as long as the space itself is not encountering a "breaking" situation, such as operational discontinuity of organs or death (death is a total "broken" case). Topology optimization is a mathematical method that optimizes material layout within a given design space, for a given set of loads/forces, boundary conditions and constraints with the goal of maximizing the performance of the system. As a matter of fact, topology optimization has been applied by some engineers on obtaining the best layout design and best expected performance of some automotive components (Reference 2). When we look at human organs and try to determine how to achieve certain predetermined health goals, we recognize that the human metabolism is also a related form of the "topology optimization". This problem can be solved by using some available mathematical programming method in combination with finite element engineering modeling method from both structural and mechanical engineering disciplines to conduct the targeted analysis in order to obtain an optimized human organ performance or human organ's biochemical response.

Based on the above learned academic knowledge and acquired professional experience, the author spent the entire year of 2014 to develop a mathematical metabolism model. This human metabolism model consists of a total of 10 categories, including 4-categories of disease conditions (body outputs, like deformation/strain) and 6-categories of lifestyle details (body inputs, like force/stress). Similar to an engineering finite element model, these 10 categories further consist of around 500 detailed elements. Finally, utilizing complicated mathematical derivations and multiple programming techniques, he was able to proceed his topological response analysis and obtained his developed 14-page long output sheets which was then used in 2014 for his software programming work. This application software development task is a rather sophisticated job that obtains an *approximated* estimation of human metabolism situation.

A physical analogy of this mathematical metabolism model is similar to "using a finite numbers of nails that are encircled by millions rubber bands". For example, at first, we hammer 10 nails into a piece of flat wood with an initial shape of a circle with a center in the middle of the circle, then take 3,628,800 (=10!) rubber bands to encircle all of these 10 nails, starting with 2 nails, and then 2+ nails, and finally enclosing all of these 10 nails. These ~3.6 million rubber bands represent the maximum possible relationships existing among these 10 nails. In other words, a small number of data elements of 10 would create a huge number of possible relationships to connect these 10 data elements. Some rubber bands encircle 2 nails, or 3 nails, and so on, until the last rubber band encircles all of the 10 nails together (no rubber band to encircle a single nail is allowed). Now, if we move any one of the nails ***outward*** (i.e., moving away from the center of the nail circle), then this moving action would create some internal tension (or stretch force) inside the encircled rubber band. Moving one particular nail "outward" means one of these ten metabolism categories is becoming "***unhealthy***" which would cause some internal stress to our body. Of course, we can also move some or all of these 10 nails outward at the same time, and with different moving scale for each nail. If we can measure and calculate the summation of all of these internal tensions which are created inside of the affected rubber bands, then this summarized tension force is equivalent to the total metabolism value of human health. The higher tension means the higher metabolism value which creates an unhealthy situation. The author uses the above-described physical scenario of moving nails and estimating tensions inside of their encircled rubber bands to explain his developed model of mathematical metabolism for human health.

At first, he developed a medical software APP on his iPhone in 2011, he then began collecting his own health data of weight and glucose since 1/1/2012. After that, he started category by category to enter his other medical conditions, e.g. blood pressure, lipid, etc. and detailed lifestyle data for the period of 2013 to 2014. By now 8/7/2021, he has already collected more than 2 million data regarding his own body health and lifestyle details. Finally, by the end of 2014, he compiled all of his available big data together and expressed them in terms of two newly defined biomedical terms: the ***metabolism index (MI)***, which is a combined daily score to show the body health situation, and general ***health status unit (GHSU)***, which is the 90-days moving average number to show the health trend. He has also identified a "***break-even line or point" at 0.735 or 73.5%*** to separate his metabolic conditions between the healthy state (below 0.735) and unhealthy state (above 0.735).

With his collected 2+ million big data, he focused initially on weight and glucose to conduct further analysis in order to put his severe diabetes under control. This was his top priority. Like engineers looking at a project's dynamic structural design data or cardiologists reviewing a patient's EKG chart, he adopted the traditional time-series analysis approach. He then quickly realized that he could easily obtain a different conclusion dependent upon his selected time window of his data.

One day, as he studied the history of medicine, he found an interesting story about how Dr. John Snow from the UK discovered the cholera outbreak, which spread in the Broad Street area of London in 1854. He decided to adopt this similar concept, i.e. spatial analysis, from statistics as an additional tool to analyze his big and complicated medical data. A good example of his spatial analysis applications is the close relationship between morning's body weight and morning's fasting glucose which can be identified easily via eye-checking and also proved precisely by mathematics. If he uses a spatial analysis approach and analyzed all data he collected within the entire long period of time span, he could easily see a bigger picture, such as the data's relationship and data moving trend. Sometimes, the conclusion derived from a global view using spatial analysis might not be consistent with certain local views using time series analysis from a shorter time period. Spatial analysis is powerful to provide a rather clear view of the relationship and data moving trend provided when data size is big enough.

He also applied Fourier transform to convert a time domain data into a frequency domain in order to calculate and compare associated energy between high frequency with lower amplitude glucose components versus low frequency with higher amplitude glucose components. The energy theory from mechanical engineering is frequently used by him to apply it on calculating different degrees of energy on the internal organs carried by different glucose components. He also applied the frequency domain analysis to figure out the damage on human organs due to different input waveforms, such as a glucose wave or a heartbeat wave. This is how he connected the energy theory application of mechanical engineering with the wave theory application of electronics engineering.

At times, he also utilized signal processing techniques from wave theory (electronic engineering, radio-wave communication, and geophysics) to decompose a glucose waveform into many component-based sub-waveforms in order to study the impact on glucose by different contribution components, such as food, exercise, etc.

One day in early 2020, he suddenly realized that Albert Einstein invented quantum mechanics and theory of relativity to figure out the complex relationship among planets in the outer space. But, inside of our human body, there is an inner space which contains many inter-connected organs. It is similar to the many mutually-influenced planets in the outer space. The complexity of human organs and diseases are very similar to the complexity of planets in the outer space. He then decided to apply the perturbation theory (single variable with first-order to third-order polynomials only) of quantum mechanics to predict an approximate postprandial glucose (PPG) waveform before the patients eat their meals. He also applied the perturbation theory's approximation method on his risk assessment of having CVD, CHD, CKD, stroke, DR, cancers, and expected health age of longevity. Remarkably, all of his analyses to date have achieved 95% to 99% of prediction accuracy.

The author has suffered many complications resulting from his obesity, diabetes, hypertension, and hyperlipidemia, including five cardiac episodes, critical kidney condition, bladder infection, diabetic foot ulcer, retinopathy, neuropathy, hypothyroidism, diabetic constipation, diabetic fungal infection, and more. By using metabolism as the foundation of his analysis, he is able to extend his research into many different but inter-related medical branches as long as the diseases share some or many overlapping root-causes. In his extended risk study of disease complications, genetic factors, and certain environmental influences were also included in his mathematical modeling.

In some of published medical papers regarding the study of identifying direct relationships among diseases, some phrases used frequently by some medical research scientists such as, *"lacking epidemiological evidence, having incomplete biological links, or facing unclear pathophysiologies underlying of the association between disease A and disease B"*.

Consequently, the author began to contemplate the meaning of this subject deeper by using his physics and engineering background. For example, various cancers (Disease A) and diabetes (Disease B) have their own separated root-causes, but the majority of the two families of disease causes are overlapping with each other. In order to identify the direct relationship between diabetes and cancers based on ***symptoms only*** is more unclear or even difficult. However, it may be easier to start with digging into their ***overlapping causes***, e.g. lifestyle, genetics, life-long bad habits, or environmental factors, and the overall metabolism.

This situation can be illustrated using the author's engineering and physics background. For example, a steel structure can undergo three types of forces, one-dimensional (1D: tensile/compression), two-dimensional (2D: shear), or three-dimensional (3D: bulk pressure). The 1D tensile stress (stretching force) and strain (longitudinal stretched deformation) are dependent on the Young's modules, the 2D shear stress (shear force) and strain (shear deformation) are reliant on the shear modules, and the 3D stress and strain are contingent on the bulk modulus. However, these 3 Modulus of the steel material are actually the natural properties of steel material which are similar to our body health and organ strength. Let us take 1D and 2D cases to demonstrate the relationship between cancer and diabetes. If the Young's modules is equivalent to the cancers relationship between their causes and symptoms, and shear modules is similar to the diabetes relationship between its causes and symptoms, then both diseases (symptoms or deformations) are directly related to the actual causes or forces which are further dependent on the material properties of the study subject (steel or human body). The engineering material (or human body material) contains Young's modules and shear modules that is parallel to our human body as being under the influences of common causes of diseases such as genetics, life habits, lifestyle details, environmental factors, medical conditions, and overall metabolism. Therefore, we need to start with the understanding of the material (body and organs) first or the underlying causes (lifestyles, genetic, habits, environmental) instead of directly searching for the relationship between the symptoms such as tension and shear (i.e., the symptoms of cancers and symptoms of diabetes).

CVD/CHD and Stroke

Among the three chronic diseases such as diabetes, hypertension, and hyperlipidemia, diabetes causes the most fundamental damage to our blood system. The blood cells carry both nutrition via glucose produced by the liver and oxygen transferred from the lungs, then circulate through the blood vessels in our bodies. When elevated glucose flows through the arteries, it would alert the immune cells within the artery wall; therefore, these cells will treat them as an "invader" and start to fight against them. This fight will result in a situation similar to the inflammation on the artery wall, causing the blood vessel wall to thicken with a non-smooth surface. This rough surface allows the buildup of lipids in the blood with the formation of plaque. As a result, the combination of high glucose (Diabetes) and high lipids (Hyperlipidemia) will create an artery blockage (~70% cases). When high blood pressure (Hypertension) is added into the picture, an artery rupture becomes a possibility (~30% cases). These two situations can lead to a heart attack or stroke. For micro-vessels, elevated glucose may cause tiny, microscopic leakages instead. The kidney's normal functions are to discharge body waste and recycle protein back into the body. These microscopic leaking holes will reverse these two functions, which means the leaking of useful protein out of the body via urination and recycling body waste back into the body can be toxic. This is why dialysis is utilized to mechanically perform the kidney's normal expected functions. Other complications, such as erectile dysfunction, bladder complications, peripheral nervous damage, and retina damage are also based on similar biophysical interpretations and biomedical reasons.

As an engineer, the author visualizes an image in his mind with the analogy of acid (glucose), water pipe (blood vessel), water pressure (blood pressure), and butter flowing through the pipe (lipids in blood). This mechanical scenario of pipes is quite similar to the biomedical scenario happening inside our blood vessels (both macro-vessels and micro-vessels).

In addition, if the damage is not too severe and only lasts for a shorter period of time, the body and organs are still in an "elastic state", which is similar to pre-diabetes conditions that can be reversed. However, when diabetes becomes extremely severe and lasts for a longer period of time, then the body and organs are entering into a "plastic state" i.e., never fully reverting back to its original healthy state. By applying this structural engineering concept and using other math-physical techniques, the author can provide a guesstimate on the self-repair rate for his damaged pancreatic beta cells. For example, during the past 10 years, his pancreatic beta cells have been self-repaired around 30% of their initial state of damages.

Based on above-learned knowledge and biophysical descriptions of the heart/brain diseases, i.e., macro-vessel diseases, he has selected different contribution margins (or weighting factors) for each of his 10 metabolism categories for this analysis which are listed below:

CVD Risk Categories:	Contribution
m1 (Weight)	
m2 (Glucose)	16.00%
m3 (Blood Pressure)	8.00%
m4 (Lipid)	16.00%
m5 (Exercise)	10.00%
m6 (Water)	3.75%
m7 (Sleep)	5.00%
m8 (Stress)	5.00%
m9a (Food & Diet)	13.75%
m10 (Daily Routine)	2.50%
Gentic	7.50%
Weight and Habits	12.50%
Sum	100.0%

After the author compiled a large amount of data over the past 11 years, he built mathematical models to understand the progression stages of his diseases and also predict the projection of possible disease development rate in the future. Therefore, his various disease risk probabilities can then be estimated with a reasonably high degree of prediction accuracy.

The information mentioned depicts how a mechanical and structural engineer, physicist, computer scientist, and mathematician who lacks formal training on both biology and chemistry, learned about deaths caused by various chronic diseases and their complications and is able to conduct all related medical research work. With all of his developed math-physical medicine research work, his final goal is to fight against different diseases in order to survive by avoiding "pre-mature" death (at least ~80% of death cases). Living a healthier and longer life is everyone's ultimate objective. This is also his driving force in dedicating his entire efforts on medical research since 2010.

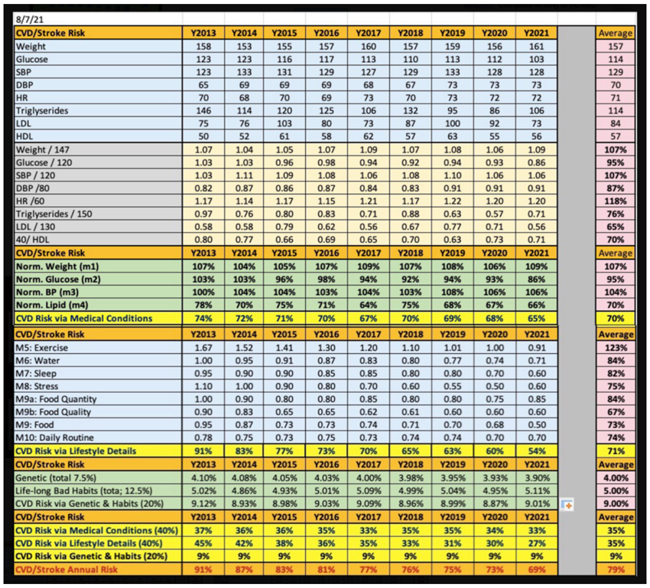
Results

Figure 1 shows the deaths in the United States during 2019. It is clear that almost 50% of deaths caused by diseases are directly related to metabolic disorders. Furthermore, at least another 50% of deaths are caused by Cancer (28%) and Infectious diseases (10%) which are partially related to metabolism. In conclusion, there are ~69% of total deaths caused by diseases that are either directly or indirectly related to metabolism; then there are 69% of deaths from diseases contribution: (0.5+0.5 * (0.28+0.10)). Furthermore, as mentioned earlier, metabolism has ~80% contribution from lifestyle. Therefore, ***the lifestyle management contributes ~55% of disease deaths: (0.69*0.8).***

8/6/21			
2017 Death Cause	Y19 Sub-Category (# per 100,000)	Metabolism related	# of Death
Heart	161.5	161.5	
Cancer	146.2		
Accidents	49.3		
Respiratory	38.2		
Stroke	37.0	37.0	
Alzheimer's	29.8	29.8	
Diabetes	21.6	21.6	
Kidney	12.7	12.7	
Pneumonia	12.3		
Suicide	13.9		
Total	522.5	262.6	
Chronic Related	263	50%	1,430,249.27
Cancer	146	28%	796,277.39
Infectious	51	10%	275,047.94
Accidents & Suicide	63	12%	344,218.41
Percentage	523	100%	2,845,793
	2,845,793		

Figure 1: US leading disease deaths during 2019

Figure 2 illustrates the input data and calculated data of ten MI categories and the final results of CVD risk from 2013 to 2021. It should be pointed out that the patient's medical conditions are maintained at an almost equal level over the long period of 8.5 years from 2013 to 2021. However, her weight has been consistently above target for the BMI value of 25. In addition, it should be noted here that her near-constant medical conditions are the results from her medication interventions for her diabetes, hypertension, and hyperlipidemia. ***Therefore, medications may be effective in controlling the external symptoms of the disease, but on the other hand, it also covers up the true causes of diseases.*** With this clinical case, her lifestyle details are undergoing improvement continuously year-after-year. This is the main reason for her CVD/CHD or Stroke's relative risk percentages are improving annually.



8/7/21										
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Weight	158	153	155	157	160	157	159	156	161	157
Glucose	123	123	116	117	113	110	113	112	103	114
SBP	123	133	131	129	127	129	133	128	128	129
DBP	65	69	69	69	68	67	73	73	73	70
HR	70	68	70	69	73	70	73	72	72	71
Triglyserides	146	114	120	125	106	132	95	86	106	114
LDL	75	76	103	80	73	87	100	92	73	84
HDL	50	52	61	58	62	57	63	55	56	57
Weight / 147	1.07	1.04	1.05	1.07	1.09	1.07	1.08	1.06	1.09	107%
Glucose / 120	1.03	1.03	0.96	0.98	0.94	0.92	0.94	0.93	0.86	95%
SBP / 120	1.03	1.11	1.09	1.08	1.06	1.08	1.10	1.06	1.06	107%
DBP /80	0.82	0.87	0.86	0.87	0.84	0.83	0.91	0.91	0.91	87%
HR /60	1.17	1.14	1.17	1.15	1.21	1.17	1.22	1.20	1.20	118%
Triglyserides / 150	0.97	0.76	0.80	0.83	0.71	0.88	0.63	0.57	0.71	76%
LDL / 130	0.58	0.58	0.79	0.62	0.56	0.67	0.77	0.71	0.56	65%
40/ HDL	0.80	0.77	0.66	0.69	0.65	0.70	0.63	0.73	0.71	70%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Norm. Weight (m1)	107%	104%	105%	107%	109%	107%	108%	106%	109%	107%
Norm. Glucose (m2)	103%	103%	96%	98%	94%	92%	94%	93%	86%	95%
Norm. BP (m3)	100%	104%	104%	103%	104%	103%	108%	106%	106%	104%
Norm. Lipid (m4)	78%	70%	75%	71%	64%	75%	68%	67%	66%	70%
CVD Risk via Medical Conditions	74%	72%	71%	70%	67%	70%	69%	68%	65%	70%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
M5: Exercise	1.67	1.52	1.41	1.30	1.20	1.10	1.01	1.00	0.91	123%
M6: Water	1.00	0.95	0.91	0.87	0.83	0.80	0.77	0.74	0.71	84%
M7: Sleep	0.95	0.90	0.90	0.85	0.85	0.80	0.80	0.70	0.60	82%
M8: Stress	1.10	1.00	0.90	0.80	0.70	0.60	0.55	0.50	0.60	75%
M9a: Food Quantity	1.00	0.90	0.80	0.80	0.85	0.80	0.80	0.75	0.85	84%
M9b: Food Quality	0.90	0.83	0.65	0.65	0.62	0.61	0.60	0.60	0.60	67%
M9: Food	0.95	0.87	0.73	0.73	0.74	0.71	0.70	0.68	0.50	73%
M10: Daily Routine	0.78	0.75	0.73	0.75	0.73	0.74	0.74	0.70	0.70	74%
CVD Risk via Lifestyle Details	91%	83%	77%	73%	70%	65%	63%	60%	54%	71%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Genetic (total 7.5%)	4.10%	4.08%	4.05%	4.03%	4.00%	3.98%	3.95%	3.93%	3.90%	4.00%
Life-long Bad Habits (tota; 12.5%)	5.02%	4.86%	4.93%	5.01%	5.09%	4.99%	5.04%	4.95%	5.11%	5.00%
CVD Risk via Genetic & Habits (20%)	9.12%	8.93%	8.98%	9.03%	9.09%	8.96%	8.99%	8.87%	9.01%	9.00%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
CVD Risk via Medical Conditions (40%)	37%	36%	36%	35%	33%	35%	35%	34%	33%	35%
CVD Risk via Lifestyle Details (40%)	45%	42%	38%	36%	35%	33%	31%	30%	27%	35%
CVD Risk via Genetic & Habits (20%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%
CVD/Stroke Annual Risk	91%	87%	83%	81%	77%	76%	75%	73%	69%	79%

Figure 2: Data table of MI and CVD risk calculation

Figure 3 is the conclusive graph of this study. It includes two diagrams. The top diagram is the comparison between her MI curve and her CVD risk curve. As the author mentioned earlier in the Method section, *the MI and GHSU scores of >73.5% would be considered as unhealthy and <73.5% would be healthy. This patient's MI curve started to pass through the break-even point in 2018 which is the year of her MI score (73%) becomes lower than her relative risk level of CVD (76%).*

Although the CVD risks are strongly related to MI scores, their mathematical calculation equations are almost totally different. ***However, their extremely high correlation of 99.8% indicates that metabolism status and relative risks of having heart or brain diseases have very strong biomedical connection.*** The bottom diagram reveals *her relative risk probability of having a stroke or CVD/CHD within the time frame starting from 91% in 2013 to gradually decreasing to 69% in 2021 with an average of 79%.*

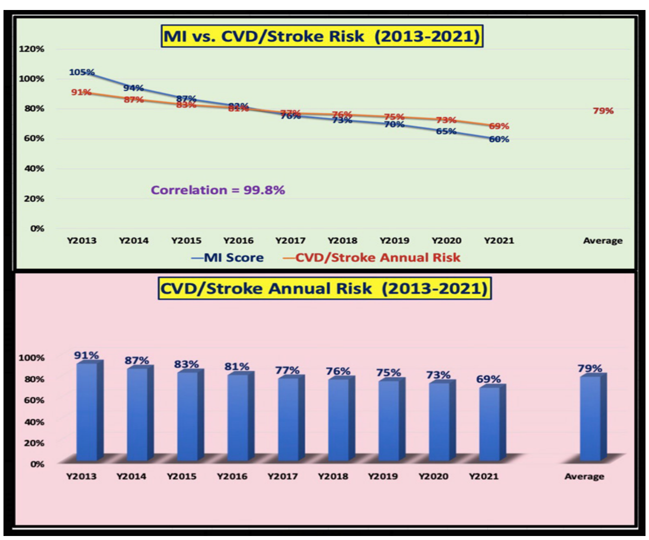
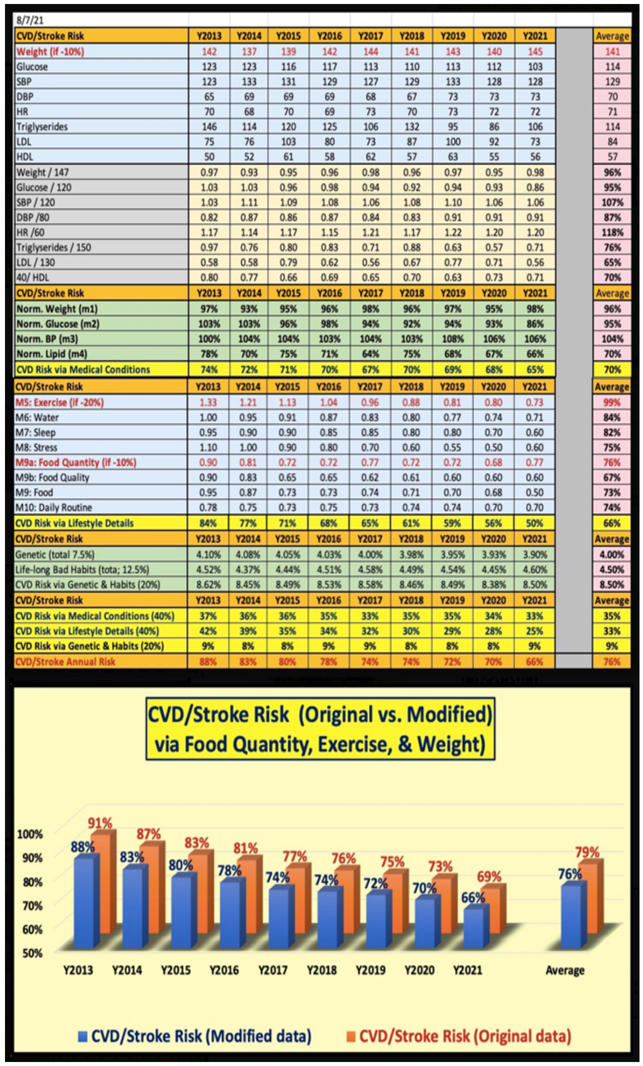


Figure 3: Comparison of MI vs. CVD risk and Relative risk probability of having a stroke, CVD/CHD from 2013 to 2020

Figure 4 illustrates the supporting data and calculation of his ***"what-if" analysis*** *results. In this scenario of "what-if" situation, the author's suggestions to* ***the patient are that the patient should reduce her food consumption quantity and improve her food quality by 10% along with adding 20% of daily exercise amount which would expect to reduce her body weight by 10% (within the target of BMI 25).*** *If she meets these challenges, what would her CVD relative risks be? The bottom diagram of Figure 4 provides the clear answer that* ***she would be able to reduce her annual CVD relative risks by 3%.***



8/7/21										
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Weight (if -10%)	142	137	139	142	144	141	143	140	145	141
Glucose	123	123	116	117	113	110	113	112	103	114
SBP	123	133	131	129	127	129	133	128	128	129
DBP	65	69	69	69	68	67	73	73	73	70
HR	70	68	70	69	73	70	73	72	72	71
Triglyserides	146	114	120	125	106	132	95	86	106	114
LDL	75	76	103	80	73	87	100	92	73	84
HDL	50	52	61	58	62	57	63	55	56	57
Weight / 147	0.97	0.93	0.95	0.96	0.98	0.96	0.97	0.95	0.98	96%
Glucose / 120	1.03	1.03	0.96	0.98	0.94	0.92	0.94	0.93	0.86	95%
SBP / 120	1.03	1.11	1.09	1.08	1.06	1.08	1.10	1.06	1.06	107%
DBP /80	0.82	0.87	0.86	0.87	0.84	0.83	0.91	0.91	0.91	87%
HR /60	1.17	1.14	1.17	1.15	1.21	1.17	1.22	1.20	1.20	118%
Triglyserides / 150	0.97	0.76	0.80	0.83	0.71	0.88	0.63	0.57	0.71	76%
LDL / 130	0.58	0.58	0.79	0.62	0.56	0.67	0.77	0.71	0.56	65%
40/ HDL	0.80	0.77	0.66	0.69	0.65	0.70	0.63	0.73	0.71	70%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Norm. Weight (m1)	97%	93%	95%	96%	98%	96%	97%	95%	98%	96%
Norm. Glucose (m2)	103%	103%	96%	98%	94%	92%	94%	93%	86%	95%
Norm. BP (m3)	100%	104%	104%	103%	104%	103%	108%	106%	106%	104%
Norm. Lipid (m4)	78%	70%	75%	71%	64%	75%	68%	67%	66%	70%
CVD Risk via Medical Conditions	74%	72%	71%	70%	67%	70%	69%	68%	65%	70%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
M5: Exercise (if -20%)	1.33	1.21	1.13	1.04	0.96	0.88	0.81	0.80	0.73	99%
M6: Water	1.00	0.95	0.91	0.87	0.83	0.80	0.77	0.74	0.71	84%
M7: Sleep	0.95	0.90	0.90	0.85	0.85	0.80	0.80	0.70	0.60	82%
M8: Stress	1.10	1.00	0.90	0.80	0.70	0.60	0.55	0.50	0.60	75%
M9a: Food Quantity (if -10%)	0.90	0.81	0.72	0.72	0.77	0.72	0.72	0.68	0.77	76%
M9b: Food Quality	0.90	0.83	0.65	0.65	0.62	0.61	0.60	0.60	0.60	67%
M9: Food	0.95	0.87	0.73	0.73	0.74	0.71	0.70	0.68	0.50	73%
M10: Daily Routine	0.78	0.75	0.73	0.75	0.73	0.74	0.74	0.70	0.70	74%
CVD Risk via Lifestyle Details	84%	77%	71%	68%	65%	61%	59%	56%	50%	66%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
Genetic (total 7.5%)	4.10%	4.08%	4.05%	4.03%	4.00%	3.98%	3.95%	3.93%	3.90%	4.00%
Life-long Bad Habits (tota; 12.5%)	4.52%	4.37%	4.44%	4.51%	4.58%	4.49%	4.54%	4.45%	4.60%	4.50%
CVD Risk via Genetic & Habits (20%)	8.62%	8.45%	8.49%	8.53%	8.58%	8.46%	8.49%	8.38%	8.50%	8.50%
CVD/Stroke Risk	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Y2021	Average
CVD Risk via Medical Conditions (40%)	37%	36%	36%	35%	33%	35%	35%	34%	33%	35%
CVD Risk via Lifestyle Details (40%)	42%	39%	35%	34%	32%	30%	29%	28%	25%	33%
CVD Risk via Genetic & Habits (20%)	9%	8%	8%	9%	9%	8%	8%	8%	9%	9%
CVD/Stroke Annual Risk	88%	83%	80%	78%	74%	74%	72%	70%	66%	76%

Figure 4: Graphic comparison of "what-if" analysis results

Conclusions

This article discusses the clinical case of a female patient's risk probability of having a stroke or CVD/CHD, known as the "CVD Risk" during the past 8.5 years. Her CVD Risk is closely related to the subjects on metabolism, medical conditions, disease prevention or control, and lifestyle management. From this case study, we can clearly observe that, despite the patient's "near-constant" state of her three chronic diseases (diabetes, hypertension and hyperlipidemia which are under medication interventions), her continuous improving lifestyle details has brought her "CVD risk" on a consistent downward trend. This means that she has been lowering her relative risk probability of having a CVD/CHD or stroke each year regardless of her increasing age.

In order to look into this particular study deeper, the author also conducts a *"**what-if" analysis.** He made an assumption that if the patient reduces 10% of her average food consumptions quantity, improves 10% of her daily meal's quality by reducing red meat along with her between-meal snacks, and increasing her daily walking steps by 20%, then what would to happen about her overall CVD risks? This what-if analysis finds that **her CVD risks would be reduced by 3%** if she makes above-mentioned lifestyle improvements on her diet and her exercise.*

Life is precious and health is important where a long and healthy life is a desirable goal for everyone. Both of heart diseases and brain stroke cause a high percentage of death and disability. In order to avoid these health hazards, chronic disease conditions must be avoided or at least under control. As a result, lifestyle management is the crucial tool for achieving these health goals. This article provides a logical and practical way to lower risk probabilities of having a stroke or CVD/CHD.

References

For editing purposes, the 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.

1. RJ Yang, AI Chahande (1995) Automotive applications of topology optimization. Structural optimization 9: 245-249.