

The Effect of Lifestyle Modification on the Overall Health, Particularly During the Covid-19 Period Using GH-Method: Math-Physical Medicine (no. 298)

Gerald C Hsu*

eclaireMD Foundation, USA

Abstract

This paper describes the author's health condition quantitative improvements resulting from his lifestyle modification, especially on his diabetes control within a 4.5-year period covering two years from 7/1/2018 to 6/30/2020. Special attention has been placed on the COVID-19 quarantine timeframe from 1/1/2020 to 6/30/2020.

COVID-19 is more than 100 times worse than SARS that occurred in 2003, in terms of its spreading speed, fatality number, and emotional impact on the world population. People belonging to the "vulnerable" groups, such as the elderly with existing chronic diseases and history of complications who require special attention to their health conditions and lifestyle management during this COVID-19 quarantine period. In this particular period, the author achieved better results on both his diabetes control and overall metabolism management. The knowledge and experience he has gained in the past 10 years of medical research and his developed Metabolism Index (MI) model along with his four diabetes prediction tools assisted him in many ways. During the quarantine period, he has stopped traveling and suffered no jet-lag, eating home-cooked meals, maintaining nutritional balance, continuing his daily walking exercise of 16,000 steps (~10.7 km or 6.7 miles), sleeping 7.2 hours per night, living a stress-free life, avoiding negative news of politics and the virus, and keeping a regular daily life routine. Conducting medical research is his hobby, not his job; therefore, he feels no pressure to continuously perform his medical research. As a result, he has turned the COVID-19 crisis into his health advantage!

Keywords: Covid-19; Overall health; Vulnerable

Introduction

This paper describes the author's health condition quantitative improvements resulting from his lifestyle modification, especially on his diabetes control within a 4.5-year period covering two years from 7/1/2018 to 6/30/2020. Special attention has been placed on the COVID-19 quarantine timeframe from 1/1/2020 to 6/30/2020.

Methods

Background

The author spent ~30,000 hours over the past 10 years, from 2010 to 2020, to conduct his research on chronic diseases and complications, along with endocrinology, specifically focusing on metabolism and glucose.

In the beginning, from 2010 to 2013, he self-studied internal medicine and food nutrition. He specifically focused on six chronic diseases, i.e., obesity, diabetes, hypertension, hyperlipidemia, Cardiovascular Disease (CVD) & stroke, and Chronic Kidney Disease (CKD). In 2014, he allotted the entire year and used topology concept

***Corresponding author:** Gerald C Hsu, eclaireMD Foundation, USA, Tel: +1 5103315000; E-mail: g.hsu@eclairemd.com

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of mathematics with modeling technique of finite element method of mechanical and structural engineering to develop a complex mathematical Metabolism Index (MI) model. This MI model includes 4 body outputs, i.e. symptom which include weight for obesity, glucose for diabetes, blood pressure for hypertension, and lipids for hyperlipidemia; and 6 body inputs, i.e., causes, stressors or stimulators which include food portion and nutritional balance, water intake (for blood dilution, circulation and detoxification), regular and persistent exercise, high quality sleep, stress reduction, daily life routine regularity. Not only do they have a strong connection between these 6 inputs and 4 outputs, they also have a complicated inter-relationship within these two groups, outputs and inputs. Furthermore, the author also defined about 500 detailed elements within these 10 categories. Theoretically, the total number of inter-relationships among these 500 elements is 500! (500 factors). This is an unnecessary obstacle with a nearly impossible task. In summary, he decided to use a series of linearized operations to describe this highly nonlinear dynamic system. In addition, he can calculate a "static" snapshot to peek into this complex and dynamic biomedical metabolism system. By the end of 2014, he has finally developed a practical yet accurate enough mathematical metabolism model embedded in a specially designed application software ("eclaireMD") on his iPhone for his daily use in order to maintain his health status.

During the development process, he has defined two more new variables, Metabolism Index (MI) and General Health Status Unit (GHSU), where GHSU is the 90-days moving average MI that is similar to the relationship between HbA1C and 90-days moving average glucoses. The analysis results of this dynamic model can be expressed through these two "ever-changing" overall health variables, MI and GHSU, to describe a person's health status and also identify shortcomings in any specific health area at any moment in time. For example, at any time instant of a day, particularly when he has some

changes or new inputs into his system, he can immediately see his “static snapshots” of health through his MI and GHSU values on his iPhone screen.

In the following two-year period, 2015 and 2016, he dedicated his time to research four prediction models related to his diabetes measurement conditions, i.e. weight, Postprandial Plasma Glucose (PPG), Fasting Plasma Glucose (FPG), and HbA1C (A1C).

As a result from using his own developed metabolism model and four prediction tools, his weight reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), averaged finger glucose from 280 mg/dL to 120 mg/dL, and HbA1C from 10% to ~6.5%. During the recent COVID-19 quarantine period, his weight is further reduced to 169 lbs., daily average glucose to 110 mg/dL, and his HbA1C to 6.4%. Another remarkable accomplishment is that he no longer takes any diabetes medications since 12/8/2015. He has lived a “medications free” life for almost 5 years.

From 2018 to 2019, he traveled to 50+ international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to both of his diabetes control, through eating out along with exercise disruption, sleep disturbance, stress, and overall metabolism score increase due to his irregular life routines through traveling. The effect of his busy traveling schedule during 2018 and 2019 along with the lifestyle disturbance and minor damage to his health conditions via his strokes and Cardiovascular Diseases (CVD) risk probability can be seen on Figure 1.

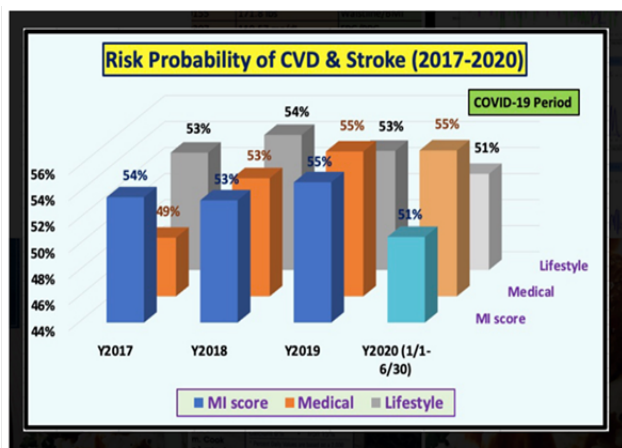


Figure 1: Bar chart of CVD & stroke risk probability due to medical conditions, lifestyle details, and metabolism index via comparison of three periods: 2017, 2018-2019, and 2020.

Note: the traveling period (2018 & 2019) has higher %

The author eluded the 2003 SARS threat in China and Taiwan. In early January of 2020, when the strange “Wuhan pneumonia” rumors suddenly appeared on certain Asian news networks, he immediately recognized the danger associated with this newly found virus. The spread of this disease depends mainly on the physical contact among people. Therefore, he started his “self-quarantine” in the United States on 1/19/2020, much earlier than the majority of Europeans and Americans who became aware of its potential damage and severity. As of today, 7/21/2020, he has been self-quarantined for 6+ months or 203 days. This timeframe’s regular life pattern with home cooked meals and consistent walking exercise have made his medical and lifestyle conditions of diabetes control (from his glucose values) and overall metabolism (from his MI scores) reach to its “best” status over the past 25 years.

Data collection

Since 1/1/2012, the author measured his glucose values using the finger-piercing method: once for FPG and three times for PPG each day. On 5/5/2018, he applied a Continuous Glucose Monitoring (CGM) sensor device (Freestyle Libre) on his upper arm and checked his glucose measurements every 15 minutes, a total of ~80 times each day. After the first bite of his meal, he measured his Postprandial Plasma Glucose (PPG) level every 15 minutes for a total of 3-hours or 180 minutes. He has maintained the same measurement pattern during all of his waking hours. However, during his sleeping hours (00:00-07:00), he measured his Fasting Plasma Glucose (FPG) in one-hour intervals.

Math-physical methodology

The author is a mathematician, physicist, computer scientist, professional engineer, and an experienced entrepreneur. However, he lacks the academic training in both areas of biology and chemistry; therefore, he cannot conduct his medical research utilizing the “traditional biochemical” approach. This was the reason he has utilized his past acquired knowledge and experience to study and research his diabetes conditions and its various complications since 2010. In that year, his three medical physicians warned him about the severity of his diabetes, cardiovascular disease, renal complications that reached a life-threatening stage. Out of desperation, he shut down all of his business activities and moved to Las Vegas to launch his self-study and research of his multiple chronic diseases to save his own life.

Any system, whether political, economic, engineering, biological, chemical, and even psychological have causes or triggers (inputs) and consequences (outputs). There are definitely some existing connections between inputs and outputs that can be either simple or complicated. The inputs and outputs of any type of system, whether biological or chemical, can be observed visually or measured by certain instruments. These physically observed phenomena, including features, images, or numbers, are merely the “physical expression” of these underneath system structure (e.g., human organs for biomedical system). Once we collect these physical phenomena image and data, we should be able to re-organize or categorize them in a logical manner. When we check Ana analyze the physical phenomena output and cannot figure out why they act or behave a certain way, we can formulate guesses or hypotheses based on some basic principles, theories, or concepts from physics. At this point, you just cannot pull out an equation from a physics textbook and insert it like a “plug and play” game. An equation is an expression of a concept or a theory, which is usually associated with some existing conditions, either initial or boundary. On the contrary, the biomedical system usually has a different kind of conditions from other systems. After understanding the meaning of observed physical phenomena, the next step is to prove the hypothesis, guess, or reason of the phenomenon being correct or incorrect. A solid understanding of mathematics becomes extremely useful to develop a meaningful model which could represent the observed physical phenomena and created hypothesis. Computer science tools, including software, artificial intelligence, and/or big data analytics can offer great assistance on verification of analysis results from these mathematical operations. If the mathematical results cannot support the hypothesis, then a new hypothesis needs to be formulated. If this hypothesis is proven to be correct, then we can extend or convert this hypothesis into an equation or a simpler formula for others to adopt this easier way of thinking and results. In the final stage, the mathematical equation or formula will be able to “predict” future outcomes based on different sets of input.

The above description explains what is the “Math-Physical Medicine” (MPM) research methodology developed by the author for his biomedical research.

Epidemic information

COVID-19 is a disease caused by SARS-CoV-2 virus which uses ACE-2 for cell entry (see Reference 1: Dr. Joshua A. Davis, COVID-19 at NYPH). The current thought is that the disease is spread through respiratory droplets, though the transmission is still under investigation. Also, the virus has been found in blood and stool. Figure 2 [1] shows that COVID-19 is a spectrum of diseases. Approximately 80% of confirmed cases are uncomplicated SARS-CoV-2 infection which may lead to mild pneumonia. About 15% would lead into severe pneumonia, with the remaining 5% ending up as Acute Respiratory Distress Syndrome (ARDS).

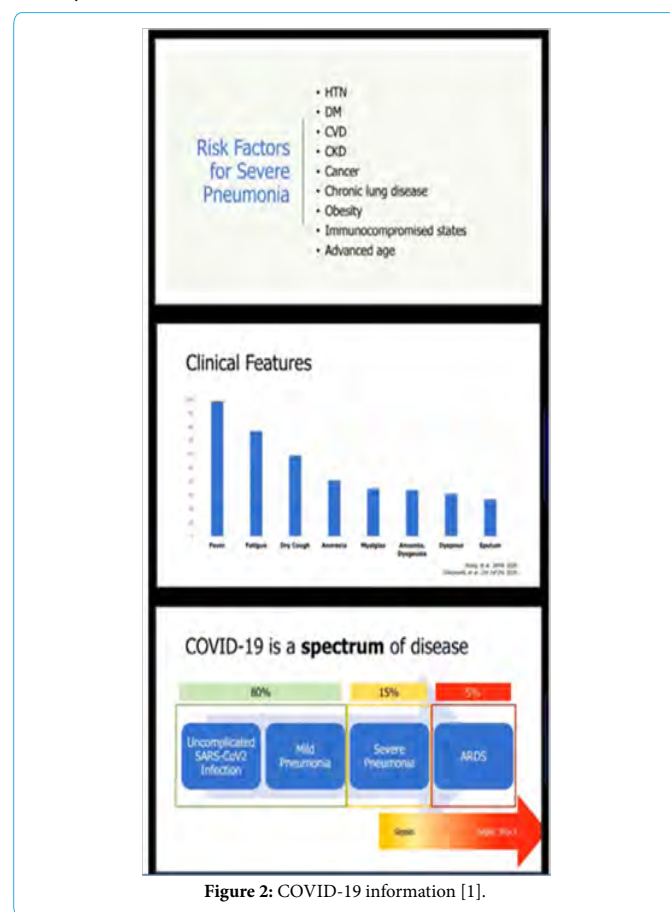


Figure 2: COVID-19 information [1].

Figure 3 (from the author's own customized software calculations based on data from public domain) depicts numbers of confirmed cases and death cases in the US since its inception until now, 7/20/2020. This figure contains both curves in real scale and logarithm scale. It is obviously that, COVID-19 is still not under control in the US; therefore, the author has mentally prepared that he will remain in his existing self-quarantined life until the end of 2020. From this article, the reader can figure out why the author do not dislike his “quarantine lifestyle”. Not only is he healthier, he is also more productive with his medical research work. He has written a total of 76 medical papers along with conducting a few on-going experiments during the 6-month quarantine period, with a new paper every 2.7 days.

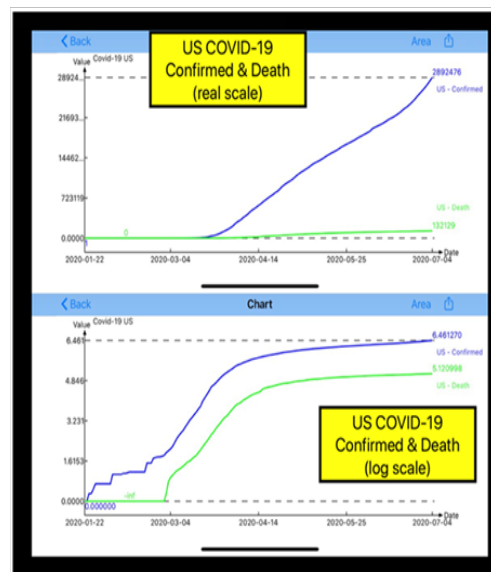


Figure 3: COVID-19 history and current status in USA (7/21/2020) from the author's customized software program based on data available in the public domain.

Chronic diseases and health

Linkage among metabolism, immune system, and various diseases using GH-Method: Math-Physical Medicine (MPM) [2], the most effective defensive protection against COVID-19 is our immune system. Furthermore, our immune system is closely related to our overall metabolic conditions. We can safely say that metabolism and immunity are two sides of one coin. In order to strengthen our overall metabolism, we must manage our daily lifestyle to build up a strong and firm foundation over a long period of time for overall health (Figure 4).



Figure 4: Relationships among Lifestyle management, metabolism conditions, immunity strength, and disease fighting.

In short, lifestyle is similar to the product quality and production capacity of an arsenal based on the overall educational, technological, and industrial power, whereas metabolism is similar to the effectiveness and destruction power of the weapons available to soldiers which are produced by an arsenal [3]. Immunity is similar to the overall military strength of the armed forces (assembly of soldiers with weapons), while diseases (chronic, cancer, and infectious) are similar to an enemy's invasion force. Lastly, the study of death is similar to the investigation of outcomes of a war, which is the probability and rate of death.

Results

The author's research specialty is in the area of metabolic disorders. In this article, he will summarize the knowledge and experiences gained regarding his diabetes control and metabolism improvement over the last two years, especially during the COVID-19 period.

The bold italic statements in the following paragraphs indicate the COVID-19 period.

Figure 5 lists his lab tested HbA1C results during the last two years from 7/1/2018 to 6/30/2020. Figures 5, 6 and 7 illustrate the detailed curves of his daily data of finger glucose, sensor glucose, and MI values. Figure 8 shows the bar chart comparison of the four biomedical values during the four different time periods. Texts in figures 6 through 8 may be difficult to read because the photos are a combination of 4-periods into one picture. However, the texts in the yellow boxes reflect the different period which are readable plus the overall curves moving trends and relative heights are important and can be seen.



Date	Lab	eclairMD	Adjusted
06/20/2020	6.4	6.32	6.33
12/20/2019	6.6	6.62	6.73
09/25/2019	6.6	6.52	6.55
07/11/2019	6.7	6.69	6.68
04/04/2019	6.8	6.81	6.84
02/13/2019	6.7	6.74	6.78
02/12/2019	6.7	6.74	6.79
01/18/2019	7.0	6.72	6.76
10/22/2018	6.6	6.82	6.74
06/29/2018	6.5	6.71	6.68
05/29/2018	6.8	6.71	6.73
01/26/2018	6.9	6.99	7.12
12/20/2017	6.8	6.79	6.89

Figure 5: Lab-tested HbA1C results (7/1/2018 - 6/30/2020).

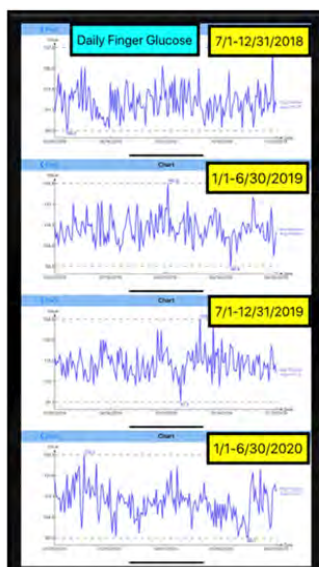


Figure 6: Finger-piercing glucose results (7/1/2018 - 6/30/2020).

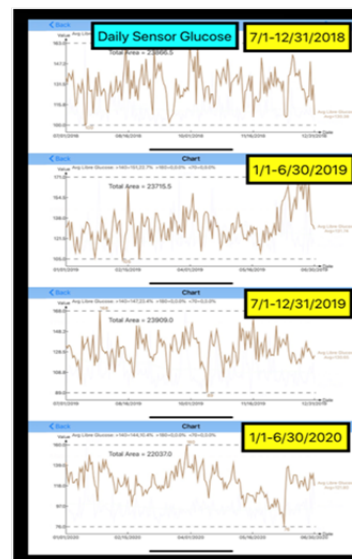


Figure 7: Sensor-collected glucose results (7/1/2018 - 6/30/2020).

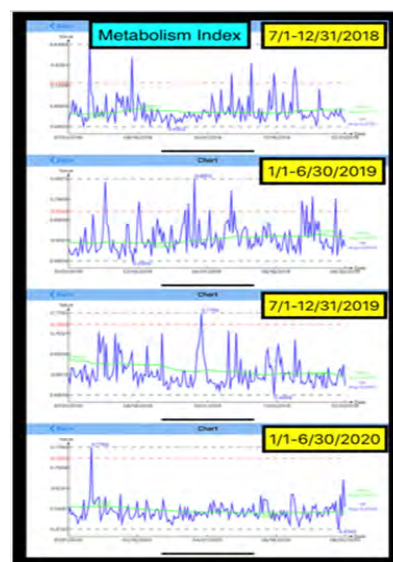


Figure 8: Metabolism Index (7/1/2018-6/30/2020).

It is obvious that the COVID-19 period, from 1/1/2020 to 6/30/2020, has the best performance scores on both diabetes control and metabolism conditions.

The following list depicts the actual values of these four periods in the order of HbA1C %, MI score, finger glucose value, and sensor glucose value.

Period A (7/1/2018 - 12/31/2018):

6.6%, 57.5, 116 mg/dL, 130 mg/dL

Period B (1/1/2019 - 6/30/2019):

6.8%, 59.7, 116 mg/dL, 132 mg/dL

Period C (7/1/2019 - 12/31/2019):

6.6%, 57.9, 113 mg/dL, 131 mg/dL

Period D (1/1/2020 - 6/30/2020):

6.4%, 54.3, 111 mg/dL, 122 mg/dL

It should be re-emphasized that all of the above diabetes data are not under the influence of any medications.

There are three conclusive observations from the above list and in figure 9. First, the COVID-19 period has shown the best performance records. Second, the obvious impact on both of his glucoses and MI resulting from his 2017-2018 traveling which include stress, sleep disruption, exercise, and disturbance on his daily life routines, along with the frequency of eating out, can be seen via those elevated values. Third, his average sensor data of 129 mg/dL is approximately 13% higher than his average finger data of 114 mg/dL.

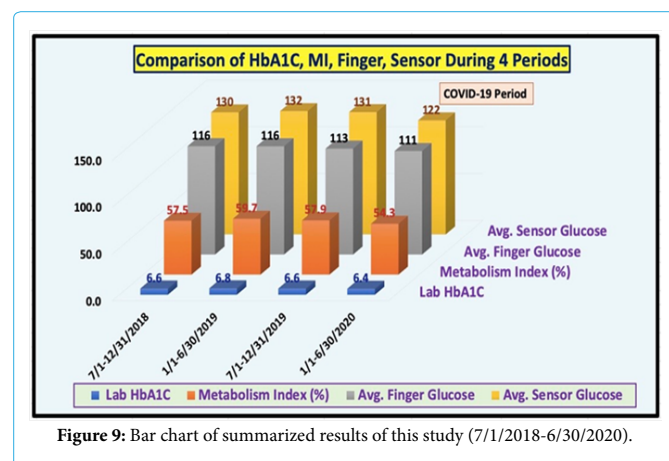


Figure 9: Bar chart of summarized results of this study (7/1/2018-6/30/2020).

Conclusion

COVID-19 is more than 100 times worse than SARS that occurred in 2003, in terms of its spreading speed, fatality number, and emotional impact on the world population. People belonging to the “vulnerable” groups, such as the elderly with existing chronic diseases and history of complications who require special attention to their health conditions and lifestyle management during this COVID-19 quarantine period. In this particular period, the author achieved better results on both his diabetes control and overall metabolism management. The knowledge and experience he has gained in the past 10 years of medical research and his developed Metabolism Index (MI) model along with his four diabetes prediction tools assisted him in many ways. During the quarantine period, he has stopped traveling and suffered no jet-lag, eating home-cooked meals, maintaining nutritional balance, continuing his daily walking exercise of 16,000 steps (~10.7 km or 6.7 miles), sleeping 7.2 hours per night, living a stress-free life, avoiding negative news of politics and the virus, and keeping a regular daily life routine. Conducting medical research is his hobby, not his job; therefore, he feels no pressure to continuously perform his medical research. As a result, he has turned the COVID-19 crisis into his health advantage!

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