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Health Age study of four clinical cases using geriatrics and longevity APP tool based on GH-Method: math-physical medicine (No. 334)

Abstract

In this article, the author describes the results of utilizing his developed geriatric and longevity tool (Health Age APP) to calculate the effective health ages of four patients who have suffered from different types and severities of chronic diseases based on their current medical conditions and lifestyle details (Four Cases).

Longevity is proof that a person's body has overcome effects of many different diseases. Most diseases can be prevented or controlled from the deepest core area and at the most fundamental level via a lifestyle management program. Once lifestyle details improve and medical conditions are under control, then the overall metabolic situation will be greatly enhanced. As a result, the immune system will also be strengthened since metabolism and immunity are two sides of the same coin. A strong immunity is the ultimate and most effective defense to fight against many diseases that can result in death.

In this analysis, he focuses on using his metabolism index (MI) value from his developed mathematical metabolism model. This combines four medical conditions and six lifestyle details as two measuring yardsticks of his body's strength of metabolism and immunity to fight against various death-causing diseases to achieve his objective of longevity. The measurement of longevity can be attained by developing an "effective health age*"* (Health Age) against the "biological real age" (Real Age). The Biological Real Age or Chronological Age is defined as the actual time a person has been alive.

The following table has a format of real age / health age / age difference which clearly illustrates the key conclusions of four cases.

Case A: 74 / 64/ -10;

Case B: 77 / 81/ +4;

Case C: 74 / 74/ 0;

Case D: 73 / 75/ +2;

The life expectancy of an American male is 76.1 years and female is 81.1 years (2016 data). If the author (Case A) continues his metabolic condition improvements, chronic disease control, as well as his stringent lifestyle management program, he stands a good chance to extend his life for an additional ten years to reach a real biological age of 86 (76 plus 10). The other three cases could achieve the same results if they try harder to control their medical conditions and managing their lifestyle details in a manner similar to Case A.

This article not only shows the changes of the four patients' health ages due to metabolic improvement but will reveal their willpower, strong determination, and persistence. It will also illustrate their continuous struggle on controlling their existing medical conditions while maintaining their stringent lifestyle management program over a long period of time. The driving force for them should be a longer and healthier life and not suffer from the chronic diseases, cancers, or various infectious diseases which could ultimately lead to their early deaths.

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Introduction

In this article, the author describes the results of utilizing his developed geriatric and longevity tool (Health Age APP) to calculate the effective health ages of four patients who have suffered from different types and severities of chronic diseases based on their current medical conditions and lifestyle details (Four Cases).

Method

Background

To learn more about the GH-Method: math-physical medicine (MPM) research methodology, readers can review his article, *Biomedical research methodology based on GH-Method: math-physical medicine (No. 310),* to understand his MPM analysis method.

Longevity

The author studied the following biomedical inter-relationships between cause and consequence:

- Poor Lifestyle management
- Unhealthy Metabolism
- Obesity and Chronic diseases
- Disease Complications

- Weak Immunity
- Various diseases leading to death

For example, approximately 70% of American adults are either overweight or obese due to poor selection of food preferences and lifestyle choices, in particular diet and exercise. As we know, obesity and poor lifestyle lead into chronic diseases such as diabetes, hypertension, hyperlipidemia, cancer, along with their various complications, such as stroke, cardiovascular disease, and/or kidney issues. In addition, unhealthy metabolism is associated with weak immunity, leaving the body unable to fight against many disorders, especially infectious diseases that would eventually result in death. The only remaining question is how long before they reach mortality. As a result, this is the concept of the author's research work on longevity with effective health age.

According to US records in 2018, approximately 50% of Americans died from chronic diseases and their complications, with 29% dying from various cancers, and about 11% dying from all types of infectious diseases. The remaining 10% of them died from non-disease related death.

Metabolism

After the first four years of self-studying endocrinology, the author then spent the entire year of 2014 to develop a complex mathematical model of metabolism. This model contains four easily measured biomarkers of medical conditions such as body weight, glucose, blood pressure, and lipids, along with six lifestyle details including food portion quantity & nutritional quality balance, water intake, appropriate exercise, sleep amount & quality, stress reduction, and daily life routine regularity. He applied the concept of topology from mathematics and the modeling technique of finite element method from engineering to develop this mathematical model of metabolism which became the cornerstone of his future medical research work. As a result, his overall health conditions started to improve after 2015.

By end of 2014, he defined a specific output parameter of his metabolism model as metabolism index (MI) which contains 10 metabolism category scores of m1 through m10. Among these 10 scores, m1-m4 are medical conditions and m6-m10 are lifestyle details. MI is the combined score of these four medical conditions and six lifestyle details which can be calculated on one specific day, a time instant, or over a period of time. He has also identified a "break-even line" of the combined MI score at 0.735 (73.5%) to separate his metabolic conditions between the healthy state (below 0.735) and unhealthy state (above 0.735).

Health age equation

Near the end of 2019, he further developed a simple equation to calculate effective health age as follows:

Effective Health Age

= Real Biological Age *

(1+((MI-0.735)/0.735)/AF)

Here AF stands for Amplification Factor, between 1 to 4, and he used 2 for his own case.

He then utilized both mi and MIdata (ten separated metabolism scores and one combined MI score) during a year or a specific time period to calculate effective health age in order to compare against real biological age.

Four clinical cases

Case A is a 73-year-old male, who is the author of the article. He was diagnosed with severe type 2 diabetes (T2D) in 1995 along with hypertension and hyperlipidemia. Afterward, he developed many serious complications, including CVD, CKD, foot ulcer, diabetic retinopathy, hypothyroidism, bladder infection, and others that became life-threatening by 2010. After ten years of self-studying and researching endocrinology and metabolism, as a result, he wrote a series of medical papers on geriatrics and created the health age APP tool used in this study.

- Case B is a 77 years old male patient with hypertension and prostate cancer.
- Case C is a 73 years old male patient with type 2 diabetes.
- Case D is a 72 years old female patient with overweight, type 2 diabetes, hypertension, and hyperlipidemia.

All of these four individuals are Americans and the sole purpose of mentioning their nationality is to compare their health ages to the US national record of life expectancy.

The detailed input data were obtained via telephone interview by the author in September of 2020; therefore, the calculated health ages reflect their most current state of health.

In Figure 4, by comparing these four sets of calculated metabolism category scores of m1 through m10, certain specific metabolism categories need to be strengthened or highlighted (as indicted bythe red colored numbers in the lower table) in order to provide useful advice and practical guidelines to individual patients on improving their longevity.

From observing this overall health age and highlighted improvement areas, patients can modify their behavior one step at a time, by taking little steps on a smaller scale. This is what the author defined as *progressive behavioral modification.*

Results

In Figure 1, it shows the background data table which includes the following:

1. Using straightforward, detailed real data of medical conditions and lifestyle details, such as weight in pounds, glucose in mg/dL, water intake in cc, walking exercise in steps, etc.
2. Ten detailed metabolic category scores (m1 through m10) which have "normalized" values in percentages. They include medical condition scores (m1-m4) and lifestyle detail scores (m5-m10). Please pay special attention on those alarming numbers in red color in the lower table of Figure 1.
3. MI combined values, health ages, real ages, and age difference (Health age minus Real age).

Figure 2 depicts the normalized metabolism scores of *mi*: m1 through m10 for these four cases.

Among these four cases, Case A obviously has the best scores overall since its blue colored curve is located at the bottom. Case B (male, hypertension and cancer) and Case D (female, overweight, diabetes, hypertension, hyperlipidemia) are similar to each other since their curves (orange and yellow) are also close to one another. Case C (male, diabetes) has a gray curve with two spikes, m2 glucose and m5 exercise. His A1C has decreased from >8% down to ~7% recently, but

it is still higher than the targeted normal range for A1C (6.0% -6.5%). Although his glucose reduction came from diet control and exercise, but his daily walking steps has not reached to its optimal state since his post-meal walking occurs twice a day instead of three times. In Fact, all of the exercise amount of walking steps for Cases B, C, and D are insufficient.

Metabolism Index Items	Case A	Case B	Case C	Case D
Weight (lbs)	171	140	153	153
Glucose (mg/dL)	102	110	155	123
SBP/DBP/HR	105/58/57	125/75/60	110/70/65	120/70/69
HDL/LDL/Chol/TG	49/123/123/110	49/123/123/110	64/50/50/81	53/77/136/108
Exercise: daily walking steps	14517	8000	7000	8000
Drinking water (cc)	2857	2000	2800	2000
Sleep hours/wakeup/quality level	7.5/1/1	6.5/1/1	7.5/1/1	7.5/1/1
Stress Level	1	2	1	1
Portion: bkfas/lunch/dinner/snacks	0.2/0.9/0.3/0.5	1.0/0.9/0.3/0.6	0.5/0.8/0.8/0.2	0.3/0.8/0.8/0.6
Food nutrition quality level	1	1	2	1
Daily routine life level	1	2	1	1
Metabolism Index Items	Case A	Case B	Case C	Case D
Real Age	73.6	77.1	73.5	72.9
Health Age	63.8	80.7	73.6	75.2
Metabolism Index Items	Case A	Case B	Case C	Case D
MI Score (%)	54%	80%	74%	78%
Difference (Health - Real)	-10	4	0	2

Metabolism Index Items	Case A	Case B	Case C	Case D
m1 (weight)	1.01	0.93	0.99	0.99
m2 (glucose)	0.85	0.92	1.29	1.03
m3 (BP)	0.85	0.99	0.96	1.01
m4 (lipid)	0.69	0.88	0.68	0.95
m5 (exercise)	0.70	1.25	1.43	1.25
m6 (water)	0.70	1.00	0.71	1.00
m7 (sleep)	0.50	0.58	0.50	0.58
m8 (stress)	0.50	0.75	0.50	0.50
m9 (food)	0.57	0.72	0.76	0.67
m10 (routines)	0.70	0.90	0.70	0.70
Metabolism Index Items	Case A	Case B	Case C	Case D
MI Score (FEM)	54%	80%	74%	78%

Figure 1 Background data tables of metabolism categories, MI and Ages of 4 cases.

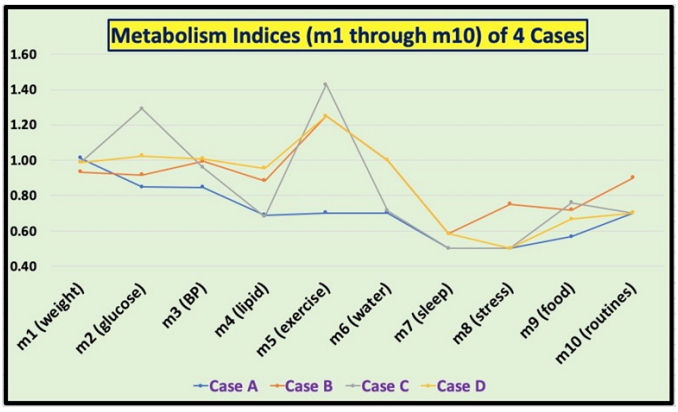

Figure 2 Detailed metabolism category scores (m1 through m10) of 4 cases.

Figure 3 and Figure 4 are the conclusive diagrams of this clinic study. In Figure 3, the bar chart signifies the comparison for real age and health age among the four cases. The following table has a format of real age / health age / age difference which clearly illustrates the key conclusions of four cases.

Case A: 74 / 64/ -10;

Case B: 77 / 81/ +4;

Case C: 74 / 74/ 0;

Case D: 73 / 75/ +2;

The age difference of health age minus his real age and MI score of the four cases are also revealed in Figure 4. The following listed table with a format of (MI score / age difference) demonstrates the difference in their overall health via MI score and their longevity aspect via age difference.

Case A: 54% / -10;

Case B: 80% / +4;

Case C: 74% / 0;

Case D: 78% / +2;

Health Age - Real Age =

(Real Age * ((MI-0.735)/0.735)/AF

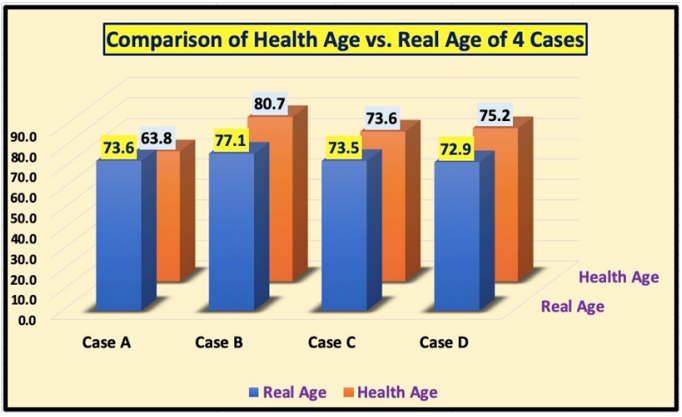

Figure 3 Comparison between Real age and Health age of 4 cases.

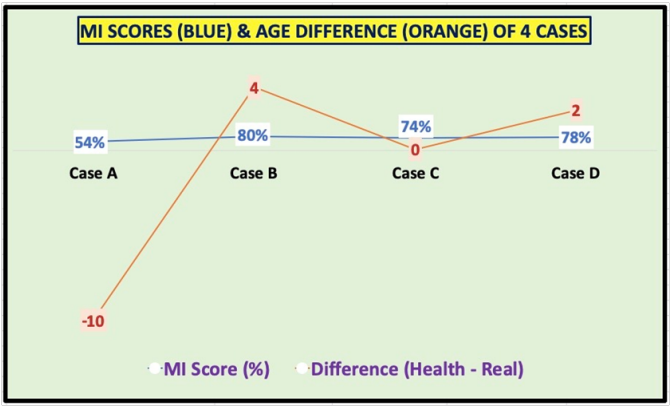

Figure 4 Age differences between real age and health age plus MI combined scores of 4 cases (correlation coefficient of 99.45%).

Based on the above equation, an extremely high correlation coefficient of 99.45% existed between these two data sets or curves. This make a perfect sense since above equation already shows that age difference is directly proportional to MI score.

In 2010, when the author (Case A) was 63 years old, three of his physicians indicated his age based on his various medical examination reports was about 10 years older than his real age. However, those same physicians also told him in 2017 that he was about 10 years younger when he reached the age of 70. These ranges of +10 years and -10 years were based on their ***empirical*** judgements from their many years of clinical experiences of seeing hundreds of patients. Now, the author uses a ***scientific*** approach (his developed GH-Method: math-physical medicine) which is based on his biomedical knowledge, physical phenomena observations, big data analytics, and mathematical derivations to draw a conclusion for his actual age difference ranges of +8 years and -10 years. Nevertheless, these two guesstimated age ranges expressed by his physicians and proved by himself are quite comparable to each other. However, his mathematical health age method provides a more precise estimation.[1–12]

Conclusion

The life expectancy of an American male is 76.1 years and female is 81.1 years (2016 data). If the author (Case A) continues his metabolic condition improvements, chronic disease control, as well as his stringent lifestyle management program, he stands a good chance to extend his life for an additional ten years to reach a real biological age of 86 (76 plus 10). The other three cases could achieve the same results if they try harder to control their medical conditions and managing their lifestyle details in a manner similar to Case A.

This article not only shows the changes of the four patients' health ages due to metabolic improvement but will reveal their willpower, strong determination, and persistence. It will also illustrate their continuous struggle on controlling their existing medical conditions while maintaining their stringent lifestyle management program over a long period of time. The driving force for them should be a longer and healthier life and not suffer from the chronic diseases, cancers, or various infectious diseases which could ultimately lead to their early deaths.

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Conflicts of interest

The authors declare have no conflict of interest about the publication of this paper.

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