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# Using GH-Method: Math-Physical Medicine and Segmented Glucose Pattern Analysis to Investigate the Variance of Risk Probability of Having a CVD or Stroke

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## Introduction

The author applied segmented glucose pattern analysis to investigate specifically the variance of the risk probability of having a heart attack or stroke due to high glucose components. The dataset is provided by the author, who uses his own type 2 diabetes metabolic conditions control, as a case study via the "math-physical medicine" approach of a non-traditional methodology in medical research.

Math-physical medicine (MPM) starts with the observation of the human body's physical phenomena (not biological or chemical characteristics), collecting elements of the disease related data (preferring big data), utilizing applicable engineering modeling techniques, developing appropriate mathematical equations (not just statistical analysis), and finally predicting the direction of the development and control mechanism of the disease.

## Method

As described in his published papers, he utilized the MPM approach to develop a mathematical model for calculating the rusk probability of having a CVD or stroke. At first, he developed a simulation model including some static baseline factors, such as age, gender, race, family history, smoking, alcohol intake, substance abuse, personal medical history, weight, waistline, and more. He then applied his learned hemodynamics knowledge to simulate the artery's blood blockage by using fluid dynamics concept and artery's vessel rupture by using solid mechanics concept. He utilized ~100,000 chronic disease data (obesity, diabetes, hypertension, and hyperlipidemia) for the past 7-years or 2,555 days from 1/1/2012 - 12/31/2018 to compute the risk probability of having a heart attack or stroke. Finally, as shown in Figures 1, 2, and 3, he used a segmented glucose pattern analysis to calculate the incremental risk probability due to high glucoses (both >140 and >180 mg/dL).

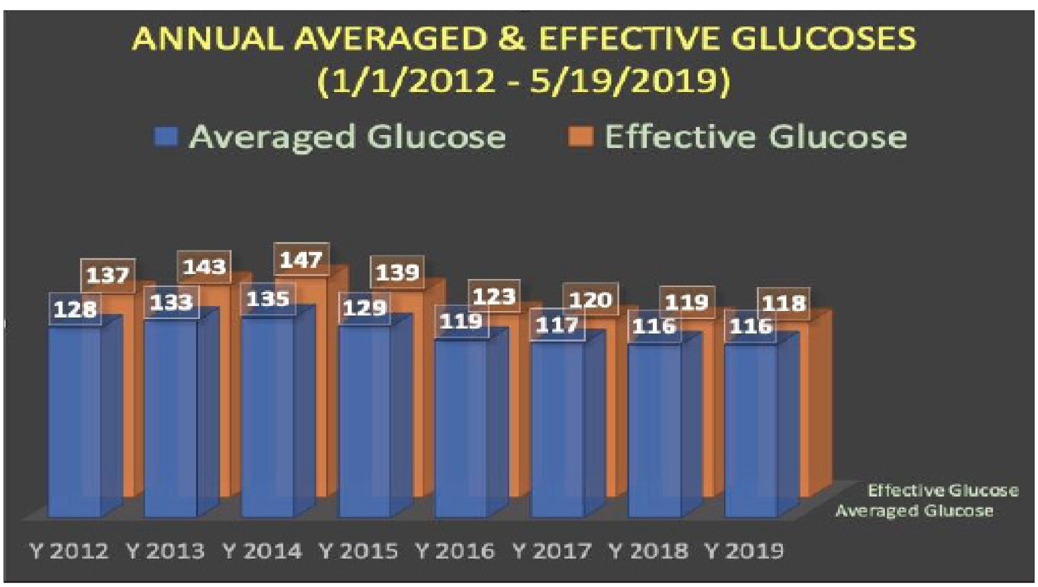


**Fig 1.** *Average annual glucose vs. Effective annual glucose with inclusion on high glucose components.*

| Annual Glucose | Averaged Glucose | M2 (Average) | FPG | Min | Max | Glucose <70 | % of <70 | Glucose >140 | % of >140 | Glucose >180 | % of >180 | Effective Glucose | Effective M2 | Glucose Delta |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 128 | 1.0642 | 131 | 108 | 150 | 68 | 0.1% | 162 | 28.1% | 199 | 4.7% | 137 | 1.1390 | 7% |
| 2013 | 133 | 1.1042 | 129 | 112 | 156 | 69 | 0.2% | 162 | 33.1% | 196 | 5.2% | 143 | 1.1902 | 8% |
| 2014 | 135 | 1.1217 | 131 | 112 | 163 | 60 | 0.1% | 167 | 31.0% | 202 | 7.0% | 147 | 1.2285 | 10% |
| 2015 | 129 | 1.0717 | 125 | 107 | 154 | 61 | 0.2% | 170 | 21.4% | 203 | 6.1% | 139 | 1.1564 | 8% |
| 2016 | 119 | 0.9950 | 117 | 103 | 140 | 65 | 0.3% | 159 | 12.3% | 201 | 1.5% | 123 | 1.0215 | 3% |
| 2017 | 117 | 0.9783 | 120 | 99 | 139 | 63 | 0.3% | 157 | 11.2% | 201 | 1.4% | 120 | 1.0019 | 2% |
| 2018 | 116 | 0.9692 | 114 | 98 | 138 | 68 | 0.5% | 159 | 8.6% | 197 | 1.5% | 119 | 0.9900 | 2% |
| 2019 | 116 | 0.9692 | 115 | 100 | 134 | 0 | 0.0% | 162 | 5.3% | 202 | 0.9% | 118 | 0.9837 | 2% |

**Fig 2.** *calculation of effective annual glucose.*

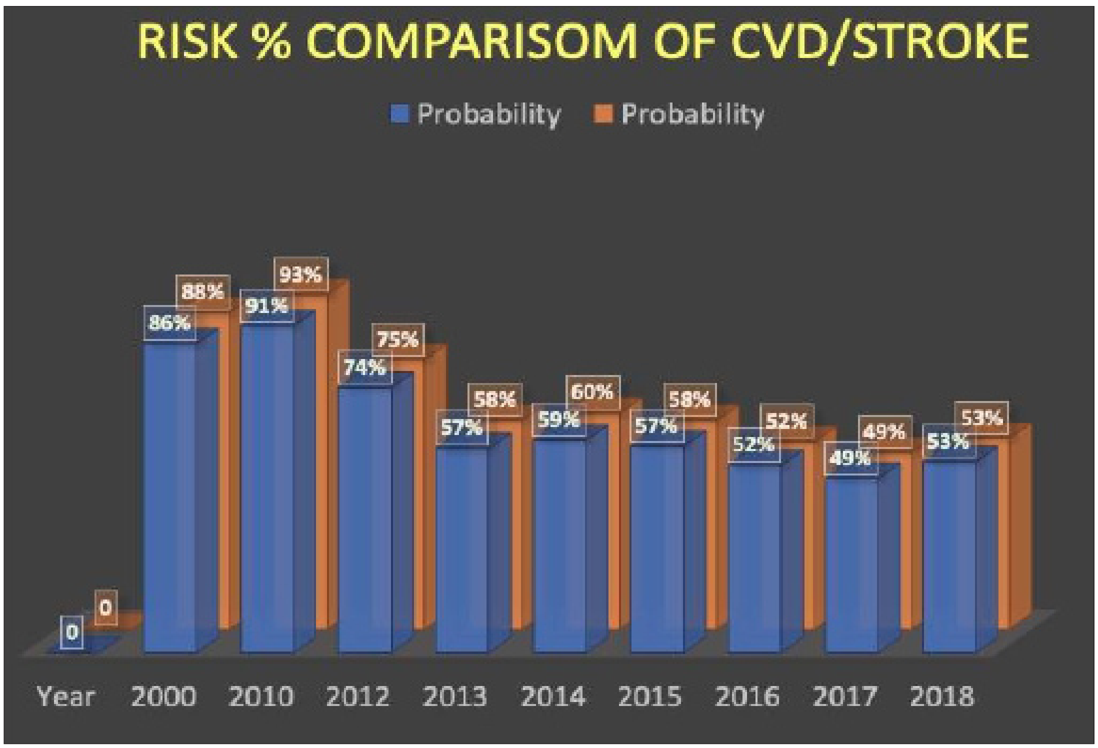


**Fig 3.** *Risk probability % based on both average annual glucose and effective annual glucose.*

## Results

Here are the listed data of the annual risk probability (%) comparison between average annual glucose (first percentage) and inclusion of high glucoses (second percentage) with their differences (third percentage):

2000: 86%, 88%, +2%

2010: 91%, 93%, +2%

2012: 74%, 75%, +1%

2013: 57%, 58%, +1%

2014: 59%, 60%, +1%

2015: 57%, 58%, +1%

2016: 52%, 52%, 0%

2017: 49%, 49%, 0%

2018: 53%, 53%, 0%

For the worst years from 2000-2012, his risks were the highest (~90%), which includes experiencing five cardiac episodes. During the period of improving years, which consists of his diabetes research from 2012-2015, his risks were ~60% and his incremental risk had been reduced from 2% to 1%. During the "controlled years" from 2016-2018, not only was his average risk maintained at ~50%, his incremental risk also dropped from 1% down to 0%, which means very little high glucose components.

The excessive energy carried by high glucose circulating inside the human body would damage the internal organs, especially affecting arteries and micro-vessels. In addition, diabetes is the major crime executer of CVD and stroke, while hypertension and hyperlipidemia are only accomplices. This simulated analysis results have proven the biomedical hypothesis above via math-physical medicine methodology.

## Conclusion

The connection between diabetes and CVD/stroke has been well established. However, most research data on glucose or cardiovascular variables are based on average values. The author has analyzed 28,105 glucose data and their associated 1,540 waveforms in order to conduct this research. Although the impact on the incremental risk probability is moderate yet observable, by using the segmented pattern analysis method to single out the impact from "high glucose components" has further proven the power of math-physical medicine methodology.

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