Review of: "Computer Analysis of Stochastic Aging According to the Gompertz-Makeham Mortality Law"

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Potential competing interests: No potential competing interests to declare.

The Gompertz function is an empirical fit to the probability of death as a function of age. In its usual application, parameters of the Gompertz function are chosen to match observations of a known species in a known environment.

This MS proposes to apply random parameters to the Gompertz function, which is already a random distribution. This is akin to the relationship between the Student T function and the Gaussian (normal) distribution. The Student T function applies to a finite set of random variables, each of which is normally distributed. The T distribution has the same mean as the normal distribution from which it is derived, but a different standard deviation, different kurtosis, etc.

To what end do the authors wish to do this? The MS does not tell us right away, but we get a hint on page 6:

“Randomness in the aging process increases exponentially after age 60.’

This is interesting, new information for me. I would like to see a reference. It suggests that the number of individuals dying in a given period of time is not Poisson distributed but becomes progressively less predictable with advancing age. This can be true in a subpopulation even if the Gompertz distribution continues to hold in some larger meta-population. Please provide more detail.

Assuming this is true, the purpose of the paper is to predict the variability (standard deviation) in the number of (people or animals) who die during a given time period, even as the Gompertz distribution correctly predicts the average. One conclusion of the paper is that the reason for the high variability late in life is that we get the Gompertz mortality doubling time wrong, and the distribution becomes more and more sensitive to this parameter as age increases.

Why would we get the mortality doubling time wrong? Perhaps this is the case if the Gompertz parameters are derived from a reference population that is too small or if there is not enough age variation in the reference population.

“A time series representation is more convenient…”

It is not yet clear what this means.

“...whether probability distributions can remain Gaussian.”

I’m confused by this. The probability distribution is usually exponential for inanimate objects and Gompertz for animals. It doesn’t make sense for the probability of death to be a Gaussian function of age. So what is the dependent variable? I

think they are referring to the number of individuals who die within a short interval of time, which is expected to be Poisson distributed. (Poisson approximates a Gaussian when numbers are large.)

The assumption that parameters of the Gompertz distribution are drawn from Gaussian distributions is introduced without justification. I, for one, don't understand where it comes from.

The authors carry out a numerical evaluation of the moments of the modified Gompertz distribution. Analytic (symbolic) computation is probably not possible. (The same is true of the Student T distribution.)

In conclusion, the analysis seems to be an elegant piece of mathematics, but its application needs further elucidation. This should be in the introduction and also in the abstract. I have guessed at the intended application, but I may be wrong — the MS is unclear. The work would be greatly strengthened by the inclusion of a real-life application illustrating the utility of the mathematics.