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Peer Review

Review of: "Gompertz Law-Based Biological Age (GOLD BioAge): A Simple and Practical Measurement of Biological Aging to Capture Morbidity and Mortality Risks"

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1. Independent researcher

Reviewer Comments

First of all, I would like to commend the authors for their efforts in preparing this manuscript. The work addresses an important topic with potential scientific impact.

Below, I have provided comments and suggestions to improve the clarity and overall quality of the paper.

1. Throughout the manuscript, reference is made to the Gompertz Law-based model. However, in the Results section (page 3), the GOLD BioAge model is presented as a linear model, as are all the other models described. The Gompertz-based nature of the proposed models only becomes evident upon examining the details provided in Supplementary-3. To aid the reader's understanding, the authors should explicitly clarify this characteristic of the models, for instance, by providing an explanation at the beginning of the Results section. At the very least, the authors could include a note in the Results section stating that the Gompertzian nature of their models is detailed in the supplementary materials.
2. The term "significant" is used multiple times throughout the manuscript. Its usage can lead to confusion, as it may imply "statistical significance." The authors should reduce the frequency of this term and ensure that the intended meaning is clear in each context.
3. In the Introduction, the authors state:

"Then, we applied the GOLD BioAge algorithm on metabolomics and proteomics data in the UKB, to investigate the algorithm validity on omics-based data."

It is unclear what is meant by "investigate the algorithm validity on omics-based data." While this point is addressed more comprehensively later in the manuscript, a brief clarification in the Introduction would help set the context and improve the reader's understanding.

4. The sentence:

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"To further investigate the utility of GOLD BioAge with multi-omics biomarkers, we applied our algorithm to create the MetAge and ProtAge models based on blood NMR metabolomics and proteomics data in the UKB, respectively."

is misleading. It suggests that the authors are extending the GOLD BioAge model, whereas they are actually creating new biological age clocks using proteomics and metabolomics data. The sentence should be rephrased for accuracy as follows (as a suggestion):

"In addition, we created the MetAge and ProtAge models based on blood NMR metabolomics and proteomics data in the UKB, respectively."

5. At the beginning of page 23, the authors present two equations that appear to contain a typographical error. Specifically, the formula indicates that the content within the parentheses is raised to the power of 1/β1. However, based on the supplementary material (Supplementary-3), the correct formula should have the parentheses divided by β1. This correction is consistent with the simplification presented in the second formula on page 23 when β1=β2. The authors should revise the equations on page 23 to ensure they are accurate and aligned with the supplementary file.
6. The authors should ensure that acronyms and biomarkers are properly defined throughout the manuscript. Examples include "CBC" on page 5.
7. Provide definitions for the biomarkers presented in Figure 1C.
8. All hazard ratios reported in the text should include their 95% confidence intervals for clarity and consistency (e.g., see page 5).
9. Add a space before the parenthetical citation of references throughout the manuscript to improve formatting consistency.

Declarations

Potential competing interests: No potential competing interests to declare.