DELTA Tracker - A novel gamified health tracking framework for incentivizing adherence to health regimen

Chengxun Su[a,b,*,1], Peter Wang[a,b,c,*,1], Shang Wei Song[a,b,c], Gyula Seres[a,b], Yong Ting Nicole Leung[a,b,c], Nigel Hon Wei Foo[a,b,c], Lissa Hooi[a,b,c], Yoong Hun Ong[a,b], Poonam Rai[a,b], Han Shi Jocelyn Chew[d], Xavier Tadeo[a,b], Yoann Sebastien Sapanel[a,b], Edward Kai-Hua Chow[a,b,c,e,f,g], Dean Ho[a,b,c,e,h,I,*]

[a]*The Institute for Digital Medicine (WisDM), National University of Singapore, Singapore 117456*

[b]*The N.1 Institute for Health (N.1), National University of Singapore, Singapore 117456*

[c]*Department of Biomedical Engineering, College of Design and Engineering, National University of Singapore, Singapore 117583*

[d]*Alice Lee Centre for Nursing Studies, Yong Loo Lin School of Medicine, National University of Singapore, Singapore 117597*

[e]*Department of Pharmacology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore 117600*

[f]*Cancer Science Institute of Singapore, National University of Singapore, Singapore 117599*

[g]*NUS Centre for Cancer Research (N2CR), Yong Loo Lin School of Medicine, National University of Singapore, Singapore 117599*

[h]*The Bia-Echo Asia Centre for Reproductive Longevity and Equality (ACRLE), National University of Singapore, Singapore 117456*

[i]*Singapore's Health District @ Queenstown, Yong Loo Lin School of Medicine, National University of Singapore, Singapore 117456*

**To whom correspondence should be addressed: Emails: biedh@nus.edu.sg, cx.su@nus.edu.sg, lsipww@nus.edu.sg*

[1]*C.S. and P.W. contributed equally to this work*

1. Introduction

In recent years, public health awareness has grown regarding the significant role of unhealthy diets and sedentary lifestyles in the development of metabolic disorders such as obesity, hypertension, type 2 diabetes mellitus, and cardiovascular diseases[1], [2]. This heightened awareness has catalyzed a growing interest in modifying lifestyle habits and self-monitoring health biomarkers to attain optimal health and prevent metabolic decline[3]. While digital health technologies and wearables enable convenient longitudinal monitoring of health metrics, a key challenge that impedes their success is the low adherence to health regimens due to disengagement over time and failure to obtain actionable insights. Furthermore, the conventional approach that primarily focuses on 'disease management' rather than 'health management' limits support and accessibility for healthy individuals undergoing health interventions.

Health insights generated by artificial intelligence (AI) - especially conversational AI tools like ChatGPT - serve as a 'hook' to engage users by providing personalized and context-aware feedback that promotes behavior change[4], [5]. Herein, we present the DELTA Tracker, a novel gamified health tracking framework for incentivize long-term adherence to health regimens by transforming passive tracking into an interactive, engaging and scientifically enriching process. The DELTA Tracker framework is based on observations from a real-world health intervention study. Lastly, we demonstrated a proof-of-concept user interface by configuring key principles of this framework into a customized GPT.

2. Substantial section

Our previous study showed that tracking blood glucose and ketone dynamics indicative of metabolic switch gamified adherence to health regimen[6]. Importantly, assessing the metabolic switch process rather than single static measures offers deeper insights into the body's ability to maintain homeostasis according to energy demand and substrate availability – the metabolic flexibility – which is an early indicator of metabolic decline[7], [8]. In this study, we further examined the metabolic dynamics and long-term health outcomes resulted from a sustained health regimen consisting of fitness, healthy diets and nutrition, a regular sleep schedule and intermittent fasting (Fig.1). Interestingly, we

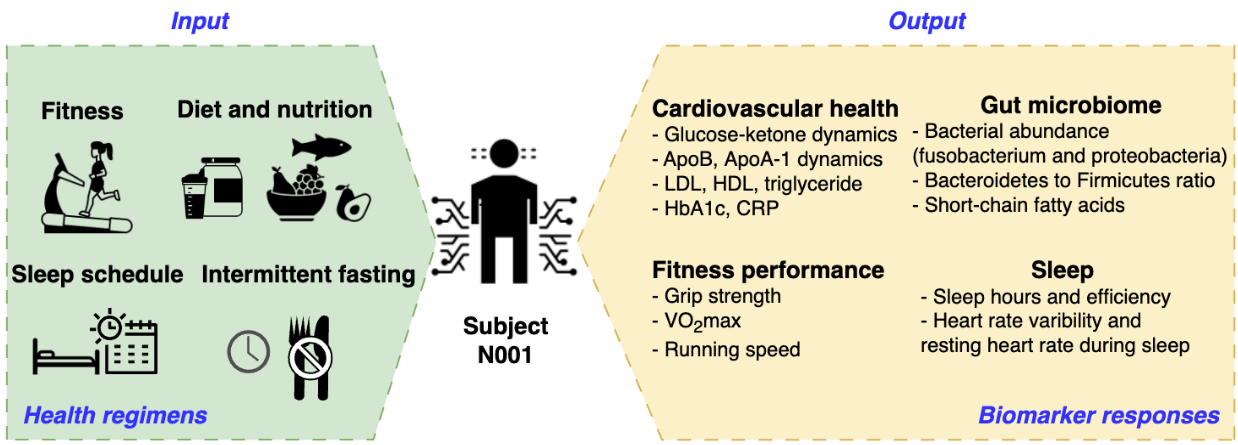

Fig. 1: Overview of the real-world health intervention trial for subject N001 who adheres to a health regimen and collects biomarker responses longitudinally. Dynamic changes are observed in biomarker response when health regimen varies. Abbreviations: ApoB - Apolipoprotein B, ApoA-1 - Apolipoprotein A-1, LDL - Low-Density Lipoprotein, HDL - High-Density Lipoprotein, HbA1c - Hemoglobin A1c, CRP - C-Reactive Protein, VO_2max - Maximum Oxygen Uptake.

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noted a 'dose-responsive' relationship between health regimens and biomarker responses, inspiring the development of our gamification framework. For instance, Apolipoprotein B (ApoB), Apolipoprotein A-1 (ApoA-1), and ApoB:ApoA-1 ratio rise after prolonged fasting and return to baseline in non-fasting state. This underscores that varied inputs (e.g. fasting/non-fasting, duration of fasting) could give rise to individualized kinetic biomarkers like ΔApoB, ΔApoA-1, and time to return to baseline. By recommending users to track the patterns of change and response differentials across metabolic states, this framework gamifies the health tracking process and guide users to gain deeper insights into their metabolic health. Collectively, a comprehensive gamified health tracking framework could be constructed based on knowledge from the real-world benchmark dataset (Fig. 2). The dataset and gamification strategies are subsequently incorporated into a customized GPT, the 'HealthSpan CoPilot', which provides analysis and adaptive recommendations based on users' initial input.

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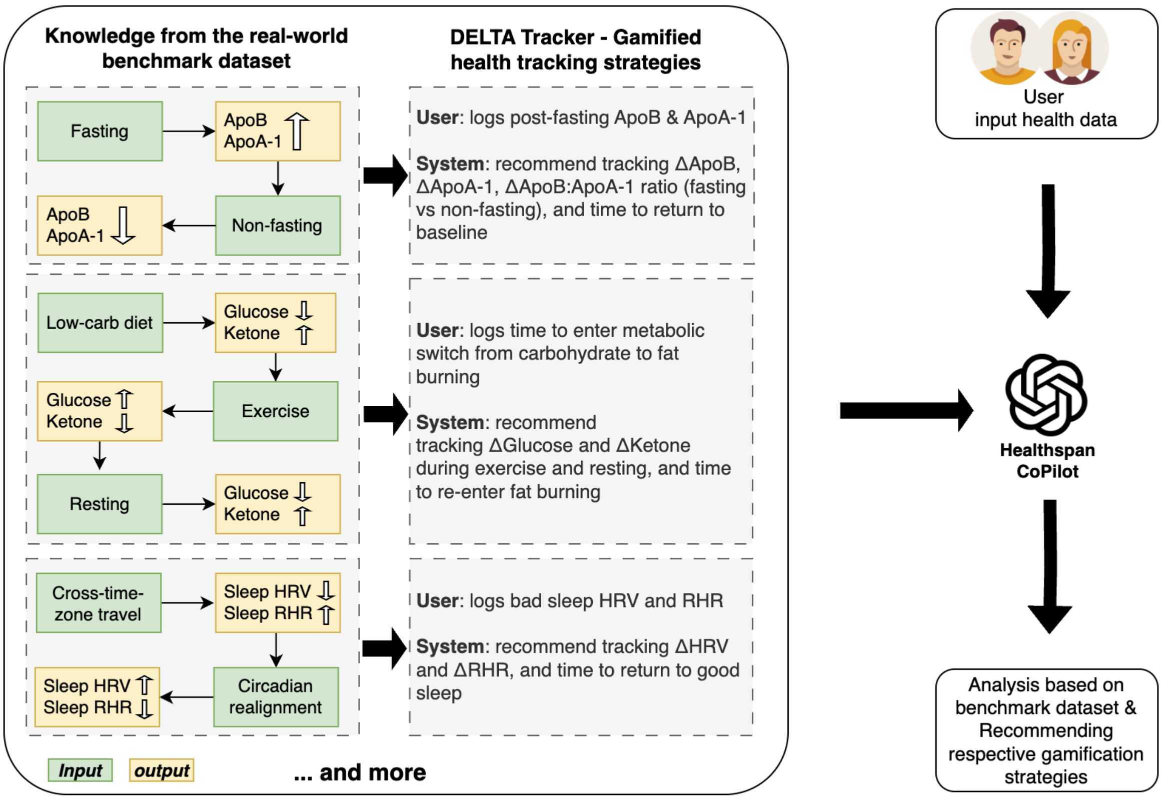

Fig. 2: Mechanism of the DELTA Tracker framework. Adaptive recommendations encourage users to track biomarker dynamics based on their initial input. Abbreviations: ApoB - Apolipoprotein B, ApoA-1 - Apolipoprotein A-1, HRV - Heart Rate Variability, RHR - Resting Heart Rate.

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Appendix A. An example conversation with the customized GPT 'Healthspan CoPilot'