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MY YOUTHSPAN: A MACHINE LEARNING-BASED SOFTWARE PROGRAM THAT LETS PEOPLE CUSTOMIZE LONGEVITY AND WELLNESS PLANS TO THEIR PERSONAL LIFESTYLES AND GOALS

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ABSTRACT

There are exciting advancements being made in the scientific areas of wellness and longevity such that now there are numerous interventions and lifestyle changes that people can make that will extend their lifespans and healthspans (number of healthy years they have). The challenge that people face is that a plethora of resources are available to guide them, and these typically recommend optimal or "best practice" solutions that are the same for all people within the same demographic and lifestyle category. This becomes problematic because not only are different people different and may respond differently to changes in their lifestyles, people also differ in the degree to which they are willing to make changes in their lifestyles. The present paper

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discusses the need to present people with the ability to implement satisficing as well as optimal strategies in improving their health and expected lifespans and the tools necessary to see the potential changes in outcomes/benefits that result from these satisficing options. A software program, My Youthspan, that provides users with optimal recommendations on improving lifespan and healthspan, but also allows them to conduct sensitivity analysis to determine the benefits associated with customized plans they create is discussed.

Introduction

Optimizing health and longevity remains a persistent goal for individuals, yet the adoption of lifestyles to achieve these objectives is often hindered by the intricate interplay of personal, societal, and environmental factors (Schwartz, 2000). This paper delves into the concept of "satisficing" (Simon, 1957) in health-related decision-making—a pragmatic strategy where individuals seek incremental health improvements without resorting to radical lifestyle overhauls. The discrepancy between health aspirations and the pragmatic constraints of everyday life underscores the prevalence of satisficing. Unlike traditional notions that advocate for sweeping lifestyle modifications, satisficing acknowledges the reality that individuals are often constrained by time, resources, and psychological barriers. This paper posits that measuring tradeoffs is crucial for understanding decision-making in health optimization, requiring an assessment of how incremental changes impact health outcomes versus the corresponding increase in effort (Kahneman & Tversky, 1979).

A key notion underlying the concept of satisficing is that a person accepts an option from a set of choices that does not necessarily maximize the attainment of that person's goals but achieves an acceptable level of benefit at a cost the person is willing to pay for those benefits. As such, satisficing is inherently a personal process. While one can specify an objectively optimal solution, i.e., one that maximizes positive outcomes and minimizes negative outcomes given the resources available, a solution that satisfices rather than optimizes depends on what an individual considers to be "good enough" and what an individual considers to be a price worth paying.

In the area of health, this can become problematic. A layperson may not have the requisite knowledge to understand the tradeoffs between lifestyle changes and health benefits in order to arrive at a lifestyle that satisfices health outcomes. Instead, the layperson may find him/herself relying on experts such as doctors and scientists who study the effects of interventions of health and longevity outcomes.

In order to assist with this process, the layperson may turn to a variety of books, videos or other materials for information and guidance. There are two challenges that laypeople may face when adopting this approach. The first is that content providers are usually looking to sell millions of

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copies of the content or get comparable numbers of views if the content is placed on a social media platform. As such, the content is explicitly designed to be general in nature so as to have as wide appeal as possible. However, people are different and have different needs, goals and lifestyles. Therefore, a "one-size fits all" may not be useful to any individual consumer of the content. However, since it is not cost-effective or a good use of a content creator's time to create personalized solutions for a particular consumer, that consumer may be left unserved. Personalized content may be available from specialists such as doctors, nutritionists, fitness trainers or other consultants, but such content is expensive to purchase and is likely not to be a scalable solution.

The second challenge that laypeople may face in turning to books, videos and other forms of content for information and guidance on lifespan extension and improving health is that such content may prescribe optimal or target levels of interventions. Advocates of particular diets may recommend specific foods to avoid or eat and quantities to be eaten. However, our own surveys suggest that, while people do want to achieve longevity and health benefits, most people are willing to make only moderate, at best, changes to their lifestyles. Moreover, people often do not follow advice they are given. For example, while it has long been known that smoking tobacco products is extremely unhealthy and will both shorten lifespans and increase the risk of serious diseases, there are still millions of people around the world who smoke.

Similarly, even when people do want to follow the advice they are given, their compliance can be far less than what is recommended. In the well-known CALERIE study (Belsky et al., 2017), researchers studied the effects of calorie restriction on biological age. Researchers targeted a 25% reduction in calories consumed per participant, but the actual average reduction was closer to 12% or about half the target.

This type of finding is consistent with what we find in our own surveys of people. We find that people overwhelmingly love the idea of living longer, healthier lives. However, most people do not want to make major changes to their lifestyles to achieve these goals. Fortunately, health and longevity interventions are not all or known. There are typically significant benefits to be had by doing partial interventions, even if the full recommendations are not adhered to. For example, in the above-referenced CALERIE study, even though Participants, on average, achieved only about half the reduction in calories the researchers were targeting, Participants still showed a remarkable 9 to 1 benefit in slowing their biological age progression, meaning that their biological ages advanced only one month for every nine months they were on the program.

The key, then, is to balance the recommendations made to people with what they're willing to accept. The 100% solution may not be acceptable, but the 20% or 50% solution might be. Strategically, an incremental approach may work best. A person gets an easier, more achievable

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plan to follow at first. Then, as a person demonstrates compliance with the simpler program and gets measurable health successes, the person can be offered increased levels of the interventions to follow with projections of increased benefits for doing so.

The My Youthspan Software

This type of strategy is embedded into My Youthspan, a machine learning-based software product that METY Technology is creating. A user starts off by filling out an intake form that contains personal information such as age, gender, height, weight as well as medical history and lifestyle information such as foods s/he eats, exercise s/he does, nutritional supplements s/he takes, sleep, and stress. The software then uses a machine learning algorithm, trained by aggregating research results from hundreds of scientific papers on the relationship between these variables and lifespan and chronic diseases, and then presents the user with a projected lifespan and risk of major diseases such as heart disease, stroke, cancer, etc.

The next step is that the machine learning model takes the personal information and the aforementioned research and calculates the optimal values of each lifestyle variable to produce the longest lifespan and the lowest risk of disease. This is referred to as the "optimal plan." The optimal plan is then presented to the user. The user is then able to compare his/her current lifestyle choices to the proposed lifestyle recommendations and see the corresponding improvements in lifespan projections and reductions in risks of major diseases.

Consistent with the discussion above regarding satisficing, users are then given the opportunity to perform a sensitivity analysis (cf. Saltelli et al., 2008). In this analysis, while having their current and optimal lifestyle data available for viewing, users can change the values of any intervention (e.g., dietary recommendation) and see the impact on the projected lifespans and risks of major diseases. This allows the user to decide what tradeoffs s/he is willing to make in terms of lifestyle changes in exchange for lifespan and health benefits.

Since life is a dynamic and evolving process and user choices themselves can evolve (people can be overly optimistic about what they can sustain or underestimate what they can achieve), the software then provides each user with a daily log into which s/he can enter actual levels of each intervention (e.g., how much s/he exercised, slept, ate of different types of foods). Additionally, the user can periodically enter changes in dependent variables such as weight, blood pressure, cholesterol levels, sleep duration and quality, stress levels. The software also has online questionnaires and metrics for measuring things like happiness and even reaction time and memory.

The log and health progress data are used for two purposes. First, health progress data are used to create reports on what users have achieved for the purpose of motivating users to continue

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with their longevity programs. Second, the log and progress data are used to update our general machine learning models as well as provide updated projections on lifespan and risk of disease. When this happens, new "optimal" plans are calculated for the user and the user can adjust this new plan (or keep the old one) as before. In this way, the user can calibrate whether s/he wants to scale back what s/he thought s/he could do in the way of lifestyle changes, stay with his/her current plan, or increase the plan to increase the benefits. In this way, the plan becomes dynamic rather than static.

Conclusion

The My Youthspan program represents an attempt to allow people to customize longevity and wellness programs to their actual lifestyles and willingness to change them. It balances the desire to provide optimal recommendations to people, based on scientific research, with awareness that one-size-fits-all approaches, even for people with similar demographics and lifestyles, is not practical. It also recognizes that life is dynamic and that optimal or even satisficing solutions may change as a result of practice and outcomes.

The implications of this reasoning extend beyond the present software. Health and other agencies routinely communicate guidelines for diet, exercise, etc. and state that these are what are recommended for people fitting specific demographics (e.g., age, gender). While these guidelines may indeed represent "best practice" advice, it is also widely known that many, if not most, people do not adhere to these guidelines. Often, the guidelines are accompanied by statements of projected benefits such as reductions in risk of disease if people adhere to said guidelines. What is missing from this type of messaging is a presentation of options or potential tradeoffs that people will make by partially following the guidelines.

For example, if doing 150 minutes of cardiovascular exercise a week produces a given health benefit, how much benefit is accrued if a person does 75 minutes? 100 minutes? Generally, people do not receive this type of information. Therefore, if they feel that 150 minutes (e.g., 30 minutes a day, 5 days a week) is too much of a strain on their lifestyles, they do not have good information about what benefits they will get if they do only 75 minutes (e.g., 25 minutes a day, 3 days a week) of cardiovascular exercise and whether this is close enough to the benefits of 150 minutes of exercise that they would be willing to accept and sustain this level of exercise. We believe health outcomes could be improved in society if people were informed about benefits they could receive from trying to satisfice rather than optimize their health benefits. People may be more likely to adopt healthier lifestyles if they were convinced of and could quantify, even roughly, the benefits of modest and more lifestyle-friendly changes. This type of information should be provided to them.

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