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Targeting healthspan to optimally combat non-communicable disease in an aging world

Joshua C. Drake [a,b], Zhen Yan [a,b,*]

[a] School of Medicine, University of Virginia, Charlottesville, VA, USA
[b] Center for Skeletal Muscle Research at Robert M. Berne Cardiovascular Research Center, University of Virginia, Charlottesville, VA, USA

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ABSTRACT

Human lifespan and life expectancy have increased worldwide, but the number of years that we spend free of chronic or debilitating disorders, known as healthspan, has not shifted along with increased lifespan. This unfavourable trend presents a tremendous global social-economical problem. We propose a model of promoting optimal human health with proactive, holistic interventions across the lifespan, which require multi-disciplinary, innovative approaches to research and care. We contend that this is the only hope that we have to face the challenges of population growth and aging, as well as the upward trend in non-communicable disease prevalence.

The biomedical discovery boom over the past century has contributed greatly to a consistent rise in human lifespan and life expectancy worldwide. However, the number of years that we spend free of chronic or debilitating disorders, known as healthspan, has not shifted along with increased lifespan.[1] In the US alone, 45% of the population over the age of 65 and 21% of the 45–64 demographic has two or more chronic, non-communicable diseases (e.g. obesity, diabetes, neurological diseases, etc.).[2] With a life expectancy of approximately 80 years between the US and UK (72.6 years globally),[3] the impacts, both personal and societal, by living a projected several decades longer while suffering from a non-communicable disease (let alone two or more) cannot be understated. Considered in tandem with the growing aged demographic globally there is little room for optimism. By the year 2050, approximately a quarter of the world's population (26.1% in Northern America and Europe), with the exception of Africa and Southern Asia, is predicted to be over the age of 65[3]. It is clear then that not only is poor healthspan a global problem, but also it is unlikely to improve in the coming decades without a shift in the existing paradigm from reactively treating disorders to a paradigm that seeks first to promote health and wellbeing across the whole lifespan.

The current accepted model of human health and wellbeing has its origin in the theory of salutogenesis, developed by Aaron Antonovsky in the late 1970's, which focuses on factors that support human health and well-being rather than on factors that cause disease (pathogenesis).[4] We contend that optimal human health and wellbeing (physical, mental, and social) requires an appropriate amount of physical activity, nutrition, sleep, body-mind practice, and social interaction. We propose that creation and implementation of interventions targeting two or more of these lifestyle elements (holistic intervention) will be more effective in promoting health and wellbeing, and therefore healthspan, than any single intervention that does not take into consideration other complimentary and/or competing variables. Having a more healthspan-centric ethos in research, education, and care is therefore more likely to promote personal and societal flourishing through the improvement of health and well-being at all ages.

Healthspan is influenced by a myriad of internal and external factors, both biological and environmental, that have no regard for the constraints imposed between fields or our focus as researchers, educators, and healthcare providers. However, much of our efforts to combat non-communicable disease rely heavily on a focused, reductive approach, targeting one disease condition in isolation, which does not reflect the real-world problem.[3,5,6] Limiting external/environmental factors and focusing on the target(s) of interest within the confines of a single field of study or system is practical and, arguably, necessary in many respects. Certainly we have derived much knowledge and treatment interventions through these approaches, however, the impact upon healthspan has not followed.[1] Therefore, we propose that simultaneous investigation across diverse fields of study and/or assessment of multiple, even overlapping, stimuli or factors should become more prominent in our strategies so to not limit the efficacy of potential interventions. Investigators should engage, and institutions should promote collaboration across a wide range of disciplines that extends beyond the traditional walls of medical

* Corresponding author. 409 Lane Road, MR4-6041A, Charlottesville, VA, 22908, USA
E-mail address: zhen.yan@virginia.edu (Z. Yan).

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centers. Such cross-pollination between different, and at first glance possibly uncomplimentary, disciplines could foster the creation of truly novel and impactful ideas for healthspan promotion and better maximize potential benefits of biomedical discovery. For example, collaboration between architects, engineers, and health professionals could lead to the creation of infrastructure that subversively promotes healthier lifestyles,[7] thus fostering healthspan in the broader community. Engaging others that we would not seek as collaborators a priori and focusing on multi-disciplinary, more holistic approaches are but a few possible starting points.

Age itself is a major risk factor for non-communicable disease,[3,5] but we have little understanding of how to best promote healthspan or how intervention efficacy changes over the entirety of the lifespan. Also, we now know that our susceptibility to non-communicable disease later in life can be influenced as early as during gestational development.[8] As environmental stressors encountered and the biologic means by which to deal with those stressors change over the course of our lifespan, understanding these processes precisely and how to best intervene at a given age is critical for healthspan promotion. However, investigations are often narrowed to a single age group with little justification. In the case of clinical trials, age is commonly an unjustified exclusion criteria.[9] Relying on results from different age demographics makes it difficult to predict how well results will translate into an affected population, if at all. Additionally, co-morbidity is also a common exclusion criteria in clinical trials,[9] the prevalence of which, as we have already highlighted, also increases with advancing age.[1,3] As a consequence, the results of such investigations may have limited or, worse, no application in the clinic. The championing of personalized medicine in recent years as a means of increasing treatment efficacy is certainly a move in the right direction, but is likely to move forward slowly if the research by which personalized approaches are based does not reflect the environment and age demographic of the individual being treated. While precision medicine is focused on the treatment of specific diseases, precision nutrition, physical activity and/or other interventions, tailored for age, gender, genetic background, etc., will be an inevitable effort to optimally improve healthspan as the future trend to combat non-communicable diseases for an aging world.

We believe that the current evidence and arguments we present illustrate a clear need for a more holistic and multi-disciplinary approach to research and care to promote healthspan. There are, however, considerations to be made in regards to how we teach and instruct our students and patients that should be taken into account if we are to move forward in bringing a promotion of healthspan into the realm of reality. The presuppositions upon which we educate our patients, students, and, thereby the community at large, is primarily from the stance that non-communicable diseases are to be managed, despite patient adherence and efficacy of long-term disease management programs being decidedly poor.[10–13] That there could be impact that occurs at a point prior to the development of chronic disease is not widely given serious consideration. The challenges ahead of us in population growth and aging, as well as the upward predicted trend in chronic disease prevalence, mean that we must rethink how we are training the next generation to engage in their work and communicate with their patients. If healthspan is to be improved then it should be taken seriously as an attainable patient outcome, or maybe even starting point. If not, then there is little hope of healthspan improving, regardless of the innovation of our research.

An ancient Chinese medical text, *Huangdi Neijing*, states that superior doctors prevent disease, mediocre doctors treat disease before it becomes evident, and only inferior doctors treat full-blown disease. As researchers, clinicians, and educators of those that will succeed us, we would be remiss to not aim for the first admonishment; to be and to make superior doctors. Unless we find ways to do so, healthspan will remain as it is, unchanged.

Conflict of interest

The authors have no conflicts of interest to declare.

Submission statement

This manuscript has not been published and is not under consideration for publication elsewhere.

Each authors' contributions

JCD and ZY wrote and edited the manuscript.

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