The Future of Health

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In the 1980s, it was demonstrated that, as life expectancy rose in the United States, the healthier we became. The rationale was simple; we were living longer because we were healthier—which suggested that we could be in line to achieve even longer and healthier lives in the future. Other Scientists suggested that we should be careful what we wish for, because life extension in the future would probably not yield the same amount of healthy life as it did in the 1980s or occur for the same reasons. It’s possible that humanity has squeezed about as much healthy life out of public health interventions as possible and that the human body is now running up against inherent limits that the genetically fixed attributes of our biology impose. I will take the latter position in this essay, while recognizing that some population subgroups still have significant room for improvement in health and longevity.

The story of human longevity and health has a remarkable resemblance to the legend of Faust. In Goethe’s version of the story, Faust is a scholar who becomes disillusioned with his own limits of knowledge and eventually consider to suicide. The devil, Mephistopheles, steps in and makes Faust an offer. In exchange for unlimited knowledge, continuous youthful vigor, pleasures of the flesh, and magical powers, the devil will eventually claim Faust’s soul. The story of Faust is a metaphor for a bargain that at first seems appealing but with time is revealed to be a ruse.

For those knowledgeable about Greek mythology, the story of the goddess Eos and the mortal Tithonus should come to mind. Eos falls in love with Tithonus but eventually realizes that, given her own immortality as a goddess, she will eventually lose him to aging. She asks the god Zeus to grant Tithonus physical immortality, and he does so, but she forgets to ask for eternal youth. The story ends tragically as a typical Faustian bargain as Tithonus withers away in his immortal body, succumbing like everyone else to the ravages of time but without the gift of death to take him away from his misery. The Struldbrugs from Gulliver’s Travels faced a similar fate, with their immortality a curse rather than a blessing.

The modern increase in human longevity and our endless quest to extend life is in my opinion, in its current form, a cruel and potentially dangerous Faustian bargain. Let’s take a look at the evidence. The first longevity revolution that began in approximately 1850 occurred because of reductions in death rates from infant and child mortality brought forth by advances in basic public health. Thirty years was added to life expectancy at birth at lightning speed—a benefit to humanity like nothing else in history.

The conventional understanding of why life expectancy gains decelerate in long-lived populations is simple to understand. Reductions in childhood diseases can occur only once for a population; once achieved, the only outlets for further gains in life expectancy must come from saving the lives of older people. Because aging-related diseases accumulate in bodies that face the test of time (known as competing risks), irrespective of improved lifestyles, once survival past age 65 becomes common in any country, life expectancy gains decelerate. Somewhere between 84% and 91% of all babies born today in developed nations will survive past age 65, so the point of diminishing returns and the upper limits of life expectancies (approximately 85 for men and women combined) for long-lived national populations appears to have been approached. Others suggest that, if there is a limit to life expectancy, it could be older than 85 because anticipated advances in medical technology that do not yet exist will continue to generate survival time in the future—even for people at older ages.

Here’s the dilemma. Life extension in an aging world that is achieved through interventions that modulate...
disease risk (which could happen through lifestyle modification or medical interventions) exposes the saved population to greater risk of all other aging-related diseases. It is here that a distinction between aging and disease is needed. Various definitions of aging have been proposed, but my colleagues and I have defined aging as

the accumulation of random damage to the building blocks of life—especially to DNA, certain proteins, carbohydrates and lipids (fats)—that begins early in life and eventually exceeds the body’s self-repair capabilities. This damage gradually impairs the functioning of cells, tissues, organs and organ systems, thereby increasing vulnerability to disease and giving rise to the characteristic manifestations of aging, such as a loss of muscle and bone mass, a decline in reaction time, compromised hearing and vision, and reduced elasticity of the skin . . . . Aging . . . makes us ever more susceptible to such ills as heart disease, Alzheimer’s disease, stroke and cancer, but these age-related conditions are superimposed on aging, not equivalent to it. Therefore, even if science could eliminate today’s leading killers of older individuals, aging would continue to occur, ensuring that different maladies would take their place. In addition, it would guarantee that one crucial body component or another—say, the cardiovascular system—would eventually experience a catastrophic failure [competing risks—my emphasis]. It is an inescapable biological reality that once the engine of life switches on, the body inevitably sows the seeds of its own destruction.7

This phenomenon of competing risks means that, the longer we live, the more important our aging biology becomes in determining length and quality of life. A new Faustian bargain has presented itself, and humanity seems all too willing to sign the papers. What I mean by “signing the papers” is that our modern world has adopted a vertically oriented disease model in which investments are made in attacking one disease at a time, as if they were all independent of each other. There is no better example of this than the National Institutes of Health, where entire institutes and funding streams have been constructed to combat heart disease, cancer, Alzheimer’s disease, etc., with little or no recognition that the most important underlying risk factor for all of these diseases is the biological process of aging. The evidence that has emerged in recent years suggests that the terms of this new Faustian bargain may be unfavorable (e.g., the added survival time achieved by attacking diseases without influencing aging could lead to a prolongation of frailty and disability in survivors).

If Mephistopheles had laid out the health and longevity bargain presented to us in 1850, he would have simply said look around you—you have the choice of continuing to lose your children to communicable diseases, or in exchange for 30 years of life, I’m going to give you heart disease, cancer, stroke, Alzheimer’s disease, Parkinson’s disease, diabetes mellitus, and a long list of nonfatal disabling conditions. We signed the papers, and in retrospect, it was worth every part of the bargain, but Mephistopheles isn’t done with us. Like a street magician who lets you win the first game and then sucks you into a bigger con with larger stakes or a drug dealer who hooks you with free samples, the next, much costlier offer is before us now. We’ve had our taste of longevity, but now we want more, and we seem willing to pay a heavy price for additional life.

Just like in 1850, Mephistopheles is giving us a window into the future, and here’s the “bargain.” In exchange for incrementally smaller lengths of survival time—months or a few years at most—we experience what we fear most: a suite of fatal and disabling conditions expressed at later ages that rob us of what we hold most precious—our mental and physical functioning. A few examples among many include cancer, cardiovascular disease, diabetes mellitus, Alzheimer’s disease, dementia, osteoporosis, osteoarthritis, and sensory impairments involving vision and hearing loss. Furthermore, we now must battle chronic diseases with one hand tied behind our back. The only weapon at our disposal is to manufacture survival time using the same vertically oriented “infectious disease model” that brought forth the first longevity revolution. This model is simple. As soon as a disease appears, attack that disease as if nothing else is present; beat the disease down, and once you succeed, push the patient out the door until he or she faces the next challenge; then beat that one down. Repeat until failure.

This model worked well for infectious diseases, and it has been somewhat effective for some chronic degenerative diseases, and no doubt there is still progress to be made, but evidence has emerged that this approach is likely to run out of steam soon.8,9 “It appears that life expectancy among the older people has been increased by reducing mortality among older persons with disease and disability . . . . We have saved people from dying who had a disease, an accomplishment that leads to more years of life with heart disease, diabetes, and cancer.”8 In other words, saving and extending the lives of people with chronic diseases is likely to yield an expansion of morbidity and disability, and when a vertical approach to disease management is applied, that is the result.

What is the solution to this new Faustian bargain? Don’t sign the contract! Clues about what we should do instead were presented to us decades ago. In the mid-1950s, gerontologists suggested that attacking aging itself rather than the diseases associated with it offer the greatest hope in warding off the infirmities of old age.10 The first formal discussion of delayed aging as a public health intervention appeared in Extending the Human Life Span: Social Policy and Social Ethics11. The critical thing to remember is that health extension is the goal; we must not continue to be seduced by life extension, and the time has arrived to pull our other hand out from behind our back and combat the fatal and disabling diseases of aging by attacking aging itself rather than just its consequences.

In 2006, my colleagues and I extended this line of reasoning by coining the phrase “the longevity dividend” to describe the economic and health benefits that would accrue to individuals and societies if we extended healthy life by slowing the biological processes of aging.12 This idea was distinctive because we proposed to extend healthy life by shifting our emphasis from disease management to delayed aging. The longevity dividend is an
approach to public health based on a broader strategy of fostering the extension of healthy life using a new horizontal model of health promotion and disease prevention. Unlike the current vertical approach to disease that targets individual disorders as they arise—with life extension as the goal—the longevity dividend model seeks to prevent or delay the root causes of disease and disability by attacking the one main risk factor for them all—biological aging. Slowing down the processes of aging—even by a moderate amount—will yield the gift of millions of person-years of healthy life for current and all future generations.

The case can be made that delayed aging could be the most efficient method of achieving primary prevention available to us in this century. A large-scale, concerted, coordinated effort is underway to translate the science behind the longevity dividend into real-world clinical trials and a resulting suite of therapeutic interventions. Multiple organizations around the globe are pursuing this new model of health promotion. If we do not take control over our own biology, my prediction is that the latest Faustian “bargain” of an expansion of morbidity and disability will be the price we pay for incrementally smaller amounts of survival time.

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REFERENCES