More recent declines in death rates, especially at middle and older ages, are largely a product of a successful disease model in which physicians and scientists have found ways to either delay the onset and progression of fatal diseases or extend the lives of those who have them. The contemporary disease model is an outgrowth of the approach to infectious diseases that arose centuries ago in which each disorder is treated as it arises—as if independent of all other conditions.

The longer lives we enjoy have come with both desirable and undesirable side effects. On the positive side, healthy life span has risen rapidly for many during the last century—offering individuals and societies unique opportunities to benefit from many more healthy, active, and productive older people than ever before in history. In fact, in one of our forthcoming publications (Lowsky, Olshansky, Bhattacharya, & Goldman, in press), we demonstrate that even in the oldest region of the life span (those ages 85-plus) in the United States, a surprisingly large percentage of people are in nearly perfect mental and physical health. In many important ways, a segment of the oldest old is not much different than people decades younger. In addition, the absolute number of healthy older people will rise rapidly due to population aging in the coming decades, and there is reason to be optimistic that the healthy lifestyles adhered to by many will pay off in even further extensions of healthy life.

Longer lives also have been accompanied by a Faustian trade—the rise of chronic fatal and disabling conditions at unprecedented rates in recent decades. Keep in mind that children saved from dying of communicable diseases, which killed many before the age of 10 throughout human history, now live long enough to experience the complications that accompany aging bodies. Although the good news is that a much longer portion of our total life spans are lived in relatively good health, the rise of cardiovascular disease, cancer, Alzheimer’s, and a host of other conditions is largely a product of living long enough to experience them.

An additional complication of longer lives is that many more people are now qualifying for old-age entitlement programs, such as Social Security and Medicare, and they will remain in these programs longer. These social programs were not originally designed with this level of extended survival in mind.

There may be considerable debate about the future course of health and longevity, but one important factor that influences them both has not changed: The approach to fatal diseases remains firmly entrenched in the disease model. We tend to wait until a health condition arises, treat it, and then live on until another health hurdle gets in the way. Proactive primary prevention is relatively rare.

Although advances in attacking diseases have extended life, evidence suggests they may not continue to extend healthy life at older ages—especially not at the levels witnessed in recent decades. Demographic
modeling has shown that increased disability rates are now accompanying increases in life expectancy in the United States—or, at best, leaving healthy life span unchanged. The rise of adult-onset and childhood obesity suggests that future cohorts of older people may face even more health challenges than cohorts reaching older ages today.

As people age, they are much less likely to fall victim to a single, isolated disease. Instead, competing causes of death more directly associated with biological aging cluster within individuals as they approach later ages. These conditions elevate mortality risk, as well as create the frailty and disability profile that can accompany old age.

A new form of aging science is beginning to emerge (described in greater detail in this issue of *Public Policy & Aging Report*) that has the potential to extend healthy life and simultaneously reduce the prevalence of comorbidities over the entire lifetime. In deciding whether and how much society should invest in this new delayed-aging model, three questions arise:

1. What are the relative health and economic benefits and costs of delayed aging versus the delayed-disease model?
2. Can we afford to continue with the delayed-disease model given the large demographic shifts that are forthcoming and the anticipated diminishing returns from investments that treat diseases after they arise rather than proactively delaying their occurrence?
3. Can society afford to invest in the science that would lead to accelerated development of interventions that extend healthy life?

A newly published white paper (Goldman et al., in press) answers these questions. Here, we provide a brief summary of the findings.

Using the Future Elderly Model (a microsimulation that tracks cohorts of people age 51 or 52 and older through time based on the Health and Retirement Survey), we predicted medical spending, health conditions, functional status, and employment given initial demographic and health conditions. In addition, we developed five scenarios about the future course of mortality (projected to 2060) and compared them along health and medical spending dimensions.

Two disease-specific scenarios represented continuations of the status quo in medical research, disease treatment, and improvements in behavioral risk factors (e.g., attacking diseases either individually through treatments or systemically through behavior modification). A delayed-aging scenario was designed to be a hypothetical assessment of a successful effort to translate research on the biology of aging into therapeutic interventions that reduce and compress both morbidity and mortality into a shorter duration of time at the end of life. We then added in delayed-cancer and delayed–heart disease scenarios to represent realistic improvements in death rates from both major causes of death in the coming decades. The published manuscript contains details of the data, microsimulation model, and all related assumptions.

Our results demonstrate, first, that the number of people ages 65 and older in the United States is expected to more than double over the next 50 years under current optimistic scenarios about major fatal diseases, rising from 43 million in 2010 to 106 million by 2060. However, if delayed aging comes to pass, there would be just under 7 percent more people ages 65-plus in the United States in 2060. More important, under the delayed-aging scenario, a significantly larger number of people who reach ages 65 and older between now and 2060 would be healthy relative to conditions that would exist under the other scenarios. Additional evidence of the health benefits of delayed aging is that per capita Medicare spending is shown to be lower in the delayed-aging scenario.

Delayed aging would also yield a larger 65-plus population between now and 2060, which means more people would qualify for federal entitlement programs—thus raising their costs. A hypothetical increase in the age of eligibility for Medicare would fix this problem, but it is uncertain whether this fix or some other modification to Medicare would be most appropriate to handle the larger, healthier older population that would result from delayed aging.

Our results demonstrate that shifting the focus of medical investment to delayed aging would lead to a unique set of desirable but economically challenging circumstances. The potential gains are significant. Although the disease model has reduced mortality from lethal conditions dramatically in the past century, its influence is now waning because of competing risks. As people live longer, they are more likely to experience competitive conditions.
multiple diseases. Our simulations of reduced incidence of cardiovascular disease and cancer suggest incrementally smaller gains in longevity going forward by continuing to attack these diseases independently.

More generally, the focus on healthy aging should also be emphasized. Recent research has shown that decades of improvement in the functional status of older Americans has halted since 2002 (Bhattacharya et al., 2004; Crimmins & Beltran-Sanchez, 2011; Hulsegge et al., 2013; Lakdawalla, Bhattacharya, & Goldman, 2004). This trend suggests that many of the historical drivers of better health in older adults will not continue, so we now need to look elsewhere. Declining disability buttresses the case for research on slowing aging by compressing morbidity and extending healthy life, because it will provide an adequate workforce for the goods and services the future aging society will use.

Still, the fact remains that longer lives mean that Social Security and other income-support programs have greater fiscal burdens, and total Medicare and Medicaid expenditures increase even as per capita medical costs decline. An unequivocal answer to the question of whether the current focus of medical research and investment should be shifted from the disease model to delayed aging depends on whether the potential gains can be realized and the adverse consequences allayed.

It is clear that competing health risks limit the impact of major clinical breakthroughs for specific diseases—that is, making progress in one disease means another one will eventually emerge in its place. This state of affairs makes research and investment to delay aging quite valuable, given the evidence suggesting that all fatal and disabling disease risks are lowered simultaneously. Not surprisingly, we see extremely large population health benefits in our delayed-aging scenario. The major challenges of delayed aging appear to be of a fiscal nature, although these are manageable. In any case, benefits to societies from delayed aging would accrue rapidly and extend to all future generations.

**References**


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