

Living to 100: Socioeconomic Implications of Increased Longevity

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Living to 100: Socioeconomic Implications of Increased Longevity

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Abstract

Most actuarial explorations of increased longevity have, quite understandably, focused on direct financial implications for things like health care costs, retirement systems, and social security or other public policy provisions. But future life extension has many other potential implications, both direct and indirect, for various socioeconomic factors, which in turn have the potential to affect the actuarial valuation of future risk contingencies. This paper examines a sampling of the socioeconomic issues emerging from the possibility of substantially increased longevity. Because of the complexity and interrelatedness of these issues, actuarial and risk modeling of this prospective environment could be a significant challenge.

I. Introduction

While there is large variability between specific projections of human life extension in both the near and far future, one thing seems clear: Expected lifetimes will increase, possibly significantly. Historically, expected lifespans have increased primarily because of improvements with respect to infant mortality. At least in developed countries, that source of expected lifespan improvement has largely been exhausted. Nevertheless, going forward, scientific and medical advances are anticipated to continue (although to what degree is open to much debate), and late-life improvements will be the primary source of life extension.

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Actuarial science, of all professions, is one of the most interdisciplinary in the scope and breadth of the factors relevant to its analysis. Most actuarial explorations of enhanced longevity have, quite understandably, focused on direct financial implications for things like health care costs, retirement funding, and social security or other public policy provisions. But increased longevity has many other implications, both direct and indirect, for social and economic factors with the potential to affect the actuarial valuation of future risk contingencies.

This paper examines a variety of socioeconomic issues and implications emerging from anticipated increases in longevity. By exploring a sample of these issues, the intention is to demonstrate how complex and interrelated these issues, taken as a whole, can be. Nevertheless, to model future risks, including the parameterization of the many variables and factors involved, actuaries will need to appreciate these issues and their interactions. This is a difficult but exciting challenge and will require an understanding of the total future environment both at a holistic macro-philosophical level and at a quantitative-analytical level.

Section II of this paper provides a brief summary of the scientific and medical advances that have led us here, to the realization that significant increases to human longevity are likely imminent and, at the very least, need to be prepared for. Sections III, IV and V discuss some of the major issues resulting from this development. These issues are categorized respectively as economic, family and ethical issues. The listing of issues (and the discussion of any one issue) is not intended to be complete and thorough, but rather a sampling that demonstrates the complex thought process necessary to fully appreciate the modeling challenge. Section VI concludes and summarizes.

II. Scientific and Medical Background

Over the past 100 years, expected human lifespans have increased by about 30 years—an exceptionally large increase, whether considered as an absolute number or as a percentage change. This increase has a variety of important causes: scientific and technological innovations, pharmaceutical advances (perhaps most significantly antibiotics), sanitation and general health care improvements, and some cultural factors.

The interesting thing about the historical increases in longevity is that they have primarily occurred at the beginning of the lifespan—infant mortality has decreased substantially (probably to the point where there is little more that can be gained, life expectancy-wise, in this area, at least in the industrialized world). Furthermore, the additional 30 years of life expectancy has not simply been “tacked on” to the retirement phase at the end of life—it has affected many aspects of how people live and corresponded to better health overall.²

The extension of life has, to some degree, been desired by most cultures. In some cases, tradition holds that eternal life was once a reality for humans but it was taken away because of one or more transgressions against god or nature.³ In some other cultural traditions and myths, there is a search or striving by mortal humans for immortality, through a traveling quest,⁴ through a search for an elixir of life⁵ or even through trickery,⁶ that ultimately fails,⁷ sometimes disastrously. Thus, in many traditions, there is an acknowledgement that striving to live beyond what humans can rightfully expect is somehow “tempting fate,” and will not end well.

Recently, there have been many books, articles and other media that have described, and prescribed, diets or other approaches to dramatically extend life. Some of these efforts have been met with a healthy skepticism.⁸ However—and perhaps partly because of the increasing number of such books, as well as great advances in research and medical technology—the science and biology associated with life extension recently seems to have gained considerable respect, perhaps even becoming fashionable or trendy. There are several good reasons for this. For example, according to Duncan (2012),

² Admittedly, there are some concerns, like obesity, that have emerged recently as potential problems that could threaten the degree to which greater longevity is achieved.

³ One interpretation of the book of Genesis, especially when supplemented by certain passages in the New Testament, is that Adam and Eve, by sinning, lost eternal life for humans and introduced death into the world.

⁴ In *Epic of Gilgamesh*, the eponymous character, grieving at the death of his companion Enkidu, seeks immortality but is unable to achieve it, and eventually realizes his mortal skills and gifts make even a finite life worth living.

⁵ Qin Shi Huang, the first emperor of a unified China in the third century B.C., had court alchemists and physicians search for an eternal-life-giving potion, although he probably died earlier than he otherwise would have due to the presence of mercury in many of the attempted concoctions.

⁶ For example, in Greek mythology, Sisyphus tried to outsmart Hades and Persephone and avoid death, only to end up eternally pushing a boulder up a hill.

⁷ And we haven’t even mentioned some far more recent examples—such as Voldemort!

⁸ Holliday (2007, chapter 9) describes some of these efforts.

The first is a realization that aging is the highest risk factor for many diseases, and therefore needs to be seriously addressed by biomedical research. ...
... The second trend making life-extension science less outrageous for traditionalists is that interventions have actually worked in animals.

To Duncan's two items one could add a third point: Over the last decade or so, evidence has accumulated that aging might not be necessary in all parts of the animal kingdom. For example, hydra seem to be virtually immortal (Kirkwood 1999). This is still a contentious issue but seems to be accepted by many.

The reference in Duncan's second observation is primarily to calorie restriction, which some investigators have found to provide evidence of successful life-extension in certain simple animal species.⁹ However, other approaches involving restriction or inhibition have also been associated with life extension. For example, according to Kenyon (2011),

Inhibiting insulin/IGF-1 signalling extends lifespan and delays age-related disease in species throughout the animal kingdom. This life-extension pathway, the first to be defined, was discovered through genetic studies in the small roundworm *Caenorhabditis elegans*.

So there is some evidence that, at least in some animal species, it is possible to favorably affect life expectancy. But how does this potentially apply to humans? While it is difficult to do controlled laboratory studies of life extension on a relatively long-lived species like humans, certain characteristics in people have been observed to be associated with health and longevity. For example, Friedman and Martin (2011), reporting on an eight-decade study that followed many lives, found the best early predictor of long life is "conscientiousness"—i.e., individuals being basically attentive, thorough and organized. They ascribe three reasons for the predictive nature of this trait: Conscientious people probably make better health and risk decisions, they

⁹ It is still very unclear whether these accomplishments have any potential applicability to humans.

may be biologically predisposed toward healthiness, and they may have personalities that tend to result in healthier relationships and conditions.

So, the science of life-extension has become acceptable, progress is being made, and we can begin to identify the traits in humans that seem to be associated with longevity. What about the future? To what degree can we project successful lifespan enhancement into the future? The answer, of course, is that no one knows for sure—but there are lots of opinions, and they can vary quite substantially. For example, people like Kurzweil and Grossman and de Grey and Rae believe we are very close to achieving a precedent-shattering improvement in human lifespans.

Immortality is within our grasp. ...

... The knowledge of how to maintain our biological “house” and extend its longevity and vitality without limit is close at hand. (Kurzweil and Grossman 2004)

That night, I swept aside all that complexity, revealing a new simplicity in a complete redefinition of the problem. To intervene in aging, I realized, didn't require a complete understanding of all the myriad interacting processes that *contribute to* aging damage. To design therapies, all you have to understand is aging damage *itself*: the molecular and cellular lesions that impair the structure and function of the body's tissues. Once I realized that simple truth, it became clear that we are far closer to real solutions to treating aging as a biomedical problem, amenable to therapy and healing, than it might otherwise seem. (de Grey and Rae 2007)

Other commentators and researchers, while not necessarily pessimistic, are much more moderate in their projections. They anticipate continued improvements in human life expectancy but not necessarily to the degree that some have claimed for the near future. And there is even some question as to whether some of our recent demographic analyses have been

completely accurate—for example, Willets (2012), which discusses the fact that the recent census has not found as many high-age people as were being projected.

It is likely that updated population estimates produced using the 2011 Census will result in slightly lower life expectancies (at age 65). It is also probable that projections of the population reaching high ages, e.g., projected numbers of centenarians or the likelihood of reaching age 100, may be more materially affected.

As with so much in our contemporary world, there is great volatility and uncertainty in projections of future life expectancies.

When one hears about the possibility of extreme increases in longevity, an immediate thought is often that populations—national or global—will thereby increase without bound, stretching resources to the limit and creating general discomfort, or worse. Indeed, this is a possibility—but it certainly need not be inevitable. A very simple (and highly simplified) mathematical demonstration shows this. Let $P(t)$ be the population at time t , let b be the birth or fertility rate per time period, and let d be the death or mortality rate per time period. Then the expected population level one time-period in the future can be expressed as

$$E[P(t+1)] = P(t) + b \cdot P(t) - d \cdot P(t) = P(t) \cdot \{1 + b - d\}.$$

With successive substitutions for each additional time period, the expected population level n periods in the future can be expressed as

$$E[P(t+n)] = P(t) \cdot \{1 + b - d\}^n,$$

which depends upon the relationship between b and d . In particular, if the birth and death rates are not very different, the population won't increase significantly and may even decrease. This demonstrates what we know intuitively: Population growth is significantly a function of the

birth rate and, more precisely, the birth rate as it relates to the mortality rate. Large decreases in mortality rates need not have dire consequences for total populations, depending upon how birth rates change or respond to that decrease.

Of course, the above model is meant to be merely demonstrative; it is extremely simplistic, and ignores obvious issues such as fertility and mortality rates changing over time and changes over time in the demographics of the total population (young versus fertile versus old). But the same general result holds when greater detail is considered. For example, in one recent paper several longevity scenarios were projected using a model along the lines of that employed by the World Bank.

A general conclusion of this study is that population changes are surprisingly slow in their response to a dramatic life extension. ... Even for very long 100-year projection horizon, with the most radical life extension scenario (assuming no aging at all after age 60), the total population increases by 22 percent only. (Gavrilov and Gavrilova 2010)

Interestingly, this somewhat counter-intuitive result has important implications for another issue in demographics, namely the lower-than-replacement-level birth rates in many countries.

That is why life extension in developed countries is a part of the solution of demographic problems rather than a problem itself. Many developed countries (like the studied Sweden) face dramatic decline in the native-born population in the future, and also a risk of losing their cultural identity due to massive immigration. Therefore, extension of healthy life span in these countries may in fact help to prevent, rather than create, a demographic catastrophe. (Gavrilov and Gavrilova 2010)

Given that increases in lifespan, to whatever degree, are a current and continuing reality, we can now consider some of the implications from such increases. Some consequences of longer human lifespans are obvious, at least at a superficial level. Other implications are very unclear

and debatable. The next three sections speculate on three broad types of implications: economic, personal and ethical. Given the complexity of human societies, it is often the case that extreme consequences (either positive or negative) can result from a largely unpredictable chain or combination of causes. Actuarial science, as one of the most interdisciplinary of subjects, must consider numerous effects and their interrelationships if it wishes to accurately project the value and impact of future contingencies related to expected lifetimes.

III. Economic and Financial Implications of Increased Longevity

Much of the discussion of the impact of increased longevity has involved the effects on pensions and retirement funding. This is appropriate: The most direct consequence of longer lifespans is the potential drain on funds collected presuming retirement years would on average be shorter than they will turn out to be.

In this section, we explore not only this issue (briefly), but other possible economic and financial implications that may stem from recent and future increases in human longevity. Murphy and Topel (2005) address the broad economic implications and importance of increases in longevity.

Over the 20th century, cumulative gains in life expectancy were worth over \$1.2 million per person for both men and women. Between 1970 and 2000 increased longevity added about \$3.2 trillion per year to national wealth. ... Even a modest 1 percent reduction in cancer mortality would be worth nearly \$500 billion.¹⁰

A. Pensions and Retirement

How will increased longevity impact the financial condition of pension plans? Indeed, how will the entire structure of retirement—age and length of retirement, activities during retirement—be affected?

¹⁰ The economic figures in the Murphy and Topel paper are based upon estimates of peoples' "willingness to pay" for health improvements, as "determined by the expected discounted present value of lifetime utility."

Of course, to the extent that longer lifespans imply longer working lives, and thus later retirement ages, longevity can appear to have a positive impact on the solvency of pension and retirement plans. But, just as obviously, that appearance can be an illusion if the number of years a person receives pension benefits also increases. So, the pension question is deeper than that, and requires both historical context and philosophical understanding.

Life expectancies were much shorter than they are now when Chancellor Otto von Bismarck designed the first social (old age) security system for Germany in 1889. Interestingly, even at that time, when life expectancies were less than 50 years, Germany initially set the social security retirement age at 70 (and only several decades later lowered it to 65) (SSA 2013). This historical note provides an interesting perspective on the current social security system. Given how much expected lifetimes after retirement (as well as the proportion of elderly people in the population) have increased since the 1935 Social Security Act in the United States, the current system has become increasingly difficult to fund.

In the future, our entire approach to retirement may have to change in response to increased life expectancies. This is discussed in more detail in section VI, but for now, it's interesting to consider whether a substantial life extension will so impact the human life cycle that retirement, a social and cultural construct, as we know it today, may be altered and superseded. A better way of "saving" for retirement may involve the acquisition of opportunities that will provide income during old age, as opposed to socking away money that will hopefully be sufficient to provide a desired standard of living.

B. Workforce

How will younger workers handle the need to wait longer for opportunities for promotion in an organization? Will this lead to dissatisfaction and more entrepreneurial efforts?

An immediate concern with respect to increased longevity could involve longer periods during which workers are entrenched in jobs, leading to increased waiting periods for younger people for promotions, or possibly even to get certain types of jobs in the first place.¹¹ Indeed, if

¹¹ This is known as the "boxed economy" or "lump of labor" theory.

increased lifespans simply translate into longer working lives at the same companies—i.e., the lifespan is essentially just stretched out horizontally—then this could be an issue. In that case, dissatisfaction could be rampant, and younger people might be more likely to leave traditional employment, possibly to create new companies or pursue other entrepreneurial opportunities.

However, there are at least two ways this situation might turn out differently. First, perhaps longer lives and longer careers within professions and individual jobs will result in greater insight and abilities, leading to increased productivity and improvements. If so, the overall economy could be positively affected, resulting in greater general wealth and prosperity, leading to growth in jobs and opportunities for everyone. There is some support for this outcome.

I find no evidence that increasing the employment of older persons reduces employment opportunities for youth and no evidence that increasing employment of older persons increases their unemployment. (Wise 2010)

Second, and perhaps as or more likely, the entire approach to, and structure of, the life cycle might change. Again, this is covered further in section VI, but for now, suffice it to say that such a new education-work-retirement life cycle paradigm might actually lead to shorter periods of employment in individual professions and jobs, possibly resulting in opportunities for young people to progress in their own careers.

C. Human Capital

What are the possible implications of the greater human capital and intellectual resources afforded by longevity increases?

Longer lifespans should, in theory, mean not only more and longer opportunities to acquire skills and education, but also greater flexibility in the timing of various life stages. There have been empirical economic studies that do indeed support this contention; however, these studies are often limited in the data examined, and differ in the resulting indications. This is an area where the last word has certainly not yet been written. However, here are a couple of examples.

In the first paper, people with Huntington's disease provide the basis for inferences about the life expectancy versus education/job training relationship.

Human capital theory predicts that life expectancy will impact human capital attainment. ...

... We provide a strong and direct test of the qualitative assumption behind human capital theory; namely, that variation in life expectancy drives human capital investment. We find that it does. ...

... We find an elasticity of demand for college completion with respect to life expectancy of about 1.0. (Oster, Shoulson and Dorsey 2012)

In the second example, data involving a drop in maternal mortality in Sri Lanka between 1946 and 1953 provide the basis for the study.¹²

Theory suggests that longer life expectancy encourages educational investment because a longer time horizon increases the value of investments that pay out over time. ... We find that for every extra year of life expectancy, literacy increases by 0.7 percentage points (2 percent) and years of education increase by 0.11 years (3 percent). (Jayachandran and Lleras-Muney 2009)

D. Saving and Investment

How will the resulting changes in spending, saving and investment affect the economy?

Although there is disagreement among finance advisers and professionals, a common rule of thumb for investing throughout the life cycle is that, the further away from retirement (and thus the more long term is one's investment horizon), the greater should be the proportion of stocks (as opposed to bonds) in one's investment portfolio. With longer life expectancies, the implication might be that equities would have even greater relevance for the typical individual's investment portfolio in the future than they do now. Furthermore, additional years

¹² As mentioned above, some of these studies are quite limited as to the specific data and situation examined. Nevertheless, in a field like economics, where controlled laboratory tests are largely impossible, having a number of these kinds of specific situations can be the main way by which hypotheses can be tested.

with which to enjoy the fruits of investing, and the greater time over which investments can accumulate during one's lifetime, would suggest that investing would be a serious desire for most people.

But is it that simple?

If the entire life cycle paradigm changes due to enhanced longevity, as is suggested in section VI, the actual impact on savings, spending and investment could be much more complex than that. If, in early adulthood, people start to delay their serious money-making jobs and careers in favor of child-raising and additional education, they may have minimal resources to invest or save. Similarly, if a lucrative first career is cut short in favor of a sabbatical for family development or a career shift, and if that change is anticipated, one might be inclined to initially invest for the short term. Indeed, to the extent that a significant increase in longevity results in a life cycle that typically involves multiple, discrete time-periods in which different careers or opportunities are pursued, someone may spend much of their life thinking in terms of accumulating monies to fund the next inflection point, and thus make investment decisions on a short-term basis.

IV. Family Structure and Personal Considerations Implied by Increased Longevity

A. Marriage

Could increases in longevity lead to serial marriages, perhaps to the point of being institutionalized in a term-contractual framework? Or might marriages simply last proportionately longer?

For some time now, the age at which people first marry has been increasing. This could be a function of many things, including various cultural trends and increasing life expectancies historically. An initial thought would be that future life extensions would simply involve more of the same underlying factors, and so the age-at-first-marriage would continue to increase.

Perhaps more interesting is what happens once a marriage has been entered into. Recently, Mexico has considered implementing a marriage contract with a term as short as two years. More generally, whether two, five, 10 or whatever number of years, such a contract would presumably be renewable but could also form the basis for serial marriages to different spouses.¹³ Such an environment, in addition to having enormous cultural consequences, would also have the potential to be a logistical nightmare from a financial and a legal standpoint. Pension plans with spousal provisions would likely have to be reworked to clarify and protect the various parties.

Of course, for some, a single lifetime marriage would simply last longer (or perhaps not, if one or both spouses waited longer to get married in the first place). But other possibilities than lifetime or serial marriages are imaginable. There could be additional and lengthened periods of nonmarital cohabitation. Periods of singleness could increase in frequency and/or severity. There could even be increased periods of sexual experimentation, probably most likely either before the time of sexual commitment for child-rearing or after the period of fertility.

B. Families

Will longevity lead to more mixed and extended families?

If, in addition to increased longevity, medical science is successful in extending the period of fertility, then one might expect the possibility of somewhat more children per person and somewhat larger families. Whatever the number of children in a family, though, it's logical siblings would likely have greater age differences between them. Also, the incidence of one person or a couple having a small child contemporaneously with a grandchild would likely increase. These age differences—not to mention the possibility of more frequent siblings with different mothers or fathers—mean that the children in a family would likely have less in common with one another than they do now. That could result in less family cohesiveness, resulting in an inadequate support structure for a family member's personal problems, perhaps including long-term care for old-age parents. On the other hand, it could result in better

¹³ The Mexico anecdote is not a consequence of life extension—it reflects a social trend that has been emerging for decades. Also, it is possible that multiple marriages will primarily be concentrated at younger ages, mitigating the impact of life extension on this issue.

communication and interrelationships between people with socioeconomic differences, or even between generations.

C. Education

Might the educational period of the typical person's life be lengthened?

This would seem to be one of the easier questions we have asked. In a world with longer life expectancies, and where technological change and advancement requires periods of retraining for many people, one would anticipate that education would occur not just at the earlier stages of life, but at various points throughout life, depending upon needs, opportunities and desires. The recent changes we have seen in education—including online training and massive open online courses (MOOCs)—would very much serve to support this result logistically.

D. Health and Fertility

As human lifespans extend, will health also improve, particularly during old age? Will the period of fertility also be extended?

As the director-general of the World Health Organization wrote in 1998, “one of the main messages of the World Health Report 1997 was the need to recognize that increased longevity without quality of life is an empty prize—that health expectancy is more important than life expectancy.” (WHO 1998) Indeed, most people would probably not be interested in living longer per se, but rather in living longer in a healthy state. Without the possibility of a healthy old-age period, most people may prefer to die fairly quickly after the healthy period of their life ended.

A key factor (along with better sanitation) in both recent past and future improvements in longevity has been improvements in health care, where tremendous breakthroughs seem to occur regularly. Still, there are concerns regarding health during old age, both for quality-of-life reasons and to avoid using up all one's financial resources on health care in retirement.

Fertility rates have trended significantly downward over the last few decades, even falling below the replacement rate in the industrialized world. Will this trend continue in an environment where longevity increases further? That's a difficult empirical question, and is probably a function of some of the other issues we have discussed—for example, in a world where serial marriage becomes common, new couples may want to have their own children, not just previous children they bring to the marriage. In addition, the history of medical advances in general, and of fertility-related improvements and options in particular, would certainly suggest human fertile ages can be extended upward.

V. Ethical Concerns and Implications of Increased Longevity

A. Medical Ethics

Is it possible a popular backlash, based on ethical considerations, could emerge against the medical enhancements that make longevity possible?

This would seem to be a real possibility. There are significant and deeply felt religious implications of longevity and death; no doubt there will be people who feel that extending life expectancy beyond 70 or 80 years is unnatural. It's possible there will be a segment of the population that refuses to participate in life extension. If so, this could necessitate a bifurcation, whereby different analytical approaches regarding health and mortality analysis are used on different groups of people.

B. Value Systems

Will longevity change our value systems?

This is an interesting question. In economics and other social sciences, beliefs and values are the foundation upon which people make decisions, determine market prices, etc. Thus, any change in attitudes, or in the ways that people approach life, or in the things they desire or how much they desire them, has the potential to alter the valuation dynamic. Furthermore, to the extent that life extension and the concomitant improvements in health make life more valuable and productive, actions by someone which tend to impede the life of (or the enjoyment of life

by) another person may be considered more serious and punishable by higher fines or sentences.

C. Level of Contentment

Could an increase in longevity also lead to discontentment with the quality of life, possibly resulting in an increase in violence or suicide?

This may seem like a question that is almost self-contradictory. After all, aren't contentment and longevity related? Well, not necessarily. As Friedman and Martin (2011) noted,

one of the biggest bombshells of our entire project: cheerful and optimistic children were *less* likely to live to an old age than their more staid and sober counterparts! ...

... We found that healthy people are happy but happy people are not necessarily healthy.

There may be at least two ways in which increased longevity has a “dark side.”

- If someone is physically or mentally hurting, whatever the cause, a longer life expectancy may not be viewed as a blessing. Indeed, longer life could increase the pressure and hopelessness felt by the hurting person.
- While there will be many agreeable aspects to a life with higher longevity, with more opportunities and greater flexibility, such a life also has the potential to be much more complex. This greater complexity could be more demanding and challenging for some people to deal with.

VI. General Impressions and Concluding Thoughts

In the last three sections, a variety of potential implications of increased longevity were briefly discussed. The purpose of this paper was not to be completely thorough either in the number of issues addressed or in the discussion of each issue, but rather to identify a sample of issues that

have important implications for risk analysis and actuarial science, and to demonstrate the complexity and interrelatedness of these issues.

Perhaps the overwhelming conclusion of this paper is just how uncertain the future world is if significant increases in longevity do indeed emerge. Not necessarily uncertain in the sense of major public policy issues that must be addressed—many of those are quite clear even if the optimal policy decisions are not. For example, changes will be necessary to public pension parameters in a world where people are suddenly living much longer. What is meant here is the uncertainty with respect to specifics, and with respect to how to model future economic, financial and insurance activity. Even if we can adequately describe a general modeling structure, the parameterization of such a model, with the complex interrelationships among all the socioeconomic factors, will be a major challenge.

We actuaries certainly have our work cut out for us. It's going to be a challenge—but a satisfying and exciting one!

Regarding the future, and a world characterized by longer life expectancies, and taking all the implications and issues mentioned in the prior three sections and considering them holistically, what will be needed is a change in the basic way we view the progression of a typical life.

Although there are no clear-cut lines separating them, it's fair to say that, traditionally, lives have been viewed as having three stages:

- (1) Youth, when personal development, education and occupational training are achieved
- (2) Adulthood, which includes starting and raising a family, working and earning money, and saving for retirement
- (3) Old age, primarily involving retirement

A significant increase in longevity can probably only be embraced and absorbed by altering this approach and these life stages, and, as Carstensen (2011) suggests, “diffus(ing) work across the life span.” In particular, the following adjustments are anticipated.

- Second- and third-career jobs will become more common.
- The total amount of education accumulated during a lifetime will increase. It will also be more spread out across one's life: There will still be an initial period involving maturation and education, and it might even last slightly longer than it currently does, but education will also be pursued at various times throughout life, including occasional substantial pockets of education at middle ages in connection with preparing for new and different careers.
- Adulthood will not only be split up into multiple work-career periods, but may well be interrupted or overlapped by occasional periods of education, community service/volunteering and/or child-rearing.
- Old age will be less characterized by retirement, as career periods are spread out throughout life, and medical advances make a healthy and active old-age period much more common. There also may be a decrease in "full-time retirement," as people gradually diminish their work hours during old age, or possibly commit to community service/volunteerism during their later years.

Kalache (2013) also realizes that "current policies and practices are based upon a traditional and increasingly outmoded view of the 'typical' life-course." He goes deeply into the public policy issues necessary to achieve a new societal approach. In his document, prepared for the government of South Australia, he advocates "creating a society for all ages," and makes 41 policy recommendations, including

Recommendation 11: Develop new approaches to the retention of older workers (including those transitioning to retirement) by creating suites of flexible workplace practices and training for staff.

We all need to continue the interdisciplinary thought process, at both a macro-philosophic level and a quantitative-analytical level, to guide us all into the new, complex and interconnected world of increased longevity.

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