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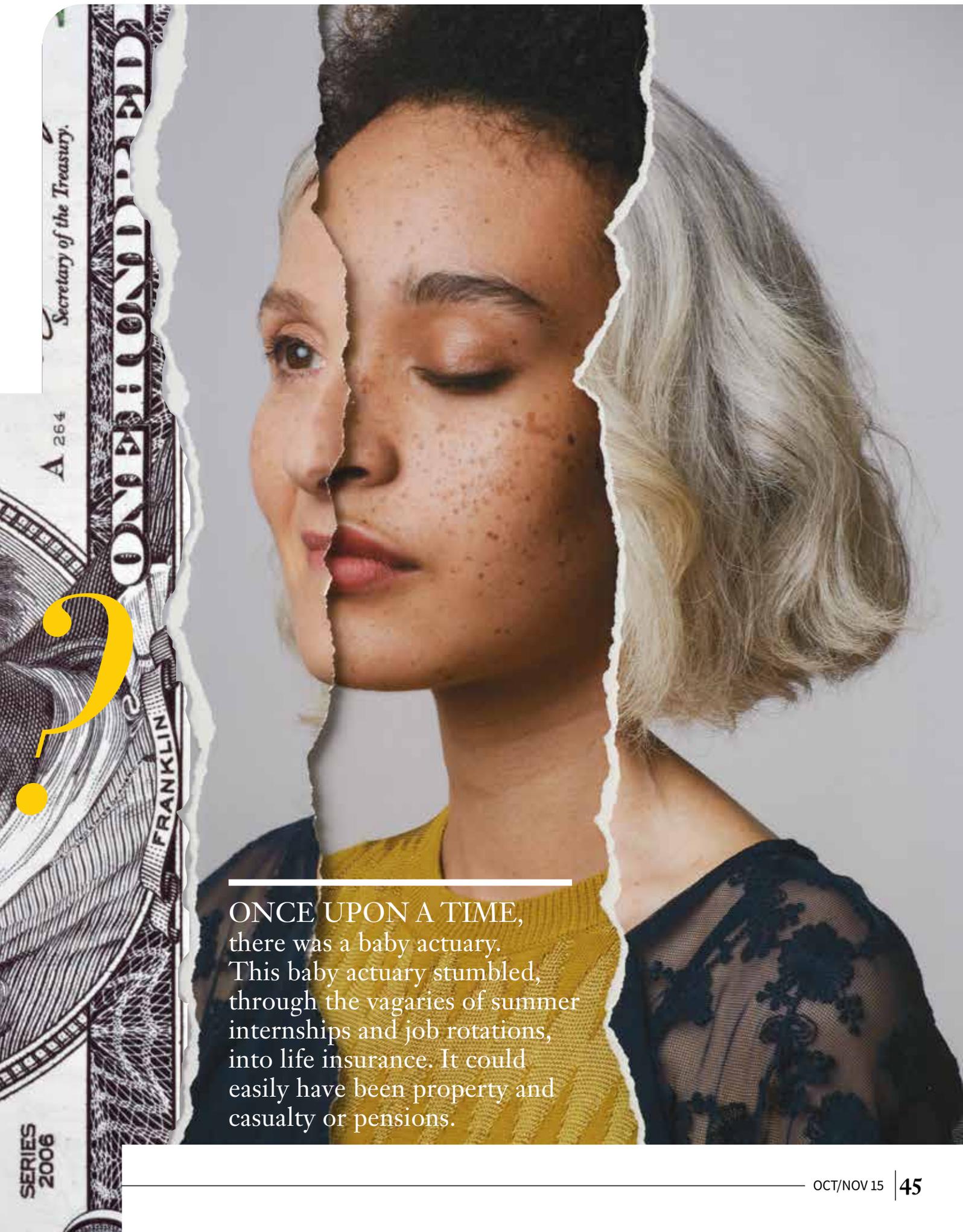
SOCIETY OF ACTUARIES



Live Long and Prosper

THE ROLE OF ACTUARIES IN LONGEVITY RISK

BY JEAN-MARC FIX



ONCE UPON A TIME, there was a baby actuary. This baby actuary stumbled, through the vagaries of summer internships and job rotations, into life insurance. It could easily have been property and casualty or pensions.

Fast-forward 25 years and this baby actuary—me, now all grown up—is still in the life insurance business, and to quote one of my favorite TV spies, “and loving it.” I don’t price life insurance on a daily basis anymore, but I still am fascinated by mortality, its components and its variations—in one word: its complexity. One reassuring thing about mortality was that it kept getting better—no wild ride like interest rates, where once savings accounts earned 12 percent (yes, they did!) and now earn 0.01 percent.

Nonetheless, with experience comes an appreciation for gray—in your hair and in your thinking. Gone are the days of black and white, of certitude, that marked your new student days—where your boss knew all the assumptions for you to plug into your pricing and you believed he *really* knew that lapses for a policy issued today to a male nonsmoker age 45 would be 4 percent 20 years from now, but 3.5 percent if that male nonsmoker were age 46 instead.

So with experience come better questions, and, with questions, doubt creeps in. Mr. Spock’s greeting of “live long and prosper” starts to take on a different coloration. Lower mortality is great news for life insurance companies, but is it great news for me as a person? For society as a whole? Living long seems to be a given, but where is the prosperity coming from? And with this question, longevity risk starts to take on a personal dimension.

From a financial and more rigorous perspective, longevity risk is the risk that an entity will outlive its assets because of improving mortality. The entity can be a person like you or me. It can also be a pension plan or the ultimate pension plan: social security.

We, as actuaries, are part of a profession whose mission is to study risk and, especially, mortality risk. I personally understand “profession” at its most expansive: We owe a duty not just to our employers but to society at large. As a life insurance actuary, my job is not just to design and price attractive—or at least useful—life insurance products, but also to make sure that the promises we make to the buyers of our products are kept.

It is but a little, yet crucial, step for actuaries to be the logical actors at the forefront of the longevity risk issue. This is an issue of critical importance not just to our employers but to the whole of our aging society—and no, I am not talking just about the Society of Actuaries (SOA).

WHAT IMPACTS LONGEVITY AND MORTALITY

Of course, what drives longevity risk are secular changes in mortality. So let’s explore the trends.



“Lower mortality is great news for life insurance companies, but is it great news for me as a person?”

In the last 40 years, there has been tremendous improvement in coronary heart disease. What few of us appreciate is the exact magnitude of the change: an over-fourfold drop of the overall population mortality rate despite an aging population! This is mostly due to a combination of surgical improvement in treatment and better follow-up drug regimens.

Later, mortality continued its decrease following the introduction of better algorithms for treatment and even better therapies, including drug-eluting stents and the introduction of statin drugs to lower cholesterol in the 1980s.

Since the 1964 report on smoking by Dr. Luther Terry, the then-U.S. Surgeon General, and due to long-term and concerted efforts from government, education and health professionals, the prevalence of smoking started decreasing. This also contributed to the decrease in cardiovascular deaths, as nicotine is a dangerous toxin for the cardiac system.

Additionally, age-standardized cancer death rates have finally started to decrease since the mid-1990s—after increasing for most of the 1970s and 1980s—despite a very limited decrease in the incidence rates since then. The decrease is driven by strong improvement in mortality rates for lung cancer (due to decreased smoking mostly in men) and prostate cancer.

MORTALITY IN THE FUTURE

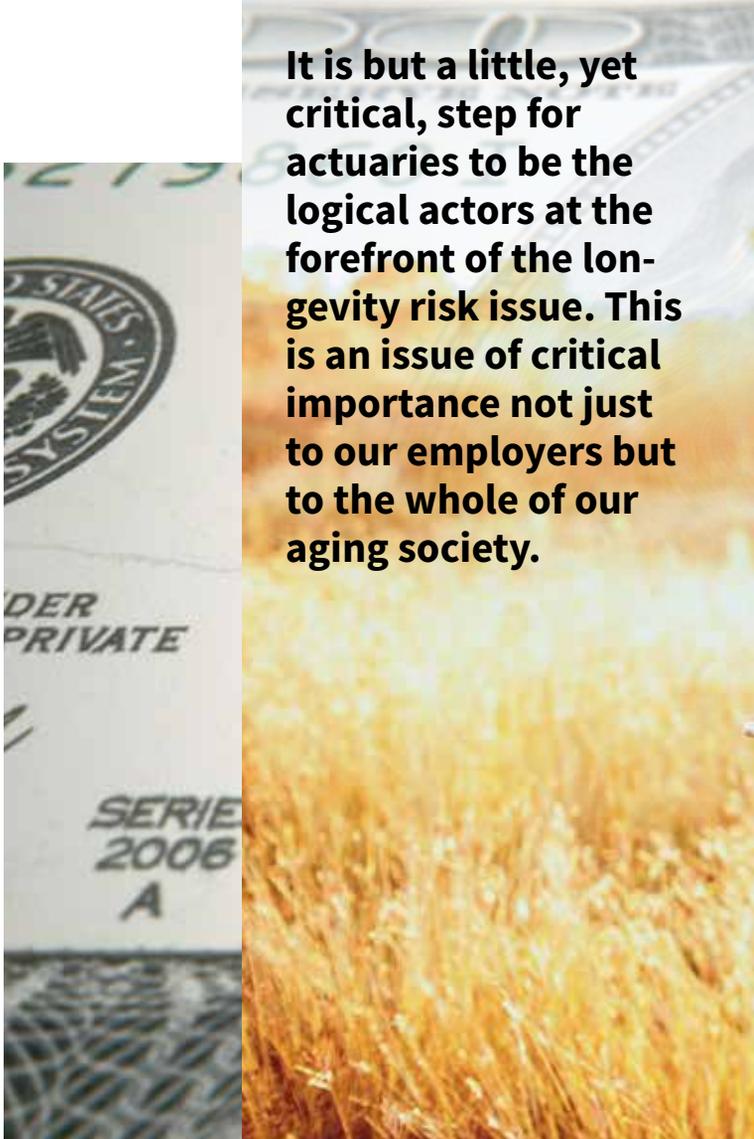
In the investment world we are well aware of the warning: “Past performance does not guarantee future results.” Is that also true for mortality? This is an area of much debate within the actuarial and demographic communities.

One can look at some of the systemic causes of improvement—mostly lower rates of smoking—and wonder if we have reached a plateau. In addition, rising obesity rates have put a damper on the improvement. Could obesity become high enough to reverse the improvement trend? I personally believe that this is not going to be the case. Increasing obesity has been with us since the early 1980s, and some reports show that there may be a slackening of the increase in the last 10 years. Despite the sharp increase of the 1980s, improvements have continued to this day. Nonetheless, this remains an issue of fiery controversy.

Others, like Dr. James Vaupel of the Max Planck Institute for Demographic Research, insist that predictions of life expectancies have always underestimated the actual outcomes and therefore are “likely” to do so in the future ... the flip side of our earlier warning: “Past errors guarantee future errors.”

An interesting difference between the state of science today and what it was 30 years ago is the maturation of genetics. For many years we have known that some specific populations have produced an extraordinary percentage of extremely long-lived people (e.g., Dr. Michel Poulain’s “Blue Zones”¹). Is that a result of nature or nurture? We now have the tools to investigate the “why.”

Another exciting development is that now there is a field of aging research where aging is not considered as just a natural entropic process but as a syndrome that affects multiple organs concurrently. Work on caloric restriction and on roundworms (see Dr. Cynthia Kenyon’s TED talk²) seems to imply that one (or a very limited number of genes) may accelerate or decelerate the manifestations of aging depending on what mutations are present.



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The advances in robotics and human/machine interface may start to impact mortality like they have disability. Will the mortality of people with robot-assisted elder care fare better than those with no care? We will watch the lessons from Japan closely.

Finally, the possibility of creating artificial yet living organs is in its infancy (see Dr. Anthony Atala's TED talk³). What will that bring when it matures?

Despite all the exciting developments, we must keep in mind the warning one can find in French railroad stations: "One train may hide another." Assuming we are able to "cure" a major cause of mortality, the people who were spared—possibly frail and certainly older people—will now be exposed to the other causes of death and may not live that much longer.

MEASURES AND MODELING OF MORTALITY

Since the early 19th century, when the English actuary Benjamin Gompertz came up with the mortality law that bears his name, actuaries and demographers alike have been fascinated with fitting mathematical models to the mortality curve. Developing parametric mathematical models significantly simplifies the modeling of the future state of mortality.

More recently, with the advent of both increased computing power and better data sources, stochastic models came to the forefront, pushed by the seminal work of Ronald Lee and Lawrence Carter in 1992 introducing their eponymous model. In the following years, many others proposed "new and improved" models. For an extensive discussion of the relative merits of a variety of stochastic



models, I would refer you to the article by Andrew Cairns et al. in the January 2009 issue of the *North American Actuarial Journal*.

Two major criticisms, especially of stochastic models, are that they are based exclusively on some statistical version of the past and that they do not reflect the interaction of the different causes of death that may alter the future. A strong proponent of the importance of reflecting this interaction is Dr. Severine Gaille of the University of Lausanne. Indeed, some commercially proprietary models do reflect that interaction and purport to be better predictors of the future.

If you are interested in exploring many of those issues further, I recommend the series of Living to 100 Symposium monographs.

ADDRESSING LONGEVITY RISK CORPORATELY

Because longevity risk is subject to movement in one direction across a broad swath of the population, it is not a risk that can be hedged through diversification alone; it must be actively hedged by identifying asset classes that move in the opposite direction.

One obvious purveyor of such assets is the life insurance industry. While pension actuaries rightfully bemoan longevity as an issue, life insurance companies have been reaping the reward of longer-living customers. Why not then use life insurance product results to offset the longevity risk? There are two issues to the so-called “natural” hedging. The first is that the correlation between life insurance purchasers (usually younger people) and annuity and pension fund participants (usually older people) is not very strong. Second, the pension market needs alone dwarf what could be available from the life insurance industry.

There have been some significant transactions on the so-called “de-risking” of pension plans using reinsurance-type vehicles, not just in Europe but also in the United

States—for instance, the \$3 billion Motorola risk transfer transaction with Prudential in September 2014. They have been conducted either through professional reinsurers or insurers, or through banks. Those transactions are a challenge to implement, being customized—especially as to exactly what risk is transferred in addition to longevity risk—and private, and only scratch the surface of the potential available demand.

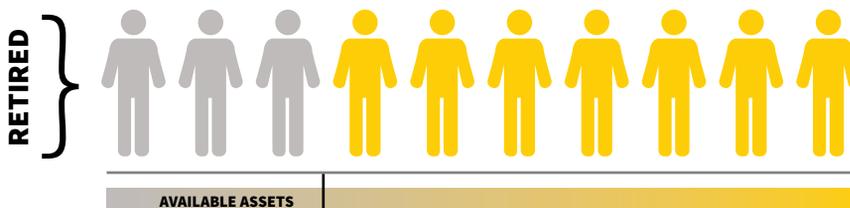
So the next logical step is to approach the capital markets. The advantage of longevity risk for investors is that it is poorly correlated with other risks traditionally borne by the capital markets. It offers a profile that allows further diversification of the investor’s portfolio. Unfortunately, challenges have prevented the development of a robust market.

Two key challenges are the lack of fully transparent popular models and the lack of a clear index, like the S&P 500 for stocks, to evaluate the risk. In order for the capital markets to work effectively, one needs an unbiased indicator of the level of mortality that is sufficiently responsive. What would be lost in fit with one’s risk profile would be gained in market efficiency and breadth. The development of such an index could be something that the SOA can spearhead, adding relevance and visibility for actuaries in this environment.

ADDRESSING LONGEVITY RISK INDIVIDUALLY

In the end, individuals are the key bearers of their own longevity risk. The magnitude of the problem was highlighted by a 2009 survey from Americans for Secure Retirement and conducted by Ernst & Young: Seven out of 10 middle-market households approaching retirement will outlive their assets. This number jumps up to almost 10 out of 10 for those who do not have defined-benefit (DB) income. In order to minimize this risk, households without

Seven out of 10 middle-market households approaching retirement will outlive their assets. This number jumps up to almost 10 out of 10 for those who do not have DB income.



Source: Americans for Secure Retirement, 2009 survey conducted by Ernst & Young



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DB income should plan for a standard of living that's *half* of their current standard.

A way to mitigate that risk is to include annuities in your retirement portfolio. In the current low-interest environment, annuities with guaranteed lifetime withdrawal benefits are especially attractive. Another product that can be useful, although it may require a greater psychological leap of faith from the customer, is the deferred income annuity that guarantees payment at some time in the distant future. Waiting 20 years before getting this income is a popular option, as it seems to be the sweet spot of enough protection at a reasonable cost.

ADDRESSING LONGEVITY RISK AS A SOCIETY

We are continually reminded of the impact of longevity risk by the discussion on the future viability of Social Security. As workers are now almost exclusively shouldering the investment risk in their retirement asset portfolios, and as the stock market has had a lackluster performance,

In the end, individuals are the key bearers of their own longevity risk.



we can expect significant shortfalls in income for retirees to come as their proportion in the population increases.

The societal problems are complex, poorly understood by the general public and politically touchy. This is not a recipe for fast political action. On the other hand, the demographic forces are irresistible and have been long in motion, and a “solution” will happen. It is likely that the concept of retirement will cease to exist, just like it did in

action

SOA LONGEVITY PLANNING

In 2012, the SOA, recognizing the necessity for actuaries to act in the longevity risk space, created the Longevity Strategy Task Force to “consider both what the SOA should do in response to the rapidly changing science and what it could do to be more proactive with public stakeholders.”

The task force came up with a number of strategies centering on education; communication, including building a consistent framework to look at the risk; and a timelier and more robust experience-gathering process.

SOA LONGEVITY ADVISORY GROUP

This group, created in 2014, is made up of actuaries involved in studying longevity and longevity risk across practice lines, and is tasked with the implementation of the ideas of the Longevity Strategy Task Force.

Members:

Jean-Marc Fix
George Graziani
Jenny Haid
Tom Jones
Al Klein
Larry Pinzur

SOA staff:

Dale Hall
Andy Peterson
Larry Stern, supporting the
SOA staff

the early years of the Industrial Revolution and for millennia before that.

As Pablo Antolin of the OECD Financial Affairs Division mentioned earlier this year at the Longevity Seminar, “Governments should facilitate the measurement of mortality.” It is critical to have the proper tools to measure the risk as accurately as we can. Furthermore, regulations should help and not hinder that task, and we are unfortunately seeing the opposite with the reduced access to and reliability of the Social Security Death Master File.

We, as professionals with a responsibility to society at large, and our professional organizations are uniquely qualified to understand this risk and offer solutions. I think that to be fully effective we need to extend the reach of our discussions so that all can appreciate at a gut level the significance of the issues we are facing. (See the sidebar on page 52 for more on the SOA’s role in this process.)

The Longevity Seminar in Chicago in February was the first public event organized by the SOA’s Longevity Advisory Group. By the time you read this, there should be numerous initiatives in the works, including a number

of sessions at the 2015 SOA Annual Meeting & Exhibit. I look forward to seeing you at one of them! ■

¹ https://en.wikipedia.org/wiki/Blue_Zone

² http://www.ted.com/talks/cynthia_kenyon_experiments_that_hint_of_longer_lives?language=en

³ http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en

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Author’s Note: It is important to keep in mind that this is my perspective on this issue and in no way reflects any official position of the SOA.



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