



SOCIETY OF ACTUARIES

Article from:

The Actuary Magazine

June/July 2014 – Volume 11, Issue 3

THE FRONTIER SURVIVOR

and the Actuarial Profes



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THE LIVING TO 100 SYMPOSIUM EXPLORES LIVING LONGER, SEEKS OUT NEW PERSPECTIVES AND IDEAS, AND BOLDLY PROPOSES NEW PATHS FOR RESEARCH. BY RONORA STRYKER

Every three years, the Society of Actuaries (SOA) issues a call for papers on advanced-age mortality and the implications of a growing aging population. Authors of the accepted papers are invited to present them at the Living to 100 Symposium. Topic areas are usually broad to attract a diverse audience. A sample of the topics from the 2014 symposium held in January range from the technical, such as mortality trends and projections of older age, to the practical, including strategies for managing long-term care needs in retirement.

Leaders from many disciplines are also invited to share their perspectives on the aging process and its implications. When I began working on this project, I did not see the “big picture” and why the other disciplines were involved. I knew the research was providing a benefit but I was not sure it outweighed its cost. I did not have the same passion as the numerous volunteers involved with this project.

My view and outlook quickly changed as I realized that the actuarial profession impacts lives! This message sometimes gets lost in day-to-day actuarial duties, especially given company shareholder needs and other stakeholder demands. As a baby boomer, I am one of the “faces” of the graying population. I think about retirement and financial security, and actuaries play an important role in my financial future and quality of life.

Once I made this connection, I really began to understand what this important research effort was all about. Living to 100 tries to capture the latest thinking on aging. By including other disciplines, it gives actuaries a well-rounded perspective, helping to expand and enhance actuarial practice so that we can better identify the risks associated with longevity, improve our forecasts of what the future may hold for the rate of mortality at older ages and the number of older-age individuals, and provide solutions to complex issues around health care, retirement and supporting the elderly.

The 2014 symposium featured more “rock stars” than ever before. Rock star is the term used by the planning committee for the elite leaders in the other disciplines who attend the event. This article will summarize some of the takeaways from the presentations of four of the rock stars in attendance:

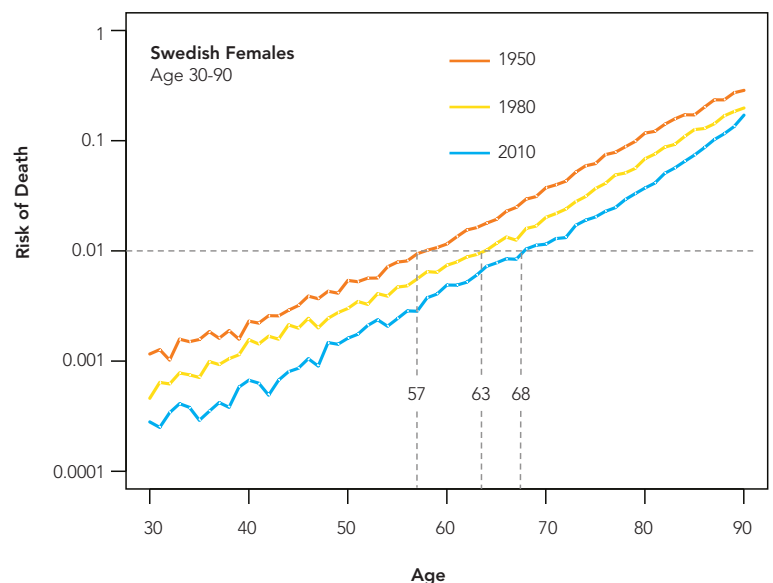
1. James Vaupel, Ph.D., a member of the U.S. National Academy of Sciences and executive and founding director of the Max Planck Institute for Demographic Research
2. Dr. Nir Barzilai, professor of medicine and genetics and director of the Institute for Aging Research at Albert Einstein College of Medicine.
3. Aubrey de Grey, Ph.D., biomedical gerontologist and chief science officer of SENS Research Foundation, which is dedicated to combating the aging process
4. Dr. Anthony Atala, director of Wake Forest Institute for Regenerative Medicine

THE FRONTIER OF SURVIVAL IS ADVANCING

Vaupel began his presentation by identifying three areas of thought regarding human life span.

1. Everyone is born with a maximum life span and nothing can be done about the natural mortality associated with biological aging.
2. Everyone born has a maximum length of life but the natural limit can be evaded and individuals can live longer than the natural limit.
3. The frontier of survival is advancing because senescence (the increase in mortality with age) is being postponed, as shown in Figures 1 and 2.

Figure 1: Postponement of Senescence



Source: Calculations based on Human Mortality Database by Elisabetta Barbi and Giancarlo Camarda (unpublished).



Figure 2: Current Age and Age of Equivalent Mortality 50 Years Ago

EQUIVALENT AGE 50 YEARS AGO								
AGE	FEMALE				MALE			
	France	Sweden	USA	Japan	France	Sweden	USA	Japan
50	42	40	44	23	44	43	44	39
60	49	52	53	43	51	53	51	50
70	59	62	63	53	59	62	60	57
80	71	72	74	67	71	73	73	70
90	83	85	85	79	84	87	85	81

HISTORICAL U.S. OLDER-AGE MORTALITY DECLINE IS UNCOMMON

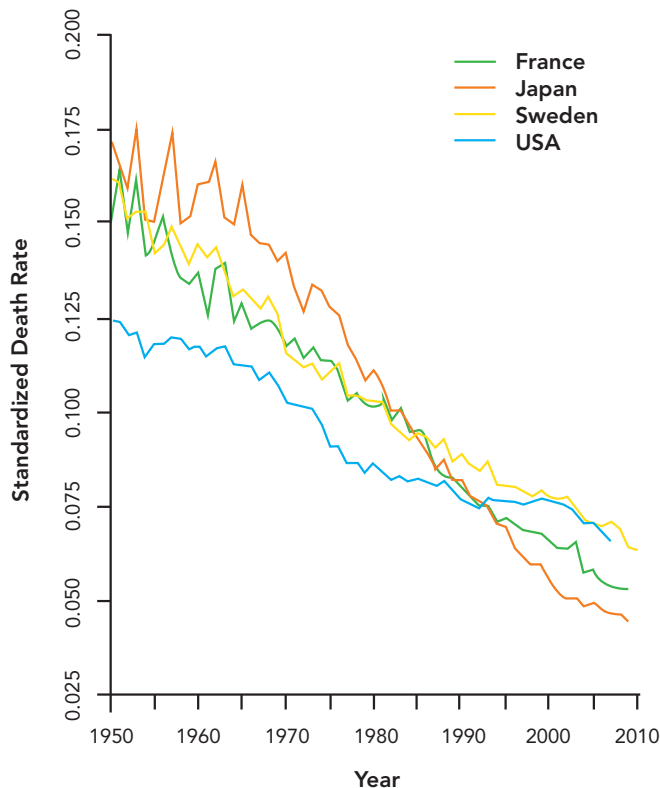
While the above figure shows that the postponement of senescence happened in the United States, Vaupel pointed out that the mortality decline in the United States at the older ages compared to other countries has been very different. As the figure shows below, it was stagnant for a period and in recent years is similar to the rest of the other countries. This pattern is also true of U.S. octogenarian male mortality and nonagenarian mortality.

LINEAR EXTRAPOLATION IS THE BEST MORTALITY FORECASTING METHOD

Yes, you read that correctly. Vaupel argues that actuaries and others should be using linear extrapolation to forecast future life expectancy. He explains that since the 1800s there has been a revolution in life expectancy with it *linearly* increasing by three months per year (2.5 years per decade). For rates of improvement in life expectancy at age 65, it is about two months per year. In Figure 4 on page 20, Vaupel shows that mortality forecasts based on expert judgment have been less accurate than linear extrapolation.

Figure 3: Octogenarian Mortality

Women, Ages 80–89



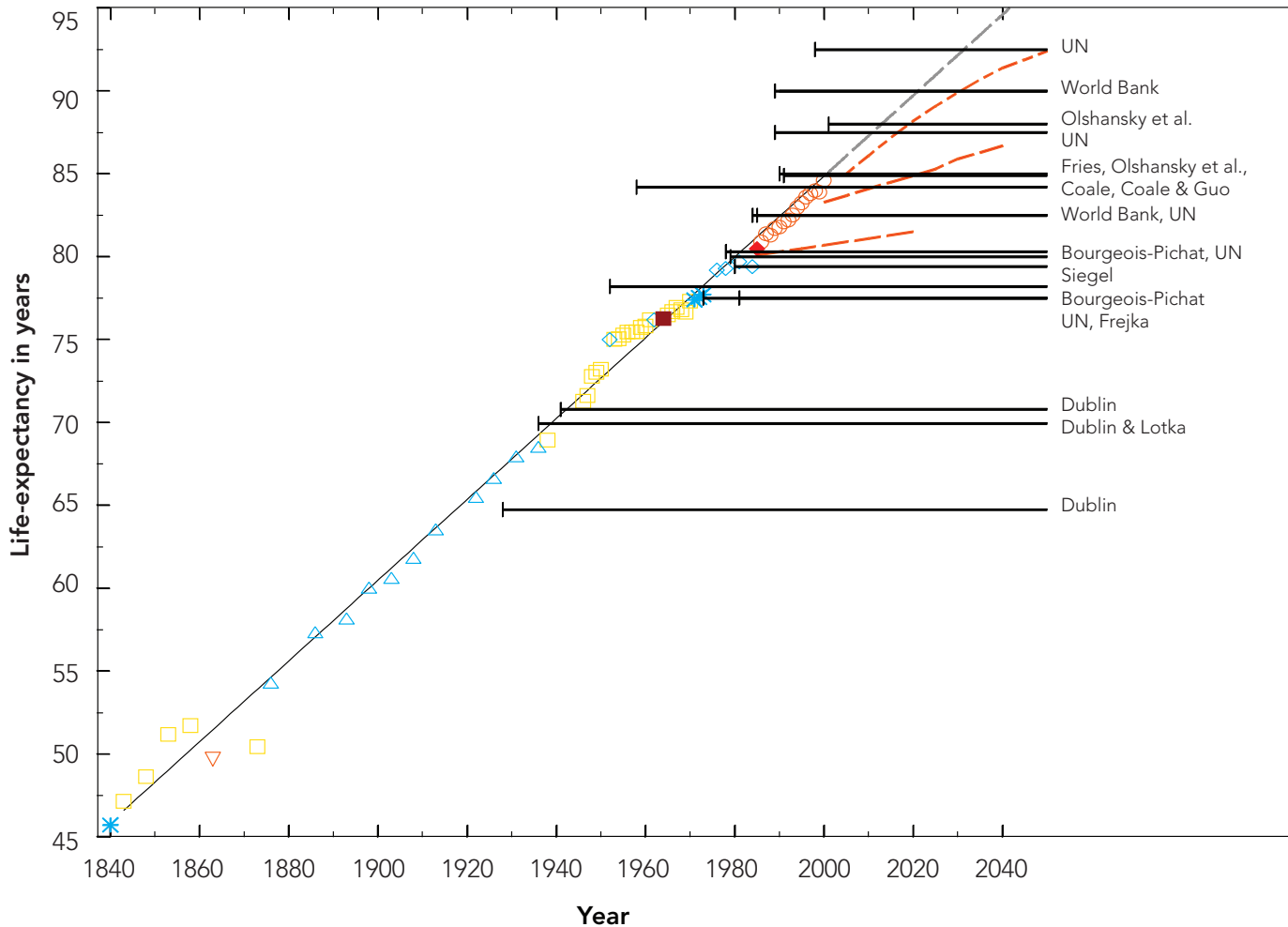
The black line is the linear rise in life expectancy since 1840 and the horizontal lines are expert judgments about the ultimate limit to human life. If one went back in time and just used linear extrapolation, this method produced better results. This figure supports Vaupel’s argument that the best way to forecast life expectancy is to extrapolate the long-term historical trend, then adjust the result by asking why it might be faster or slower.

Vaupel pointed out the first name in Figure 4, Louis Dublin. Dublin, an actuary, made a forecast in the 1920s that no country in the world will ever have a life expectancy greater than 65. He was incorrect as New Zealand already had a life expectancy at birth of age 65. Dublin did not have the data for New Zealand and may have made a different forecast if he had. Vaupel used this example to reinforce his view on linear extrapolation and why it is the best method: The data supports it. Vaupel explained:

Mortality forecasts, based on expert judgment, have been less accurate than extrapolation. In my studies of this field, what I’ve learned is never trust experts unless they have

Source: Calculations based on Human Mortality Database by Roland Rau (unpublished)

Figure 4: Historical Mortality Forecasts



some numbers. You have to be extremely careful about expert opinion because experts know a lot about the past, but experts know very little about the future and experts over and over again have demonstrated a colossal failure of the imagination to try to foresee what the future might bring, so I'm a firm believer in extrapolation.

Of course, many are skeptical of this method, asserting that the future will be very different from the past. Vaupel's rebuttal is that the future has always been different from the past. In the past, individuals would not have foreseen advances that occurred such as antibiotics or the breakthrough in managing cardiovascular disease. But since 1840, future progress has been different from past progress and this has been taken into account in the linear rise in life expectancy. Therefore, linear extrapolation of historical trend

already incorporates the unforeseen advances and shocks that will likely occur in the future.

MORTALITY AT OLDER AGES (ESPECIALLY OVER 80) WILL CONTINUE TO DECLINE

Vaupel opened the symposium and actually introduced the theme of the other three speakers: There has been some progress in slowing the rate of aging but there will be substantial progress made in the future. Some examples are genotype-specific therapies for age-related diseases like cancer and regenerating and rejuvenating tissues.

Barzilai is one of the individuals trying to unlock the secrets of the biology of aging and determine how to stay healthy longer. It is recognized that people age differently but it is not known what



makes some individuals age more quickly than others. It is known that the age of death of a parent has some correlation with the age of death of their children. If a parent survives to older than 80, there is an impact on the occurrence of age-related disease in their children. It has also been shown that environment impacts the aging process.

THE BIOLOGY OF AGING IS COMPLEX

While biologists can distinguish old bodies from young bodies, there are so many things in the human body that fluctuate it is difficult to distinguish whether the changes are a cause of aging, a marker for aging or actually a protector against aging. Barzilai indicates there have been three areas of focus to date in understanding the biology of aging:

1. Aging of the genome
2. Aging of the cells
3. Effects on metabolism as we age.

Each area has shown to be a cause of aging and also to be affected by each other.

This again makes it difficult to determine how aging starts. However, by understanding the biology of aging, we can prevent aging and its diseases, which can lead to healthier aging and more dividends, such as a reduction in health care costs.

There has been significant success in emphasizing longevity. Instead of trying to really understand the biology of aging, this perspective stresses looking at how something can be maintained. Maybe along the way, insights into what aging really is will be discovered. Barzilai mentioned that healthy life span has been extended in numerous models.

He also commented on his belief that life span cannot be extended forever. As a species, humans probably have a maximum life span.

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The oldest person in the world, Jeanne Calment, died at 122 and, from a biology standpoint, there is probably a limitation somewhere between 100 and 122.

LIVING TO AGE 100 AND BEYOND IS UNIQUE

Barzilai studies centenarians to discover the secrets of aging. He looks for the “best of the best,” meaning healthy and living independently, to join the study. There are currently 600 enrolled from ages 95 to 116 (average age is 100). One might think they achieved this by never drinking alcohol or smoking, maintaining the appropriate weight, exercising daily and always doing what their doctor told them to do. They did not.

When Barzilai began the study over a decade ago, about 1 out of every 10,000 were centenarians. Now it seems there has been such an increase in the prevalence of centenarians that reaching the age of 100 is commonplace.

He argues the numbers are likely overstated and living to age 100 and beyond is very rare.

What has been discovered about centenarians is that there’s a strong family history of longevity. While the genetic component of longevity may not be as important at 70 or 80, it is very significant at age 100 and above. So in the study, they hypothesized that the centenarians had a perfect genome, which is why they were staying alive. The results showed this was not the case. Now the emphasis of the study is identifying the genes helping these individuals live to extreme old age.

End-of-life medical costs are another interesting aspect of the centenarians studied. The costs are much smaller than for individuals who die at earlier ages. In comparing the medical costs incurred in the last two years of life, Barzilai said the centenarians in the study have one-third of the costs as those who die between 60 and 70. This supports the “longevity dividend” idea developed by Jay Olshansky and others that by understanding the biology of aging, the aging process can be delayed/slowed, resulting in more healthy aging and benefits such as reduced medical costs.

MORE ON LONGEVITY RESEARCH

ADDITIONAL RESEARCH on aging and longevity can be found on the SOA’s website under completed research projects. Visit www.soa.org/research/research-projects/default.aspx.



ARE REJUVENATION BIOTECHNOLOGY AND REGENERATIVE MEDICINE THE FOUNTAIN OF YOUTH?

Another perspective on the “frontier of survival” was presented by de Grey, who believes that age-related disease and aging itself are medical problems and are medically preventable. He has categorized the biological deterioration of aging into seven categories of damage.

He claims we currently have the treatments and therapies to remove, repair, reinforce or replace all such damage, thus increasing life span significantly. Although these therapies are still being refined and enhanced and are not yet ready for widespread practice, de Grey indicates even crude rejuvenation therapies would produce mortality-reduction results.

Atala described the progress made to date in the field of regenerative medicine. He showed video clips of human tissue and organs being “printed” in the lab and how once the tissue and organs were implanted, the recipients were restored to normal health. He indicated that many tissues and organs, including the heart, liver and kidneys, have been successfully generated in the lab.

THE ACTUARIAL PROFESSION HAS A BIG RESPONSIBILITY

While debate continues around the upper limits of life expectancy and how long the human species could live, there is general consensus that healthy life has been and can be extended and life expectancy is increasing. This increases the need for actuarial thought leadership to help extend healthy financial life spans of individuals, businesses, governments and society trying to meet the challenges and opportunities human life extension poses. This is not an easy task given the diverse views on the future of longevity.

Vaupel mentioned failure of imagination by experts in foreseeing what the future might bring. I disagree. Instead of failure of imagination, I think lack of education is the reason for not being able to see the possibilities of the future. As longevity and its implications are both a very personal and public issue, actuaries need to know the latest advancements, data, methodologies, views or policies to ask the necessary questions to be able to envision a future different from the

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status quo. The SOA has devoted resources to helping members learn about what the future may hold for the frontier of survival, as well as the needs of the aging population and the required support systems. Besides Living to 100, many of the SOA’s research committees and sections have sponsored research on this topic in the past and are considering longevity research projects in the upcoming year. The

SOA even has a committee that initiates and develops continuing education programs and research related to risks and needs during the post-retirement period.

There is no doubt the actuarial profession has a big responsibility in helping support the aging populations around the world. I

think actuaries will deliver as failure is not an option. After all, people are depending on us. **A**

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Note: Special thanks to James Vaupel, who kindly agreed to allow the publishing of Figures 1 through 4 in this article.

To read more about the concepts discussed in this article, visit the Living to 100 page at livingto100.soa.org/.