LIVING TO 100 SYMPOSIUM*

Orlando, Florida
January 12–14, 2005

Theories of Longevity

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For the median or middle estimate of the growth of the U.S. centenarian population, in 2050, you indicate 1,150,000 centenarians. Based on your other figures, that means that the population of the United States must be about 3.8 billion. Could you give me an idea of what the rest of the world is going to look like when the U.S. has a population of 3.8 billion in 2050? What's the total population?

MR. JACOB S. SIEGEL: Are you saying that the United States has a population of 3.8 billion?

MR. DOUG ANDREWS: Isn't that what it calculates out to based on those numbers?

MR. SIEGEL: Nowhere near that! Do you mean if you take the number of centenarians there and divide it back by the percent of the total population, which is given as .03 percent, that it calculates to something in the order of billions? I don't know the numbers for the United States, but I would assume we're talking about a number on the order of 350 million, not billions. It should come out something like that. These are purely Bureau of the Census numbers, so that's where any discrepancy comes from.

MR. ANDREWS: I was just trying to contemplate what the world would look like with these projections going forward for many years. It's easy to get caught up in doing the projections, but I think it is important to try to then look at the outcome and see what would, in fact, the

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world look like? And I would think there probably would be some fundamental changes that would take place. Thank you.

DR. ROBERT GLEESON: I do know that in the year 2050, all of America will look like Florida, demographically.

MS. ANNA RAPPAPORT: I'd like to thank the last two authors for the paper on disability and the paper on driving. One of the things that has disturbed me in thinking about developing solutions and products is that when we think about long term care insurance, there are many steps in the gradual decline. The work that Eric Stallard has done has been really interesting in defining steps along the way, between totally needing help and being totally independent. Often, when people think about long-term care and think about people needing help, they forget about many of those intermediate steps. It's a problem when your parent can't use the answering machine or can't answer the telephone and some of these other things along the way. I would like to challenge our industry to think more about those issues and hope that we might, in the future, have more issues to deal with the same as the decline in driving.

I want to raise one other issue. A different aspect around the study of mortality and mortality tables has come up in both life and pension practice in the last few years, sort of a political question, but not only political. It is the question of what the appropriate ways are to classify mortality. Should it be by smokers versus nonsmokers, if it's life? Should it be by blue collar versus not blue collar? We know that all these different things influence mortality, but the data we have may not support it. It turns out that this can be important to the profession and to the public, because it might affect the way products are priced. It might affect the reserves that companies have to hold. This is something for us to think about. It's not so much of a research aspect, but it is needed to get us to the reality of the practical world.

MR. SIEGEL You really put your finger on an interesting question, and that is, where do you draw the line between a risk factor and a disease? Is obesity a risk factor or a disease? I believe the line is arbitrary. I've chosen to believe that obesity is not a disease, but it is a serious risk factor. On the other side, going from risk factors to nominal diseases, there's a new thinking that has to take into account the multiple causes of disease. That begins then to erase the standard categories and look to something that we haven't really set down—recognizing that death is not caused by a disease, except in nominal heuristic terms. It's caused by the progressive deterioration of the cells and tissues in the body, and it's a crapshoot as to what you die from unless it's a straight out-and-out accident. This is being recognized in some of the studies that are being done with respect to the risk factors, or what they call allostatic load among teenagers, that accumulate. They use conventional risk factors, but you can clearly see that it's really, as I say, a crapshoot as to whether you die from diabetes or cancer.

MR. VANAYA SHARMA: In some of the discussions that have been taking place, I'm seeing a

combination that is somewhat disturbing to me. We've talked about smokers and people who are obese, and we've seen in society some of the problems that have come about. We've seen in several states that people cannot smoke indoors. Southwest Airlines has a policy for people who are obese. Basically, society is pushing the other way on people who have these lifestyles. With these people reaching retirement age, and our limited resources for Social Security, Medicare, etc., can we see a possibility where lifestyle choices may be cut out of Social Security or Medicare? Where it's something that's a choice, will those people get cut short in the future because there aren't enough resources to go around to cover them?

DR. GLEESON: It's an interesting question, and it makes a lot of sense. I don't think that socially we would identify those risk factors as having any determination on whether somebody got benefits. They have the rather unfortunate result that people pay into the Social Security system and then don't have the opportunity to collect. It balances the question of Medicare payments versus Social Security payments. I won't take up Dr. Siegel's question of whether they are conditions or diseases; they're choices. But they are choices that we have to understand have a substantial impact. You as actuaries understand that the difference between average population, a smoker and the very healthy population is 14 years. The rest of the world doesn't understand how big that difference is and what impact it has, and they think it's okay if I smoke only a little. The point is that it's not. They need to at least understand that to make informed choices, if they're going to make them.

MR. ROB BROWN: I want to add a little credibility to the paper by Ms. Leng. At first glance, it may appear to be an extension of a seminar entitled "Living to 100 and Beyond." Let me preface my comments by telling you that two provinces in Canada have now prohibited the use of age as risk class variables in automobile insurance. This means there are a total of five of the 10 provinces in Canada that do not use age as a rating variable for auto insurance. We have three provinces where auto insurance is available only from a government monopoly, and they have never used age as a rating variable. The argument that caused age to be prohibited recently in these two "private enterprise" provinces was that driving has become a human right, and you can't discriminate in those areas on variables like age, gender, race or religion. The issue was raised through complaints by elderly members of the population, not 16- to19-year-old male drivers, who saw their premiums rising. In the next 25 to 30 years, the elderly population is going to become massively important politically. The numbers alone would decide that, but also they tend to vote in much higher proportions. We may want to think as a group, as a profession, as an industry, about other ramifications that may come with the political activity of the increasingly large number of elderly North Americans. If you think you don't care about auto insurance, and there are no property/casualty actuaries here, go through my argument and substitute access to hospital because of healthcare premiums, and see how much of the logic aligns. It might cause you to go through a process.

MR. JEFFREY HARPER: I'd like to hear Eric Stallard and Natalia Gavrilova's comments about

the observation that there is some vacillation in longevity by the month of birth. There are other observations such as farmers do better than blue collar workers and living in the west is better than living in the south or the east. The speculation is that this comes from exposure to things that are outside your control—different germs in the different months or different germs in different parts of the country. I know there's an exotic disease you can get in Kentucky and nowhere else. Is that one of the reasons there might be vacillation where you might use up some of your life force, or whatever it is, fighting off other germs in the hospital? Does the same thing apply in crowds, sports arenas and meeting rooms like this? Or elevators or airplanes, any time you're breathing other people's air?

MS. NATALIA GAVRILOVA: First of all, when we started to study month of birth about five years ago, we were reluctant to publish this initially, because we knew about astrology and all these other things. But we found that this is a solid result, and we found it on another data set on European aristocracy. Now there are many other authors starting to publish similar results, but of course, the month of birth preferral was a little different. But actually, this is not a new result. The only difference is that we studied a birth covert, and these birth coverts are very large. We could even find very small differences, because actually the differences are not very large, but they are persistent and repeat in every birth covert. The causes of these vacillations might be early infections. There are more and more studies that show that early life infections result in later life mortality from cardiovascular diseases and some other diseases. Many historical studies confirm these results. The second explanation may be seasonal variation in vitamins. For example, some nutrients that people consumed in the late 19th century and early 20th century did not keep so well, and in fact, people didn't know that vitamins are so important. I would like to emphasize that these results were found on the American death certificate data, although this data may be subject to biases. We found that these results are repeated in every birth cohort.

The second question was about why people of different geographical regions have different longevity. We need to make further studies and, in particular, we need better control populations for our studies, because here we simply use random samples from the general population. It would be better to take samples from the same genealogists. But for some reason, this result is consistent with what is known from the census data, where the percentage of centenarians is highest in South Dakota, so there is some consistency. There might be different explanations, but there are much more rural populations in these areas, and as I already showed, living on farms is beneficial for survival to extreme ages. Secondly, perhaps, there may be a compositional effect, because we know that people from Scandinavia and Germany settled mostly in these areas from our study of the early census. In Europe, we know that people from Scandinavia have a higher life expectancy. Perhaps there are some ethnic differences. At this moment we cannot say for sure, because we need further studies and, for example, to use data that is available from the early census about the origin of population. Then we will know more accurately the reasons for these differences.

MR. P. J. ERIC STALLARD: When I was setting up the fixed frailty model and then the analog to it, we had to assume that there were characteristics of individuals that, at the start age of the calculations, either age 30 or 65 or whatever, were fixed. Initially we thought they must be genetic factors, but month of birth is fixed. When we see the people at age 30 or 65, the assumption that there are fixed factors in fact, is quite consistent. It's not part of the genetic component that would be identified from the twin studies. It's part of what I call the modifiable non-genetic, but it's not modifiable much at all. It's more fixed than any of the other factors that were listed with the nongenetic factors. Part of the listing included microbial agents and infections and things like that, and it may be that month of birth operates through those factors. Are they worth further investigating? In terms of the simple assumption of whether you can assume that people at age 65, or whatever age you would do insurance underwriting, are interchangeable, I believe the answer is no. The characteristics are fixed and, over time, they will evolve. For different people, they will evolve at different weights. That's why some people go into very poor health in their late 60s and early 70s, and other people, like the centenarians that were discussed, it turns out that they've been healthy all along. They do not look like a random sample. There is real heterogeneity in there, and it would be desirable to reflect that. For an individual who is looking for his or her own prognostic factors, it would be desirable to recognize that. For people who are interested from a medical perspective in advising patients or people who are under their care, it would be worthwhile to advise them for those factors that can be improved, for example, quit smoking now, it's never too late. It would be worthwhile to advise them that the longer they have deleterious factors, the worse off they will be and the more quickly they will reach the end of life.

DR. LEONID GAVRILOV: I'd like to add a short comment. What was really striking in this recent study on birth months was that the effect was observed eight years later. Our usual studies were made at age 30, and we were surprised that, 30 years later, it still matters in what month you were born. But now when you study the data from the Social Security death index, life expectancy is at age 80, and even 80 years later, it still matters in which month you are born. I thought that if it mattered, then all these fragile people should be selected out by age 80, and they are not. It was an intriguing finding.

MR. TOM EDWALDS: I have a couple comments. The first concerns the Gavrilov study and farm ownership being a significant factor. Without the type of food processing that's currently available, living on a farm 100 years ago meant fresher food with more nutrient value. It very well might correlate to prenatal and perinatal nutrition to have that as one of your significant factors predicting the mortality at advanced ages. Then in terms of the future life expectancy, for those of us who work as actuaries, the population life expectancy is not the most critical number that we're worried about. We need to know for the people in our client pool whether that's insured lives for life insurance or annuitants. Some of the factors could definitely lead to a higher bifurcation of life trajectories. We might find the people that are willing to buy annuities from us living extremely long lives, while population life expectancy is staying flat or, even as

you suggest, maybe even declining, because the people who are obese aren't going to be coming to us to buy an annuity. That's the kind of thing that we need to think about. Professor Siegel, you mentioned that you had a formula on how to blend these two views.

MR. SIEGEL: Do you want to hear it?

FROM THE FLOOR: Yes, I would.

MR. SIEGEL: It's simply life expectation at birth, e sub zero, divided by e sub 100 plus the number 100. That's the attained age at 100. Or, in words, life expectation at birth divided by total life expectation at age 100. I picked the 100 because that moves upward if life span has no wall. In other words, it can gravitate upward, and that will do it. Previously, I had just used life expectancy, which meant that I was assuming a life span of 100. If you take life expectancy at birth and watch that grow, that would assume life expectancy. That number is a measure of variation in deaths. If you use that alone, it means that you're assuming a life span is fixed at 100, but this one lets it float. It's just another among a half dozen ways of measuring the compression of mortality.