LIVING TO 100 SYMPOSIUM*

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Data Sources, Quality and Analysis

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FROM THE FLOOR: I have a question for Mr. Robine. You mentioned that mortality improvements are maybe due larger to improvement in summer mortality than winter mortality. I wonder if this could be in part, at least in part, attributed to the underlying cause, because I think mortality depends on the seasons. So if gains in mortality were larger, for example, in cardiovascular diseases as compared to cancer, this could at least in part explain the pattern that you found.

MR. ROBINE: Thank you for your question. We did not look at the cause of death. Probably you are right and probably it's a contrast between other factors. So maybe in a few months, or two years, I can answer your questions better.

MR. JAY OLSHANSKY: I have a question for Jean-Marie. I noticed in your table of 660 supercentenarians, none of them are from India or China, the two most populated countries on the planet. So I'm wondering if you believe that they don't exist or that they do exist and we just don't know who they are yet? And then after you answer that I'll give my other comment.

MR. JEAN-MARIE ROBINE: I think it's a very good question. Probably it exists, but very few, very little. Now, there are more than 25,000 centenarians in Japan. And there's a huge increase in the number of centenarians in most countries in the middle of the 1940s, and in Japan it started just at the beginning of the 1960s. So we can imagine that in China it started later than, or 15 years later. It's clear in Taiwan or in Hong Kong, increasing the number of the centenarians started in the 1980s. And probably in India the same even started later.

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MR. YUE: I want to make a comment about the centenarians in China. I know about three years ago there was a survey conducted in Beijing, China, and I heard that the number of centenarians is almost 10,000 people according to their survey. So maybe you could double-check with the government. I only saw the result; I don't know the details.

MR. OLSHANSKY: Related to that, I visited a part of China, a southern island, and there they claim, it hasn't been verified, but they claim that there's a village. It's probably worth studying where there are a number of individuals they claim are exceptionally long-lived. Including, they say, some supercentenarians. So it might be worth checking into. I don't know what the records are like at all in that part of China.

I want to echo a point that was made by Leonid, and this is sort of a general comment to everyone, regarding this issue of mortality rates at extreme old ages, and the identification that they decelerate at older ages. Now, Leonid appropriately pointed out that Benjamin Gompertz, in his own article, as you know, did not apply his formula to older ages. He basically said he only went to 60. With the Makeham modification, they went up to 80. And then if you look at the historical literature, there have been at least a dozen articles that have been published not just on humans, but on other species, all saying the exact same thing. That Gompertz does not apply at older ages and should not be applied at older ages. And I would strongly encourage anyone who's talking about old age mortality, whether it's humans or other species, to be fully aware of this rich historical literature that addresses the issue of old-age mortality.

The summary appeared in an article that my colleagues and I published in *Demography* in 1997 titled "Ever Since Gompertz," and we basically documented most, if not all, of the articles that appeared since Gompertz's 1825 article demonstrating that old-age mortality rates level off at about .5.

MR. EDWIN HUSTEAD: Just elaborate on the last point. The first two studies are very interested in looking at what happens over a 100. We have a pretty good picture of what happens to 110, some idea of 110 to 115. Five years from now we'll know more about 115; we won't know about 120. So there will always be this unknown area. But the first paper I took as concluding that the rate does level off, and it is about .5, somewhere in that area. And also, in Mr. Kestenbaum's paper, he has table 1 where he shows the before and after fitting the Gompertz, and the numbers fit the Gompertz pretty well up to about 102. And then Gompertz swings off and predicts the rate at 110 is about .7. And, the actual data never gets above .5. So again, probably, in ending our tables, we should think of something in the neighborhood of .5 or .6 and not show a pattern going up to one except as mentioned in the German paper yesterday; decide you've got to end the table somewhere. So let's pick a one at 121.

MR. LEONID GAVRILOV: Data analysis of survival at extreme old ages in humans and laboratory animals suggests that lifespan is not fixed. In other words, there is no fixed upper limit to longevity, no specific fixed number that separates possible and impossible longevity records. Therefore, there is no reason to assume that the probability of death should reach a value of one (1.0) at some extreme age corresponding to longevity limit. It is true that for all populations of finite size the empirical estimates for the probability of death jump to a value of one (1.0) at extreme old ages, when a population becomes extinct. However this observation is related to limited sample size only, and this age at last death is increasing with population size. Now if we talk about the mortality force (failure rate) rather than the probability of death, then there is also no reason to assume that it should level-off at exact value of one (1.0) at some extreme age. Theoretically, the mortality force can be of any non-negative value, including the values that are above one (1.0).

MR. JEAN MARIE ROBINE: I brought the paper with me, so the discussant had just one night to go through the paper, and the paper is not totally completed. I still have to complete it and, of course, we will add all the previews, studies. And, remember, you gave me the Greenwood and Irwin paper three years ago, and it was very useful paper. I think the Greenwood and Irwin paper is very interesting because you are foreseeing this level-off and they are suggesting a very strong environmental explanation of the level off. And also, just for your two last remarks, I want to say the monograph explains exactly how the data has been validated in each country and we are late in the publication of the monograph. Also, it's true that the data should be available on the Web site, and will be available soon but we are late with the monograph, and because of that we are late with putting the data on the Web. But you will find all the data available on the Web site. The main problem we have is for the time being we are dealing with 15 countries, which are officially participating in the international collaborated effort, we have to consider all of the privacy laws in all the countries. It is extremely difficult to officially put on the Web the data on an individual person. You can go on some Web site where today you will find some list of living and nonliving supercentenarians. But on this Web site I'm not respecting the different international laws. I don't know what will be the issue because of that. But what is clear is there is no one official statistical bureau collaborating with this Web site. And if you don't have the collaboration of national statistical bureaus, you cannot add complete data. Because we know that, for example, it's very interesting. Because the track for supercentenarians started in the United States and there are a lot of people who are looking for all the supercentenarians in the United States. And they were able to find about 40 supercentenarians. But they were very active and they were pretty sure to have all the supercentenarians in the United States. And when the Social Security Administration started working on this topic and brought its own data, we discovered more than 500 validated supercentenarians in the United States. It just goes to show you that if you don't have the collaboration of the official statistical bureau, you can miss something like 90 percent of the supercentenarians.

MR. LEONID GAVRILOV: When I read the paper, I got the impression that the data completeness is not proven in this study, but it is rather assumed on the basis that the data comes from the official sources. In the paper, it was mentioned in the case of France, for example, that the data was taken from official sources. Still, there were five more missing cases of supercentenarians found later. There should be some mechanism of validation for supercentenarian data completeness. I understand that this data completeness may be difficult to achieve, but without this proof of data completeness the interpretation of results is always questionable. I would also like to mention that extensive supercentenarian studies are performed by the Gerontology Research Group in Los Angeles (lead by Dr. L. Stephen Coles, M.D., Ph.D.), and I would recommend to collaborate with the experts from this group.

MR. OLSHANSKY: I can't resist the opportunity to ask such a distinguished panel a very straightforward set of questions about longevity. I'd appreciate an answer from everyone on the panel. It's a very simple question: Do you believe that anyone alive today will break the longevity record of 122? And do you believe that anyone alive today will live to 150 or older?

MR. ROBINE: Yes, of course. Why not 170? So this will be in about 150 years. I don't really know. We are extremely powerful to master our own environment. We are really at the beginning of the process. I think that we are always thinking we are at the end of the progress, we are able to do everything and nobody after us will be able to do better than us. If we are a little bit modest, we can see it's not true. Even the new generation is much more clever, powerful, able to go further in mastering the environment. Three things are killing us: the food, the liquid we are drinking and the air we are breathing. On these three things, are we conquering the food, the liquid and the air we are using to live and to die? We are more or less repeating what we learned to do since the early times. We are really beginning to understand the impact of the food and of the liquid, of the air and how to use it. Because you are looking for the coming 150 years, maybe in 150 years, the way we are controlling the quality of the water, or the quality of the air, the way in which we are living will be so different from what we can see today. So, you know, life expectancy was about 30, 35 years, from so many years during the middle age, and now it's 85 in Japan or in Hong Kong. So, who knows what will be our ability to have better food, much better food. For the time being we are just repeating the choice of the food made by our ancestors. Genetically modified food could totally change the benefit of the food of tomorrow.

MR. JACK YUE: For the light side, there is a Chinese fairy tale that says the maximum life span in Chinese history is 820 years old. This is just a fairy tale. But just for reference, only 40 years ago, the United Nations model life table said the maximum life span I think was 80 or 85 years old. Maybe you could double-check the United Nations record. So, in my opinion, I guess the maximum life span will increase. But to which limits I don't have any answer either. I agree with a lot of

people that if we reduce our daily activity maybe we can live longer. What is the purpose of life? That's another question.

MR. ROBERT JOHANSEN: OK, I will venture a guess, and it's an educated guess. If anyone breaks the record, it will be a person covered under a 403b annuity. Do we have any more questions?

MR. LEONID GAVRILOV: I would like to say that the future of human longevity depends on our own behavior and research efforts today. If we just sit and wait, then nothing significant will happen with human lifespan. However if proper research resources and the best minds become concentrated on the studies of human longevity and aging in a way similar to the Manhattan Project in the past, then a spectacular breakthrough in the extension of healthy life span may become possible.

FROM THE FLOOR: Jody Faustuous from Hanover Life Re. I just have two comments to make. Recently we were scratching around and we came across a Web site where they were introducing the concept of the mechanical heart. And I think given that cardiovascular causes, cardiovascular complication is probably the predominant cause of death, I wonder what sort of confidence anyone can place on the estimates for maximum life span in the presence of innovations where you're leaking technological advances and biological advances in such a fashion? And I think another comment, just a general one, is that with these sort of studies, I think it's important to reinforce that life expectancy for the population as a whole is quite a different thing to, say, the upper and the lower social economic quartiles. There are a lot of innovations and advances that are going to affect these two groups in drastically different ways. Obesity is predominantly prevalent to the one group, and there's access to the advanced medical technologies on the other end I think the divergence is something that we should pay more attention to at conferences like these for practical purposes.

MS. ANNA RAPPAPORT: I think this is really an interesting discussion. I'd also like to hear anything from the audience that they want to predict. I'd like to bring us a little bit closer to where many of the practicing actuaries are today and say that the maximum possibility is certainly something we ought to be interested in. But during the next five to 10 years, one strategy for dealing with this is to, say, shift more risk back to the individual. But really what we ought to be about is helping individuals not have to assume that risk. So I'd be very interested in people's ideas, if they have any ideas, what are the practical implications of this for the products, the programs, the things that we're going to be designing in terms of what we're going to be doing in the next five to 10 years? And I'd like to hear not only from the panel, but also from the audience.

MR. GAVRILOV: One possible practical implication is that some particularly wealthy individuals concerned with their health and longevity may take advantage of forthcoming biotechnological innovations, and will live an incredibly long life, far

beyond current actuarial estimates. So, this "longevity risk" needs to be taken into account quite seriously in actuarial practice for this small selected group of particularly wealthy biomedical technocrats.

MR. RICHARD HUMBLE: I'd just like to take up the point as to how the industry should deal with this particular issue and the level of uncertainty involved. In my belief, the recipe for disaster for the industry to attempt to reinsure or to ensure the aggregate increase in longevity, and I think what the industry should be concentrating on is insuring individuals against their variance from the average, but not attempting to insure the average. So that it requires products, which involves some sort of risk sharing not in terms of an individual's life expectancy, but in terms of the life expectancy about the whole population. But I think that would require a significant amount of education of the population in order to move to that point.

MR. WARD KINGKADE: I don't have a question, I just have a point of clarification to make coming out of Burt Kestenbaum's paper with Renee Ferguson, which I agree with basically. The Census figures that the Census Bureau releases are not adjusted for age over statement or anything like this. When we do make estimates and projections of the population we do correct for that type of error, and we do it using the Medicare database in part. So just as a point of clarification, when you look at the census results that are on our Web site, you're looking at data that's uncorrected for problems and reporting old age. When you look at estimates and projections, you're dealing with something else, which has an adjustment built into it.

MR. JOHANSEN: I have a question. Suppose we have a listing of centenarians, suppose we're able to establish that. How do you keep it up to date.

MR. THOMAS HERZOG: If you have the Medicare system, it's an ongoing system. It's not like the census. It's not like the census, which is done every 10 years. So you can look at the Medicare data anytime. I guess once you edit them, then they're ready to go. It's something like a population register.