A Discussion of the Paper "IDL, the International Database on Longevity"

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This is a discussion of the paper "IDL, the International Database on Longevity" presented at the Symposium by Dr. Jean-Marie Robine, et al. The comments of this discussion are applicable to the paper as it was presented at the Symposium, rather than to its final revised version, which I have not seen yet. I hope that the constructive criticism expressed in this discussion will be taken into account by the authors, and that consequently this criticism will not be applicable to the final version of the discussed paper.

Let us start with the question of why the topic of this paper—a study of extreme cases of longevity after age 110 years—is important. A Russian physicist, the Nobel Prize winner Dr Peter Kapitsa, once commented that extreme cases in Nature such as extreme low temperatures, extremely high pressure, extremely strong magnetic fields, etc., are particularly informative for discriminating between competing theories in physics.

If we apply the same principle to human longevity studies, we can say that the extreme cases of longevity are particularly informative for discriminating between competing theories of aging and longevity. Indeed, many mathematical theories of mortality can be discriminated, because they provide very different predictions on mortality trajectories at extreme old ages (see Gavrilov L.A., Gavrilova N.S. 1991. *The Biology of Life Span: A Quantitative Approach*, NY: Harwood Academic Publishers). Thus this study of supercentenarians (people living to 110 years and beyond) seems to be justified.

It is important to put the paper under discussion into a historical context. The history of mortality studies at extreme ages is rich in ideas and findings. Early studies, starting with Gompertz (1825) himself, suggested that the Gompertz law of mortality is not applicable to extreme old ages, and that mortality deceleration and leveling-off takes place at advanced ages. (For an excellent historical review of studies on mortality deceleration at extreme old ages, see Olshansky, S.J. 1998. "On the biodemography of aging: a review essay." *Population and Development Review* 24, pp. 381–393). In 1939, the British researchers Greenwood and Irwin published a research article, "Biostatistics of Senility," with the intriguing finding that mortality force stops increasing with age at extreme old ages and becomes constant (see Greenwood, M., Irwin, J.O. 1939. "The biostatistics of senility." *Human Biology*, vol. 11, 1-23). Their study and findings were considered to be so important that they were featured on the front page of the academic journal where their study was published.

This study, accomplished by the famous British statistician and epidemiologist Major Greenwood, is applicable here because it is directly related to the topic of discussed paper. The first important finding was formulated by Greenwood and Irwin in the following way:"“…the increase of mortality rate with

age advances at a slackening rate, that nearly all, perhaps all, methods of graduation of the type of Gompertz's formula overstate senile mortality" (Greenwood, Irwin, 1939, p. 14). This observation was confirmed later by many authors (see review in Gavrilov L.A., Gavrilova N.S. 1991. *The Biology of Life Span: A Quantitative Approach*, NY: Harwood Academic Publishers), and it is known as the "late-life mortality deceleration."

The authors also suggested "the possibility that with advancing age the rate of mortality asymptotes to a finite value" (Greenwood, Irwin, 1939, p. 14). Their conclusion that mortality at exceptionally high ages follows a first-order kinetics (also known as the law of radioactive decay with exponential decline in survival probabilities) was confirmed later by other researchers, including A.C. Economos ("Kinetics of metazoan mortality," *J. Social Biol. Struct.* 1980, 3: 317-329). Economos demonstrated the correctness of this law for humans and laboratory animals (linear decrease for the logarithm of the numbers of survivors). This observation is known now as the "mortality leveling-off" at advanced ages, and as the "late-life mortality plateau."

Moreover, Greenwood and Irwin made the first estimates for the asymptotic value of human mortality (one-year probability of death, *qx*) at extreme ages using data from the life insurance company. According to their estimates, "… the limiting values of qx are 0.439 for women and 0.544 for men" (Greenwood and Irwin, 1939, p. 21). It is interesting that these first estimates are very close to estimates obtained later using more numerous and accurate human data, including recent data on supercentenarians.

Returning to the discussed paper, we can see that the authors came to essentially the same conclusions as did the earlier 1939 article. The present paper concludes: "… Striking feature of these [supercentenarian] survival curves is the seemingly exponential decline in survival probabilities."

I am not sure whether this finding is striking at all, because it was already known to researchers for many decades (Greenwood and Irwin, 1939). What is really striking is that the authors of the discussed paper do not cite or acknowledge the earlier studies by other authors with the same findings. This is very unfortunate, because the authors were publicly informed about this important and relevant 1939 publication by Greenwood and Irwin at the previous SOA Symposium held in 2002, and still chose to ignore it. One of the authors of the discussed paper had already been criticized in a published article by Dr. S. Jay Olshansky ("On the biodemography of aging: a review essay." *Population and Development Review*, 1998, vol. 24, pp. 381–393), for the failure to cite and acknowledge the earlier relevant

scientific publications. So I am not the first scientific reviewer who raised concerns over the practice of this research team of claiming credit for the findings made earlier by other authors.

There are some other remaining questions and methodological concerns. The paper discusses in length that, for demographic analysis of mortality, the list of supercentenarians should be complete or age-ascertainment-bias free. However, the authors do not provide proof that their data meet these criteria. Instead, they simply cite a paper by Kestenbaum and Fergusson, 2002, to claim that "… this [supercentenarian] list is assumed to be age-ascertainment-bias free." This leaves two questions unanswered: Is this list really bias free? How do we know that it is unbiased?

In addition, the paper announces that the International Database on Longevity can be found at www.supercentenarians.org. I have checked this Web site and found absolutely no data there. What is the purpose of announcing a database Web site without putting any data there?

I hope that in the final version of their paper the authors will address the concerns expressed in this review.