Mortality Measurement and Modeling Beyond Age 100

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Abstract

The growing number of people living beyond age 100 emphasizes the need for accurate measurement and modeling of mortality at advanced ages. However, mortality measurement at extremely old ages poses serious challenges to researchers: age reporting at extreme ages may be inaccurate; small numbers of people at advanced ages requires pooling data for people belonging to different birthcohorts, which results in data heterogeneity; and, finally, a standard approach based on annual mortality estimates may not be applicable to extremely high and rapidly changing risk of death at advanced ages.

The study uses data from the Social Security Administration Death Master File (DMF) to conduct mortality estimates for more homogeneous single-year birth cohorts with hazard rates estimated for narrow (monthly) age intervals. Mortality after age 88 was estimated for 1881-95 single-year extinct birth cohorts. Data quality control checks demonstrated that deceleration of mortality in later life is more expressed for data with lower quality. Additional quality checks using female-to-male ratio at advanced ages identified age 107 as the upper limit for acceptably good level of age reporting. Model comparison using Bayesian information criterion (BIC) showed that in the age interval 88 to 106 years and for data with reasonably good quality (U.S. Northern states), the Gompertz model shows better fitting of hazard rates than the logistic model. Hazard rate estimates obtained on the basis of DMF data agree well with estimates calculated on the basis of the 1900 actuarial cohort life table.

This study shows that mortality deceleration in humans observed at advanced ages may be an artifact caused by age exaggeration, data heterogeneity or use of improper estimates of hazard rate. The phenomenon of mortality deceleration at older ages vanishes for datasets of higher data quality. The study was supported by National Institute on Aging Grant AG028620.