Lives Saved in a Population

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The number of lives saved and the ages when this occurs is the focus of this paper. For presentation, I have divided the manuscript into two complementary parts. First, I study the change over time in life expectancy in term of lives saved, as alternative to the usual interpretation of average number of years gained. This alternative interpretation of changes in life expectancy can be used to rank periods of heaps or of few lives saved in a country. The measure can also be used to compare across countries. Secondly, we look at the mortality shift in age at death. To assess this change I look at a fixed mortality level at a given time and find the matching age at which this level of mortality is found in a more recent year. As an example, a person aged 50 in 1950 in Sweden has the same mortality level than a person aged 80 in 2000. However, when looking at life expectancy level for a 50 year old in 1950 this is found at age 56 in 2000. The reason for this paradox is the great disparity in life extension existent from age to age. Similarly, lives saved can be just a handful, but their life duration will vary from age to age, and we combine the two ideas in this study.

How many lives have been saved?

Let the change over time in life expectancy, $e_o(t)$, be calculated as the derivative respect to time of this measure and expressed with a dot on top of the variable:

$$\frac{de_o(t)}{dt} = \dot{e}_o\,, \tag{1}$$

The interpretation of this measure is the number of years gained in the average number years lived by an initial population of ℓ_o persons. To obtain the total number of extra years gained, not the average, it is necessary to multiply the expression in equation (1) by the initial population of persons, $\dot{e}_o\,\ell_o$. Finally, this total number of years gained can be divided by life expectancy to obtain the number of new lives saved, assuming that on average they live $e_o(t)$:

$$\ell^{\dagger} = \left(\frac{\dot{e}_o}{e_o}\right)\ell_o\,. \tag{2}$$

How old are we today?

The level of mortality shift has been suggested as an alternative measure of relative “ages” of populations over time (citation). For example, the death rate at age 50 in 1950 in Sweden was $m(50,1950)=0.005898$, the closest level of mortality is found in Sweden in 2000 among the 80 year olds as $m(80,2000)=0.060690$, which corresponds to a 30 year shift in mortality. However, there has been some variation from age to age and the average and variance of these shifts is of interest in this study. Furthermore, we can similarly ask about the shifts by remaining life expectancy and see the big contrast on the shift in mortality depending on the measure studied. For example, the remaining life expectancy at age 50 in 1950 in Sweden was $e_o(50,1950)=25.80$ and in 2000 the same level of remaining life expectancy is found at age 56, $e_o(56,2000)=26.14$. A final addition to this analysis is the inclusion an international comparison of this shifts to allocate countries in groups by their pace of shift.