Mortality Improvement in the Elderly Population

Population mortality rates for the extreme elderly have improved significantly in the last decade compared to late 20th century trends. What has caused this recent improvement, and is it likely to continue at this rate in the future? In this article, I investigate the improving mortality of this age group by analyzing cause-of-death statistics from the Centers for Disease Control (CDC).

Historical Trends in Mortality for the Extreme Elderly

Historical mortality rates between 1980 and 2000 have remained steady for males aged 90+ and improved only slightly for males ages 85-89 in this period, as seen in Figure 1. This is in contrast to the steep decline in mortality rates following year 2000. A similar trend occurred in female mortality for the same age groups.

Based on the above historical mortality rates, crude annualized male and female mortality improvement rates were calculated for the periods 1950-99 and 2000-07, as shown in Figure 2.

Cause of Death Analysis

To gain insight behind such noteworthy changes in mortality improvement, I analyzed CDC historical cause-of-death information for the extreme elderly. Figure 3 shows how male age 85+ mortality rates have changed over the past 27 years by cause of death.

Note the following mortality trends by cause of death for males age 85 and over in Figure 3:

- Atherosclerotic heart disease death rate has decreased significantly since 2000.
Death rates from cardiovascular causes have decreased significantly since 2000, while cancer rates have remained fairly level for an extended period.

- Other heart disease combined with other vascular disease death rates have decreased since 2000
- Cancer death rates have remained fairly stable since 1980, although there has been some improvement since 2000
- “All other” death rate has slowly grown over the years, taking up the slack from decreases in cardiovascular death rates through 2000, but has shown improvement since 2000.

I next used the CDC data to calculate annualized improvement rates by cause of death for the two periods before and after calendar year 2000. From Figure 4, it is clear that atherosclerotic heart disease and other vascular disease are the main drivers of improvement in elderly males during the 21st century.

### Persistence of Recent Mortality Improvement

Before using data from the 2000s to project future mortality rates for the elderly, it is prudent to determine if the forces driving recent changes are likely to persist. Discussions with SCOR’s medical research group concluded that the introduction of coronary care and heart-related drug regimens introduced in the 1970s likely contributed to a large part of the rapid decrease in cardiovascular mortality in the extreme elderly. Once this introduction into the elderly population is complete (if it is not already), future improvement rates from these causes likely will return to more normal levels. Thus, adjusting the observed improvement rates from cardiovascular causes before using them to project mortality is advisable.

While there are undoubtedly many different methods for adjusting the cardiovascular improvement rates, I devised a rather simple and practical approach to the problem. The question I wanted to answer was: “What would have been the overall improvement from 2000 to 2007 if the effect from cardiovascular causes had only been half of that observed?” Figure 5 shows the results of my process with the first three rows giving data for the cardiovascular causes. The Improvement Factor 2000-07 column is the ratio of mortality for calendar year 2007 divided by the mortality for 2000. In other words, it is an indication of how much overall mortality decreased in the intervening seven years. For the cardiovascular causes, I halved this reduction (increasing the factor) and recalculated improvement rates.
So, if mortality improvement due to cardiovascular causes continues in the future at only half of its effect from the 2000s, then overall future improvement will decrease from its recent rate of 3.1 percent per year to around 1.9 percent for elderly males. Similarly, improvement will decline from 2.3 percent a year to 1.1 percent for females.

Conclusion
In general, using a fairly long historical time horizon is preferable when analyzing mortality improvement trends (see my June 2011 Messenger article “Insured Mortality Improvement in the 21st Century: Is It Real?”). However, when there is a significant and permanent change in the pattern, a much shorter time frame may be more appropriate. For the extreme elderly in the US, recent trends indicate that such a change may have occurred around the year 2000 – whether it is permanent remains to be seen. In the absence of that knowledge, I recommend tempering any improvement assumption used to project future mortality for the elderly. This article has described one adjustment method. ∞


3Discrepency in 2000-07 annual improvement rates between figures 2 and 4 is due to slightly different mortality rates tabulated by the Human Mortality Database versus the Centers for Disease Control.