On August 9, 2011, SCOR SE, a global reinsurer with offices in more than 31 countries, acquired substantially all of the life reinsurance business, operations and staff of Transamerica Reinsurance, the life reinsurance division of the AEGON companies. The business of Transamerica Reinsurance will now be conducted through the SCOR Global Life companies, and Transamerica Reinsurance is no longer affiliated with the AEGON companies.

While articles, treaties and some historic materials may continue to bear the name Transamerica, AEGON is no longer producing new reinsurance business.

Archive Materials

Over-Using Life Expectancy

Reprinted from the June 2009 Messenger newsletter

Individual life insurance is a voluntary purchase decision and for it to remain a viable product, insureds must pay premiums commensurate with their risks. While premiums fund most of the cost of life claims, the balance comes from return on investments, so the timing of claims is very important.

Life expectancy (LE or ex) as a summary statistic for mortality gained popularity because it is a single number that seems to capture what one needs to know about mortality. Popular in the press and with the government agencies charged with health policy decisions, LE has long been used as the measure of expected survival in structured settlements. More recently, life expectancy has been used as a measure of expected mortality in viaticals and life settlements and as a measure of comparative mortality in the medical literature.

Professor C.L. Chiang defines life expectancy as “the number of years, on average, yet to be lived by a person of age x,” represented symbolically as:

\[ e_x = \frac{T_x}{l_x}, x = 0, 1, ..., w \]

where \( T_x \) “is the total number of years of life remaining to the \( l_x \) individuals” alive at age \( x \) and \( w \) is the final age interval for a life table.

He adds: “Each \( e_x \) summarizes the mortality experience of persons beyond age \( x \) in the population under consideration, making this column the most important in the life table.”

I must disagree with Professor Chiang. The probability that a life aged exactly \( x \) will die before attaining exact age \( x+1 \) (represented by \( q_x \)) is the most important column in a life table. It is the quantity that is derived from experience, and it is the basis for all the other columns, including \( e_x \). It is also my opinion that life expectancy is frequently misused and misunderstood.
At Birth” vs. “Attained Age” Life Expectancy

A common oversight in the use of life expectancy is failure to state the attained age for which the LE applies. Generally, total life expectancy (LE plus attained age) increases with age. Critics of the U.S. health care system like to highlight unfavorable comparisons of LE for the U.S. versus other developed nations. What they leave unsaid is that they are using “at birth” LE’s, which can be misleading, as shown below.

For a variety of reasons, the U.S. experiences higher infant mortality. As an arithmetic mean, LE is overly influenced by outliers; a relatively small number of extremely short life spans have a large influence on the LE. What receives less publicity is that the LE gap between U.S. and other developed Western nations closes at older ages, and 80-year old Americans have a longer LE than their foreign counterparts.

Another cause of misunderstanding in the use of life expectancy stems from the fact that it is calculated using age-specific qx’s from a period life table. This is a snapshot of mortality rates and probabilities from a specified period of calendar time. But persons aged 20 during the period of the life table are not likely, 40 years later, to experience the 60-year-old qx from that same table, but the LE is calculated as if they would. The qx’s are very real and exactly what they purport to be, but life expectancy is an abstraction.

Life expectancy is the “coin of the realm” for the life settlement industry. “LE estimators” evaluate medical evidence, determine a mortality ratio (MR), multiply the qx’s from a mortality table by the MR and then calculate an LE which is quoted to their client. This is a competitive business. The mortality tables used and the exact methodology are usually proprietary.

As a summary statistic, life expectancy hides details about the expected mortality, notably when claims are expected to occur. The life settlement investor must translate the LE back into a vector of qx’s in order to model the expected cost and revenue streams. Since the estimator’s mortality table is proprietary, the back-calculation is often done using a different table yielding variable results.

Mortality tables are period life tables from experience studies. Their qx’s rarely incorporate mortality improvement. Some LE estimators incorporate mortality improvement in their LE calculation, but improvement factors are always cause for debate.

How does one incorporate excess mortality into the calculation of a life expectancy? Traditionally, one takes a given mortality ratio (e.g., 200 percent), multiplies all the future qx’s for an individual by that ratio and then calculates the LE. Actually, the excess mortality for a particular impairment is unlikely to follow such a pattern. Many impairments exhibit a permanent flat extra (FE) pattern while others will follow a temporary FE or perhaps a combination of MR and FE. This is especially true at older ages with their high baseline qx’s.

Mortality vs. Survival

Another basic issue with LE is that it is more directly related to survival (px) than mortality (qx), although the two quantities are complementary as seen in the formula:

\[ p_x = 1 - q_x \]
The mortality rates that we deal with generally are very small (e.g., 0.00136 for 20-year-old U.S. male, 2005). This leads to a problem very much like that seen in relative survival: relatively large changes in the qx will cause relatively little change in the survival and in life expectancy.

For example, if the qx of 0.00136 is doubled to 0.00272, the change in px is only a tenth of a percent (from 0.99864 to 0.99728). In the case of LE, doubling present and future mortality for a 20-year-old male (U.S. general population, 2005) will decrease his LE by only 15 percent. A five-fold increase in mortality is required for the LE to decrease 33 percent.

Life expectancy can be a misleading measure of mortality. Personally, I would rather work with a vector of qx’s or even a matrix of qx’s, selection factors and improvement factors. Unfortunately, the public’s need for a simple, single-number summary statistic for mortality means that life expectancy is likely to remain in common use.

References:
2. Wesley D. Mis-Measures of Mortality.