



SOCIETY OF ACTUARIES

Article from:

Product Matters!

November 2002 – Issue No. 54

Mortality Table Slope and Future Improvements

by Michael S. Taht

Many actuaries are starting to pay more attention to the later duration slope of pricing mortality. There have been a couple articles wondering whether mortality assumptions are taking a too aggressive posture for later durations. The NAIC's Life and Health Actuarial Task Force has a new charge for 2003: to "Investigate whether inappropriate mortality assumptions are being incorporated in life insurance illustrations." Note that mortality at very long durations, while not material for pricing (a present value basis including lapse), can have a material effect on illustrations at longer durations.

In the August 2002 issue of *Product Matters!*, Larry Warren compared the slope of the 1990-95 S&U mortality table to the 1975-80 S&U mortality table. He noted that the 1990-95 table has a steeper slope and concludes that actuaries who price off of the 1975-80 table may unwittingly be taking an aggressive posture on future mortality. I agree that the difference in slope of the two tables is significant, and that slope is an issue that the pricing actuary should address explicitly. I disagree that the 1990-95 table is proof of the inadequacy of the 1975-80 table.

Why is the 1990-95 table steeper than the 1975-80 table? I can think of two reasons, neither of which invalidate the 1975-80 table. First, we have seen a large increase of nonsmoker and preferred-risk underwriting classes since 1980. This business undoubtedly has a disproportionate effect on the early durations of the 1990-95 table, making it steeper. Second, there were higher industry lapse rates in the early 1980s, so the later durations of the 1990-95 table may be suffering from antiselection that occurred then. The 1990-95

table is built from non-homogeneous data. The 1975-80 table may be the most recent table that has homogeneous data for all durations.

There are (at least) three issues that the pricing actuary ought to consider in evaluating the appropriateness of later duration mortality:

1. What portion of the underwriting improvement should wear off over a "normal" select period (e.g., 15-25 years)?
2. Should the remaining underwriting improvement wear off at the higher attained ages?
3. What role does underlying population improvement have?

Regarding the "normal" select period, some medical studies demonstrate that the effects of underwriting selection can persist for a long time.

- Alcoholism: A 1952-76 study of the effects of alcohol abuse showed that the mortality ratios (as calculated against the 1965-70 Basic Tables) remained relatively constant by duration.
- The Framingham study on cholesterol showed that for males with a cholesterol level of 270 or higher, the mortality ratio in durations 1-12 was 150 percent while it was 140 percent for durations 13+.
- Blood pressure and urine abnormalities: A study of policyholders issued

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between 135-50 showed that the extra mortality for those with abnormalities in the urine and high blood pressure persists well into durations 10-15 and increases with duration.

- Diabetes: A 20-year study of diabetes showed that the impact of diabetes continued well into durations 15-20.

Regarding the high attained ages, opinions are mixed. Smoker/ nonsmoker differentials wear off at high attained ages, but male/female differences do not. The RP2000 table shows blue/white collar and annuity size differences grading off at higher ages. I believe that much underwriting will wear off at high attained ages, but suspect that family history differences would persist.

Regarding underlying population improvement, there are various population projection scales that have improvement factors that peak somewhere between age 50 and 80. Therefore, if population improvement is used to update an old mortality table, it will flatten a table at younger issue ages, but steepen a table at older issue ages.

The issue of slope is not going to go away, and the data required to address this issue does not exist, and will not for many years. However, it is important that pricing actuaries understand any implicit assumptions they are making through the selection of a base mortality table and understand the impact of these assumptions. □

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