Mortality: A Quest for the Ultimate

By Missy Gordon and Shawn Stender

Although generally decreasing over time, mortality assumptions for long-term care (LTC) have been a moving target. Additionally, the length of the assumed selection period has been increasing—years ago, the select period might have been only 10 years, but today it could be as long as 20 or 25 years. There may be a number of reasons why the select period is longer, one of which may be due in part to decreases in the average issue age for LTC insureds. We seek to provide more insight into the elusive ultimate mortality level by developing an assumption using a combination of modeling techniques.

Today, a plethora of tools and approaches exist to develop lifetime projections of LTC business. Within these tools lie two distinct approaches to project mortality; namely, by using assumptions that are applied: (1) to an all-lives exposure base, or (2) separately for disabled- versus active-lives exposure bases. Using disabled versus active mortality allows for more granular modeling of the two different cohorts that exhibit dramatically different mortality. Therefore, when using an all-lives mortality assumption, is the projection missing important details about the appropriate mortality level? Herein lies our quest.

To complete our quest, we examined the experience and results developed from one company as an illustrative case study (with the company's permission). It is worth noting that these results may vary for different blocks of business and/or underlying assumptions.

MIX OF ACTIVE VS. DISABLED DEATHS

When using an all-lives model (as is usually the case when using claim costs), all policies are projected using a total mortality assumption that does not track or vary according to whether the policy is active or disabled—that is, all policies receive the same mortality assumption. Traditionally, an all-lives mortality assumption is often developed through a comparison by policy duration (and possibly gender) of actual mortality experience for all lives with what would be expected using a chosen standard mortality table. Typically, the standard table provides mortality rates by gender and attained age (not by issue age and policy duration). The comparison is used to create a vector, commonly by policy duration, of percentages of the standard table—there may be only one vector for all policies (unisex) or two if the vectors differ materially by gender. The vector(s) are then used to adjust the standard table's mortality rates to create a mortality assumption that varies by gender, age and policy duration. We will refer to this development process as a "traditional study" and refer to the vector produced by the study as an "all-lives durational vector."

Underlying the mortality experience is a mix of active versus disabled deaths. Consideration for this underlying mix, and how it might change over the projection period, is typically missing from a traditional study.

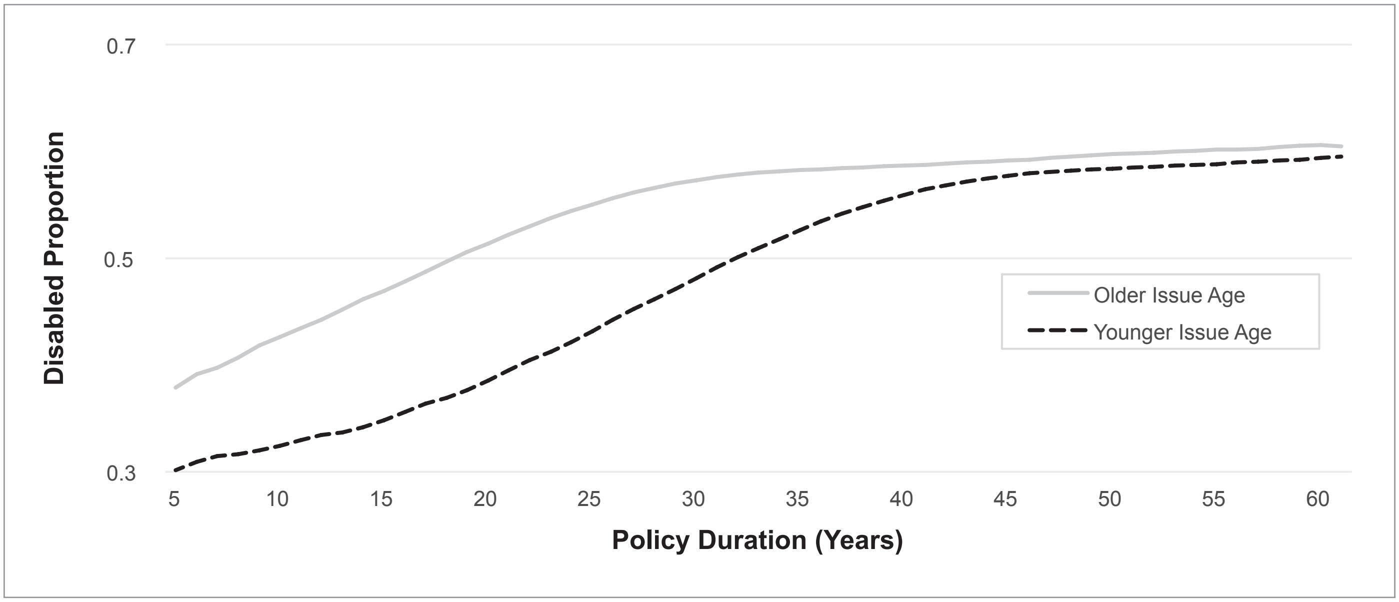
This is the first leg of our quest: understanding how the mix of active versus disabled mortality changes over time. To do so, we performed separate active mortality and disabled mortality studies by comparing one company's historical experience with the 1994 Group Annuitant Mortality Static (94GAM) table. We then used Milliman's MG-ALFA® first principles model to project active versus disabled deaths using this one company's experience to provide an illustrative case study.

From the study of active-life mortality as a percentage of 94GAM, we found the percentages to be relatively flat by policy duration, and from this created an "active-lives durational vector." The disabled-life mortality study revealed that the percentages of 94GAM by attained age exhibited a wide variance, but decreased by attained age. Using this experience, we developed a "disabled-lives attained age vector." Assumptions that are more granular could be developed if supplemented with industry experience to increase credibility. However, we developed high-level assumptions, using the experience of one company, to isolate the impact of considering an active versus disabled mix in the assumption development compared with that of a traditional study for illustrative purposes.

Issue age matters, big time.

These assumptions (along with additional assumptions required for a first principles model) were used to project active and disabled deaths over the life of the business from issue. Figure 1 provides a graphical comparison of the projected proportion of total deaths from the disabled cohort by policy duration. The "Older Issue Age" line shows the disabled death proportions for a block with an average issue age in the mid-60s, whereas the "Younger Issue Age" reflects an average issue age in the low 50s.

Figure 1
Proportion of Total Deaths That Are From Disabled Cohort by Policy Duration



The disabled proportions are connected to attained age and so the younger average issue age cohort takes longer to reach the point at which the disabled proportion levels off. These proportions are dependent on the underlying morbidity assumptions. For instance, higher incidence or lower recovery will result in a higher proportion of disabled deaths.

COMPARING A NEW ALL-LIVES ASSUMPTION WITH A TRADITIONAL STUDY

Next, we developed a new durational all-lives mortality vector assumption using active and disabled deaths from the first principles model, along with extensive algebra that essentially calculates a weighted average of the active-lives durational vector and the disabled-lives attained age vector.

Because the disabled-lives vector is by attained age, but we want an all-lives vector by duration, for consistency with a typical traditional study, we projected active and disabled deaths by quinquennial issue age bands. This allowed us to produce a table of deaths by attained age and policy duration for use in the weighted average calculation. The results were then aggregated across policy duration to develop a new all-lives durational vector.

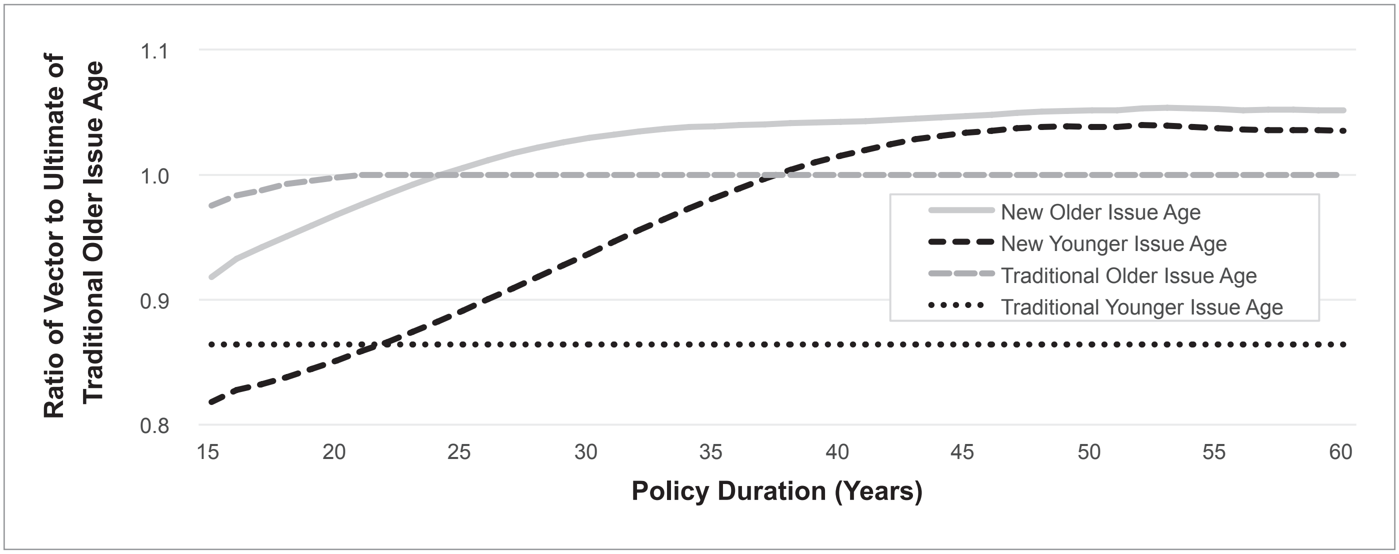
Comparing the new all-lives durational vector with that developed from a traditional study, we found that the assumptions aligned reasonably well for an older issue age (average in mid-60s) block. The new assumption reached an ultimate level at a little later duration and higher level compared with that produced by a traditional study based on all-lives experience for durations over 20. However, as the active versus disabled mix will vary based on the age of the block, we looked at an illustration for a younger issue age (average in low 50s) block. What we found was that the average issue age materially affects the length of a select period (that is, when the block reaches its ultimate level).

Figure 2 provides a graphical comparison of the new all-lives durational vector for each block (older and younger issue age) relative to the ultimate levels that might be produced by a traditional study.

Figure 2 reveals the following key findings relative to studies used to develop all-lives mortality assumptions in the "traditional" sense.

1. Ultimate level is *too low*: Setting an ultimate level (that is, percentage of the standard table) based on the experience for durations 15+ or 20+ may understate mortality. This is because the vector continues to increase as the block ages, which creates a downward bias in the average level. The understatement is more substantial for younger issue age blocks because the percentages of the standard table are lower for a longer period of time, which produces a bigger downward bias on the average level.
2. Ultimate duration is *too early*: A select period of 15 or 20 years may be too short. Depending on the average issue age of the block, the ultimate duration may not be for another 10 or 30 years, which will overstate mortality for a number of durations.

Figure 2
All-Lives Durational Vector Relative to the Ultimate Level for an Older Issue Age Insured Using a Traditional Study



Often, the experience of an established, credible block is used to set the ultimate assumption for a newer block. While the ultimate level of the two blocks may be close (assuming all else equal), the number of years to reach the ultimate level is materially different, as shown in Figure 2, and could be reached too early. If the average issue age of the block is not considered, then mortality may be overstated because the ultimate level is reached *too early*.

3. Issue age matters, big time: Its impact on how the proportion of disabled deaths changes over time is an important consideration in developing a mortality assumption that avoids setting the ultimate too low or too early.

4. Choice of standard table impacts the select period: Underlying the 94GAM table is a mix of active versus disabled deaths that varies by attained age. If the underlying mix is not "correct," then the length of the selection period will vary by issue age in order to capture the correct mix by attained age. Using a different standard table could result in a shorter selection period that is more consistent by issue age.

FINANCIAL IMPACT OF "NEW" ALL-LIVES ASSUMPTION

The final leg of our quest considers an illustration of the financial impact on the future loss ratio (LR) and present value of future profit. These illustrative financial impacts are shown in Figure 3 and represent the impact of moving to a new all-lives durational vector relative to what might have been generated under a traditional study for a younger issue age block.

The new all-lives durational vector corresponds to what is shown in Figure 2 above as the "New Younger Issue Age." As a comparison with what might result from a traditional study, we developed two illustrative scenarios and set the ultimate assumption at durations 15 or 25.

One scenario assumes the ultimate level is set too low (and too early), by holding the values in the new all-lives durational vector constant starting in durations 15 or 25. This is an illustration of what could occur if the traditional study uses experience for durations over 15 or over 25 of the younger block to set the assumption. Also shown is the impact relative to using the "Traditional Younger Issue Age" mortality assumption from Figure 2 above.

The second scenario assumes that the ultimate level is set too early (but at the right ultimate level), by using the ultimate level from duration 50 starting in duration 15 or 25. This is an illustration of what could occur if the experience of an older block is used to set the assumption. Also shown is the "Traditional Older Issue Age" mortality assumption from Figure 2 above, which captures the combined impact of too early and too low (albeit slightly).

Figure 3
Illustrative Financial Impact* of Changing to New All-Lives Mortality Vector Assumption

Ultimate Duration	Ultimate Level Based on Experience in Select Period (set too low)		Ultimate Level Based on Older Block Experience (set too early)	
	Change in Future LR	Change in Future Profit	Change in Future LR	Change in Future Profit
Duration 15+	–8%	37%	5%	–24%
Duration 25+	–4	19	4	–19
"Traditional"	–5	23	2	–11

* Impact of changing from what could occur under a traditional study to that under a new study as percent change.

The illustrations in Figure 3 show that it is financially beneficial to change approaches to use a new all-lives durational vector (rather than what might be produced by a traditional study) when there is a reduction in the future loss ratio or increase to profit. Using a new all-lives durational vector has a substantially larger impact on future profit compared with that on the future LR. This is because, in addition to shifts in the mortality assumption that affect projected claims and premium, this vector also impacts the timing of reserve release, investment income on reserves, and expenses (e.g., lower persistency reduces claim administration, premium, and policy expenses).

All projected present values underlying Figure 3 use one new all-lives durational vector assumption that is reflective of the weighted-average issue age of the block. We tested the impact of using a different all-lives durational vector for each issue age band and found that implementing such granularity in the mortality assumption does not have a material impact on the financial results in aggregate.

LOOKING FORWARD

In our quest for the ultimate mortality, we found an approach to developing an all-lives mortality assumption that takes advantage of certain first principle concepts for companies that have not yet made the transition to a first principles model.

Considering the average issue age, and how the mix of active versus disabled deaths changes as the block ages, can materially affect the ultimate mortality level and length of the selection period. The ultimate mortality may be set too low if based on experience that does not capture the ultimate proportion of disabled deaths. On the other hand, it may be set too early if based on the experience of an older issue age block. Revising the mortality assumption to consider the average issue age of the block and projected mix of deaths may have a positive (if otherwise set too low) or negative (if otherwise set to early) financial impact.

Traditional studies might also consider introducing issue age bands as another variable beyond policy duration (and possibly gender), if credible experience is available at this more granular level. Using an all-lives assumption that does not vary by issue age may result in mortality that is too high or too low for projections of a subset of the block with a different average issue age.

The vectors used in this analysis are based on the experience of one company relative to 94GAM. Underlying a standard table is a mix of active versus disabled lives by attained age. To the extent that different experience or underlying standard mortality table is used in developing a mortality assumption, these implications may vary or not be applicable. Using a standard table that better captures the "correct" underlying mix could result in a shorter selection period from that shown in this illustrative analysis. It may be fruitful to test different standard tables. This is especially true in a traditional study or when company experience is limited and more reliant on the mix underlying the standard table. Performing a traditional study by attained age to adjust the standard table to better reflect the correct underlying mix, and then developing adjustments by policy duration, may also shorten the selection period.

While we pursued a new look into mortality assumption development in this article, our quest is not yet over. The implications for considering changes in mix between active and disabled lives as the block ages extends to an all-lives lapse assumption as well. Benefit expiry may be embedded in an all-lives lapse assumption for policies with non-lifetime benefits. For younger attained ages, there will be relatively few benefit expiries, but they will grow as the block ages. Our quest for the ultimate continues as we explore the impact on the all-lives lapse assumption. ■

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