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## Society of Actuaries

**AAA/SOA Review of the Interim Mortality Tables Developed by Tillinghast and Proposed for Use  
by the ACLI from the Joint American Academy of Actuaries/Society of Actuaries Review Team**

**Presented to the National Association of Insurance Commissioners'  
Life and Health Actuarial Task Force**

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## EXECUTIVE SUMMARY

The tables recommended in the American Council of Life Insurers (ACLI) Proposal constitute a reasonable split of the 2001 CSO Mortality Table into preferred risk and residual classes. The method and assumptions used to develop the tables conform to actuarial principles and practices. It would not be unreasonable to adopt these tables as an interim valuation standard provided that associated regulatory and professional practice issues are adequately addressed.

The methodology used to split the tables is the same as that used to develop the 1980 CSO Smoker/Nonsmoker tables and the margins in the split mortality tables are calculated using the same methodology as in the 2001 CSO Mortality Table. This will result in the same formula margins as are included in the 2001 CSO Mortality Table. Margins were not increased or decreased for any of the split tables.

Our opinion is primarily based on the method used and the assumptions employed. We did not evaluate the resulting reserves that would develop from using these tables, nor the implications for “non-valuation” purposes such as nonforfeiture. We also considered data utilized, appropriateness of calculations, recent developments, the framework of the tables, the correlation of tables to underwriting practices, development of levels and slopes of tables, appropriateness of assumptions utilized to produce the tables, and other items we deemed appropriate.

We understand an actuarial guideline is being developed to address the appropriate usage of these tables. Therefore, our review did not include numerous regulatory and professional practice issues that would need to be considered before a recommendation could be made as to adoption of the tables.

In determining proper mortality tables for use in valuing its policies, each company must consider its own particular underwriting criteria and mortality for each class of policyholder on which the valuation is performed as well as distinctions due to mix of business, issue age, gender, product type and face amount.

It is intended that readers of this report should read it in its entirety before using any of the conclusions or findings contained herein.

### *Acknowledgements*

We wish to thank the ACLI and Tillinghast for their assistance. They provided an overview of their work and written answers to our extensive questions.

We thank Larry Gorski and Dave Sandberg who stepped in as representatives of the American Academy of Actuaries (AAA) and supported our efforts to complete this report in a proper and timely manner.

We also thank the Society of Actuaries (SOA) for providing staff support and in particular Jack Luff for verifying the reasonableness and accuracy of the SOA data sources cited in the ACLI report.

## CHARGE FROM THE NAIC

LHATF respectfully requests that the SOA and AAA, working in concert:

1. Evaluate the ACLI Interim Tables in terms of applicability of generally accepted actuarial principles, practices and procedures;
2. Develop comments and recommendations regarding these tables;
3. Consider the following items:
  - A. Data utilized,
  - B. Appropriateness of calculations,
  - C. Recent developments,
  - D. Framework of tables,
  - E. Correlation of tables to underwriting practices,
  - F. Development of levels and slopes of tables,
  - G. Appropriateness of assumptions utilized to produce tables; and
  - H. Other items deemed appropriate by the SOA or AAA.
4. Endorse the tables – with modifications, if necessary – as a reasonable basis for statutory reserves relative to the current 2001 CSO mortality table, if appropriate.

## SUMMARY OF CONSIDERATIONS

### ▪ *Background*

The ACLI has proposed to the Life and Health Actuarial Task Force (LHATF) of the National Association of Insurance Commissioners (NAIC) a set of interim mortality tables (ACLI Interim Tables) to be used as an optional, alternative basis of mortality to determine minimum reserve liabilities for life insurance. The ACLI Interim Tables were developed for the ACLI by the Tillinghast business of Towers Perrin (Tillinghast).

The ACLI Interim Tables consist of three non-smoker tables and two smoker tables. The three non-smoker tables are super preferred (SP-NS or best nonsmoker class), preferred (P-NS or second best nonsmoker class) and residual standard (RS-NS); the two smoker tables are preferred (P-SM) and residual standard (RS-SM). Like the 2001 CSO, the tables are in Select/Ultimate and Ultimate form for both male and female lives. Tillinghast first developed the set of five separate tables (ACLI Basic Tables) from the 2001 Valuation Basic Tables (2001 VBT) and then loaded them using the same loading formula used to develop the 2001 CSO Tables. The method used to develop The ACLI Basic Tables was similar to the method used to develop the 1980 CSO Smoker/Nonsmoker Mortality Tables. The method requires that assumptions be made about the prevalence of each class, the relative mortality of each class, and the persistence of preferred mortality differentials. It should be noted that these assumptions are not directly based on the underlying experience of the 2001 CSO as there was no 2001 CSO data on which to base these assumptions.

An assumption was made about the prevalence and relative mortality of each class in order to split the 2001 VBT into the new classes. The prevalence used for the non-smokers was 15% super preferred, 15% preferred and 70% residual; for the smokers this was 30% preferred and 70% residual. This enabled the development of separate mortality for each class within the ACLI Interim Basic Tables. To summarize, the critical factors included in the assumptions used to split the table were:

1. the number and prevalence of each of the underwriting classes used when splitting the 2001 CSO VBT
2. the level of mortality in each of the classes at issue
3. the persistence of preferred mortality differentials anticipated in the table as the business ages.

The residual classes of the ACLI Basic Tables were developed by using equations that ensure that the total deaths at each age and duration in the ACLI Basic Table are the same as the total deaths for that cell in the 2001 VBT. This assumes that there is no change in overall mortality and that the creation of higher mortality for residuals and lower mortality for preferred insureds does not change the mix of business in the combined table. This was the same process used for the smoker/nonsmoker split of the 1980 table.

In support of the preferred product valuation efforts, the Society of Actuaries has expanded its Individual Life Experience Study to collect and study data on the "risk class rank" of preferred products. In addition, data on the underwriting criteria for preferred products is being collected and associated with the corresponding experience data. At this time (mid-August 2006), no results are available from this effort. Preliminary results may be available for the September 2006 LHATF meeting. However, anecdotal evidence indicates that the aggregate level of mortality on the current lowest premium preferred products is noticeably less than that of the ACLI super-preferred non-smoker table.

### ▪ *Review Steps*

In determining the appropriateness of the data and assumptions utilized by Tillinghast to develop the ACLI Interim Tables, we reviewed the following:

- The studies referenced in the Tillinghast documentation, including the Society of Actuaries individual life experience studies from 1990-95 and 1996-2001, the Society of Actuaries Preferred Underwriting Survey Reports from 1995<sup>1</sup> (1995 Survey), 1997 (1997 Survey) and 2002 (2002 Survey), and the Tillinghast Old Age Mortality Study (TOAMS);
- The application of the data used from the studies;
- The calculations and formulae used; and
- The approach/calculations for relating the SOA 1975-80 Basic Select & Ultimate tables to the 2001 VBT table.

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<sup>1</sup> In the ACLI document there is a reference to the "1994 SOA preferred risk survey" and this is also listed as a reliance item. There was no official SOA survey in 1994. The reviewers interpreted this to actually be the 1995 Preferred Underwriting Survey Report, which was published in May 1996.

We verified the studies referenced in the Tillinghast documentation and are satisfied that they were accurately retrieved, were appropriate and were applied reasonably.

We intended to test the residual nonsmoker mortality in the ACLI Proposal for reasonableness by comparing it to the expectations reported by participants in the above referenced surveys, but even the surveys do not tie back to actual, realized mortality. Therefore we concluded this test was not material.

We conclude the ACLI Interim Tables were developed in a manner utilizing generally accepted actuarial principles, practices and procedures and, when used with proper consideration of the limitations discussed in the remainder of this report, could be appropriate as interim tables for valuation purposes. We also conclude they maintain consistency with the 2001 Commissioners Standard Ordinary Tables (2001 CSO). The remainder of this report provides further analysis and insight into the construction of the mortality tables and the limitations that will need to be kept in mind when decisions are made about the usage of the tables.

## REVIEW AND DISCUSSION

### ▪ *General Points*

Tillinghast used the 1990-95 experience study to form the equivalence for aggregate mortality between the 1975-80 basic mortality table and the 2001 VBT. This means a rate of X% of the 1975-80 table is equivalent to Y% of the 2001 VBT. The procedure used to equate the tables involved weighting durational experience by expected deaths from the 1990-95 SOA experience study and issue age by typical term insurance sales distribution. Details of the term insurance sales distribution were not provided in the Tillinghast documentation, so we could not replicate the calculation. However, mortality results fit reasonably with the older age TOAMS results.

The early duration results of the 1990-95 SOA experience study are compared with those of the 1996-2001 SOA experience. A high rate of improvement in lower age mortality rates was observed. The ACLI assumed this improvement was primarily the result of an increase in the prevalence of preferred risks. In light of the lower premium rates on preferred business relative to the residual standard business, we believe this is reasonable. However, some improvement will be due to general improvement in population mortality.

The development of the prevalence of preferred risk assumptions applicable to the 1990-95 study is reasonable. The difference in prevalence rates between durations 1- 6 and duration 7+ appears to be consistent with the development of medical testing for underwriting purposes in the later 1980s. Our group did not test the impact of different prevalence levels on the mortality tables.

The derived mortality rate results of the assumed preferred risk distribution in the ACLI Basic Tables were compared with the early duration term experience of the 1996-2001 study and the results were consistent. The assumed preferred risk distribution is reasonable, even though alternative distributions were not tested.

The analysis done in determining the level of preferred risk mortality focused on term business, as the 2002 Survey data was for a 10-year level term product. Term business tends to be issued with much larger face amounts than permanent business. The level of preferred underwriting may be different for smaller face amount permanent business. As always, when using these tables for valuation, the actuary will need to consider applicability for either term or permanent business, and/or to larger or smaller face amounts.

The following subsections detail the considerations and limitations identified in our review that will need to be understood for the appropriate usage of the tables. They include:

1. the number and selection of preferred tables
2. the prevalence rates for the various risk classes
3. the level of mortality assigned to the preferred classes
4. the durational wear-off of the preferred underwriting
5. additional considerations regarding the approach and the resulting tables proposed.

### ▪ *Prevalence Rates – Tillinghast Analysis*

The experience data underlying the development of the 2001 VBT Non-smoker table was primarily based on the data from the Society of Actuaries 1990-95 experience study. In that study, there were no explicit risk classification criteria that could be used to determine the prevalence of preferred risks versus standard risks. The Tillinghast documentation

states, however "... there is evidence that the prevalence of preferred risk in the insurance industry has changed over time. Specifically, overall mortality in the SOA's experience studies has improved at a much faster rate at early select durations than in the general population." The documentation gives an example that from the SOA 1996-2001 experience study for durations 1-5, term mortality was 77% of the 2001 VBT and that this represented a 4.3% annual improvement in mortality from 100% of 2001 VBT over the central year of the 2001 VBT experience. The documentation concludes that based on this example, it is not unreasonable to expect that the majority of improvement in ratios are due to an increased prevalence of preferred risks.

In order to estimate the prevalence of preferred risk in the 1990-95 experience study, Tillinghast focused on an analysis of mortality experience by underwriting method (medical/paramedical/non-medical underwriting). There were four assumptions made:

1. Policies underwritten on a non-medical basis would exhibit mortality, in aggregate, equivalent to residual standard mortality.
2. Experience from durations 1 to 6, for policies underwritten on a medical/paramedical basis, would be 50% preferred risks and 50% residual standard risks. This assumption was based on the risk class prevalence reported in the 1995 Survey.
3. Experience from durations 7 to 15, for policies underwritten on a medical/paramedical basis, would be 25% preferred risks and 75% residual standard risks. The assumption for durations 7 to 15 appears to be a best guess and is lower than in durations 1 to 6 due to less blood testing in the later select duration business in the 1990-95 experience.
4. The prevalence rate of preferred vs. non-preferred is level throughout the table (does not vary by age or gender).

Based on the above assumptions and the analysis of mortality experience by underwriting method, the conclusion reached by Tillinghast was that in aggregate, the overall prevalence rate of preferred risks in the 1990-95 experience study is 30% and that the overall prevalence rate of residual standard risks is 70%.

#### ■ *Prevalence Rates – Observations*

One of the assumptions made by Tillinghast is that policies written on a non-medical basis would exhibit mortality, in aggregate, equivalent to residual standard mortality. This is an assumption based on professional judgment. While not an inappropriate assumption, if one were to take a cohort of lives and strip out the super preferred and preferred risks, leaving a residual standard risk class, such risk class might exhibit mortality higher than the non-medical risk class which consists of the same cohort of lives without splitting out the super preferred and preferred risks.

In estimating the prevalence of preferred risks, the aggregate medical/non-medical mortality was split by Tillinghast between durations 1-6 and durations 7-15 and different assumptions as to the prevalence of preferred risks in each group were made. Again, different results might have been derived from dividing the groups between durations 1-3 and 4-15 and/or assuming 60% preferred in durations 1-3 and 10% preferred in durations 4-15.

There is no clear demarcation between a preferred risk and a residual standard risk. Preferred risks are assumed not to exist in non-medical experience data. Preferred risks and residual standard risks are assumed to be equally distributed in medical/paramedical experience data for policy durations 1-6. In medical/paramedical experience data for policy durations 7-15, it is assumed that 1 out of 4 risks are preferred while 3 out of 4 risks are residual standard.

Since the data in the Society of Actuaries 1990-95 experience study was collected on a basis that did not define or differentiate preferred risk classes, the data in and of itself does not present any way to estimate the prevalence of preferred risk classes. As stated previously, Tillinghast made assumptions to estimate the prevalence of preferred risks within the experience data. The assumptions resulted in a preferred risk prevalence rate of 30% and a residual standard prevalence rate of 70%.

The Tillinghast documentation referenced the 2002 Survey in determining prevalence rates for the amount of preferred risk in the underlying 2001 VBT. In the 2002 Survey, the 3 non-tobacco, 2 tobacco risk class structure was the most prevalent among the participants in the survey. The majority of respondents in the 2002 Survey had 3 or more non-tobacco classes (26% used a 4 or 5 class structure) and approximately 60% had at least 2 tobacco classes so the choice of the number of classes at first appears reasonable. However, the underlying mortality experience in the 2001 VBT table is the SOA 1990-1995 inter-company mortality experience. The 1995 Survey correlates better to the underlying mortality data. In this survey and in the 1997 Survey, the most prevalent risk class structure was a 2 non-tobacco, 1 tobacco class system and, in the 1995 Survey, only 6% of the participants had 3 or more non-tobacco classes. The Tillinghast split is more consistent with risk class structures used today and is not necessarily consistent with those most

likely in use and reflected in the underlying mortality experience to the 2001 CSO VBT. In our professional opinion, this was not an inappropriate approach for representing interim preferred mortality.

The prevalence assumptions for the various risk classes used by Tillinghast do appear to be consistent with the practices at the time of the underlying experience with 50% in the early durations falling into the preferred class – this is consistent with the prevalence reported in the 1995 Survey although actual qualifications ranged from 7% to 96%. The assumption of an even split of the resulting preferred class into a super preferred and preferred class is fairly consistent with current practices (as in the 2002 Survey); however, the resulting 15% super preferred classification may be low, even more so by today's standard. This may result in a more aggressive discount to the mortality for the residual standard than what would have developed with a prevalence assumption more consistent with qualification assumptions typical of a 3 non-tobacco class system today. As a point of reference, respondents to the 2002 Survey generally designed their best non-tobacco class to qualify 30% of the applicants, even those with 4 or more non-tobacco classes. Secondly, all surveys indicate that most carriers that participated cut off preferred issuance above either age 70 or 75 whereas the ACLI interim tables reflect preferred discounts at most issue ages.

Tillinghast also assumed a constant prevalence rate for the respective classes across ages, gender, and smoking status. While this may be consistent with the *pricing* approach many companies used in the respective surveys, it may not necessarily be consistent with current conditions. More companies are beginning to assume a difference in prevalence for pricing. In the 2002 Survey, about 1/3 of the respondents varied their prevalence rate either by issue age, gender or both. A flat, consistent assumption across ages and genders is questionable. Following what companies have used for pricing does not necessarily provide a reasonable basis for setting the experience mortality assumption.

For example, in looking at data available today for prevalence of various cardiovascular indicators (e.g., The Framingham Study, lab data, etc.), expected qualification percentages for common "best class" selection criteria will show a higher prevalence rate for younger insureds and female risks than for older insureds and male risks. At younger ages, the differential in the prevalence rates between males and females could be an additional 5% to 10% higher for super preferred (i.e., the real prevalence is 20% or 25% for females, not 15%). In addition the differential in prevalence rates also occurs between younger ages such as 25 versus older issue ages, such as 65, in a similar fashion, although perhaps with a more pronounced differential such as a 20% differential in prevalence. However, this emerging recent experience is not available at the time of this report to more fully determine if the prevalence assumption is not appropriate.

The prevalence rate is just an assumption used to split the tables and set the respective mortality. The impact of using a level prevalence rate assumption across issue ages and gender could be a mortality discount from the base table that may be too high at the younger ages, which results in mortality rates that may be too low for this subset of the class. Likewise, for the older issue ages, the approach could result in a mortality discount from the base table that may be too low, resulting in mortality rates that may be too high for the subset. In other words, the Tillinghast split assumed 15% will have mortality that is, for example, 80% of the base table. However, at younger ages, 25% could have mortality that is 90% of the base table and at older ages only 5% may have mortality that is 70% of the base table. In aggregate, the resulting mortality may be reasonable; however, the fit may break down at a more finite level, such as by issue age and gender.

In summary, the prevalence assumption is reasonable and using the prevalence rate assumptions made by Tillinghast, the ACLI Interim tables consolidate to the aggregate table. However, this will only happen for individual companies to the extent their distribution of business is the same as that assumed in the Tillinghast work. This may provide disconnects between the new valuation table and certain market segments and may put pressure on the market to innovate and create products to exploit these disconnects. The longer the ACLI Interim tables are used (i.e., the more business covered by the ACLI Interim tables), the higher the financial impact of these disconnects.

▪ *Level of Preferred Mortality – Tillinghast Analysis*

To estimate the level of preferred mortality, two studies were utilized. The Tillinghast Old Age Mortality Study (TOAMS) was the first study. Its mortality experience examined was from 2000-2002 and consisted of all preferred non-smoker risks at attained ages 50 and over for face amounts above \$100,000, excluding all non-medical experience. The second study examined was the 2002 Survey released in 2005, which provides information regarding levels of preferred risk pricing mortality under various preferred risk class systems. The data from this Survey that were examined were based on a 3 non-tobacco class system.

From TOAMS, mortality in aggregate for policy durations 1 to 15 was 63% of the 2001 non-smoker VBT. Mortality ratios were relatively level by issue age bands and policy duration bands up to issue ages 70 to 74. For issue ages 75 and

higher an increase in mortality ratios by policy durations was noted. There is not any conclusive evidence as to why this occurs. One theory is that underwriting is effective at older issue ages, but wears off more quickly.

From the 2002 Survey, in a 3 non-tobacco class system, the median mortality experience assumption for the best preferred risk class was 28% of the SOA 1975-80 basic table; the assumption for the second best risk class was 35% of the SOA 1975-80 basic table. Tillinghast converted percentages of the 1975-80 basic table to percentages of the 2001 non-smoker VBT by weighting durational experience expected deaths from the 1990-95 SOA experience study and weighting issue age by typical term insurance sales distribution. Conservation of deaths for preferred mortality was maintained and the residual standard risk class mortality percentage of the 2001 non-smoker VBT was solved for by assuming conservation of deaths within the 2001 non-smoker VBT.

Based on the above analysis and the previously developed prevalence rates for preferred risks and residual standard risks, Tillinghast made the following decisions:

1. The 2001 non-smoker VBT will be split into 3 risk classes defined as SP-NS, P-NS and RS-NS.
2. The level of aggregate mortality for the preferred risk class is 60% of the 2001 non-smoker VBT. Based on data provided in the Tillinghast documentation, the preferred risk class consists of the super preferred class with aggregate mortality of 50% of the 2001 non-smoker VBT and the preferred class with aggregate mortality 70% of the 2001 non-smoker VBT.
3. Based on Tillinghast judgment, the preferred risk class prevalence rate of 30% is divided evenly between super preferred risks and preferred risks. Our judgment is that this is a reasonable assumption.
4. By assuming conservation of deaths within the 2001 non-smoker VBT, the level of aggregate mortality for the residual standard risk class is 117.143% of the 2001 non-smoker VBT. This is not an unreasonable result, though even if the result were greatly different it would be hard to draw a meaningful conclusion since the 2001 S/NS splits were based estimates as well - not underlying experience.

▪ *Level of Preferred Mortality – Observations*

A concern with using the 2002 Survey data to set the level of expected preferred mortality arises from the fact that mortality assumptions reported by the respondents to the Survey were based only on pricing mortality and not necessarily actual experience and were only reported for select durations (1, 3, 6, and 10). It appears the Tillinghast mortality assumptions used from the Survey were the median reported amounts for issue age 45. It is true that there was not considerable variation in assumptions indicated in the 2002 Survey by age. There was, however, a fairly wide range of expected mortality levels by company. Because the data in the 2002 Survey is based on pricing assumptions, they may not be reasonable or representative of actual experience at the time of the underlying table. For example, one respondent reported a mortality assumption of 5% of the SOA 1978-80 Basic Male ANB Table as the mortality assumption for their best non-tobacco class at age 45, and this assumption was held constant across all durations reported. This is clearly not representative of the underlying experience in the table. Additionally, similar pricing mortality information was reported in the 1995 Survey, where expected mortality for the preferred risk class was significantly greater than that reported in the 2002 Survey.

The ACLI Interim Table uses pricing mortality assumptions that may or may not be based on credible experience and which may incorporate mortality improvements as the basis for the mortality experience assumption in the underlying table. This is a key issue to understand when applying the ACLI Interim table in actual usage for a specific company. While in the 2002 Survey, 52% reported that their actual experience was the same or better than their assumption, 44% reported it was too early to tell or worse than expected. Unfortunately, there really isn't any other source of credible preferred mortality experience for the underlying data in the 2001 VBT to reference. This has the potential to provide too much of a mortality discount to the preferred classes in the ACLI Interim Table. However, this would be offset by a higher mortality assumption for the residual classes, since overall they balance back to the 2001 VBT. Whether this is a material issue depends upon the usage requirements in place for companies to select the various tables. However, in aggregate, the resulting mortality levels appear reasonable.

In summary, there are likely two reasons for improved mortality in the later experience – better underwriting and overall improvements in all mortality. It is not clear how the ACLI Interim Table is applying later mortality improvements to the retrospective split of the 2001 table.

▪ *Wear-off of Preferred Mortality – Tillinghast Analysis*

The Tillinghast documentation cites evidence from four medical studies that the adverse impact of impairment persists for many years and, that if selected out through preferred risk classifications, the preferred risk class mortality will persist for many years. The studies cited are:

1. 1952-76 study of the effects of alcohol abuse which shows mortality ratios (calculated against the 1965-70 basic table) remain relatively constant by duration
2. Framingham study on cholesterol showed that for males with a cholesterol level of 270 or higher, the mortality ration in durations 1-12 was 150% and in durations 13+ was 140%.
3. Insureds whose policies were issued between 1935 and 1950 showed that extra mortality for abnormalities in urine and high blood pressure persists well into durations 10-15 and increases with duration.
4. A 20-year study of diabetes showed that the impact of diabetes continued well into durations 15-20.

Based on the above, the ACLI concludes that the preferred risk mortality differentials persist as follows:

1. For issue ages below 25 the full preferred differential persists to attained age 49.
2. For issues ages 25-69 the full differential remains level for the first 16 policy years.
3. For issue ages 70 and above, the full differential remains level for less than 16 years after issue.

▪ *Wear-off of Preferred Mortality – Observations*

The TOAMS study was used as evidence for the persistence of preferred risk for at least 15 years – there was no experience thereafter and the referenced studies were used to guide the development of the table after duration 15. However, the studies cited are quite old and may not reflect the effects of new drugs that have been developed to control blood pressure, cholesterol and diabetes. These drugs could delay the wearing off of preferred mortality even more than assumed, and thus cause still lower later duration mortality rates. Additionally, while these studies support the persistence of preferred risk mortality associated with the primary cardiovascular factors, such as blood pressure and cholesterol as well as diabetes and alcohol abuse, they do not provide evidence of preferred mortality persistence for other factors such as family history or motor vehicle records, which may be more applicable for younger aged insureds.

For issue ages 69 and under, the assumption was that the full differential is expected to remain in effect for at least 16 years after issue. This assumption does not seem to be based on any underlying experience or hard evidence relating directly to the 1990-95 experience data. The rate to which the full differential grades, after it remains in full effect for at least 16 years, is also not supported by any underlying experience or hard evidence. As a result, the grading assumption is just an assumption. However, it appears, as of today, reasonable to believe that, based on the evidence from the limited studies available, the assumption is likely to be conservative, in that it assumes the persistence wears off faster than may be occurring due to newer medical developments and drugs available, especially for the primary cardiovascular factors.

## CONCLUSION

The documentation for the development of these ACLI Interim Mortality Tables often referred to pricing information reported by the industry for guidance in establishing mortality cells. In determining proper mortality tables for use in valuing its policies, each company must consider its own particular underwriting criteria and mortality for each class of policyholder on which the valuation is performed as well as distinctions due to mix of business, issue age, gender, product type and face amount.

The tables were reviewed from the perspective that the proposed ACLI Interim Tables would be used on an interim basis until such time as a longer term solution is provided. A comprehensive study of underwriting guidelines and resulting experience is currently being conducted by the SOA for this purpose. We did not define a specific timeframe for use of this table but did not envision an unrestricted timeframe for its use. The longer the ACLI Interim Table is in use, the greater will be the differences between the general assumptions used to derive these tables and actual experience.

In theory, Tillinghast could have chosen any number of mortality tables and associated prevalence rates as long as the mortality assumptions were consistent with the prevalence chosen. The set of split tables developed is one of many reasonable sets that might have been developed.

In practice, two other conditions should be met as a basis for the number of splits to make in the 2001 CST VBT.

- The choice of classes should be useful. That is, it should correspond to the risk classes currently or potentially in use.
- Second, and most important from an actuarial point of view, to make a reasonable choice of mortality assumptions, each company needs to be able to map its anticipated mortality to the mortality level in the tables.

## Summary of Limitations

The following considerations need to be remembered when a company selects a table for its use. They stem from the key assumptions used in the construction of the ACLI Interim Tables.

1. 2001 CSO VBT data was based on mostly permanent insurance. The 2002 survey used to set the ACLI Interim Table preferred level focused on term insurance above \$100,000 face amount.
2. Prevalence
  - a. Tillinghast assumed that policies written on a non-medical basis would exhibit mortality, in aggregate, equivalent to residual standard mortality.
    - *Possible implication* – the actual non-medical mortality would probably be less than the residual standard mortality assumption. Therefore, the ACLI Table may (but certainly not necessarily), understate the actual realized mortality for the residual standard class.
  - b. Tillinghast's use of 3 nonsmoker tables is a "bridge" from the underwriting practices most commonly in place for the underlying experience in the 2001 VBT and CSO to current risk classification practices. It does not fully reflect either, but is a reasonable approach.
  - c. Tillinghast did not vary the prevalence assumption by issue age or gender, when emerging experience suggests that can be significant variation by both.
    - *Possible implication* – while the resulting mortality tables are reasonable in aggregate, the fit breaks down at a more finite level, such as issue age and gender. Therefore, the mortality may be understated for younger insureds or female risks and overstated for older insureds and male risks for the super preferred and preferred risk classes.
  - d. On average, many companies qualify and issue more than 15% of risks in their super preferred category, which was the assumption in the Tillinghast table
    - *Possible implication* – The mortality discount for the super preferred class in the ACLI Table may be overstated or, more likely, the mortality rates for the residual standard class may be understated, as the mortality rate assumption for the super preferred class was based on industry data and not a true discounting approach.
  - e. Most carriers cut off preferred issuance at older issue ages, typically above 70 or 75, whereas the ACLI Tables assume a preferred discount at most issue ages.
    - *Possible implication* – The ACLI Table, for these older issue ages, may understate the realized mortality in the preferred risks and overstate the realized mortality for the residual standard class.
  - f. Early results from the new SOA preferred mortality study indicate that realized mortality will likely be better than the proposed ACLI table mortality for younger females and worse than the proposed ACLI table mortality at higher ages. However, we cannot currently estimate the amount of potential impact. This also is a reminder that the next step in mortality studies will allow greater discrimination in the application of insurer mortality
3. Level of Preferred Mortality
  - a. While the ACLI Interim table ties back to the aggregate 2001 VBT, there are wide ranges of mortality by company.
  - b. In addition, Tillinghast used survey data based on pricing assumptions to set the level of preferred mortality. This data may include assumed mortality improvements and may not be adjusted for credibility.
    - *Possible implication* - This may mean that the ACLI Interim table mortality rates for preferred classes are lower than they were actually intended to be, since they were based off pricing assumptions and may include future expected mortality improvements.
4. Wear Off of Preferred Mortality
  - a. The studies used to project the wear off of preferred mortality are quite old and only reflect experience for a portion of common preferred risk factors.
    - *Possible implication* – The impact of new drugs and medical treatments, especially those impacting cardiovascular factors, are not reflected in these studies and may prolong the persistence of preferred mortality. This may imply the ACLI Interim table overstates the expected mortality rates for the later durations for the preferred mortality tables and understates the mortality in the later durations for the residual standard tables.

On balance, based on the above analysis and observations, we believe that the methods and assumptions used in deriving the ACLI Interim Table are reasonable. The methodology and resulting tables produce a reasonable aggregate split of the 2001 CSO into the three non-tobacco and two tobacco classes for use on an interim basis, keeping in mind the above background and summary of limitations.