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Final Report of the American Academy of Actuaries' Commissioners' Standard Ordinary Task Force

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Executive Summary

At the request of the National Association of Insurance Commissioners (NAIC), the Society of Actuaries (SOA) and the American Academy of Actuaries (Academy) have worked together to produce a proposal for a new Commissioners Standard Ordinary Mortality (CSO) Table for use in the current statutory valuation system. The Academy's Life Practice Council believes that a move to a valuation system that provides more actuarial flexibility and responsibility to set reserves that reflect individual company characteristics is desirable, however, the practice council recognized that a new table was necessary under the current statutory system.

The Academy has worked with both the SOA and the NAIC's Life and Health Actuarial Task Force (LHATF) in developing the 2001 CSO Table. The SOA was responsible for developing the 2001 Valuation Basic Table (2001 VBT), an underlying basic table, that both represented current experience and was smooth enough to be the basis for a valuation table. The LHATF provided guidance and direction to the Academy in its assessment of the 2001 VBT and in the creation of the 2001 CSO Table.

The 2001 VBT was developed in the following manner. It is based on the 1990-1995 Basic Table that was developed by the SOA's Individual Experience Studies Committee (SOA Committee). The 1990-1995 Basic Table is based on the mortality experience collected annually by the SOA over the years 1990-1995 for companies that participated in the study. Additional data from other sources was used to supplement the 1990-1995 Basic Table at young and old ages where the experience data was sparse. The mortality was projected to the year 2001 using recent mortality improvement trends. Finally, the 1990-1995 Basic Table was graduated to provide the smoothness necessary for a valuation table.

The Academy's CSO Task Force (Academy Task Force) recommended possible courses of action to LHATF, developed a loading formula to apply to the 2001 VBT that met the overall level of loading established by the LHATF, and evaluated the appropriateness of the loads. The use of terms such as "load," "loaded," "loading," and "margin" in this report refer to additions to the 2001 VBT so the 2001 CSO Table will provide for some variation in mortality risk both over time and among companies.

The type of loading formula is similar to that used to develop the 1980 CSO Table. The loading is an inverse function of the curtate expectation of life, which provides an absolute loading that increases as age increases and a percentage loading that generally decreases with age. At the instruction of the LHATF, the parameters were established to provide an overall 15 percent load.

The 2001 CSO Table was then examined for consistency by the Academy Task Force. Sample reserve values were calculated using select and ultimate as well as ultimate mortality, and these were examined for appropriate relationships.

The 2001 CSO Table is based on recent mortality experience and is intended to provide a minimum standard for the valuation of standard ordinary life insurance. However, this standard may not produce adequate reserves in all cases. For example, those companies with limited underwriting - simplified issue, guaranteed issue, or simply less intensity than is the norm for the business - may find that the 2001 CSO Table does not provide adequate reserves. The 2001 CSO Table is based, both in the development of the level of mortality and in the testing of loads, primarily on experience from companies contributing data to the SOA. It should also be noted that the 1990-95 SOA experience was concentrated in a relatively small number of companies. As such, an individual company may have mortality that is materially different from the 2001 CSO Table.

The Academy Task Force recommends that the 2001 CSO Table be adopted for use as a statutory valuation table to replace the 1980 CSO Table under the current valuation structure. The new table is consistent with current available experience and will result in reserves (excluding deficiency reserves) that overall are approximately 20 percent lower than those produced by the 1980 CSO Table.

Introduction

The current statutory valuation standard, the 1980 CSO Table, is more than 20 years old. As is shown in this report, current mortality levels, represented by the 2001 Valuation Basic Table, are lower than the mortality levels underlying the 1980 CSO Table. The current valuation mortality standard produces reserves, excluding deficiency reserves, that overall are higher for the illustrated model office than those produced by the 2001 CSO Table.

At the request of the LHATF, both the SOA and the Academy have worked to develop a mortality table intended to replace the 1980 CSO Table in the current statutory valuation structure. While the Academy's Life Practice Council believes that a move to a valuation system that provides more actuarial flexibility and responsibility to set reserves that reflect individual company characteristics is desirable, we recognize that a new table is appropriate.

The SOA and the Academy divided this work into two pieces: the construction of a valuation basic experience table, and the development of an appropriately loaded valuation table. The first part of this work was completed by the SOA's Individual Life Insurance Valuation Mortality Research Task Force (SOA Task Force). This group developed the 2001 VBT, a graduated experience table suitable for use as the basis for a valuation table. The second part was done by the Academy Task Force, which, with guidance and direction from the LHATF, developed the loads and reviewed the resulting reserves described in this report.

These two groups have developed the 2001 CSO Table -- a table that is appropriate as a replacement for the 1980 CSO Table. This 2001 CSO Table is shown in Appendix A. Separate nonsmoker, smoker, and composite nonsmoker/smoker tables were developed for males and females for a total of six tables. Each table has values for a 25-year select period and for ultimate ages.

The 2001 CSO Table is intended to provide a minimum standard for the valuation of standard ordinary life insurance. However, this standard may not produce adequate reserves in all cases. In addition, since the table is intended only for valuation, the use of this table may not be appropriate for pricing or for other pricing related purposes.

These tables were constructed to be used with standard ordinary business. The experience submitted by the companies in the SOA study is based on the companies' representation that the business has been underwritten in a manner consistent with standard ordinary business. The SOA instructions concerning the classification of business are the same as those used in gathering data for the 1980 CSO Table. This is detailed in the VBT Report of the SOA in Appendix K. The data from which the table was constructed did not include simplified issues business or guaranteed issue business. As a result, the table may not be appropriate for these types of business. This report describes the work performed by the SOA and Academy Task Forces in developing this 2001 CSO Table. Additional details, various results of the table, and the testing of that table can be found in the appendices.

Since the 2001 CSO Table is intended only for valuation, the use of this table may not be appropriate for pricing or other pricing related purposes. The Academy's CSO Implications Work Group is exploring other implications of adoption of the 2001 CSO Table. This group is charged with the analysis and review of the 2001 CSO Table's affect on nonforfeiture values for variable universal life (VUL), universal life (UL), whole life, and term product lines. The group is also charged with the analysis and review of the 2001 CSO Table's affect on the ability of a policyholder to reasonably fund a VUL product.

The Academy Task Force would like to recognize and thank those members of the SOA who developed the 2001 VBT:

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In addition, the Academy Task Force would like to thank the following organizations for providing data used in the development of the 2001 CSO Table:

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LIMRA International
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The Academy Task Force also would like to thank the following individuals who peer reviewed this report:

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Construction of the 2001 Valuation Basic Table

The SOA Task Force created the 2001 VBT as a first step toward development of a mortality table to replace the 1980 CSO Table. In constructing the 2001 VBT, the following basic premises were set by the SOA Task Force:

- Utilize the SOA 1990-95 experience study as the primary source of experience. This is United States business.
- Develop six separate age nearest birthday VBT: nonsmoker male, smoker male, composite nonsmoker/smoker male, nonsmoker female, smoker female, and composite nonsmoker/smoker female.
- Supplement the SOA experience with experience from other sources where the SOA experience was limited or not available. Mortality experience above issue age 75 and attained age 90 were specifically noted as areas where experience should be supplemented.
- Consider such issues as preferred risk underwriting, the impact of Acquired Immune Deficiency Syndrome (AIDS) and mortality improvement in the construction of the VBT.

The SOA Task Force published a draft of the 2001 VBT in March 2001 and the Academy Task Force used this table in its initial development of the 2001 CSO Table. The SOA Task Force later released its final report, including final mortality tables. This report is attached as Appendix K. The reader of the Academy report needs to be familiar with the SOA report to fully understand the Academy proposal. The Academy Task Force incorporated the finalized 2001 VBT in the final testing and development of the 2001 CSO Table.

SOA 1990-95 Experience Tables

In order to fulfill its charge of reporting on insured lives mortality experience over successive five-year periods, the SOA Committee released the 1990-95 Basic Mortality Tables in April 2000. These 1990-95 Basic Mortality Tables are based on insurance company experience submitted to the SOA. The data underlying the 1990-95 Basic Mortality Tables consists of:

- Standard, ordinary, individually underwritten life insurance experience contributed by 21 companies for policy anniversaries between 1990 and 1995, nearly 60 percent of which came from four companies. This includes term conversions tracked from the original issue date as well as preferred risk policies, but excludes policies with limited or no underwriting (such as simplified issue, guaranteed issue, extended term insurance, reduced paid-up insurance).
- \$4.1 trillion of exposures for males and \$1.6 trillion for females.
- Medical (20.5 percent of duration 1-15 exposures), non-medical (42.6 percent of duration 1-15 exposures) and paramedical (36.8 percent of duration 1-15 exposures) issues combined.
- Average policy sizes of \$116,000 for male nonsmokers, \$75,000 for male smokers, \$65,000 for female nonsmokers, and \$47,000 for female smokers.

Because the SOA Committee was primarily interested in developing experience tables with a good fit to the underlying data, this experience was graduated (extrapolated for issue ages over 72) without adjustment for large claims or other features. The resulting 1990-95 Basic Mortality Tables included male composite (smoker, nonsmoker and smoking status unknown experience combined) and female composite tables in age nearest birthday and age last birthday formats.

The mortality data in the 1990-95 Basic Mortality Tables is concentrated in a few companies. As a result, an individual company may have mortality that is materially different from the 2001 CSO Table.

Male/Female Composite Tables

The first step in developing the 2001 VBT utilizing the 1990-95 Basic Mortality Tables was the creation of composite (combination of smoker, nonsmoker and those with smoking status unknown) tables for each of male and female lives. The actuarial issues the SOA Task Force considered that were relevant to the creation of these tables were:

- *Separate male and female mortality.* The SOA has been reporting experience separately for males and females for many years. Consistent with this practice, separate male and female mortality tables have been created as part of the 1990-95 Basic Mortality Tables.

- *Select period:* The 1990-95 Basic Mortality Tables were created using a 25-year select period format. However, at younger and older issue ages, the effect of selection wore off in less than 25 years. This is an observation based on the data. In these instances, mortality rates for the remainder of the select period were set equal to the ultimate mortality rates for the corresponding attained age. The select period is consistent with the SOA 1985-90 Basic Mortality Tables and reflects insured lives experience from the study period. It should be noted that the 1980 CSO Table was created with no select period, and subsequently 10-year select factors (and 19-year select factors with the adoption of Regulation XXX) were developed.
- *Smoothness:* The 1990-95 Basic Mortality Tables emphasized fit of the underlying data. However, the SOA Task Force indicated they believed that a valuation mortality table should emphasize smoothness over fit. The SOA Task Force utilized a two-dimensional Whittaker-Henderson Type B graduation method to ensure smoothness of the 2001 VBT. This graduation method is different from the Jenkins fifth-difference interpolation used in the development of the 1980 CSO Table. The Jenkins graduation worked well for the 1980 CSO Table one-dimensional graduation (ultimate mortality only), but does not work well for the 2001 VBT two-dimensional graduation (select and ultimate mortality).

Also, after application of the graduation techniques, the SOA Task Force utilized certain tests that were designed to ensure that the VBT met certain goals as described below:

1. *Duration within issue age row test:* With a few reasonable exceptions where the experience clearly justifies, such as mortality at very young ages (less than five), mortality for any given issue age should increase with duration since issue. That is,

$$q_{[x]} \leq q_{[x]+1} \leq q_{[x]+2} \leq \dots$$

2. *Issue age within column test:* With a few reasonable exceptions where the experience clearly justifies, such as mortality at very young ages (less than five), mortality for any given duration since issue should increase with issue age. That is,

$$q_{[x]+t} \leq q_{[x+1]+t} \leq q_{[x+2]+t} \leq \dots$$

3. *Attained age test:* Mortality for any given attained age should increase with duration since issue. That is,

$$q_{[x]} \leq q_{[x-1]+1} \leq q_{[x-2]+2} \leq \dots$$

- *Older and younger issue age mortality.* The 1990-95 SOA mortality experience database had no experience data above central issue age 72, limited data for attained ages over 85 and limited data for juveniles for use in the creation of the 1990-95 Basic Mortality Tables. The SOA Task Force utilized data from other sources to supplement its experience data at these ages. A special mortality study was prepared for the SOA Task Force by John M. Bragg and Associates, Inc., with results split by nonsmoker, smoker, and smoking status unknown; by male and female; and by select and ultimate periods. Male ultimate, composite mortality was also obtained from the U.S. Department of Veterans Affairs (specifically, the National Service Life Insurance program that covered millions of servicemen from World War II).
- *AIDS claims.* At later durations (durations six and later) for issue ages 20 through 30, the 1990-95 Basic Mortality Table spiked above 100 percent of the 1975-80 Basic Mortality Tables. The SOA Task Force believed that the high values at these durations were attributable to excess AIDS deaths, both identifiable and non-identifiable, and that these results overstate the impact of AIDS today.

Smoker/Nonsmoker Tables

The SOA Task Force was charged with developing a VBT that provided separate tables for smokers and nonsmokers. This is consistent with the 1980 CSO Table that has smoker distinct versions. In developing smoker/nonsmoker distinct tables, the SOA Task Force explored experience data on a smoking status distinct basis for both insured and non-insured lives. Insured experience data was obtained from several sources, including the SOA 1990-95 experience and John M. Bragg and Associates, Inc.' experience. Non-insured experience data was also obtained from various sources, including "An Assessment of US and Canadian Smoking Reduction Objectives for the Year 2000" (Pechmann, Dixon, Layne) from the American Journal of Public Health.

The preliminary composite 2001 VBT for males and females was multiplied by the nonsmoker/smoker factors and projected using the same mortality improvement assumptions as for the composite table. The resulting mortality rates were not uniformly smooth based on the tests established, and therefore a separate two-dimensional Whittaker-Henderson Type B graduation was conducted.

Mortality Improvement

In developing the VBT, the SOA Task Force explored mortality improvement in both insured and non-insured populations and recommended how the mortality experience underlying the 1990-95 Basic Mortality Tables could be projected to 2001, the projected date at which the valuation table would be released.

Mortality improvement up to the date at which the valuation table would be released was considered by the SOA Task Force because the experience underlying the table has a central year of 1992, and mortality improvement has been experienced in both insured and population mortality in recent years.

The SOA Task Force examined improvement in insured lives mortality from the 1985-90 Basic Mortality Tables to the 1990-95 Basic Mortality Tables. It also considered mortality improvement from various non-life insurance sources (general U.S. population over the period 1987-97, RP-2000 Study data, Social Security data for the period 1990-94, Federal Civil Service data for the period 1988-96, and SOA Group Annuitant Mortality for the period 1988-94). Based on these sources, the following observations were made:

- Mortality improvement has tended to be larger for males than females.
- Mortality improvement has tended to be smaller at attained ages under 45 and at attained ages above 85.
- Annual mortality improvement for males aged 55-80 is in the range of 1.0 percent for Social Security and Federal Civil Service data. Insured experience is somewhat higher.
- Annual mortality improvement for females aged 55-80 is in the range of 0.5 percent.
- In some studies, female mortality has deteriorated in recent years.

As a result, the projection of annual male mortality improvement in the 2001 VBT is 0.0 percent at attained ages 0-45, grading to 1.0 percent at attained ages 55-80, and grading back to 0.0 percent at attained ages 90+. The 2001 VBT annual female mortality improvement is 0.0 percent at attained ages 0-45, grading to 0.5 percent at attained ages 55-85, and grading back to 0.0 percent at attained ages 90+.*

* For more details, see the SOA's "Report of the Individual Life Insurance Valuation Mortality Task Force" released November 2001.

Consideration was also given to projecting mortality improvement past the projected release date of the valuation table. Although some companies may anticipate mortality improvement past the projected release date of the valuation table, life insurance mortality tables used in the current regulatory environment (Standard Valuation Law, model illustration regulation, Valuation of Life Insurance Policies Model Regulation) have not allowed the use of mortality improvement. A future event could have a significant negative or positive impact on mortality; this cannot be predicted. Therefore, no mortality improvement past the projected release date of the valuation table was utilized.

Preferred Risk

Throughout the 1990's, there has been an increased use of preferred risk classes. Preferred risk classes have been primarily used with term insurance products, however, preferred risk classes can also be found on universal life, variable universal life, and other permanent life insurance products.

The SOA Task Force considered varying the basic mortality table by preferred risk class. However, since there is no clear definition of preferred risk in the industry, no experience data has been compiled. Therefore, the SOA Task Force did not construct separate mortality tables for preferred risks.

Extended Term Insurance

The SOA Task Force also considered development of a separate table for extended term insurance (ETI). The SOA Task Force obtained information from only one company. This information indicated that there was not a material difference between ETI mortality and ordinary insured mortality. The SOA Task Force indicated in their report that they believed that the increasing prevalence of universal life and variable universal life has reduced the importance of ETI as a nonforfeiture option and therefore the amount of ETI exposures. Given the ETI experience collected and the limited amount of ETI exposures, it was determined that a separate ETI table was not warranted.

2001 Valuation Basic Table

The 2001 VBT was created by the SOA in nonsmoker, smoker, and composite nonsmoker/smoker forms for both males and females and has served as the base for the 2001 CSO Table.

Loading the 2001 Valuation Basic Table

The Academy Task Force first developed considerations that it would take into account in the development of the 2001 VBT loads. Note that terms such as "load", "loaded", "loading", and "margin" refer to the amounts added to the 2001 VBT so the 2001 CSO Table mortality will provide for variation in the mortality risk both over time and among companies.

After receiving guidance and direction as to the overall level of loads from the LHATF, the Academy Task Force developed the 2001 VBT mortality loads presented in this report. The Academy Task Force performed various analyses on the 2001 CSO Table before making its recommendation.

Loading Considerations and Tests

The Academy Task Force took the following considerations into account in the development of the 2001 CSO Table:

- Statutory reserves based on the 2001 CSO Table, using either select and ultimate mortality or ultimate mortality, should not be materially less than statutory reserves developed using the underlying 2001 VBT select and ultimate mortality. Reserve comparisons for both terminal and mean reserves use the Commissioners Reserve Valuation Method (CRVM) with current statutory interest rates and no provision for lapses.
- The 2001 CSO Table should make reasonable provision for possible adverse mortality experience.
- Terminal reserves based on the 2001 CSO Table should not be significantly distorted when compared with terminal reserves based on the 2001 VBT.
- The loading should be consistent in providing margins for males and females; for smokers, nonsmokers, and smokers and nonsmokers combined; and during the select and ultimate periods.

Loading Approach, Form and Level

Two possible loading approaches were considered – “Mortality Margin” and “Reserve Margin.”

In the “Mortality Margin” approach, the mortality load is established to ensure that the loaded table covers the mortality experience of most companies that contributed to the 1990-95 Basic Mortality Tables. This approach is consistent with one of the constraints used in the development of the 1980 CSO Table, that “loaded mortality rates should encompass the standard mortality experience ... of most companies writing ordinary insurance with normal underwriting standards.”*

In the “Reserve Margin” approach, the loaded table is established so that the reserves produced are adequate for most companies that contributed to the 1990-95 Basic Mortality Tables. This requires consideration of factors other than mortality in the determination of the loaded table. These factors may include those that are in the statutory reserve calculation (such as interest) as well as those that aren’t (such as lapse).

Preliminary work involving these two approaches was done to estimate the amount of loading needed to produce an appropriate valuation table for use in the current valuation system. Using the “Mortality Margin” approach, the goal was to produce a table that covered the mortality of about 85 percent of the companies that participated in the SOA study. The Academy Task Force discovered that an overall 20 percent load covered 17 of the 21 companies (81 percent). Using the Reserve Margin approach, the goal was to produce a reserve that was greater than the comparison reserves outlined later in this report. An overall load of 10 percent seemed appropriate for that purpose.

Additional work considered the shape of the load. In the 1980 CSO table, the load was established as an inverse function of the curtate expectation of life. Using this type of load provides an absolute load that is monotonically increasing with age and a percentage load that generally decreases with age. The Academy Task Force concluded that the continued use of this approach was appropriate for the new table.

* TSA XXXIII, page 643.

The Academy Task Force presented this preliminary information to the LHATF at its 2001 spring meeting in Nashville and asked for guidance on several key issues. After discussion, the LHATF asked the Academy Task Force to:

- use the Mortality Margin approach in determining the 2001 CSO Table,
- develop the load in the form of a function of the reciprocal of the curtate expectation of life, and
- target a load level that overall is 15 percent of the 2001 VBT.

Determination of Loading Formula

The loading formula used in the development of the 2001 CSO Table is:

$$\text{Load}_{[x]+t} = \frac{0.0056 - 0.00016 \cdot (x + t) + 0.000008 \cdot (x + t)^2}{e_{[x]+t}}$$

where $e_{[x]+t}$ is the curtate expectation of life based on the 2001 VBT.

The constant term in the numerator (+0.0056) was set to produce a 15 percent load when expressed as a percent of the VBT at age 0 for males based on the working version of the 2001 VBT available to the Academy Task Force early in 2001. (At that time, the female 2001 VBT was not complete.) Subsequent revisions to the 2001 VBT increased the male mortality rate at age 0 but had minimal effect on the load. As a result the load expressed as a percent of the VBT at age 0 was reduced to about 8 percent. Analysis of reserves indicated that this change was insignificant. As a result, the Academy Task Force decided not to revise the loading formula.

The negative term involving $x+t$ $[-0.00016 \cdot (x+t)]$ was necessary to keep the loading at appropriate levels at younger ages.

The positive term involving x^2 $[+0.000008 \cdot (x+t)^2]$ was chosen to maintain mortality margins of at least 10 percent for ages 50 and over.

The determination of the factors in the loading formula was done using composite, ultimate mortality. Since the level of the load was established at approximately 15 percent, the coefficients in the numerator of the loading formula were determined such that the expected number of extra deaths that the composite, ultimate loaded table produced over the composite, ultimate unloaded table would be 15 percent.

Grading Loads to Zero at Age 120

The loads generated by the loading formula, when added to the 2001 VBT, produce mortality rates greater than one at the very high attained ages (approximately 115 and above). To resolve this situation, the loads above age 100 were modified so that the load produced by the formula at age 100 was linearly graded to zero at age 120. The resulting mortality rates in the 2001 CSO Table equal one only at age 120 and never exceed one at any age.

2001 Valuation Basic Table and 2001 CSO Table

Appendix A contains 12 select and ultimate mortality tables – the 2001 VBT and the 2001 CSO Table; for males and females; and for composite, nonsmokers and smokers. It also contains an ultimate mortality table for both the 2001 VBT and the 2001 CSO Table.

The Academy Task Force performed consistency tests on the mortality. The following mortality relationships were desired:

- $q_{[x+1]+t} > q_{[x]+t}$, with reasonable exceptions (e.g., ages 0-5 and males in their 20's).
- $q_{[x]+t+1} > q_{[x]+t}$, with reasonable exceptions.
- $q_{[x]+t+1} > q_{[x+1]+t}$, with reasonable exceptions.
- 1st Differences: $(q_{[x]+t+2} - q_{[x]+t+1})$ generally greater than $(q_{[x+1]+t+1} - q_{[x+1]+t})$.
- 2nd Differences: Pattern of 2nd differences should be smooth.
- $q^{\text{Smoker}} > q^{\text{Composite}} > q^{\text{Nonsmoker}}$
- $q^{\text{Male}} > q^{\text{Female}}$
- Any significant variation by age in the ratio of $q^{2001 \text{ CSO}}$ to $q^{2001 \text{ VBT}}$ should be explainable.

In general, these relationships are present in both the 2001 VBT and the 2001 CSO Table. There are a few isolated 2nd difference patterns that are not as smooth as the Academy Task Force would prefer. However, since these patterns appear to have no significant impact on statutory reserve levels and are very difficult to smooth, no changes were made to the table to try to correct these patterns.

Comparisons of Mortality Rates

Various comparisons of the mortality rates are shown in Appendix B. Specifically, the following comparisons are made:

- *1975-80 Basic Table versus 1990-95 Basic Table on an ultimate, composite basis.* The large increase in the ratio of 1990-95 to 1975-80 mortality from about age 25 to age 50, particularly for males, is due to AIDS.
- *1990-95 Basic Table versus 2001 VBT on an ultimate, composite basis.* The dip in the ratio of the 2001 VBT to 1990-95 mortality from about age 25 to 50, particularly for males, is due to the fact that some of the impact of AIDS has been removed through the smoothing process in the development of the 2001 VBT. For female mortality at younger ages, the combined effect of graduation and a lack of mortality improvement at ages less than 45 resulted in the 2001 VBT being greater than 100 percent of 1990-95 mortality.
- *2001 VBT versus 2001 CSO Table on an ultimate, composite basis.* The ratio of the 2001 CSO table to the 2001 VBT shows the load added to the 2001 VBT. As was desired, the percentage load generally decreases with age. The discontinuity at age 100 is a result of the load being graded from its calculated value at age 100 to 0 at age 120.
- *1980 CSO Table versus 2001 CSO Table on an ultimate, composite basis.* For most of the commonly insured ages (from about age 25 to age 75), the 2001 CSO Table mortality rates are in the range of 50 percent to 80 percent of the 1980 CSO Table. In addition, this ratio is generally increasing with age, which means that the slope of the ultimate 2001 CSO Table is generally greater than the slope of the ultimate 1980 CSO Table.
- *1980 CSO Table versus 2001 CSO Table on an ultimate, nonsmoker basis.* Since nonsmokers comprise most of the composite mortality (over 75 percent of the composite 1990-95 mortality), the relationship between the nonsmoker versions of the 1980 CSO Table and the 2001 CSO Table is very similar to the relationship between the composite versions of the 1980 CSO Table and the 2001 CSO Table.

- *1980 CSO Table versus 2001 CSO Table on an ultimate, smoker basis.*
The general shape of the graph of the ratio of the 2001 CSO Table to the 1980 CSO Table for smoker mortality is similar to composite and nonsmoker mortality. However, the 2001 CSO Table female ultimate smoker mortality is higher than the 1980 CSO Table female ultimate smoker mortality from age 57 to age 74.

2001 CSO Table Impact on Statutory Reserves by Cell

The Academy Task Force calculated statutory reserves for three plans of insurance – whole life, 20-year level premium term, and universal life with level premiums set so that the cash value is positive at all ages prior to 100 and is near zero at age 100 (hereinafter referred to as “level premium to zero UL”). Both mean and terminal statutory reserves were calculated for whole life and 20-year level premium term; mean statutory reserves were calculated for universal life. The reserves were calculated according to current NAIC valuation rules on a CRVM continuous basis. The following reserve relationships were desired and attained:

- Reserves based on ultimate mortality should generally be less than reserves based on select and ultimate mortality.
- Reserves based on the 2001 VBT should generally be less than reserves based on the 2001 CSO Table.
- Terminal reserves based on the 2001 CSO Table should not be significantly distorted compared to terminal reserves based on the 2001 VBT.
- A weighted average of the 2001 CSO Table smoker reserves and the 2001 CSO Table nonsmoker reserves, with the weights based on the underlying distribution of smokers and nonsmokers in the 1990-95 mortality, should approximate the reserves based on the 2001 CSO Table composite mortality.
- Reserves on an age and duration basis should be smooth and follow the expected patterns (i.e., increasing with duration for whole life and UL; “humpback” for level premium term).

Appendix C compares CRVM continuous reserve values at 4.50 percent interest on a cell by cell basis for various plans of insurance, issue ages, policy durations, and mortality tables (select and ultimate/ultimate, composite/nonsmoker/smoker, 1980 CSO Table/ 2001 CSO Table/2001 VBT). All reserve comparisons involving the 1980 CSO Table were done on an ultimate basis and thus did not include select factors (neither the 10-year 1980 CSO Table select factors nor the Regulation XXX 19-year 1980 CSO Table select factors). In practice, reserves are usually determined using ultimate mortality rather than select and ultimate mortality, since reserves based on ultimate mortality are generally less than those based on select and ultimate mortality.

For whole life, with the exception of the first duration when the CRVM reserve is a one-year preliminary term reserve, reserves based on the ultimate 2001 CSO Table are generally 80 percent to 90 percent of reserves based on the 1980 CSO Table during the first 25 durations or so. (The 2001 CSO Table terminal reserves gradually grade to \$1,000 per \$1,000 at age 120, while the 1980 CSO Table terminal reserves grade to \$1,000 per \$1,000 at age 99.) This relationship holds for both nonsmoker and composite mortality.

For whole life reserves using smoker mortality, the same general relationship holds for males. However, for female smokers, the reserves based on the 2001 CSO Table are higher than the reserves based on the 1980 CSO Table at some ages and durations. This result is due to the slope of the 2001 CSO Table female mortality, from around age 50 to age 70, being much steeper than the corresponding 1980 CSO Table female mortality.

The whole life reserves based on the ultimate 2001 CSO Table are generally greater than the reserves based on the 2001 VBT by a few percentage points. For the age 45 example shown in Appendix C, renewal year 2001 CSO Table reserves are about two percent to four percent higher than 2001 VBT reserves depending on duration.

For 20-year level premium term, male reserves based on the 2001 CSO Table are generally 55 percent to 70 percent of reserves based on the 1980 CSO Table for issue ages 35, 45, and 55. This reserve ratio drops down to close to 40 percent at some durations for issue age 25, and increases to nearly 80 percent for issue age 65. These same general relationships hold for smoker, nonsmoker and composite mortality.

For female 20-year level premium term, the ratio of the 2001 CSO Table reserves to the 1980 CSO Table reserves varies by issue age and duration more than for males, but is generally less than 100 percent. The ratio exceeds 100 percent for female smokers at some issue ages because the slope of the female smoker mortality is much steeper for the 2001 CSO Table than the 1980 CSO Table between ages 50 and 70.

The 20-year level premium term reserves based on the 2001 CSO Table are greater than the reserves based on the 2001 VBT by percentage amounts that vary by issue age. For the age 45 example shown in Appendix C, renewal year 2001 CSO Table reserves are about 10 percent to 14 percent higher than the 2001 VBT reserves, depending on duration. Other ages were also examined, but are not shown in Appendix C. In general, the ratio of 20-year level premium term reserves based on the 2001 CSO Table to those based on the 2001 VBT decreases as the issue age increases.

For level premium to zero UL, reserves based on the 2001 CSO Table range from about 60 percent (depending on issue age, gender and smoking status) to 100 percent of reserves based on the 1980 CSO Table. Generally, by the sixth or seventh policy duration, the policy's cash value takes over as the reserve. From this duration forward, the underlying valuation mortality table does not affect the reserve, so the statutory reserves based on the 2001 CSO Table equal the statutory reserves based on the 1980 CSO Table.

Overall Effect of the 2001 CSO Table on Reserves

The following analysis compares reserves calculated using the ultimate 2001 CSO Table to those calculated using the ultimate 1980 CSO Table. Deficiency reserves were not considered. CRVM reserves for individual cells were weighted using a relatively simple model office (consisting of three plans, five ages, and both genders) based on industry business distributions obtained from LIMRA International (see Appendix D for a description of the model office). To produce a single number for comparison, the Academy Task Force assumed that sales levels increased at five percent per year and focused its analysis on results after 10 and 20 years. Additional detail on this analysis is given in Appendix E.

Table 1
Comparison of Basic Reserves on the 2001 CSO Table
to Basic Reserves on the 1980 CSO Table
(aggregated results)

	<u>After</u> <u>10 years</u>	<u>After</u> <u>20 years</u>
Overall	79.0%	82.4%
Gender		
Male	76.5%	80.2%
Female	85.6%	87.7%
Plan		
Whole Life	85.6%	86.9%
20 Year Level Premium Term	68.4%	68.7%
Level Premium to Zero UL	95.0%	98.8%
Age		
25	80.9%	84.9%
35	74.8%	79.8%
45	78.7%	82.5%
55	79.8%	81.9%
65	81.2%	84.2%

This table shows that overall basic reserves are about 20 percent lower under the 2001 CSO Table. The reduction is larger for males than for females, reflecting the larger reduction in mortality rates for males. Term insurance exhibits the largest reductions, followed by whole life. The level premium to zero UL plan shows the smallest reductions because reserves cannot be less than cash values and the cash value typically determines the reserve by the sixth to eighth duration under both the new and old tables. When the cash value determines the reserve, reserves are the same under both tables. The biggest reductions will be seen at age 35 while the smallest reductions will be seen at ages 25 and 65.

Loading Analysis

To examine the level of the loading in the 2001 CSO Table, the Academy Task Force performed two analyses. First, the Academy Task Force reviewed the extra deaths produced by the loading formula in various situations. Second, the Academy Task Force reviewed Actual/Expected ratios in various situations for the companies that contributed to the 1990-1995 Basic Table.

Expected Deaths Analysis

In this review, the Academy Task Force analyzed the percentage of extra deaths produced by the formula in 25 different cells (policy years 1-10, 1-20, 1-30, 1-40 and 1-50 for issue ages 25, 35, 45, 55 and 65). Survivorship was based on the composite, ultimate 2001 VBT. As anticipated, the percentage of extra deaths produced by the loading formula varied by cell. The tables below show the increase in the number of deaths produced by the loading formula for each of the 25 cells considered, as well as a weighted average by age for each of the policy year groupings.

Table 2a
Increase in Number of Deaths Produced by the 2001 VBT Loading
Formula For Composite, Ultimate, Male Mortality

Policy Years	Issue Age					Weighted Average
	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	
1-10	17%	22%	18%	13%	11%	18%
1-20	20%	19%	15%	11%	10%	17%
1-30	19%	15%	12%	10%	9%	14%
1-40	16%	13%	11%	10%	10%	12%
1-50	13%	11%	10%	10%	10%	11%

Table 2b
Increase in Number of Deaths Produced by the 2001 VBT Loading
Formula For Composite, Ultimate, Female Mortality

Policy Years	Issue Age					Weighted Average
	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	
1-10	28%	27%	21%	15%	13%	23%
1-20	27%	22%	16%	13%	12%	20%
1-30	23%	17%	14%	12%	11%	17%
1-40	18%	15%	12%	11%	11%	14%
1-50	15%	13%	11%	11%	11%	13%

While a more common method of measuring extra mortality may be to simply compare the mortality rates for any given issue age and duration, the increase in the number of deaths approach was used because it takes into consideration the cumulative extra mortality over a given number of policy durations. This is a logical way to view extra mortality for valuation purposes since current statutory valuation rules require life insurance reserves to be determined under the assumption that (as long as the insured survives) the policy will remain in force until it expires.

The Academy Task Force also considered the impact of the loading formula on select and ultimate mortality. The increase in the number of deaths produced by the loading formula for select and ultimate mortality is shown in the following two tables. The same analysis was performed as described above, only using select and ultimate mortality for the numerator and denominator instead of ultimate mortality.

Table 2c
Increase in Number of Deaths Produced by the 2001 VBT Loading
Formula For Composite, Select & Ultimate, Male Mortality

Policy Years	Issue Age					Weighted Average
	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	
1-10	28%	33%	28%	23%	19%	28%
1-20	25%	23%	17%	14%	12%	20%
1-30	21%	16%	13%	11%	11%	15%
1-40	16%	13%	11%	10%	11%	13%
1-50	13%	11%	10%	10%	11%	11%

Table 2d
Increase in Number of Deaths Produced by the 2001 VBT Loading
Formula For Composite, Select & Ultimate, Female Mortality

Policy Years	Issue Age					Weighted Average
	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	
1-10	42%	45%	30%	26%	23%	36%
1-20	32%	26%	19%	16%	14%	23%
1-30	25%	18%	15%	13%	12%	18%
1-40	18%	15%	13%	12%	12%	14%
1-50	15%	13%	12%	12%	12%	13%

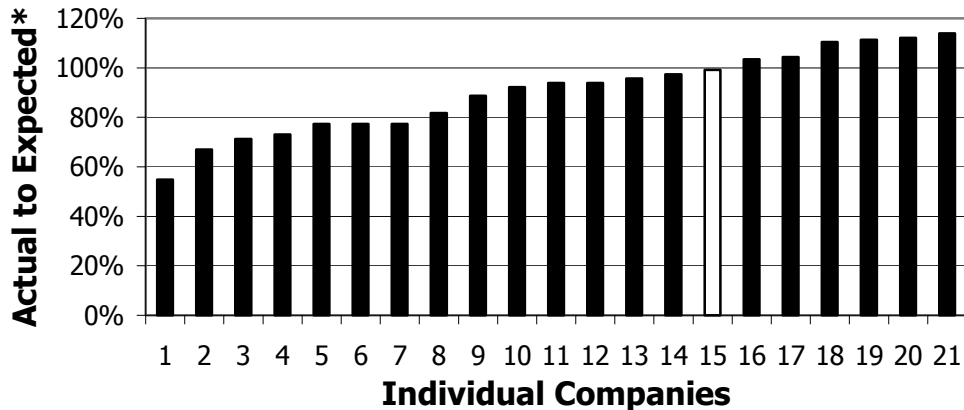
Note, the percentages in Tables 2a-2d generally decrease as the number of policy years considered increases. This occurs because, while the absolute load added to the 2001 VBT increases with age, the percentage load generally decreases with age (see the comparison of the 2001 CSO Table to the 2001 VBT in Appendix B). As the number of policy years considered in Tables 2a-2d increases, so does the attained age of the insured. Thus, as more policy durations are considered, more older ages are considered. Since the percentage loads decrease with age, one would also expect the percentages in Tables 2a-2d to decrease as the number of policy years considered increases.

Variation by Company Analysis

As part of its analysis of the loads, the Academy Task Force reviewed the actual to expected ratios produced for individual companies in the SOA study using the 2001 VBT table as expected. This, in turn, was compared to the overall 15 percent load in the 2001 CSO Table. In reviewing this analysis, it should be noted that the company experience was from the period 1990 to 1995. The 2001 VBT was projected for mortality improvement to the year 2001. This resulted in about a six percent reduction in the overall mortality rates of the 2001 VBT as compared with the underlying experience of the 1990-1995 Basic Mortality Tables. As a result, companies that have an A/E ratio of less than 121 percent are likely covered by the table even though in this analysis we compared to 115 percent.

The Academy Task Force looked first to the experience in the first 15 durations. All 21 of the companies in the study were able to provide data on this basis. During the first 15 years of the select period, an overall 15 percent load produces expected tabular deaths that exceed the number of actual deaths in the 1990-95 study period for 15 of the 21 companies (71 percent) that contributed to the SOA study. The white bar, in Chart 1 below, represents the 15th of the 21 companies.

Chart 1
1990-95 SOA Comparative Mortality Study
Issue Years 1980-94 (Policy Years 1-15)

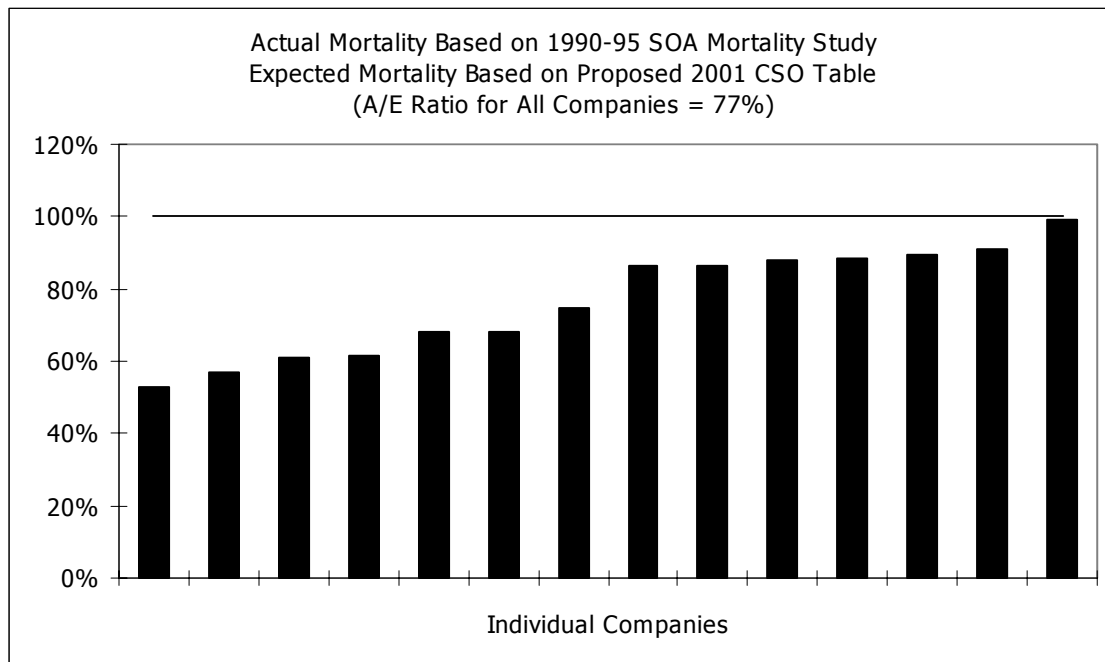


*expected based on the proposed 2001 CSO Table

In addition, the 1990-95 SOA mortality study provides information by issue year groupings of 1990-94, 1985-89, and 1980-84. These issue year groupings contain policies in durations 1-5, 1-10, and 6-15, respectively. For both the 1990-94 and 1985-89 groupings, the expected tabular deaths produced by the overall 15 percent load exceed the actual deaths in the 1990-95 study period for 15 of 21 companies (71 percent). For the 1980-84 issue year grouping, the expected tabular deaths produced by the overall 15 percent load exceed the actual deaths in the 1990-95 study period for 14 of 21 companies (67 percent).

Of the companies that contributed data to the SOA's 1990-95 study, 14 had data during the entire select period (i.e., policy years 1-25). Actual to expected mortality ratios were calculated for these 14 companies, with expected mortality based on the 2001 CSO Table. For all issue ages, both genders, both smoking statuses, and all select period durations combined, each of the 14 companies had actual to expected ratios less than 100 percent (see Chart 2a below).

Chart 2a
Actual to Expected Ratios by Company
M & F, NS & SM, All Issue Ages



When the mortality data is split by gender and smoking status, the individual company actual to expected ratios are usually less than 100 percent, but there are a few exceptions. Specifically, of the 14 companies, three have actual to expected ratios above 100 percent for male smokers, one has an actual to expected ratio above 100 percent for female nonsmokers, and four have actual to expected ratios above 100 percent for female smokers (see Charts 2b, 2c, 2d, and 2e below).

Chart 2b
Actual to Expected Ratios by Company
Male, Nonsmoker, All Issue Ages

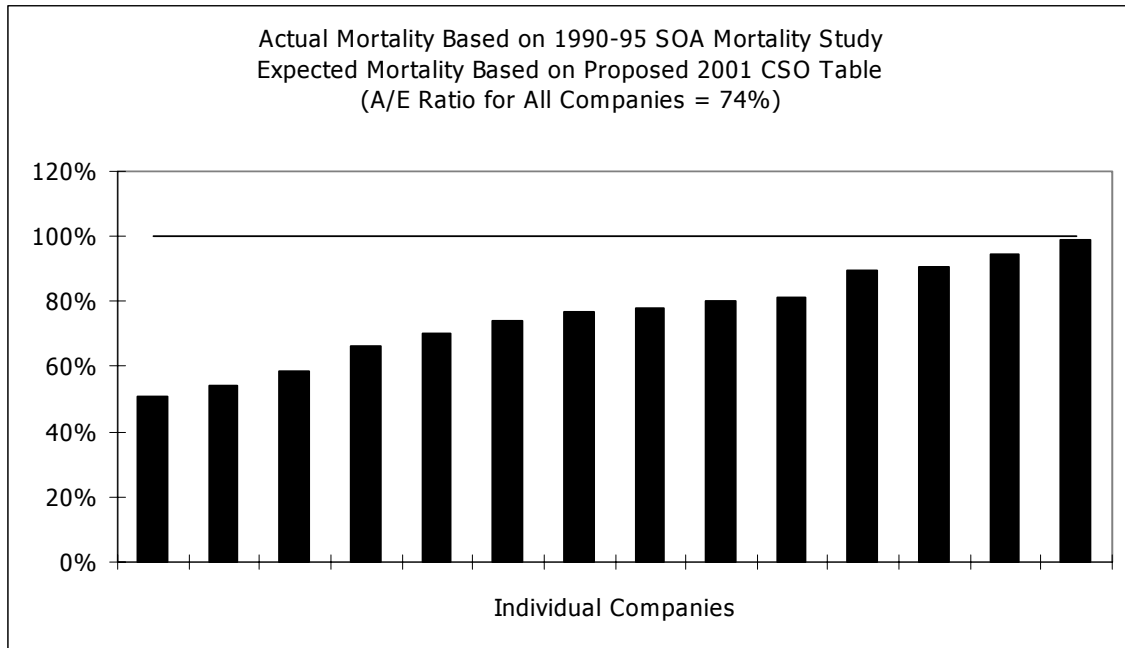


Chart 2c
Actual to Expected Ratios by Company
Male, Smoker, All Issue Ages

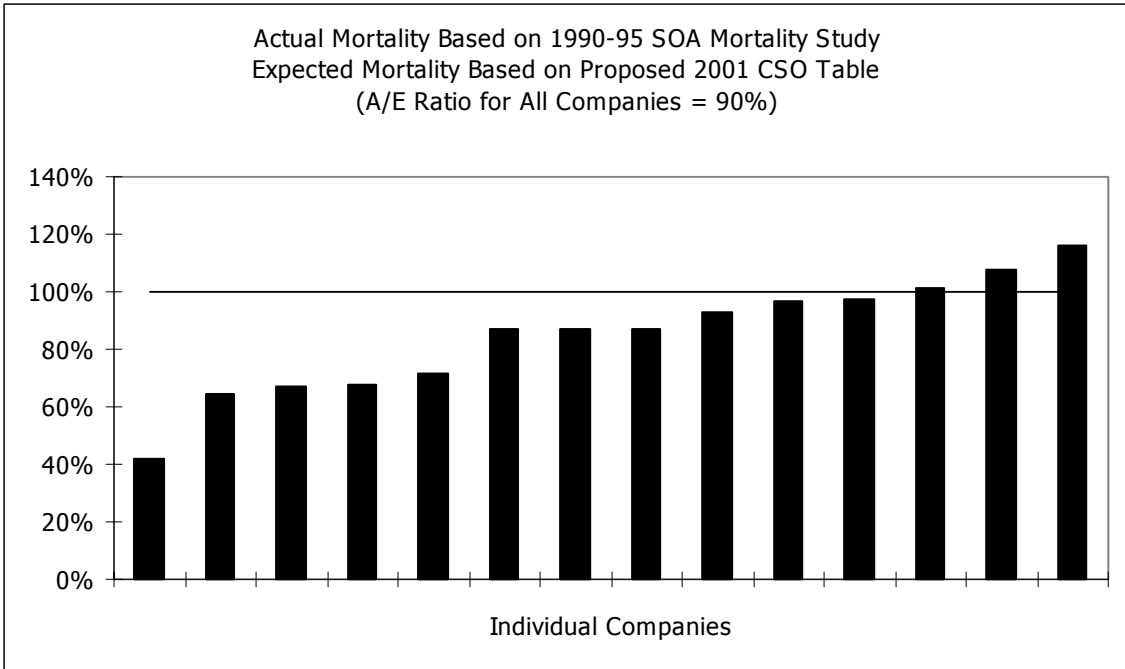


Chart 2d
Actual to Expected Ratios by Company
Female, Nonsmoker, All Issue Ages

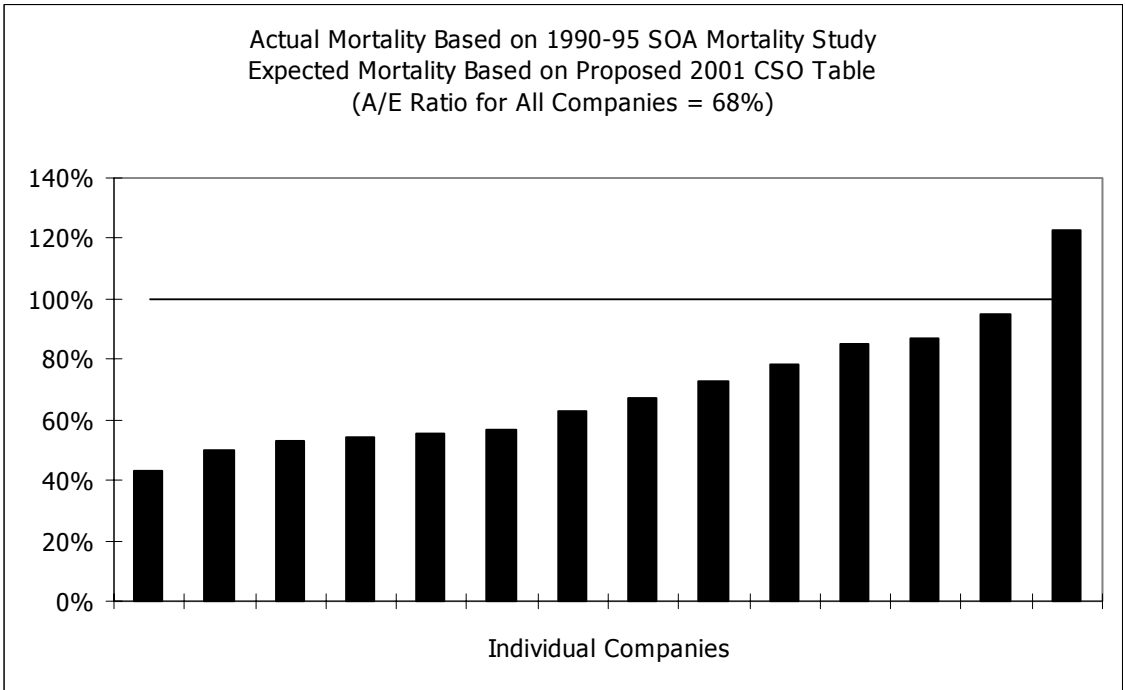
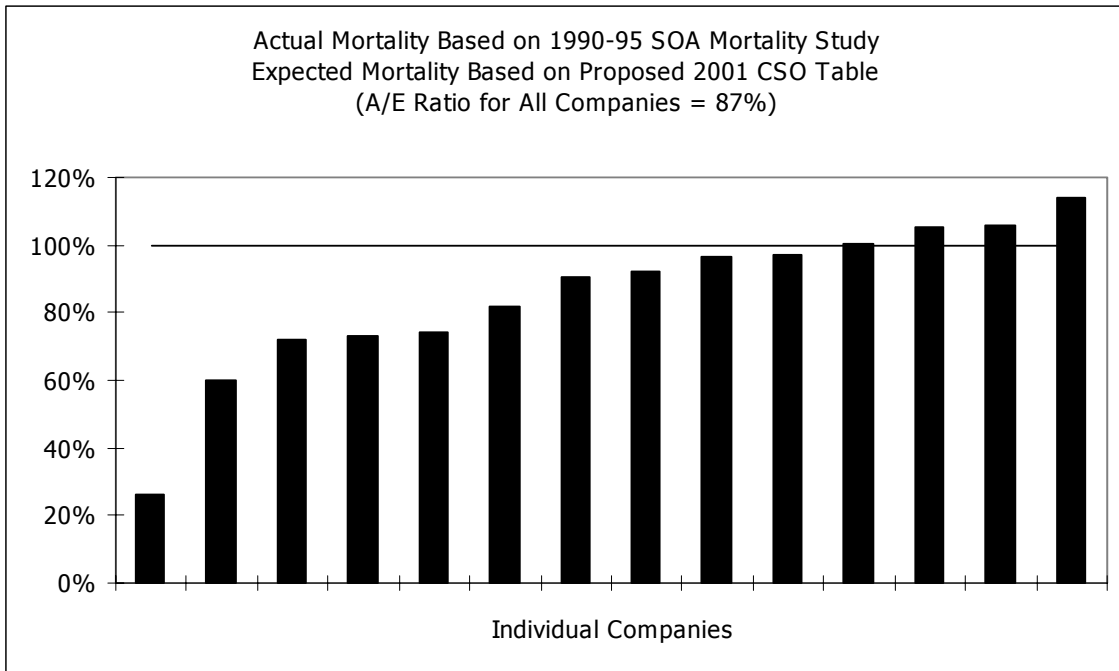


Chart 2e
Actual to Expected Ratios by Company
Female, Smoker, All Issue Ages

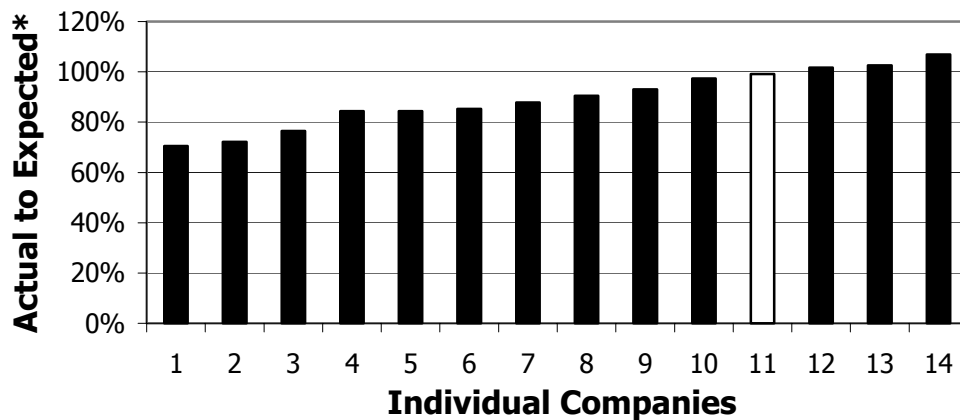


All of the actual to expected ratios contained in Charts 2a – 2e above are shown in Appendix F.

In addition John M. Bragg & Associates prepared a Report on Company Variations in Mortality using their Ordinary insurance data. The amount of data was even greater than that available in the Society of Actuaries experience study. This report compared experience to the 2001 VBT and demonstrated wide variability by company and also by experience year within company. This report was commissioned by the SOA and is titled, "Report on Company Variations in Mortality." Further information regarding this report is available in the July 16, 2001 *National Underwriter* story, "It's a New Ball Game for Life Insurance", or by contacting John M. Bragg and Associates, Inc.

The final comparison done by the Academy Task Force reviewed the ultimate portion of the table. Fourteen of the companies contributing to the SOA study were able to contribute data on this basis. During the ultimate period, an overall 15 percent load produces expected tabular deaths that exceed the number of actual deaths in the 1990-95 study period for 11 of the 14 companies (79 percent) that contributed ultimate mortality data. The white bar, in Chart 3 below, represents the 11th of the 14 companies.

Chart 3
1990-95 SOA Comparative Mortality Study
Ultimate Period



*expected based on the proposed 2001 CSO Table

As a result of these analyses, the Academy Task Force concluded that the 2001 CSO Table mortality exceeded the 1990-1995 mortality experience of the individual companies contributing to the SOA experience study most of the time during both the select and ultimate periods.

Small Company Considerations

Because of the smaller size of the block of insurance issued by smaller companies, smaller company results may be more subject to random fluctuation. In order to consider the ability of the 2001 CSO Table to cover the experience of smaller companies, the Academy Task Force performed a Monte Carlo simulation of a block on 12,000 lives amounting to just over \$600 million of exposure.

The distribution of business by age, gender and duration were based on the in-force block of a smaller company. Expected claims were based on the 2001 VBT using the select and ultimate table, gender and smoking specific rates. (The composite table was used where smoking status was unknown.) One year's experience was simulated one hundred times, assuming a \$50,000 retention. This was the same retention considered for the small company Monte Carlo simulation for the 1980 CSO Table. Specific consideration of an appropriate small company retention limit was not investigated. (See Appendix L for more detail on the analysis.)

The following table shows results using a \$50,000 retention limit in terms of the percentage of times the simulated claims were below or above those produced by the 2001 CSO Table:

Table 3
Comparison of Simulated Claims to Those Produced by the 2001 CSO
Table
\$50,000 Retention

	By Number of Claims			By Amount of Claims		
	Male	Female	Total	Male	Female	Total
Percent below 2001 CSO	78%	84%	94%	76%	79%	78%
Percent above 2001 CSO	22%	16%	6%	24%	21%	22%

This table shows that, in total, the 2001 CSO Table produced a greater claim amount 78 percent of the time using a \$50,000 retention. It is not expected that the table will produce claims greater than actual in all situations. Indeed, the Academy Task Force noted that the table covered only 71 percent of the companies that contributed to the SOA Study.

Based on this analysis, the Academy Task Force concluded that the random fluctuation in smaller company portfolios did not make the 2001 CSO Table inappropriate for those companies when a reasonable retention limit was used. However, the amount of variation does indicate that it is important for valuation actuaries to consider their own company's characteristics and asset adequacy when selecting to use the 2001 CSO Table.

Reserve Analysis

The Academy Task Force reviewed reserves and net premiums produced by the 2001 CSO Table. These analyses took the form of both a review of the margins in the net premiums and reserves and a comparison of statutory reserves using the current statutory valuation model and the 2001 CSO Table to those calculated with estimates of experience assumptions at the 85th percentile level for the United States insurance industry.

Analysis of Margins in Statutory Reserves and Net Premiums

The Academy Task Force examined the margins in the reserves and net premiums by gender (male v. female), by smoking status (nonsmoker v. smoker), and by issue age (25 v. 35 v. 45 v. 55 v. 65) for a 20-year level premium term policy using the select and ultimate 2001 CSO Table mortality. The Academy Task Force chose this representative term plan since term reserves and net premiums are more sensitive to the mortality assumptions than whole life or universal life reserves and net premiums.

Appendix G contains many graphs that compare statutory reserve and beta net premium percent margins and dollar margins per \$1,000. The graphs on pages G1 – G12 compare the margins by gender, with the percent margin on the left-hand scale and the dollar margin per \$1,000 on the right hand scale. In general, the margins for males are larger than the margins for females on a dollar basis, but less on a percent basis. Since the female mortality rates and reserves are less than the male rates, it is not surprising that the percent margins for females generally exceed those for males (smaller denominators cause larger percentages). Likewise, it is not surprising that the dollar margins for females are generally less than those for males (females have a higher life expectancy, which results in a smaller mortality load and smaller reserve and net premium margins).

The graphs on pages G13 – G24 compare the margins by smoking status, again with the percent margin on the left hand scale and the dollar margin per \$1,000 on the right hand scale. Similar to the relationship between males and females, the margins for smokers are generally larger than the margins for nonsmokers on a dollar basis, but less on a percent basis. The same explanation used above for males and females can be used for smokers and nonsmokers if smokers are substituted for males and nonsmokers are substituted for females.

The graphs on pages G25 – G34 compare the margins by issue age. In general, the reserve and net premium margins for higher issue ages are larger than the margins for lower issue ages on a dollar basis, but less on a percent basis. Like gender and smoking status above, the differences are due to the mortality levels and life expectancies at the various issue ages.

The Academy Task Force concluded that the relationships in the level of reserve and net premium margins between genders and the various issue ages is appropriate. However, the Academy Task Force determined that more analysis was needed to validate the relationship in reserve and net premium margins between smokers and nonsmoker was appropriate. This additional analysis took the form of a discussion of the purpose of mortality loads, as well as the development of an alternative loading formula to demonstrate the feasibility of the reserve and net premium relationships between smokers and nonsmokers (see Appendix H).

Comparison Reserves

The comparison reserves used in this analysis were set using a CRVM reserve calculation involving interest, mortality and, for term insurance, lapse. These assumptions were based on industry statistics*, and the tests were done to simulate the experience of companies that are at approximately the 85th percentile in terms of experience. In other words, only 15 percent of companies have experience worse than that covered by these tests. Testing was done using the ultimate composite table. This reserve analysis is covered in detail in Appendix I.

Two forms of analyses were performed. The first compared statutory reserves produced by the table for individual cells to the comparison reserves produced as outlined above. The second was a sensitivity test determining how much experience needed to change for one assumption (holding the others constant at the 85th percentile level) to produce comparison reserves that were equal to the statutory reserves produced by the table. This second test was done at the plan of insurance level for term and whole life.

* Mortality is based on the 2001 VBT. Interest is based on 12/31/00 yield curve, NAIC C3 model, and 1995-99 NAIC investment returns. Lapse rate data was obtained from the LIMRA International study, "1993-94 United States Lapses by Duration and Product Line: Long Term Ordinary Lapse Survey", copyright ©1996 LIMRA International.

The model office is described in Appendix D. The analysis showed that the 2001 CSO Table produces statutory reserves that are greater than the comparison reserves for term insurance and slightly under the comparison reserves for whole life. For level premium to zero UL, the new table produces reserves slightly over the comparison reserves. The following table summarizes these results:

Table 4
Comparison of Statutory Reserves Using the 2001 CSO Table to Comparison Reserves
All Ages, Both Genders

	<u>After 10 years</u>	<u>After 20 years</u>
Whole Life*	96.5%	96.6%
Term	105.1%	100.8%
Level Premium to Zero UL	111.5%	103.4%
All Plans	102.2%	99.3%

The Academy Task Force also considered other forms of UL, including higher and lower premium forms of basic UL and forms with “no lapse” guarantees. Under any one of these forms, statutory reserves produced by the 2001 CSO Table should be greater than or equal to their comparison reserves, at least when aggregated at the plan level using the model office outlined in Appendix D.

The testing also showed how experience for individual factors could vary and still produce comparison reserves that are less than statutory reserves. This test is summarized in the following table:

Table 5
Percentiles of Individual Assumptions Necessary, with Others Kept at the 85 Percentile Level, to Produce Comparison Reserves Equal to Statutory Reserves After 20 Years

	Mortality		Interest		Lapse	
	<u>Value</u>	<u>Pct'ile</u>	<u>Value</u>	<u>Pct'ile</u>	<u>Value</u>	<u>Pct'ile</u>
Whole Life	110%	69.1%	4.80%	81.4%	3.90%	85.9%
20 Year Level						
Premium Term	121%	85.3%	4.10%	87.3%	3.50%	91.5%

* Changing the lapse assumption from 0 percent per year to 4 percent per year, and determining cash values based on a reserve calculation with an interest rate 1 percent higher than the valuation rate, results in 100 percent after both 10 and 20 years.

As an example, consider whole life. As shown in Table 5, the ratio of statutory reserves to the comparison reserves for whole life is about 96.5 percent. In order to increase this ratio to 100 percent, while holding the interest and lapse assumptions constant (4.50 percent interest and no lapses), the mortality assumption must be reduced from 120 percent of the 2001 VBT (the 85th percentile) to 110 percent of the 2001 VBT (the 69th percentile). Likewise, holding the mortality and lapse assumptions constant (120 percent of the 2001 VBT and no lapses), the interest assumption needs to be increased from 4.50 percent (the 85th percentile) to 4.80 percent (the 81st percentile), in order for the statutory reserves to equal or exceed the comparison reserves. Finally, holding mortality at 120 percent of the 2001 VBT and interest at 4.50 percent, requires a lapse rate assumption of 3.9 percent (less than that used for term insurance) for the statutory reserves to be at least as big as the comparison reserves.

For term, the 2001 CSO Table produces reserves that can handle a small increase in mortality or decrease in lapse rates. In this analysis, term reserves are relatively insensitive to changes in interest rates.

Recommendation

The American Academy of Actuaries' CSO Task Force believes that this report is responsive to the NAIC's request for a new valuation table to be used in the current statutory valuation system. We recommend that the 2001 CSO Table shown in this report be adopted for use as a valuation table to replace the 1980 CSO Table. The new table is more consistent with current experience and will result in reserves, excluding deficiency reserves, that overall are approximately 20 percent lower than those produced by the 1980 CSO Table.

Appendices

- Appendix A – 2001 Valuation Basic Table and 2001 CSO Table
- Appendix B – Mortality Comparisons
- Appendix C – Statutory Reserve Comparisons
- Appendix D – Model Office
- Appendix E – Analysis of Impact on Overall Reserves
- Appendix F – Select Period Actual to Expected Ratios by Company
- Appendix G – Reserve and Net Premium Margins
- Appendix H – Loading Validation
- Appendix I – Reserve Analysis
- Appendix J – Gender-Blended Tables
- Appendix K – Society of Actuaries Report on Valuation Basic Table
- Appendix L – Small Company Monte Carlo Simulation