RECORD OF SOCIETY OF ACTUARIES
1979 VOL. 5 NO. 4

NEW VALUATION MORTALITY TABLES FOR INDIVIDUAL LIFE INSURANCE

Moderator: CHARLES A. ORMSBY. Panelists: C. DAVID SILLETTO, JOSEPH C. SIBIGTROTH, WILLIAM K. NICOL

1. The Recommendation of Sex-distinct Tables
2. The Development of Basic Tables - Data Selection, Construction, Graduation
3. Margins and the Development of Loaded Tables
4. Implications for the Industry

MR. CHARLES A. ORMSBY: This forum is to be devoted entirely to the discussion of the new mortality tables being proposed as a minimum standard for the valuation of Individual Ordinary, underwritten in what you might call the regular manner, both medical and non-medical. The recommended standard is not necessarily appropriate for substandard insurance, Guaranteed Issue, Group conversions, Industrial insurance or MDO.

The Special Committee to Recommend New Mortality Tables for Valuation began its deliberations about three years ago. To facilitate the carrying out of the Committee's work three subcommittees were formed. The first of the three was asked to undertake the job of investigating and recommending to the full Committee the extent to which sex should be recognized in developing the new tables. Needing somebody with rather broad contacts throughout the life insurance business and among the actuarial consulting firms we were indeed pleased that Dave Silletto agreed to chair the subcommittee. Second, a subcommittee was formed to review recent experience data and to recommend the basis of the new tables; that is, the period of observation, the graduation of the data and whatever else is part of the job of constructing new basic tables. Joe Sibigtroth has served as chairman of this wide-ranging subcommittee. Finally, we recognized the need for a subcommittee to tackle the complex matter of appropriate margins to be added to the basic tables before arriving at the final valuation table. Bill Nicol has provided the leadership and the drive for this third subcommittee and his presentation should help all of us to appreciate some of the many questions and problems the subcommittee had to discuss and resolve before arriving at a full Committee recommendation for appropriate margins.

Over the past year your Committee has received many helpful suggestions from President-elect Leckie, who studied the report with considerable care and helped us to clarify our own thinking by raising a number of searching questions and offering his own insightful comments. It will be obvious to those of you who are familiar with the work done in connection with the 1958 CSO that your present Committee followed a similar course of investigation and analysis. We did lean heavily on the progress made by the many committees which developed both the 1958 and 1941 tables. However, we were aware throughout our own deliberations that the tables

now being considered to replace the 1958 CSO tables have to be discussed and evaluated in the light of circumstances quite different in some respects from those which prevailed in the 1950's. Perhaps the most obvious difference is that which has to do with the diametrically opposed views on the question of the extent to which sex should be recognized in the tables.

There are obviously forces at work in our environment which will surely affect the course of any recommendation for new valuation tables before they are finally adopted by the National Association of Insurance Commissioners and eventually incorporated into state laws. It is highly likely that for many reasons the matter of adopting new mortality tables today will involve stronger political crosscurrents and more controversy than heretofore. But whatever the political considerations, whatever the impact of today's consumerism, it seems to us that our job has been that of developing new valuation tables, the technical aspects of which meet the high standards of our profession.

You should also know that over the past three years your Committee has not conducted its sessions behind closed doors. At our very first meeting we decided to establish certain lines of communication and use them frequently. In addition to reporting regularly to then Vice President Leckie and to the Board, we kept the American Council of Life Insurance and the National Association of Insurance Commissioners informed of progress and problems. Dick Minck and John Booth of ACLI have attended our meetings, have contributed to our discussions and have reacted constructively to the material we have sent them. John Montgomery of the California Insurance Department and Ted Becker of the Texas State Board of Insurance, both representing the NAIC Technical Task Force on Valuation and Nonforfeiture Value Regulation, have also been on our mailing list and have followed the work of the Committee with intense interest.

MR. C. DAVID SILLETTO: The report submitted by our Committee to the membership of the Society of Actuaries contains an explanation on pages 1 to 3 as to why we felt that it was appropriate to recommend sex-distinct tables. It is appropriate for me to take a few minutes to give you information about the questions that we discussed in our deliberations and the process that we went through in resolving the issues. In addition, I would also like to comment on some items that are not dealt with by our recommendation and point out that it would be improper to assume that they had been.

First, it should be noted that the original request from the NAIC to the Society of Actuaries to study the question of new valuation mortality tables was worded in such a way as to call clearly for at least the exploration of the subject of sex-distinct tables. The request suggested comparing current experience with the experience underlying the 1958 CSO Table; it was further requested that all such comparisons be done separately for males, females, and both sexes combined. Under those circumstances, it is obvious that the Committee did not have a free choice as to whether this question should be explored. The question was, in fact, addressed at the first meeting of the Committee. There seemed to be three fundamental questions to be answered if we were to consider seriously the recommendation of separate tables.

1. Did the mortality differential between males and females appear to be large enough to be significant?

2. If so, could we continue to deal with the matter by using an appropriate age setback?

3. If separate tables were recommended, did we have sufficient mortality experience on females in order to construct a table with credibility?

The Committee concluded that it would answer the first question "yes" and the second question "no". The reasons for coming to those answers are outlined in our report. The mortality differences by sex are significant at current levels and seem to be growing larger. Furthermore, the incidence of these mortality differences by attained age are such that an age setback is an inappropriate method of reflecting the differences. This led us then to the third question and we concluded that this question should also be answered affirmatively.

My notes from that initial meeting indicate that we had female mortality experience in the 1970-75 data that was equal to 60% of the total experience underlying the 1958 CSO Table. In our opinion, this seemed adequate for the construction of separate tables.

Having concluded that sex-distinct tables were justified, at least from a theoretical point of view, the Committee then addressed some practical aspects of making such a recommendation. The obvious impact of having separate ordinary life products for males and females needed to be considered from an administrative and financial point of view. From our discussions it was clear that the members of the Committee felt that this additional complexity did not present us with any insurmountable problems. On the other hand, we realized that the Committee members were primarily employees of larger life insurance companies with an adequate actuarial staff and data processing capability.

Accordingly, we decided to try to get a much broader sampling of opinion, particularly from companies with very limited actuarial facilities or even with none at all. We received some excellent cooperation from one of the major national actuarial consulting firms in addressing this question, and the answers that we got supported the concept of sex-distinct tables, although not without some exceptions. The results of our study were presented in an interim report to the Committee and they were as follows:

1. Almost all actuaries agree that the current system of using age setbacks is inappropriate. Not only does the current three-year setback understate the differential, but the age setback mechanism is an approximation that would be hard to defend if attacked. True mortality differentials based on separate female experience will probably be needed.

2. Actuaries generally oppose the use of unisex tables. Everyone agrees that sex is a significant determinant of mortality, and to ignore that fact would be no more justified than ignoring age or some of the other factors that influence mortality.

3. There is also general agreement that while premium rate differentials are clearly justified, differentials in reserves and cash values are

very difficult to justify on the basis of achieving equity. Since reserves and nonforfeiture values will be the purpose of the table (or tables) that we recommend, this makes the work of our Committee especially difficult.

4. There is identifiable opposition to completely separate mortality tables and the concept of completely separate rates and values by sex. Admittedly, it is a minority position, and one that tends to come from smaller companies, but the opposition is there.

The completion of that survey and the recommendation to proceed with the creation of sex-distinct tables essentially completed the work of my subcommittee. From that point on, the people constructing the tables and building in margins dealt with separate male and female tables.

In conclusion, I would like to comment briefly as to what is not contained, explicitly or implicitly, in this recommendation of sex-distinct mortality tables for the valuation of Ordinary life insurance.

1. Our report should not be interpreted as suggesting that this is not a controversial subject. Any implementation of a new mortality basis in the Standard Valuation Laws will have to go through political and regulatory processes and it is there that any controversy should be discussed and resolved.

2. Our report does recommend that a unisex table is no longer the best kind of table to use for valuation. It so happens that a unisex table works to the disadvantage of females in the area with which we are dealing. This does not suggest, however, that the advocates of unisex tables would not be willing to accept the disadvantages in this area in order to gain the advantages in other areas of our business such as health insurance or retirement benefits.

3. This report should not be interpreted as suggesting that there will be no legal problems in implementing this recommendation. As we all know, the recent litigation activity with regard to unfair discrimination by sex has been high, and there may be some state anti-discrimination laws that will create problems.

This project was initiated by a request from the NAIC that the Society of Actuaries give "professional, technical consideration" to the need for new mortality tables for valuation purposes. In that sense, we concluded that the proper actuarial recommendation was for sex-distinct tables, but we are very aware that others viewing the matter from a different perspective may well advocate another point of view.

MR. JOSEPH C. SIBIGTROTH: As chairman of the subcommittee charged with the development of Basic Tables, including data selection, construction, and graduation, I would like to share with you the major decisions which were made in these areas. The first major decision, to have sex-distinct mortality tables, has already been discussed by David Silletto. In addition to the obvious effect of having to construct two Basic Tables, one male and one female, this decision implicitly affected some of our other considerations - for example, the choice of exposure period.

Exposure Period

The important considerations in selecting the exposure period for the data were: first, providing for a large enough volume of homogeneous data, second, picking a period which was most representative of recent mortality experience, and third, making sure the period picked did not include any unusual events affecting mortality, such as an influenza epidemic. The Committee decided that the exposure period would be from 1970 through 1975 policy anniversaries with war deaths excluded. This period was selected because it was the most recent period of experience available and there were no epidemics or other unusual events which would have affected mortality. A five-year exposure period was selected instead of a four-year period as was used for the 1958 CSO Basic Tables in order to provide more data, especially for the female table. It should be noted that the crude 1970-1975 mortality data comes directly from the annual study of mortality under Standard Ordinary insurance issues as prepared by the Society's Committee on Mortality under Ordinary Insurance and Annuities.

Select Period

As was done for the 1958 CSO Tables, the first five policy years of experience were eliminated from the data (except, of course, for ages 0-4). This was done to introduce an element of conservatism in the mortality rates by eliminating the favorable select experience of the early policy years. The Committee was aware of the wide variation in individual company mortality experience during the select period due to differences in underwriting rules, non-medical limits, et cetera. By eliminating the data of the first five policy years, the resulting mortality rates would cover the experience of a large number of companies. In addition, select and ultimate tables would be more complicated, requiring commutation functions varying by issue age.

Non-medical and Medical Data

In the construction of the 1958 CSO Tables, the data for policy years 6 through 15 included medically underwritten issues only. Non-medical experience was included only for policy years 16 and over and represented only a small portion of the experience. However, our Committee considered it appropriate to include non-medical data in the New Basic Tables at all durations (i.e. durations 6 and over) because non-medical business has grown substantially due to the trend toward higher non-medical amount and age limits. For policy years 6 through 15, non-medical experience represented about 39% of the 1970-75 intercompany exposure by amount, but only 15% of the 1950-54 exposure which was used for the 1958 CSO Table. At the very young ages, practically all of the experience is non-medical. Including non-medical experience for durations 6 through 15 significantly increased the amount of data available especially for the female table - non-medical experience for durations 6 through 15 accounted for about 55% of the female select experience.

There is virtually no paramedical experience included in the tables since paramedical business was not issued to any significant degree prior to 1970 and the first five policy years were excluded from the 1970-1975 data. Current intercompany paramedical mortality experience indicates that it closely parallels that of medical mortality experience.

Age Nearest Birthday

For the 1958 CSO Tables, all contributing companies submitted data on an age-nearest-birthday basis. For the new tables, three of the contributing companies submitted part of their data on an age-last-birthday basis. Data submitted on this basis were adjusted to an age-nearest-birthday basis using the same method as was used in developing the 1965-1970 Intercompany Basic Tables. (See the 1973 TSA Reports Number for details of the method.)

Crude Data

The crude mortality data for policy years 1 through 15 were generally submitted in quinquennial issue age groups. The central issue age for each group was generally assumed to be the average issue age for that group; for the issue ages 70 and over the average age was assumed to be 72. Ultimate data for policy years 16 and over were submitted on an individual attained-age basis. For the purpose of graduation, quinquennial pivotal values were developed for all actual deaths and exposures in five-year attained-age groups.

Data Under Age 20

In the construction of the 1958 CSO Tables, because the contributing companies had not contributed a sufficiently large volume of data for ages under 20, the mortality rates at these young ages were based on several sources, including the experience of four large companies for different exposure periods and intercompany standard experience during the first five policy years. For the new Tables, this was not a problem; therefore the 1970-1975 intercompany data were used for all ages, including those under 20.

Dip in Rates in 20's

A significant dip in individual attained-age mortality rates was evident in the 20's for the male experience and a very slight dip was evident in the 20's for the female experience. For the 1958 CSO Table, a slight dip in the 20's was also evident and was deliberately removed in developing the male table. While the process of developing pivotal values for the graduation eliminated the slight dip in the new female rates, it was felt that the dip in the new male rates should not be removed. (An analysis of the dip showed that it was due to the high accidental death rates among males in their early 20's.) The dip in the current male rates is more significant than that in the data underlying the 1958 CSO male table and to remove it would have meant that four pivotal values would have had to have been adjusted, effectively disregarding the experience at these important issue ages.

Adjustment in Pivotal Values at Young Ages

Because the experience at the young ages was limited, comparisons of the rates were made with other mortality tables including population statistics. Most modern tables show lower death rates at age 12 than at age 7, but our unadjusted crude values increased from age 7 to age 12. Therefore, it was decided to adjust the pivotal values at ages 2, 7, and 12 to reflect more closely the trend of most other mortality tables.

Graduation

The adjusted pivotal rates were graduated by a Jenkins fifth difference modified osculatory interpolation formula with fourth differences at the end points equal to zero. This formula was also used to graduate the 1958 CSO Table.

It should be pointed out, however, that for the 1958 CSO Table the basic experience mortality rates were not themselves graduated. For the 1958 CSO Table, the committee at that time felt that it was important to proceed with the construction of the valuation table. Therefore, the 1958 CSO Basic Table was derived from the 1958 CSO Table, in general, by subtracting the margins from the graduated valuation table.

This Committee felt that the basic experience rates should be graduated first and a smooth margin formula would be added to the Basic Tables to create the new valuation tables. One of the major reasons for this was that the Committee would be able to use the New Basic Tables in its analysis of the model office testing of reserves and the effects of various margin formulas on those reserves. Also, with the modern computer facilities available, graduating the basic rates did not slow down the construction of the new valuation table.

Ages 0 and 1

The age 1 rates in the New Basic Tables are the crude values; this approach was also used in the 1958 CSO Basic Table.

For our age 0 rates, we wanted our mortality rate to reflect the experience of age 1 day as was done in the 1958 CSO Table. At that time a special study was undertaken which resulted in mortality data with an average issue age of about 55 days for policies issued at age 0. An age 1 day rate was then calculated with the help of population statistics. Because of the extensive review done at that time, our Committee felt that we could use this work as a basis for our age 0 rate without delaying the development of the new Tables. Therefore, ratios of the age 0 rates to the age 1 rates were determined from the 1958 CSO Basic Tables and these ratios were applied against the crude age 1 rates of the New Basic Tables.

Terminal Age

It was decided to terminate the New Basic Tables at age 100 ($q_{100} = 1$) as was done for the 1941 CSO and 1958 CSO Male Basic Tables. The rates at the very high ages, ages 85 and over for the Male Table and ages 84 and over for the Female Table, were adjusted to grade smoothly into a rate of 1.000 at age 100.

The Committee did consider ending the tables at higher ages than 100 and in order to test the effects of doing this, two sets of extensions were made ending the Male Basic Table at age 105 and the Female Basic Table at age 110. Tests were made to compare reserves on the New Basic Tables with rates terminating at 100 compared to the two sets of extensions. The effect of the extensions on reserves was found to be insignificant with virtually no effect except at the high durations and the very high issue ages. Reserves on the extensions would always be lower (i.e., less conservative) than the reserves on the new Tables.

In view of this fact and the general unreliability of available mortality data at the advanced ages (such as the U.S. Life Table data and data compiled by the Social Security Administration), our Committee rejected ending the tables at ages higher than 100.

Fit and Smoothness of Tables

For most of the age groups in the Tables the actual-to-expected ratios are quite close to 1.000. The age groups where the ratios are significantly higher or lower than 1.000 are those at the younger ages where pivotal values were adjusted, or at the higher ages where the rates were adjusted to grade smoothly into the terminal value at age 100.

The New Basic Table rates determined by the graduation process and adjustments at age 0 and the high ages were adjusted to produce a perfect fit of 1.000 for the entire Male Basic Table and 1.000 for the entire Female Basic Table.

By analyzing the sums of the third differences, we determined that the New Basic Tables are "smoother" than the 1958 CSO Basic Tables.

Comparisons of New Basic Tables with Other Tables

Comparing the New Basic Tables with the 1969-71 U.S. Life Population Tables we found that the Male Basic Table mortality rates are lower than the population rates at all ages except at 96-100 where the Basic Table was graded to end at age 100. For the main insuring ages, the rates are about 45% - 70% of the population rates; similar results were found for the new Female Basic Table when compared with the 1969-71 U.S. Female Population Table, although the Female Basic Table rates are closer to the population rates than Male Basic Table rates (generally 55% - 75% of the population rates).

Comparing the New Male Basic Table to the 1958 CSO Male Basic Table, we found that except for the age range of the dip in mortality rates, the New Male Basic Table rates are generally 75% - 85% of the 1958 CSO Male Basic Table rates. The New Female Basic Table rates are about 55% - 85% of those in the 1958 CSO Female Basic Table which, of course, was a three-year setback table.

Model Office Testing

In the course of developing the New Basic Tables, the Committee made extensive tests of reserve calculations using a model office distribution of issues by age, sex, and underwriting class based on the 1970-75 intercompany experience of exposures in policy year one. Distributions by sex were graded from 80% male, 20% female in the first year of the model to 75% male, 25% female in the sixth and later years. The distribution of issues by plan was based on the paid issues of one large company and the 1974 LIMRA Study of "Life Insurance Buying." Terminal reserves using continuous functions were calculated under both the CRVM and NLP methods at 4% interest projected over twenty years with assumptions for lapse and mortality. The Committee developed 15-Year Select and Ultimate mortality tables as part of the model office testing of reserves. Lapse rate assumptions used were the LIMRA 1971-72 expected lapse rates for permanent plans. The model office reserves were calculated for assumed issues of $1

billion on both a dynamic and static basis. The dynamic basis assumed a 10% increase in issues annually and the static basis assumed one year of issues projected over 20 years.

The New Basic Tables produced total model office reserves 4.2% less than the reserves based on 1970-75 15-year Select and Ultimate table and 8.0% less than the total model office reserves based on the 1958 CSO Basic Tables. It was anticipated that the margins to be added to the New Basic Table rates would increase the model office reserves to the general level of the model office reserves under the Select and Ultimate tables.

MR. WILLIAM K. NICOL: The margin formula was developed consisting of a quadratic function of age divided by the curtate expectation of life calculated from the Basic Tables. This produced the loaded mortality rates designated as Tables K, which are the proposed valuation tables.

The margins ranged from a low of .44/1000 on the female table (.48/1000 on the male table) at age 0 compared with minimum margins of .75/1000 for the 1958 CSO Table. The use of a margin function involving the reciprocal of the curtate expectation of life enhanced the attainment of monotonic nondecreasing margins.

The prime constraint on margins was that reserves on the loaded table not be materially less than reserves developed using underlying select and ultimate mortality. Other constraints included:

1. Loaded mortality rates should encompass the standard mortality experience in the 1970-75 period of most companies writing Ordinary insurance with normal underwriting standards.

2. Terminal reserves on the loaded tables should not be significantly distorted when compared with terminal reserves on the graduated basic tables.

3. The methodology should be consistent in providing margins for both female and male tables.

4. Loaded mortality rates should not result in unreasonable statutory premium deficiencies on term insurance plans.

As Tables K have been exposed to the Society's membership, a number of questions have been raised, and the answers to these questions may anticipate some of the comments you may have.

The Special Committee to Recommend New Mortality Tables for Valuation was given a narrow charge by the Society of Actuaries, which required it to follow along the traditional lines that led to the 1941 CSO Table and the 1958 CSO Table. In part, this narrow charge reflected activity at the NAIC level of its Technical Task Force on Valuation and Nonforfeiture Value Regulation. The particular thrust of the NAIC Task Force has been to provide new mortality tables for the valuation of Ordinary insurance subject to normal underwriting which will meet conservative solvency requirements. It was not the Committee's job to restructure valuation philosophy but rather to develop mortality rates that can be used in any development of statutory reserves.

The use of select mortality for reserve purposes was considered but was rejected for several reasons, a primary one being the added complexity that would be involved. Many small insurers still are without computers. Furthermore, the terminal reserves produced by Tables K are quite close to those using select mortality. Tables K have margins built in from two sources. The first is the excess of the statutory net premium over a select and ultimate unloaded net premium. This would cause statutory mean reserves (those used for valuation) to be a larger percentage of select and ultimate unloaded reserves than the corresponding ratio for terminal reserves. Second, there would be a margin of $(q_{x+t} - q'_{[x]+t})(1 - {}_{t+1}V)$, released each year where q_{x+t} is the statutory mortality rate and $q'_{[x]+t}$ is the select and ultimate unloaded mortality rate.

The Monte Carlo testing was intended to demonstrate the suitability of the loaded table for use by a relatively small company ($100 million of Ordinary life insurance in force), and the results of the Monte Carlo testing demonstrated an acceptable level of margin adequacy. Although not detailed in the Committee's report, additional work was done in comparing year-by-year results of those companies contributing to the Society's mortality studies, and the Committee determined that death rates on the loaded table covered individual company variation satisfactorily.

Tables K were designed to provide sufficient margins to ensure solvency for most companies in valuing normally underwritten Ordinary insurance. Each actuary can think of classes of insurance, such as Group conversions, for which additional reserves for excess mortality would be appropriate. Also, an actuary may determine that his company's mortality is significantly worse than the intercompany average, and that therefore additional reserves above the legal minimum are appropriate.

MR. WILBUR M. BOLTON (presented by Ms. J. Clunas McKibbon): For companies issuing non-participating products, the first implication is a large measure of relief from the need to set up deficiency reserves. However, this relief, even at the present time, would not be total. In the large amount term market, say at amounts above $50,000, there are already term policies priced so that even with Tables K, premium deficiency reserves would be required.

Also, the number of years for which this table will endure before premium deficiency reserves again become a major problem may not be long. The intercompany mortality studies published in TSA Reports showed only modest improvements between the 1950-54 period and 1959; current intercompany studies and population statistics show a much sharper reduction in mortality mostly at attained ages above 40, between the 1970-75 period and now. Our Committee made no attempt to anticipate future improvements in mortality, beyond the basic 1970-75 experience period, in either construction of the New Basic Tables or in establishing the approaches to be used for setting margins. Any "innovative" technique adopted in order to anticipate future mortality improvements would have called into question the absolute adequacy and safety of the recommended Tables for valuation, and therefore would have increased the likelihood of controversy and delays in adopting the new Tables.

The second major implication is more realistic pricing of various life insurance plans issued to females.

At present there is a phenomenal lack of consistency among different life companies, and sometimes among different plans of insurance sold by a single company, in the method of determining premiums and dividends for policies issued to standard female risks. There are still some companies which charge identical rates to males and females. Use of a three-year setback in premiums, cash values and dividends is perhaps the most common current variation. Some companies set back the premiums and cash values but not the dividends. Some companies use the same cash values and dividends as for male lives, but use an approximation of anticipated female mortality to determine the premium. Within the market of non-participating term plans, there are companies using a four-year or five-year setback on premium rates, and even some that base their rates on anticipated female mortality. Because of the permissive six-year setback feature of the 1976 NAIC model valuation/ nonforfeiture changes, there may be some companies actually using a six-year setback on permanent plans.

Adoption of the new Tables will nudge many companies toward a more realistic pricing technique for plans issued to females, for competitive reasons if not otherwise.

A third implication of the new Tables is more realistic pricing of insurance issued to young adults. The "dip in the twenties of age" was remarked in Mort Miller's monograph on graduation (1946); it has persisted for male lives in several intercompany experiences (1946-49, 1950-54, 1957-60, 1965-70) and in the U.S. census tables (1949-51, 1959-61, 1969-71). Sometimes in insured experiences the graduation approach retained this feature; sometimes it was eliminated. To my knowledge this is the first time the dip has been retained in a table specifically prepared for valuation of life insurance policies. Many companies use published intercompany mortality experiences in their pricing, frequently with adjustments to reflect known differences between their own experience and the intercompany results. In my opinion there has been a tendency on the part of a number of companies to ignore the adverse early-year mortality on issues to young adult males on the theory that their own company results were simply a fluctuation, and not representative of the real world claim levels at these ages, even though the 1965-70 Basic Tables clearly show this phenomenon. Note that since the choice of valuation table affects terminal reserves and cash values, it has at least an indirect effect on pricing.

The primary cause of death among young adult males in recent years is accidents, associated with hazards of many of the forms of recreation pursued by young adults in our culture. (Frank Bayo analyzed this in depth in the 1976 Transactions). Pricing of coverages in these ages will be more realistic; underwriting in this age range may place more emphasis on the relative hazards of avocations of the prospective insured.

Adoption of the proposed new valuation Tables should also cause a certain amount of soul-searching within the actuarial profession. Among the Society's Guides to Professional Conduct, your attention is called to Guide 4, paragraphs b) and d). Paragraph b) says, in part: "The member will exercise his best judgement to ensure . . . . . that any assumptions made are adequate and appropriate . . ."

Tables K were constructed from mortality experience of standard issues of Individual Ordinary insurance subject to normal underwriting. It would

not necessarily be appropriate to hold Tables K reserves on issues of Ordinary insurance which are not subject to normal underwriting. Classes of Ordinary insurance for which added reserves, above those provided by Tables K, would seem necessary are Group conversions and policies issued substandard. If a company employs Guaranteed Issue, Group underwriting techniques, or highly simplified underwriting for designated classes of applicants, then business issued in those classes may also require additional reserves. The Society member responsible for valuation of such classes of business should measure mortality actually experienced on such policies, or similar policies, in order to verify that reserves held for these policies are in fact adequate and appropriate. Similar tests should be made on policies issued as term conversions, term renewals, or options under which new insurance becomes effective, at the choice of the insured, without fresh evidence of insurability.

Also, if a life company on its normal issues experiences significantly higher mortality than the mortality in the Society's intercompany study, consideration should be given to the need for added reserves. I cannot define significance for this purpose in a way which could be applicable to all companies and circumstances. The level of excess mortality above the intercompany average which would indicate that added reserves are necessary will vary with the issue age distribution of the business under consideration, the policy duration, and even recent secular trends in mortality which may add to (or subtract from) the safety margins originally designed into the valuation mortality Tables.

Bills designed to authorize these Tables for valuation and nonforfeiture purposes may be challenged, both in the legislative process and in lawsuits after the enabling laws are passed, on the legality, or constitutionality, of separate mortality tables for males and females. It seems highly probable that court tests will occur in some U. S. jurisdictions.

The fact that mortality experience is significantly different for males and females in our current civilization cannot be rationally challenged. However, if these Tables are considered as a fact to be investigated by an inquisitive scientist, several logical questions may be asked about the difference between male and female mortality:

a) How much of the difference is based on cultural influences?

b) How much of the difference is based on traditional patterns of employment in which females have been largely excluded from hazardous occupations?

c) How much of the difference is genetic/biological?

Answers to questions of this type have been outside the normal domain of actuarial investigations. Anti-discrimination proponents claim it is morally indefensible for insurance companies to recognize differences based on past cultural influences or past patterns of employment. The jury is still out on recognizing genetic/biological differences. The Committee on Ordinary Insurance and Annuities did address the question of mortality differentials by sex briefly in the 1973 TSA Reports; I would encourage any reader interested in background information to review that article.

As a benchmark for valuation mortality tables, the recommended Tables also represent a turning point or crossroads in certain aspects of construction and validation. To my knowledge, this is the first time that the safety of an aggregate level of margins designed into a proposed valuation table has been tested prospectively by a Monte Carlo simulation technique. I would expect that future valuation tables of various types will be tested similarly, to satisfy demands from both actuaries and regulators that the proposed margins provide reasonable safety from random adverse fluctuation.

The recommended mortality Tables may also represent a notable "last". For a long period of time from the nineteenth century until the late 1940's, virtually all life insurance issued by large U.S. companies was valued on the American Experience Table. The American Experience Table ends at age 96, therefore there was virtually no insured life mortality experience above attained age 95 until this decade. And even when the 1965-70 Basic Tables were published (TSA 1973 Reports), only about half of the ultimate experience could be split by sex. Under this circumstance, it has seemed reasonable to end the valuation tables at age 100. Tables K may well be the last valuation tables to end at that point. The last 20 years have seen both a lengthening of the expectation of life in the United States and an increase in the proportion of healthy persons above age 60 in the population. We see pressure on the benefit structure of the Social Security system as one aspect; another is legislation postponing mandatory retirement age from 65 to 70. Life insurers may anticipate an increasing proportion of prospective insureds in the 60's and 70's of age who have both the health and the ability to pay for new insurance. Eventually, these trends should also be reflected appropriately in the choice of terminal ages for mortality tables used for valuation.

The 1975-1980 Basic Tables, if constructed, should include valid crude data split by sex into the high 90's; the terminal ages of the next proposed valuation tables after these should be above 100, perhaps utilizing population data to extend the graduated insured life experience in the basic tables before adding the desired safety margins.

MR. ROBERT B. SHAPLAND: As I see it the purpose of a valuation table is one of solvency. That is, the NAIC wants a table that will keep the industry solvent. Yet, I see no tests or any calculations to determine the relationship between the proposed table and solvency. Solvency is based on the ability of a company, with its current funds and future premiums, to meet future claims and expenses. Thus solvency could only be determined by bringing into play expenses, inflation, deterioration in health by policy duration, true interest, persistency, nonforfeiture values - in other words the entire environment. This proposed table only looks at one or two components of that environment and then inadequately so. I'd like to add that I am a member of a committee of the Society of Actuaries on the valuation principles for health insurance. There is a good chance that our committee will come forth with some principles that would call for a different or greater testing of any valuation standard against a scenario of environments to show that the standard is indeed one that establishes solvency in a reasonable range of environments. To the degree that anybody here would like to get some input into our Committee I recommend that you do so.

MR. NICOL: Bob and I have corresponded on this matter. I think his comments are well said. I think that the charge our Committee had was

narrowly defined following along somewhat traditional lines. I would welcome, as I think he would, input to him on this subject.

MR. JOHN O. MONTGOMERY: It is the intent of the NAIC Task Force to ask for help on this matter. We do have to consider the very problem that Bob brings up; that's probably going to be one of our next questions.

MR. JOE B. PHARR : The July 1979 memorandum to the members of the Society of Actuaries recommends that the new minimum mortality standard, Tables K, not be extended beyond age 99. In my judgment, it would have been preferable to have extended the terminal age beyond age 99, probably somewhere in the 110 to 115 age range. Some of the reasons for this view are as follows:

1) Compatibility with annuity valuation tables, compatibility with population mortality tables.

2) Industry discussions on such creative products as "YRT to age 100".

3) Possibility of greater insurance needs at higher issue ages associated with longer working careers and extensions of mandatory retirement age.

4) Emphasis on protection aspects of life insurance policies which would argue against "forced" endowment at age 100 coverages.

5) Cosmetic reasons associated with comparisons of professionally-developed mortality rates by the Society of Actuaries with mortality rates experienced and readily available outside the insurance environment.

Yearly mortality or death rates per 1,000 outlined in the following table would also seem to suggest serious consideration of an extension of the Tables K beyond the presently proposed age 99. A table as archaic as the Carlisle table was extended beyond age 99. Another old table such as the American Men also ran beyond age 99. The Society of Actuaries 1965-70 Ultimate Basic Table (Males) shows much more reasonable death rates between 95 and 100 than those proposed for the new minimum valuation standard. Even the U.S. Life Table (1969-71) strongly suggests that the Tables K mortality rates are not reasonable at the older ages. Actuaries who designed the GA 1951 Table extended it much beyond age 99.

Yearly Death Rate Per 1,000

($1{,}000\ q_x$)

Age	Carlisle	American Men (5)	1965-70 Ultimate Basic Male	U.S. Life 1969-71 Male White	GA 1951 Male	Table K(M)
95	233.33	387.76	267.93	290.14	268.03	329.96
96	217.39	411.11	279.78	304.31	284.46	384.55
97	222.22	443.40	292.83	317.84	302.22	480.20
98	214.29	457.63	306.15	330.85	321.52	657.98
99	181.82	500.00	319.74	343.24	342.53	1,000.00
100	222.22	562.50	333.56	354.79	365.46	
101	285.71	571.43		365.53	390.54	
102	400.00	666.67		375.50	417.98	
103	666.67	1,000.00		384.71	450.10	
104	1,000.00			393.20	489.20	
105				401.01	537.61	
106				408.18	597.62	
107				414.75	671.55	
108				420.75	761.72	
109				426.24	870.43	

MR. SIBIGTROTH: It was primarily a matter of judgment and we could have gone either way on it. We were mainly concerned with the validity of the experience at those ages. We felt that with population data, there is a tendency toward exaggeration in age as you get into the higher ages. We wanted to stick to mortality that we could see in insurance statistics. That certainly runs out at about age 85, and so we decided that we didn't want to go above that. We felt also that because we were developing valuation tables we were not concerned about the effect of the very high ages, since it is conservative to cut off the table. But I must admit that it was our judgment to cut it off at 100. As far as the life insurance product is concerned I haven't seen much in my experience that goes beyond age 100, so I wonder if that problem is not more fictional than real.

MR. PHARR: I wonder if it is not a problem with the lack of statistics in this field. All the products are cut off at 95 or 100 and increases in cash values in relationship to the premiums the people are paying are so ridiculous that you're never going to get any statistics up there unless you come up with a set of mortality rates that are a little bit more realistic. I just don't quite see why, with population statistics which we think are fairly accurate and yet which indicate the new Tables are way off at age 100, you couldn't use those statistics.

MR. NICOL: This comment was made earlier, and we did do some additional tests of what reserve differences would be if in fact the Tables were extended beyond age 100. We found that the differences in reserves were very small with the exception of one point. At issue age 65 at the 30th year there was a percentage difference of reserves that got up to 5 or 10%. But for issue ages 25 and 45 we looked at the level of reserves up through the 30th year, and there was no real difference. So at least from the standpoint of the purpose of the tables, setting statutory reserves, we felt that we had achieved our goal even without going beyond age 100.

MR. ROBERT E. HUNSTAD: I'd like to second Joe's comment relative to the extension of the table beyond 100. I also have a separate comment, in light of the charge to the Committee and the remarks referred to in Mr. Bolton's paper about the changes that have occurred in mortality experience since the period 1970-75. In looking at the process that is ahead of us we're talking about adoption through the NAIC, through the individual states, of a standard of mortality for valuation purposes. Is it appropriate that we stop now with that 1970-75 result, recognizing that mortality has changed dramatically since then, or should we perhaps take another look at whether this change would alter the recommendations from the Society Committee? Please bear in mind that I recognize the great amount of work that has gone into your efforts thus far and that to start over again would be a horrible frustration. But frustrating or not, is it a thing to be considered?

MR. MONTGOMERY: It is not a thing to be considered at this time. We have one Commissioner from Wyoming who wants a table now, and he is ready to make his own table if we don't come up with one. The Commissioners are really getting adamant about a new table, so I think we are committed to try to get new legislation proposed on a model basis by December of 1980. We simply are under the gun with that as a deadline. If another table comes up at a later time it will have to come up, but we have to go with what we have at this time.

MR. WILLIAM A. BAILEY: Since the development and introduction of the earlier CSO tables, the techniques available to our profession have been significantly extended. It is practical to answer questions today that would have been difficult even to ask twenty years ago. The Special Committee has recognized this development in addressing the question of the adequacy of the new loaded mortality rates to encompass smaller companies' experience. They used Monte Carlo techniques. I will address this question - and related questions - somewhat differently, using two techniques that provide additional information which can be meaningful to both the small and large company. Let me assure you at the outset that my test of the Committee's test does not call into question their concluding recommendation.

The first technique is called numerical convolutions. The algorithm used is as described in a paper soon to be published in the Scandinavian Actuarial Journal. A probability distribution of "actual" to tabular claims is developed by recursively convoluting for sums the two-line distributions for each of the lives in the Committee's model. No random numbers are used in this process; it produces a theoretical population distribution. The second technique is a Bayesian approach which we have used to find answers to two questions:

1. Given a level of actual experience, what is the probability that true mortality is k% of the Tables K or k% of the New Basic Tables?

2. What stop-loss premium is appropriate to insure against claims exceeding various stop-loss levels?

Validity of Exhibit 22

Numerical convolutions were performed to test the validity of the figures shown in Exhibit 22 of the Report of the Special Committee to Recommend New Mortality Tables for Valuation. Given a group of lives and the probability (based on the New Basic Tables) of death of each life in the group, a frequency distribution of aggregate claim dollars is constructed by recursively adding one life at a time. The amounts (not the frequencies) in the resulting frequency distribution are then divided by the tabular expected aggregate claims to produce a hypothetical frequency distribution of ratios of "actual" to tabular. From these distributions can be obtained the probabilities shown in column (2) of Tables 1a - 1g. Using these probabilities (p), percentiles of binomial frequency distribution, $\Phi(100;p)$, were calculated as a benchmark against which to measure the Monte Carlo results shown in Exhibit 22. These calculations assume that 100% of the mortality rates in the New Basic Tables can be used as probabilities of death for each of the 12,349 lives exposed for one year.

A Bayesian Approach

Any particular company will not know with certainty that its lives are subject to probabilities of death according to the New Basic Tables, even if the tabular rates are adjusted to reflect the apparent underwriting class of the insured. We illustrate here a Bayesian approach to determining a frequency distribution of k, where k is a possible underlying mortality level expressed as a percentage of tabular.

An accurate hypothetical frequency distribution of aggregate dollars of claims was constructed assuming that 100% of the mortality rates in the New Basic Tables can be used as probabilities of death for each of the 12,349 lives exposed to risk. Approximations (designated A_i) to the corresponding hypothetical frequency distributions based on k% of the New Basic Tables were constructed by assuming to be invariant the frequency distribution of $(x_i-\bar{x})/\sigma_x$. k was set equal to 50%, 60%, ..., 150%. Let A_1 be based on 50% of the Basic Tables, A_2 be based on 60% of the Basic Tables, ..., A_{11} be based on 150% of the Basic Tables. We assumed a flat prior distribution of k; that is, we attached equal probability (1/11) to each of the hypothetical aggregate claim distributions A_i $(i=1,2,\ldots,11)$.

Now, suppose a company has experienced ratios of actual to tabular mortality of 100% each year for five years. Assuming no trend, what is the probability that the company is really facing an underlying mortality of 110%, rather than 100%? Further, what would be a reasonable premium for stop-loss coverage, given such experience?

To illustrate the results of our Bayesian approach to these problems, we have used the hypothetical inforce of Exhibit 22, with a $50,000 retention. The amount of tabular claims is $329,651, based on 100% of the New Basic Tables.

Now, in the absence of further data about the actual aggregate claim experience of the group of issued lives, the posterior distribution A would simply be

$$A = \bigoplus_{i=1}^{11} \left(\left[x, y, \frac{i}{11}, p \right] A_i \right)$$

that is, a merging of the eleven hypothesized distributions, weighting the probabilities in each by 1/11.

If some aggregate claim experience is available, say for the most recent n years, then this data can be used in the process of creating the posterior distribution of aggregate claims. In practice, the set of hypothesized distributions should be such that their mean values cover the range of reasonably possible expected values. Zero would be considered too low a mean value of an hypothesized distribution, and a mean value equal to the total insurance in force would be considered too high, but between these extremes some judgment can be exercised. One point needs stressing: the mean values of the hypothesized distributions need <u>not</u> (and normally would not) extend as low as or as high as the aggregate claims which might occur in one year.

Let x_j be the actual aggregate claims in the j^{th} experience year. For each $i=1,2,\ldots,11$ and each $j=1,2,\ldots,n$, we look up the probability p_{ij} that the aggregate claims, x_j, would have occurred if distribution A_i were the true underlying distribution. (We are assuming here that the same 12,349 lives were exposed for each of the j years. If the exposure varied significantly from year to year during the observation period, then hypothesized distributions A_{ij} can be created for each of the j years, properly reflecting the exposures, and utilized.)

Next calculate

$$r_i = q_i \cdot \prod_{j=1}^{n} p_{ij}$$

Then, for each i=1,2...,11, calculate

$$s_i = r_i \div \sum_{\ell=1}^{11} r_\ell \quad .$$

Finally, generate the posterior distribution

$$A = \overset{11}{\underset{i=1}{\textcircled{M}}} \left([x, y, s_i \cdot p] \; A_i \right)$$

that is, the probabilities in distribution A_i are multiplied by s_i for i=1,2,...,11, respectively, and the resulting partial distributions are merged to produce the posterior distribution A. (Again, we are assuming that the same 12,349 lives will be exposed next year. If the exposures will be significantly different next year, then the hypothesized distributions, say $A_{i,n+1}$ for next year can be created, properly reflecting the anticipated exposures, and utilized in deriving A.)

A summary diagram of this Bayesian method is shown on the next page. See Tables 2 and 3 for some numerical results.

SUMMARY DIAGRAM OF BAYESIAN METHODOLOGY

	Input Frequency Distributions for Period				Prior Probabilities	Observations			$r_i = q_i \cdot \prod_{j=1}^{n} p_{ij}$	$s_i = r_i \div \sum_{\ell=1}^{m} r_\ell$
i	1	2 ...	n	$n+1$	q_i	x_1	x_2 ...	x_n		
1	A_{11} ·	A_{12} ···	A_{1n}	$A_{1,n+1}$	q_1	p_{11}	p_{12} ···	p_{1n}	r_1	s_1
2	A_{21}	A_{22} ···	A_{2n}	$A_{2,n+1}$	q_2	p_{21}	p_{22} ···	p_{2n}	r_2	s_2
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
m	A_{m1}	A_{m2} ···	A_{mn}	$A_{m,n+1}$	q_m	p_{m1}	p_{m2} ···	p_{mn}	r_m	s_m
					$\sum = 1$					$\sum = 1$

n = number of observations

m = number of hypothesized distributions

A_{ij} = i^{th} hypothesized distribution for the j^{th} sub-period

x_j = observation for the j^{th} sub-period

p_{ij} = the probability of observing x_j, using A_{ij} as the true underlying distribution

$$\text{Posterior distribution} = A = \bigoplus_{i=1}^{m} \left| \left[x, y, s_i \cdot p \right] A_{i,n+1} \right|$$

TABLE 1a

TEST OF FIGURES SHOWN IN EXHIBIT 22
MALES ONLY - $50,000 RETENTION

(1)	(2)	(3)	(4)							
	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING		RESULT SHOWN IN EXHIBIT 22	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)#						
RATIO OF "ACTUAL" TO TABULAR*	POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	MONTE CARLO 100 YEARS	1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0003	.0002	0	0	0	0	0	0	0	1
30 - 40	.0031	.0033	0	0	0	0	0	0	1	2
40 - 50	.0139	.0153	0	0	0	1	1	2	3	5
50 - 60	.0376	.0394	3	0	1	3	4	5	6	9
60 - 70	.0739	.0725	5	2	4	6	7	9	11	14
70 - 80	.1134	.1141	12	5	7	10	11	13	15	19
80 - 90	.1373	.1357	12	6	9	12	14	15	18	22
90 - 100	.1519	.1475	16	7	11	13	15	17	20	24
100 - 110	.1351	.1346	11	6	9	12	13	15	18	22
110 - 120	.1140	.1125	15	5	7	10	11	13	16	19
120 - 130	.0843	.0862	10	3	5	7	8	10	12	15
130 - 140	.0562	.0566	6	1	3	4	5	7	9	12
140 - 150	.0350	.0356	5	0	1	2	3	4	6	8
150 - 160	.0213	.0213	3	0	0	1	2	3	4	7
160 - 170	.0116	.0134	2	0	0	0	1	2	3	4
OVER 170	.0111	.0117	0	0	0	0	1	2	3	4
	1.000	1.000								

*Expressed as a percentage of $287,112 which is the expected dollars of claims based on the New Male Basic Table.

#Random numbers were not used in the calculation of these columns.

TABLE 1b

TEST OF FIGURES SHOWN IN EXHIBIT 22
FEMALES ONLY - $50,000 RETENTION

(1)	(2)	(3)	(4)							
RATIO OF "ACTUAL" TO TABULAR*	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	RESULT SHOWN IN EXHIBIT 22 MONTE CARLO 100 YEARS	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)# 1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0521	.0521	3	1	2	4	5	6	8	11
30 - 40	.0597	.0605	3	1	3	5	6	7	9	12
40 - 50	.0752	.0739	6	2	4	6	7	9	11	14
50 - 60	.0858	.0866	13	3	5	7	8	10	12	16
60 - 70	.0835	.0860	8	3	5	7	8	10	12	15
70 - 80	.0800	.0828	4	2	5	6	8	9	12	15
80 - 90	.0830	.0780	13	3	5	7	8	10	12	15
90 - 100	.0742	.0753	7	2	4	6	7	9	11	14
100 - 110	.0587	.0592	9 (14)	1	3	5	6	7	9	12
110 - 120	.0508	.0537	5	1	2	4	5	6	8	11
120 - 130	.0482	.0458	2	1	2	4	5	6	8	10
130 - 140	.0381	.0403	7	0	1	3	4	5	6	9
140 - 150	.0349	.0330	2 (3)	0	1	2	3	4	6	8
150 - 160	.0284	.0280	3	0	1	2	3	4	5	7
160 - 170	.0238	.0261	6 (5)	0	1	1	2	3	4	7
OVER 170	.1236	.1189	9 (4)	5	8	11	12	14	17	21
	1.000	1.000								

*Expressed as a percentage of $42,539 which is the expected dollars of claims based on the New Female Basic Table.

#Random numbers were not used in the calculation of these columns.

() Numbers in parenthesis appeared in the report, but were revised later by the Committee.

TABLE 1c

TEST OF FIGURES SHOWN IN EXHIBIT 22
TOTAL PORTFOLIO (MALE AND FEMALE COMBINED) - $50,000 RETENTION

(1)	(2)	(3)	(4)							
	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING		RESULT SHOWN IN EXHIBIT 22	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)#						
RATIO OF "ACTUAL" TO TABULAR*	POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	MONTE CARLO 100 YEARS	1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0001	.0001	0	0	0	0	0	0	0	0
30 - 40	.0012	.0015	0	0	0	0	0	0	1	1
40 - 50	.0080	.0070	0	0	0	0	1	1	2	3
50 - 60	.0286	.0303	1	0	1	2	3	4	5	7
60 - 70	.0665	.0677	4	2	4	5	7	8	10	13
70 - 80	.1116	.1108	13	4	7	9	11	13	15	19
80 - 90	.1500	.1490	13	7	11	13	15	17	20	24
90 - 100	.1615	.1625	19	8	12	14	16	18	21	25
100 - 110	.1478	.1507	11	7	10	13	15	17	19	23
110 - 120	.1221	.1161	11	5	8	10	12	14	16	20
120 - 130	.0856	.0825	15	3	5	7	8	10	12	16
130 - 140	.0546	.0589	5	1	3	4	5	7	8	11
140 - 150	.0315	.0321	5	0	1	2	3	4	5	8
150 - 160	.0164	.0163	3	0	0	1	1	2	3	5
160 - 170	.0082	.0080	0	0	0	0	1	1	2	3
OVER 170	.0063	.0065	0	0	0	0	0	1	2	3
	1.000	1.000								

*Expressed as a percentage of $329,651 which is the expected dollars of claims based on the New Male and Female Basic Tables.

#Random numbers were not used in the calculation of these columns.

TABLE 1d

TEST OF FIGURES SHOWN IN EXHIBIT 22
MALES ONLY - $25,000 RETENTION

(1)	(2)	(3)	(4)							
	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING		RESULT OBTAINED FROM THE	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)#						
RATIO OF "ACTUAL" TO TABULAR*	POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	COMMITTEE MONTE CARLO 100 YEARS	1%	10%	30%	50%	70%	90%	99%
UNDER 30 %	.0001	.0001	0	0	0	0	0	0	0	0
30 - 40	.0013	.0013	0	0	0	0	0	0	1	1
40 - 50	.0073	.0084	0	0	0	0	1	1	2	3
50 - 60	.0264	.0261	2	0	1	2	2	3	5	7
60 - 70	.0616	.0641	4	1	3	5	6	7	9	12
70 - 80	.1069	.1073	6	4	7	9	11	12	15	18
80 - 90	.1532	.1464	17	8	11	13	15	17	20	24
90 - 100	.1649	.1693	20	8	12	14	16	18	21	26
100 - 110	.1553	.1549	14	8	11	14	15	17	20	24
110 - 120	.1307	.1269	15	6	9	11	13	15	17	21
120 - 130	.0860	.0886	8	3	5	7	8	10	12	16
130 - 140	.0528	.0524	6	1	3	4	5	6	8	11
140 - 150	.0290	.0297	6	0	1	2	3	4	5	7
150 - 160	.0144	.0131	1	0	0	1	1	2	3	5
160 - 170	.0064	.0075	1	0	0	0	0	1	2	3
OVER 170	.0041	.0039	0	0	0	0	0	1	1	2
	1.000	1.000								

*Expressed as a percentage of $252,589 which is the expected dollars of claims based on the New Male Basic Table.

#Random numbers were not used in the calculation of these columns.

TABLE 1e

TEST OF FIGURES SHOWN IN EXHIBIT 22

FEMALES ONLY - $25,000 RETENTION

(1)	(2)	(3)	(4)							
RATIO OF "ACTUAL" TO TABULAR*	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	RESULT OBTAINED FROM THE COMMITTEE MONTE CARLO 100 YEARS	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)#						
				1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0421	.0422	3	0	2	3	4	5	7	9
30 - 40	.0494	.0510	2	1	2	4	5	6	8	11
40 - 50	.0669	.0662	6	2	4	5	7	8	10	13
50 - 60	.0785	.0795	8	2	5	6	8	9	11	15
60 - 70	.0820	.0823	8	3	5	7	8	10	12	15
70 - 80	.0801	.0811	9	2	5	6	8	9	12	15
80 - 90	.0792	.0805	9	2	5	6	8	9	11	15
90 - 100	.0766	.0760	9	2	4	6	8	9	11	14
100 - 110	.0742	.0747	8	2	4	6	7	9	11	14
110 - 120	.0627	.0640	10	1	3	5	6	7	9	12
120 - 130	.0565	.0554	5	1	3	4	5	7	9	12
130 - 140	.0505	.0486	3	1	2	4	5	6	8	11
140 - 150	.0428	.0433	5	0	2	3	4	5	7	10
150 - 160	.0325	.0341	3	0	1	2	3	4	6	8
160 - 170	.0279	.0257	3	0	1	2	3	4	5	7
OVER 170	.0981	.0954	9	4	6	8	10	11	14	17
	1.000	1.000								

*Expressed as a percentage of $39,896 which is the expected dollars of claims based on the New Female Basic Table.

#Random numbers were not used in the calculation of these columns.

TABLE 1f

TEST OF FIGURES SHOWN IN EXHIBIT 22
TOTAL PORTFOLIO (MALE AND FEMALE COMBINED) - $25,000 RETENTION

(1)	(2)	(3)	(4)							
RATIO OF "ACTUAL" TO TABULAR*	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	RESULT SHOWN IN EXHIBIT 22 MONTE CARLO 100 YEARS	THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=100 WITH POPULATION PROBABILITY p FROM COLUMN (2)# 1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0000	.0000	0	0	0	0	0	0	0	0
30 - 40	.0004	.0004	0	0	0	0	0	0	0	1
40 - 50	.0039	.0038	0	0	0	0	0	1	1	2
50 - 60	.0179	.0172	2	0	0	1	2	2	4	5
60 - 70	.0521	.0541	1	1	2	4	5	6	8	11
70 - 80	.1061	.1067	5	4	7	9	10	12	15	18
80 - 90	.1558	.1558	19	8	11	14	15	17	20	24
90 - 100	.1845	.1844	20	10	14	16	18	20	23	28
100 - 110	.1730	.1738	19	9	13	15	17	19	22	27
110 - 120	.1309	.1277	10	6	9	11	13	15	17	21
120 - 130	.0875	.0847	14	3	5	7	9	10	12	16
130 - 140	.0481	.0513	6	1	2	4	5	6	8	10
140 - 150	.0236	.0232	2	0	1	1	2	3	4	6
150 - 160	.0104	.0107	2	0	0	0	1	1	2	4
160 - 170	.0039	.0040	0	0	0	0	0	1	1	2
OVER 170	.0019	.0021	0	0	0	0	0	0	1	2
	1.000	1.000								

*Expressed as a percentage of $292,485 which is the expected dollars of claims based on the New Male and Female Basic Tables.

#Random numbers were not used in the calculation of these columns.

TABLE 1g

TEST OF POLYSYSTEMS MONTE CARLO FIGURES
TOTAL (MALE AND FEMALE COMBINED) - $25,000 RETENTION

(1)	(2)	(3)							
	PROBABILITY THAT AGGREGATE CLAIMS WILL FALL IN RANGE INDICATED IN (1) USING		THE FIGURES BELOW REPRESENT PERCENTILES FOR A BINOMIAL DISTRIBUTION OF SAMPLES OF SIZE n=16,384 WITH POPULATION PROBABILITY p FROM COLUMN (2)#						
RATIO OF "ACTUAL" TO TABULAR*	POLYSYSTEMS NUMERICAL CONVOLUTIONS#	POLYSYSTEMS MONTE CARLO 16,384 YEARS	1%	10%	30%	50%	70%	90%	99%
UNDER 30%	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
30 - 40	.0004	.0004	.0001	.0002	.0003	.0004	.0005	.0006	.0008
40 - 50	.0039	.0038	.0028	.0033	.0037	.0039	.0042	.0045	.0051
50 - 60	.0179	.0172	.0156	.0166	.0173	.0179	.0184	.0192	.0203
60 - 70	.0521	.0541	.0481	.0499	.0512	.0521	.0530	.0543	.0562
70 - 80	.1061	.1067	.1005	.1030	.1049	.1061	.1074	.1092	.1118
80 - 90	.1558	.1558	.1492	.1522	.1543	.1558	.1573	.1594	.1624
90 - 100	.1845	.1844	.1775	.1806	.1829	.1845	.1861	.1884	.1916
100 - 110	.1730	.1738	.1661	.1692	.1714	.1730	.1746	.1768	.1799
110 - 120	.1309	.1277	.1248	.1274	.1295	.1309	.1323	.1343	.1371
120 - 130	.0875	.0847	.0824	.0847	.0864	.0875	.0886	.0903	.0927
130 - 140	.0481	.0513	.0443	.0460	.0472	.0481	.0490	.0502	.0520
140 - 150	.0236	.0232	.0209	.0221	.0229	.0236	.0242	.0251	.0433
150 - 160	.0104	.0107	.0086	.0094	.0099	.0104	.0108	.0114	.0123
160 - 170	.0039	.0040	.0028	.0033	.0037	.0039	.0042	.0045	.0051
OVER 170	.0019	.0021	.0012	.0015	.0017	.0019	.0021	.0023	.0027
	1.000	1.000							

*Expressed as a percentage of $292,485 which is the expected dollars of claims based on the New Male and Female Basic Tables.

#Random numbers were not used in the calculation of these columns.

TABLE 2

ILLUSTRATIVE RESULTS USING A BAYESIAN APPROACH
TO TEST ADEQUACY OF THE NEW MALE AND FEMALE BASIC TABLES

Experience: $329,651 each year for five years		Experience: $247,238, 329,651, 412,063		Experience: $412,063 each year for five years		Experience: $247,238, 412,063, 247,238, 412,063	
Average: $329,651		Average: $329,651		Average: $412,063		Average: $329,651	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Possible Underlying Mortality Level*	Posterior Probability of (1)	Possible Underlying Mortality Level*	Posterior Probability of (3)	Possible Underlying Mortality Level*	Posterior Probability of (5)	Possible Underlying Mortality Level*	Posterior Probability of (7)
.50	.0000	.50	.0001	.50	.0000	.50	.0000
.60	.0001	.60	.0027	.60	.0000	.60	.0007
.70	.0061	.70	.0296	.70	.0000	.70	.0179
.80	.0674	.80	.1253	.80	.0001	.80	.1233
.90	.2497	.90	.2486	.90	.0053	.90	.2874
1.00	.3903	1.00	.2687	1.00	.0428	1.00	.2807
1.10	.2130	1.10	.2081	1.10	.1858	1.10	.2146
1.20	.0657	1.20	.0906	1.20	.3459	1.20	.0652
1.30	.0070	1.30	.0219	1.30	.2653	1.30	.0093
1.40	.0006	1.40	.0039	1.40	.1255	1.40	.0008
1.50	.0000	1.50	.0004	1.50	.0292	1.50	.0000
Posterior Mean = $328,486		Posterior Mean = $325,493		Posterior Mean = $405,988		Posterior Mean = $322,579	
Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium
110%	$21,656	110%	$22,268	110%	$63,351	110%	$20,353
125	9,627	125	10,295	125	36,222	125	9,079
150	1,915	150	2,244	150	11,304	150	1,835
175	284	175	375	175	2,668	175	279
200	33	200	49	200	487	200	33

*Expressed as a percentage of $329,651 which is the expected dollars of claims based on the New Male and Female Basic Tables, using $50,000 retention.

Note: Random numbers were not used in the calculation of Table 2.

TABLE 3

ILLUSTRATIVE RESULTS USING A BAYESIAN APPROACH
TO TEST ADEQUACY OF THE NEW MALE AND FEMALE TABLES

Experience: $329,651 each year for five years		Experience: $247,238 329,651 412,063		Experience: $412,063 each year for five years		Experience: $247,238 412,063 247,238 412,063	
Average:	$329,651	Average:	$329,651	Average:	$412,063	Average:	$329,651
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Possible Underlying Mortality Level*	Posterior Probability of (1)	Possible Underlying Mortality Level*	Posterior Probability of (3)	Possible Underlying Mortality Level*	Posterior Probability of (5)	Possible Underlying Mortality Level*	Posterior Probability of (7)
.37	.0000	.37	.0001	.37	.0000	.37	.0000
.44	.0001	.44	.0027	.44	.0000	.44	.0007
.51	.0061	.51	.0296	.51	.0000	.51	.0179
.59	.0674	.59	.1253	.59	.0001	.59	.1233
.66	.2497	.66	.2486	.66	.0053	.66	.2874
.74	.3903	.74	.2687	.74	.0428	.74	.2807
.81	.2130	.81	.2081	.81	.1858	.81	.2146
.88	.0657	.88	.0906	.88	.3459	.88	.0652
.96	.0070	.96	.0219	.96	.2653	.96	.0093
1.03	.0006	1.03	.0039	1.03	.1255	1.03	.0008
1.10	.0000	1.10	.0004	1.10	.0292	1.10	.0000
Posterior Mean = $328,486		Posterior Mean = $325,493		Posterior Mean = $405,988		Posterior Mean = $322,579	
Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium	Stop-loss Level*	Pure Net Stop-loss Premium
100%	$4,908	100%	$5,444	100%	$22,457	100%	$4,655
110	1,966	110	2,301	110	11,523	110	1,884
125	423	125	545	125	3,630	125	413
150	22	150	35	150	362	150	23
175	1	175	2	175	23	175	1
200	0	200	0	200	1	200	0

*Expressed as a percentage of $448,421 which is the expected dollars of claims based on the New Male and Female Tables, using $50,000 retention.

Note: Random numbers were not used in the calculation of Table 3.

MR. MONTGOMERY: The National Association of Insurance Commissioners Technical Task Force on Valuation and Nonforfeiture Value Regulation for Life and Health Insurance Companies compliments the Special Committee of the Society of Actuaries to Recommend New Mortality Tables For Valuation on the splendid, professional and comparatively rapid manner in which mortality tables have been developed for use in updating the standard valuation and nonforfeiture value laws. The NAIC Task Force has set a target date of June, 1980 for the submission to the NAIC of proposed amendments which will include the new mortality table and a revision of the formula for computing nonforfeiture values. It is hoped that the NAIC will give its approval at its December, 1980 meeting so that most states can enact such legislation by 1983.

The new Standard Ordinary mortality tables will greatly facilitate the presentation of life insurance policies more in line with current facts of life but still leave some problem areas needing further attention. Here is a list of some of the areas of further activity apparent at this time:

1. Joint Life Tables

   Hopefully tables of joint equal ages can be developed to apply either to the male or female tables or to some unisex table in the case of male/female joint life contracts.

2. Renewable Term Insurance

   There may be differences in mortality significant enough for these plans to require separate valuation tables.

3. Industrial and Guaranteed Issue Insurance

   These require construction of separate mortality tables. Whether or not Industrial and Guaranteed Issue experience can be combined for the purpose of preparing a mortality table must be studied before such tables can be developed.

4. Substandard Insurance

   Separate tables for substandard lives may be needed. The results of the study of the Society of Actuaries Special Committee on Substandard Lives Mortality Tables should be reviewed to see if tables for substandard lives can be developed to accompany the tables for standard lives.

5. Frequency of Preparation of Mortality Tables

   The rapidity with which mortality rates are changing at the present time may require new tables within the next five or ten years. This will have to be considered regardless of the expense of issuing new policy forms. If warning of this potential problem is given far enough in advance, the life insurance industry and its regulators should have time to study and implement ways of reducing such conversion costs rather than restricting the development of more current mortality statistics as they become available.

MR. NICOL: There has been some correspondence between Bill Bolton (who is on the Committee) and others on the joint life question. The particular area that is of concern is really the nonforfeiture area because joint life policies are a fair piece of the marketplace today, and we need some easy way of providing the agent with a set of nonforfeiture values. The simple way perhaps is to prepare a joint table for male and female lives at equal ages, and then develop a method of translating actual age/sex combinations to the equal age male/female table. Some thought has been given to this. The point has been made though, that any company should be permitted to use an exact method should it choose to do so. This could be important on large multiple life cases, business environments, et cetera.

MR. RICHARD V. MINCK: We have had in the 1970's two major changes in the nonforfeiture and valuation laws. The first change took about six years from beginning to end. It occupied our staff rather exhaustively for a fair period of time and in fact towards the end of that period our staff met themselves coming in for the new round of changes. Despite that activity I think it is clear that there is a need for another change in the valuation and nonforfeiture law. We as a trade association are particularly grateful to your Committee for the work you have done and the time in which you have accomplished it. It seems to me that you could argue that there are things happening to mortality levels, but a reduction in those levels does not necessarily mean that your table is no longer perfectly appropriate for valuation purposes. I think that in the time frame in which we have to operate - if John succeeds in getting things through in 1980 we are talking about 1984 or 1985 - there are a lot of people who need changes in these laws as soon as we can get them. So I would urge that rather than wait on perfection even in times when there may be profound changes going on in mortality that we consider moving forward. While we do so we can study the results and see whether something else needs to be done. But I would not delay what is at best a time-consuming process for what I have seen so far.

At the same time when we present this table to the NAIC we are going to have to indicate clearly to them that there is a tremendous change in mortality going on at the present time. We don't know when it is going to stop. We have to make them realize that we may be coming back to them again five years from now, saying that this table is no longer appropriate. As long as the NAIC understands that, I don't think we have a problem.

MR. CARL H. ROSENBUSH, JR.: When the 1958 CSO Table was adopted as an official valuation standard, the Society of Actuaries published a set of financial tables based upon this standard. However, each book began not with the q_x table but with the l_x table, and it was from the l_x table that precisely calculated commutation columns were derived. Present values were rounded to ten places to the right of the decimal, then further rounded to eight places before multiplying by the l_x and d_x values (presumably because of limitations of the computer generating the values). Finally volumes of reserves and cash values were produced from these columns.

This was a good approach at that time. Most values were calculated by clerks on electromechanical desk calculators and actuaries could use the published volumes as the source of the more common values. Computers were

just becoming available but the languages were on the one-for-one instruction level and difficult to use.

When a new table is approved, I hope that the q_x table will be given as the primary source. If any monetary values are produced, statements should be made that the published values have been calculated by one of several valid methods, and that slight variations should not be taken as errors because regulators tend to accept these values as gospel and object if values differ due to rounding. With the vast variety of sophisticated computers and programming techniques available currently, actuaries can easily calculate reserves for a number of plans by a variety of methods in the time it once took to calculate reserves for one age. I tested some Ordinary Life minimum values at ages 35, 60, and 70 on the 1958 CSO Table at 3 1/2% using the following five methods:

(1) Premiums and reserves calculated from commutation columns using 1958 CSO rules

(2) Premiums calculated as in (1) but reserves accumulated backwards using the Fackler formula

(3) Premiums and reserves calculated from commutation columns which were unrounded and left in a double precision, floating point format

(4) Premiums calculated as in (3) but reserves accumulated as in (2)

(5) Premiums calculated from the use of unrounded present values of one and q_x and ${}_np_x$ values and reserves accumulated as in (2).

Comparisons of these methods show no real differences. Only the age 70 calculation had a difference in the five methods below age 94 where at duration 14, methods (2), (4), and (5) gave values 1¢ higher than (1). Beyond age 93, the difference was at most 3¢ except for age 99 where the difference was up to 17¢ because of the small value of l_{99}. Such small differences could presumably cause difficulties with regulators and consumerists. In addition, my company writes insurance in several countries that have adopted U.S. valuation bases and will probably adopt the new Tables. For example, the valuation basis in the Dominican Republic, Nicaragua, and Panama is 1958 CSO CRVM, at 3 1/2% for participating life and endowment and 4% for others. In El Salvador, it is 1941 CSO Full Preliminary Term at 4%. Because most of their regulators are less sophisticated, such variations are more likely to cause problems.

Concerning the use of 130% of the new Table for extended term insurance, has the Committee considered grading to 100% at the older ages? I noted that they wished to end Tables K a year earlier than the New Basic Tables to "remove the inconsistency of a loading equal to zero" but this was not mentioned when the KET Tables loading went from 30% at age 98 to 0% at 99. Considering that Tables K have already been forced to $q_{99} = 1$, couldn't the loading be dropped in at least the last five or ten years? I calculated some extended term values based on Table K(M) 4% minimum values, calculating them on both Table KET(M) and a variation where the loading decreases 1% a year for ages 70 to 99. On Ordinary Life, the differences are greatest on the lower issue ages (which have the higher cash values per attained age, of course). At age 25, the greatest difference is only 1 year and 289 days at duration 62. At age 75, the

greatest difference is 220 days at duration 19. The difference in pure endowment benefits is greater for high issue ages. A 20 Year Endowment was used to compare pure endowment values. For age 55, the maximum difference is $8 at duration 10. At 70, the maximum is $158 at duration 16. From the limited comparisons, the extra cost of both extended term and pure endowment would appear minimal.

For adequacy, I compared the graded tables based on 1970-75 five-year ultimate experience to 130% of the 1965-70 fifteen-year tables. The ratios are generally in the 90% range, except that they rise rapidly where the new tables are graded to age 99. The male table is in the 95-99% range through age 79. Then it drops into the 90-95% range until age 91. The minimum value is 0.90585 at 89. On the female table, the ratio exceeds 100% at ages 70-72, then drops quickly into the 90-95% range until 93. The minimum value (and the only value for male or female below 90%) is 0.89501 at 92. I would suggest that the Committee investigate a graded extra loading based upon their experience to see if lower high-age q_x values might be warranted.

Surprisingly, no mention was made in the Report of an age-last-birthday table, even though the use of this basis is becoming more popular in Ordinary insurance. I hope that any table published will avoid the problems of the 1958 CSO Tables. That age-last-birthday table was created by first averaging the l_x values, which reemphasized the supremacy of the l_x table. From these l_x values, derived from q_x values with five significant digits, q_x values were calculated with seven significant digits to be able to reproduce the mean l_x values. Besides violating the rules of significant digits, the l_0 value of 9,964,600 implies that out of 10,000,000 fetuses (insured fetuses, that is) of 3 months, 35,400 did not live until birth. It is my hope that when the Committee prepares an age-last-birthday table, whether from averaged l_x's or by other means, that q_x values will be expressed to five significant digits and that any l_x table will have the same radix as the age-nearest-birthday table.

To test if there would be any real difference in values, I calculated some test reserves based on age-last-birthday values derived from averaged l_x's using both the 1958 method and the suggested method. Net level reserves on Table K(M) at 4% were calculated from commutation columns using 1958 rounding rules. For Ordinary Life and 20 Year Endowment reserves at ages 25, 45, and 65, the values were never further apart than 2¢ except at age 95 and above. From this, I think that a different approach would produce satisfactory results.

MR. CHRISTOPHER H. WAIN: I find myself rather concerned by John Montgomery's reference to the pressure from the legislatures and the Commissioners for a table, and the possibility of having to go back in five years for a new table and all that that implies. The introduction of a new mortality table into the industry and all the companies has to be a job that costs tens of millions of dollars. I do hope that that cost, which has to be paid by the consumers ultimately, will be balanced against the expected benefits.

MR. THOMAS J. KELLY: I happen to be a member of the New York Insurance Department and also John Montgomery's task force, but I'm speaking for

myself. My thoughts are not original; I've heard them before. With the concern expressed this afternoon for the continuing changes in the mortality levels I am wondering if this would be a good time not to delay the further development and progress of the current proposed tables but rather to give some thought to some kind of ongoing means for adjusting mortality tables without having to go back to the legislatures each time.

MR. MONTGOMERY: One of the things we could do in the drafting of the legislation is to imitate the disability model legislation where the tables can be changed at the option of the Commissioner. I don't know whether all states would agree to that in their legislation, but it is possible that they might due to the rapidly changing mortality.

MR. JOHN M. BRAGG: A number of companies in the United States specialize in the writing of life insurance on the "home service" or "debit" marketing system. Much of this business is written in the inner city and similar neighborhoods. It was formerly referred to as "Industrial" business. More and more, however, this business is being written on Ordinary policy forms, with all the typical Ordinary privileges, and in much larger average amounts than previously. This trend towards "Ordinary" will continue. Nevertheless, the underlying mortality and other characteristics of this market are relatively unchanged. An estimate of the number of companies specializing in this type of home service marketing would be about 90. Many of these companies are small and few of them appear to report mortality results to the Society's mortality reports, which are the basis of the new "Tables K". However, the companies I refer to have many millions of policies in force in the home service market I am discussing.

Unfortunately, no consolidated or unconsolidated mortality rates have been published for this market in recent times. And yet for most ages, those mortality rates appear to be greatly in excess of the q_x's appearing in the new Tables K and KET. I have been a close observer of mortality in a fairly large number of companies specializing in this market and have some informed estimates of the mortality which was being experienced at the time (1970 - 1975) of the exposure period of Tables K. For this discussion, I am referring to these estimates as "Home Service Mortality". They are on a combined "unisex" basis. Here are some comparisons:

Attained Age	1000 q_x at Attained Age: Home Service Mortality	K(M)	KET(M)
20	1.80	1.90	2.65
30	3.80	1.73	2.48
40	7.30	3.02	3.93
50	14.00	6.71	8.72
60	30.70	16.08	20.90

It will be seen that at ages over 30 the new K and KET values are quite inadequate if used to represent Home Service Mortality.

I have also attempted to compare the emerging K net level reserves, at 4%, with "natural reserves" which use Home Service Mortality, typical expense patterns, and interest assumptions of 7% for ten durations; 6% for the next ten; and 5% thereafter. The results are as follows for a whole life policy issued at age 25:

Duration	Per Thousand Reserves: Table K 4%	Natural Reserves 7%-6%-5%
1	$ 7	$ -8
5	38	31
10	83	91
20	199	243

From this it appears that the Tables K reserves start to become inadequate about the tenth duration.

Companies operating in the home service market which I am discussing will in the future be issuing their products on Ordinary policy forms with all the Ordinary features and privileges. The question will arise of modifying the Tables K or developing new tables which will be suitable as a basis of cash values and reserves in this market.

I would like to endorse and commend the Committee for its introductory statement: "No recommended minimum mortality standard for valuation is intended to replace the judgment of the actuary responsible for the adequacy of reserves and overall financial soundness."