# Society of Actuaries and American Academy of Actuaries

# Joint Preferred Mortality Project Interim 2007 Report

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**Project Oversight Group**

Larry Gorski, FSA, MAAA, and Donna Claire, FSA, MAAA, Chairs

Mary Bahna-Nolan, FSA, MAAA
Robert Beuerlein, FSA, MAAA
John Bruins, FSA, MAAA
Larry Bruning, FSA, MAAA
Cecil Bykerk, FSA, MAAA
Tim Finnegan, FSA, MAAA
Dieter Gaubatz, FSA, FCIA, MAAA
Tim Harris, FSA, MAAA
Al Klein, FSA, MAAA
David Sandberg, FSA, MAAA

SOA Staff:
Bruce Iverson
Jack Luff, FSA, FCIA, MAAA
Korrel Crawford

**Joint Report of the Society of Actuaries and American Academy of Actuaries**
**On the Preferred Mortality Project**

## Background

In 2005, the National Association of Insurance Commissioners (NAIC) Life and Health Actuarial Task Force (LHATF) requested that the actuarial professional bodies develop mortality tables that could be used to better reflect the actual mortality of companies for reserving.

The LHATF stated that "Available life insurance mortality valuation tables are generally considered higher than the mortality of many preferred risks underwritten in the marketplace today. Setting different levels of valuation mortality appropriate for preferred risks would largely address issues of reserve redundancy emanating from the key assumption of mortality. Different levels of valuation mortality would:

1. Address large reserve increases not appropriate for preferred risks which threaten to curtail availability of coverage for such risks.
2. Reduce the reserve redundancy and its effect on insurers to seek additional capital, reinsurance relief or alternatives of letters of credit or securitization.
3. Be consistent with and useful in a principles-based approach."

LHATF therefore requested that:

1. The Society of Actuaries develop studies of preferred risks.
2. The American Academy of Actuaries and the Society of Actuaries develop preferred levels of valuation mortality.
3. The American Academy of Actuaries recommend requirements to be met in order to use such preferred valuation mortality.

Preferred risk underwriting began with the AIDS scare in the late 1980s. As companies began to have blood drawn to test for the HIV virus, they realized that there was additional valuable information that could be derived from the blood draw. This additional information, combined with some other readily available information, is what allowed companies to better evaluate individual risks and is what led to preferred risk underwriting classification as we know it today.

Initially, many companies solely introduced a preferred nonsmoker class. The number of risk classes, like the preferred underwriting criteria itself, has evolved over time. Today, according to the latest Society of Actuaries (SOA) Preferred Underwriting Survey, most companies use multiple classes for underwriting, with the average being 3-4 nonsmoker risk classes and 2 smoker risk classes.

With respect to the evolution of the preferred underwriting criteria used in the decision-making process, while the criteria have evolved somewhat, the biggest changes have been in the qualifying levels. Today, there are certain major criteria that are generally used by

companies. The new mortality tables being developed used these major criteria to develop divisions of the tables by a set of underwriting scoring criteria.

Although the driver of the project was determining the proper valuation table for preferred mortality, it was also recognized that this would be an opportunity to develop a valuation table that could be used for all levels of risk.

In order to efficiently handle this project, a joint Society of Actuaries and American Academy of Actuaries project was established. A project oversight group was formed with representatives from the SOA, the Academy, regulators and the industry. The SOA and Academy formed teams to work on various aspects of the project. These teams were:

1. Implementation Team, chaired by Mike Boerner
2. Data Validation Team, chaired by Sharon Brody
3. Underwriting Criteria Team, chaired by Al Klein
4. Experience Analysis Team, chaired by Rick Bergstrom
5. Joint AAA/SOA Review Team, chaired by Faye Albert
6. Valuation Basic Table Team, chaired by Mary Bahna-Nolan
7. Valuation Table Team, chaired by Tim Harris.

This report summarizes the work of these teams to date. At this point, the valuation basic tables have been prepared. The valuation table itself is still being developed. This work is expected to be completed by the end of 2007.

The data used for the updated table came from a number of companies. Note that the information related to the mortality experience of each company was kept confidential. The volunteers working on the project did not know which companies they were working on.

The POG wants to acknowledge the contributions of the many team members who contributed to this effort.

## Data Validation Team Report

### Members of the Data Validation Team

Sharon Brody, FSA, MAAA, Chair
Dieter Gaubatz, FSA, FCIA, MAAA, Vice Chair

Jill Brown
Paul Langevin
Vera Ljucovic, FSA, FCIA, MAAA
Mel McFall, FSA, MAAA
Susan Miner, FSA, MAAA
Steve Pummer, FSA, MAAA
Lynn Ruezinsky, ASA, MAAA

MIB Staff:
Nancy Morse
Jan Palmbach
Tom Rhodes, FSA, MAAA, FCA

SOA Staff:
Jack Luff, FSA, FCIA, MAAA
Korrel Crawford

### Data Validation Team Efforts for 2002-2004 Study

The 2002-2004 mortality study represented a new beginning in the Society of Actuaries data calls. This study was the first to include preferred mortality information using the Risk Class Rank fields. The number of companies contributing data to the study increased significantly from 20 in the prior study to 50 in the 2002-2004 study. Additionally, the mortality data needed was consolidated into a Minimal Mortality Contribution Format. A new infrastructure was successfully implemented to accommodate these needs and enhance the quality and turnaround time for the 2002-2004 study and future studies.

Cleaning the 2002-2004 data was the first step on the critical path for the overall Preferred Mortality project and it was determined that a volunteer effort was needed in order to keep within the required budget and timeframes. The timing of creating this new team was good in that an effort to improve the overall data validation process was needed. A team of volunteers was assembled and included representatives from insurance companies, reinsurance companies, consulting firms, the Society of Actuaries and MIB. Each member had experience with mortality studies and data validation techniques. A list of team members is attached to the report. This team's work resulted in useable data from 35 companies for the study.

A day-and-a-half face to face kickoff meeting was held on October 17-18, 2005 in Newark, NJ. The team continued to meet generally weekly via teleconference through

June 2006 and then less frequently through the end of 2006. The meetings were led by Sharon Brody, Chair, and consisted of reviewing status reports provided by MIB, updates by individual committee members on specific items they were assigned to review, and as needed, discussion of other methodology related items.

The Data Validation Team researched the claim practices of companies through the use of a questionnaire. Company responses to the questionnaire were reviewed by the Data Validation Team and used as input to the data validation process.

An outline of the data validation process is depicted in Appendix A of this report. The major categories within the process are summarized below.

File Validation – Data was submitted in company specific format and initial processing was performed. Reports are produced that give details on record counts, distributions, fields completed and reasonableness statistics.

Map to Standard Format – Data in company specific format is mapped to standard SOA format.

Data Validation – Minimum data contribution fields are scrubbed (reviewed and cleaned up as needed) via a series of rules and application of specific remedies. Pivot tables of scrubbed data were produced. It is during this stage that records that do not meet the definition of Standard Ordinary (e.g., impairment rated policies, conversions) are excluded.

Mortality study – Seriatim output of the data validation process is input to the mortality calculation modules. Face amount and policy exposures, actual and expected claims are grouped in relevant reporting categories and displayed in pivot tables.

The Data Validation Team participated in detail in all aspects of the data validation process for the 2002-2004 study. The weekly MIB status reports shared with the team listed each company by a code to preserve confidentiality while allowing the team to review progress for individual companies. The companies were divided up among the team members and File Validation, Data Validation and Mortality study files were reviewed by the team members. In all cases, the only identifying information in the files was the company code – the team members did not know which companies were assigned to them. The weekly meetings served as a forum to discuss issues identified. Findings were also communicated via e-mail with the MIB Data Coordinator, Jan Palmbach. Jan followed up directly with the companies as needed and, in many cases, this was an iterative process. Fifteen companies were ultimately excluded from the study as the data issues were too complex to easily resolve and not justified given the volume of exposure. Inaccurate reporting of deaths in general, and late-reporting of deaths in particular, were the most common problems found.

Specific steps in the overall data validation process were added and refined through the input and insights of the Data Validation Team. In addition to the improved data

validation process, the Data Validation Team established a list of eleven data validation rules, which can be found in Appendix B of this report.

## Data Validation Team Recommended Process for Future Studies

As a result of the lessons learned in the 2002-2004 data validation process, the Data Validation Team recommended changes in the data validation process aimed at increased accuracy, timeliness and cost efficiency. In addition, the role of the Data Validation team will change. A review of the individual coded company files by the committee was necessary the first time around to aid in the development and testing of the new infrastructure and to control costs. However, this is not a desirable long-term solution as it would be preferable for the companies and data collection agent, such as MIB, to do all this work due to the confidential nature of the files. The time invested by the SOA, MIB and Data Validation Team for the 2002-2004 study positions future studies to be better controlled and require less intensive review of individual files. For the 2004-2005 study and future studies, the intent is to also have the companies more involved in the review and signoff of their data. With the implementation of a principles-based approach to valuation, the regulators will require the industry to move from voluntary to mandatory data contributions and companies will be forced to submit better quality data that reconciles with other sources. It would be better for the data collection agent to do the data validation, so the volunteer efforts can then be better focused at experience analysis versus data validation. Some of the recommendations listed below are aimed at making it easier for companies to review their own files. The role of the team will then be to guide SOA and MIB on specific issues and enhancements to the process, as well as focusing on analysis of aggregate results for five companies at a time in order to hone in on potential individual company issues that can then be further investigated by the SOA and MIB. (Combining data from five companies at a time will make it very unlikely that a volunteer may guess the identity of the company being worked on.)

Specific key recommendations include the following:

- The conversion of the differing formats submitted by companies to a standard format should be the first step at the beginning of the data validation process.
- Analyze deaths by year and month early in the file validation process to address the late-reported death problem found at the end of the 2002-2004 study.
- In order to facilitate the comparability of results, perform all file validation processes at the same time.
- Analyze Risk Class Rank data early in the data validation process to address validity of that data earlier in the process. Similar to data validation, perform all data validation processes at the same time for each company.
- Submit pivot table results in groupings of five companies to provide useful information while maintaining company confidentiality.

The recommended process for the 2004-2005 and later studies is outlined above. Additionally, the process is diagrammed in Appendix C of this report.

The recommended steps for a data validation process are found in Appendix D of this report. These steps were followed in the Data Validation done for this project.

# Underwriting Criteria Team Report

## Members of the Underwriting Criteria Team

Al Klein, FSA, MAAA, Chair

Dieter Gaubatz, FSA, FCIA, MAAA
Ev Kunzelman
Vera Ljucovic, FSA, FCIA, MAAA
Steve MacDonald
Dave Wylde, FSA, MAAA
Paul Yates, FSA, MAAA

SOA Staff:
Jack Luff, FSA, FCIA, MAAA
Korrel Crawford

## Overview of Work of Underwriting Criteria Team

The purpose of this section of the report is to document the work of the Underwriting Criteria Team (UCT). The UCT developed an algorithm used to score every risk class in a preferred risk class structure. The scoring is based on the specific underwriting criteria used by a company. The development and details of this algorithm are documented in the following pages.

There are certain abbreviations that are used throughout this section. These abbreviations are defined below:

CA = Cancer
CV = Cardiovascular disease
HDL = High-Density Lipoprotein (the good cholesterol)
POG = Project Oversight Group
SOA = Society of Actuaries
UCS = Underwriting Criteria Score
UCT = Underwriting Criteria Team

## Mission

The UCT was one of the teams initially created by the Preferred Mortality Table Project Oversight Group (POG) to assist in the development of a new set of valuation basic and valuation mortality tables reflecting preferred underwriting. The UCT held its first meeting on October 27-28, 2005 and completed the bulk of its work in 2006.

The goal of the UCT was to create an algorithm to score every U.S. life insurance risk class underwritten in a preferred risk underwriting environment, from the best preferred risk class to the standard risk class. The scores are intended to allow risk classes with similarly anticipated mortality experience to be grouped together to help form the basis of

analysis and development of the new preferred mortality tables. The challenge for the UCT was to be able to group classes with similar mortality expectations from different companies, even if the preferred criteria and qualifying levels between two classes were quite different.

There are two types of approaches to preferred risk underwriting structures today, a knockout (or edge) type approach and a debit/credit approach.

The algorithm was built for the knockout (or edge) type approach, which is the most common approach used today. Edge or knockout type criteria place the applicant into a higher risk class if they do not meet certain qualifying levels of all of the preferred criteria.

Companies that utilize this approach often build exceptions into their preferred underwriting guidelines. Exceptions are discussed in the next section.

The other type of preferred underwriting is called a debit/credit approach. In this approach, a specific level of each criterion is given a certain number of debits or credits and the debits and credits are added together at the end. The result of this sum indicates the placement of the individual into a particular risk class. This methodology is becoming more popular; however, it is still currently used by a minority of the companies.

An algorithm for a debit/credit type approach to preferred underwriting has not yet been designed. The final results from the knock-out approach are needed to ensure consistency between the two methods. The UCT plans to create the debit/credit approach after the preferred mortality tables have been finished as there is an overlap in people involved, the development of the tables has higher priority and there could be some minor tweaks to the knock-out approach during the development of the tables.

## Exceptions

Exceptions are often used in a knockout (or edge) approach due to the rigidity of the approach. Exceptions allow an individual, who misses a class because of being slightly higher than allowed on one criterion, to be placed in that class anyway, as long as another criterion or two are at a certain level. Exceptions vary from company to company, but are very common in preferred underwriting today.

Some of the exceptions are “published” so the field and applicant know about them upfront and some are made known only within the underwriting department. When an exception is not published, the underwriter knows the rules and makes a final determination as to risk class based on this information. There are various reasons for choosing whether to have exceptions published, but these reasons are beyond the scope of this document.

The UCT asked companies to provide their routine exceptions, whether published or unpublished. When this information was provided, the UCT built the exceptions into the final Underwriting Criteria Score (UCS). This made the resulting score more accurate than it would have been had the exception criteria not been collected. As it may have been difficult for some companies to provide the routine exceptions, the UCT believes this should be taken into account when the algorithm is used for valuation purposes.

A couple of examples may help explain how exceptions are built into the scoring. In the first example, let's say a company has a limit on Cholesterol of 240 and a Total Cholesterol to HDL Ratio of 5.0. The company might have a routine exception that says it will automatically allow Cholesterol of up to 250 as long as the Ratio is 4.5 or better. In this case, the Ratio of 5.0 rather than 4.5 should be used in the algorithm for scoring. As you will see in the section below on Cholesterol, the UCT only scored the Ratio if a company uses both Total Cholesterol and the Ratio.

For the second example, let's assume that the build limit for a particular height is 200 pounds. Some companies may allow up to 205 pounds on an automatic exception basis if all other preferred criteria are met. In this case, 205 pounds should be used rather than the stated preferred guideline of 200 for scoring purposes in the algorithm.

Again, the UCT found when collecting the preferred underwriting criteria that few companies provided their exceptions even though they were requested. It is recommended by the UCT that companies take this into account when use the algorithm for valuation purposes.

A final note on this is that there are also ad hoc exceptions made for reasons unrelated to mortality risk assessment. These exceptions are not reflected in the scoring algorithm and will distort any comparison between the UCS and the resulting mortality experience.

## Basic Structure

The UCT began by reviewing some preliminary work that had been done by the Task Force on Enhancements to Life Experience Studies for a two nonsmoker class structure. While this was helpful for determining the criteria to use and the relative importance of each of the criterion, the UCT felt that a different basic structure was needed. The previous structure gave credit for criteria that met a certain level and no credit for those criteria that did not. The UCT felt that a more continuous structure was needed. Such structure will be explained below.

The UCT discussed whether to create a different algorithm for the various number of nonsmoker classes and decided that there wasn't enough data to support such a refinement. In years to come, as more credible data becomes available, differentiating by the total number of risk classes could be considered.

After reviewing the previous work, the UCT decided on a list of the most common preferred underwriting criteria used today. There were several additions to the work that was previously done. The UCT agreed with the Task Force's prior work regarding some of the criteria being more important than others. The team determined that a three-point scale would be sufficient to differentiate the relative importance of the various criteria. Table 1 below shows the most common preferred underwriting criteria used today and their relative weight, with a weight of 3 indicating most importance and a weight of 1 indicating least importance.

**Table 1 – Preferred Underwriting Criteria**

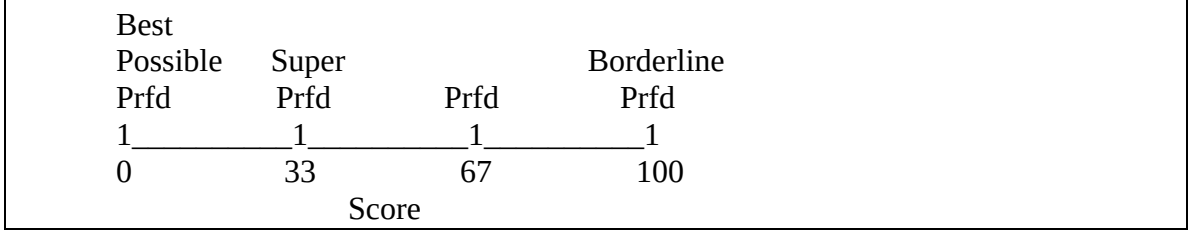
| Criterion | Weight |
|---|---|
| Alcohol and drug abuse | 1 |
| Blood Pressure | 3 |
| Build | 2 |
| Cholesterol | 3 |
| Family history | 3 |
| Motor Vehicle record | 2 |
| Personal history | 2 |
| Tobacco use | 2 |
| Other * | 1 |

* Aviation, avocations, citizenship, foreign travel, hazardous activities, residence

The UCT decided to score each criterion separately and then sum the results using the appropriate weight. The UCT built a basic structure for an algorithm that was continuous to account for the variations in qualifying levels and that was consistent for each of the criterion. The UCT started with a 100-point scoring system. In this structure, a score of 100 represented a borderline preferred risk, 67 represented an average preferred risk, 33 represented an average super-preferred risk and 0 represented the very best super-preferred risk. While the values at these points will certainly vary by criterion, the UCT decided to use this basic structure for all criteria.

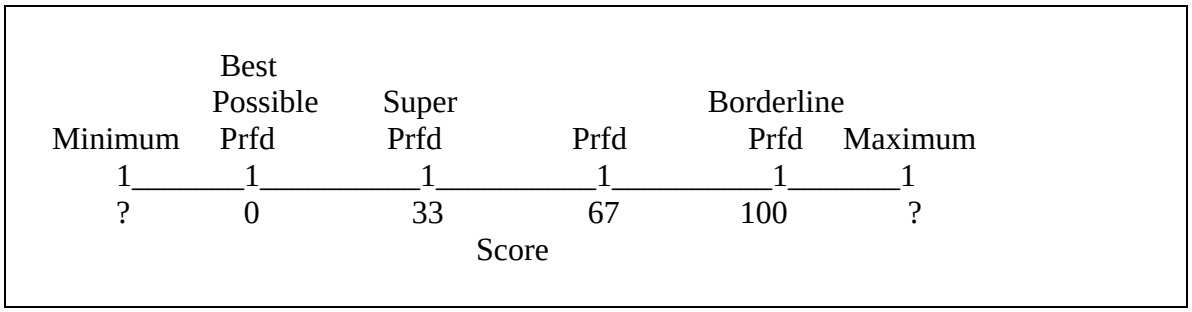
Graphically, the structure looks like what is shown below in Chart 1.

**Chart 1 – Basic Structure**



The four values were set for every criterion at what was thought to be the most common value used in the industry for that particular risk class. The UCT recognized that there would likely still be values outside of these ranges, so the final structure was developed, expanding beyond the initial basic 100-point structure. The final structure is shown in Chart 2 below.

**Chart 2 – Final Structure**




The minimum value is considered to be the absolute lowest than anyone would require for their best class. The maximum was set at what the UCT believed was the highest level that the insurance on a life would be issued standard, which was approximated at a level of a substandard Table 3 rating.

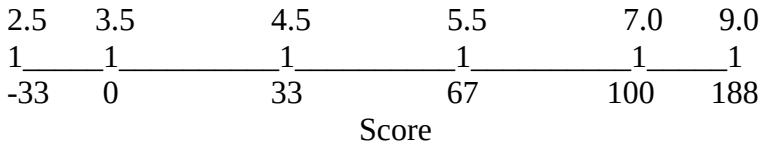
The reason for the question marks under the minimum and maximum values is that the scores for the minimum and maximum were derived for each criterion. For the minimum score, the slope between the 0 and 33 values was applied to the difference between the 0 value and the Minimum value. For the maximum score, two times the slope between the 67 and 100 values was applied to the difference between the 100 value and the Maximum value. The reason for this different treatment is the UCT felt more should be taken away from a criterion that was worse than what was considered standard than should be given for an extremely tough-to-meet criterion value. The UCT decided that the two-to-one ratio was appropriate. In a several instances, the UCT either set a maximum score or averaged the derived maximum scores. This was done to simplify the calculations and will be pointed out in the documentation below when utilized.

Any values below the minimum or above the maximum are to be treated as being at the minimum or maximum, respectively.

Like the four values under the original structure, the Minimum and Maximum values were set at what was felt to be the most common levels in the industry. The UCT utilized preferred criteria in reviewing the results, as well as the most recent Preferred Underwriting Survey published by the SOA.

An example may help in understanding how the minimum and maximum scores are determined. Chart 3 below shows the results for the Total Cholesterol to HDL Ratio.

**Chart 3 – Total Cholesterol to HDL Ratio**




The minimum score of -33 is derived as: 0 - (3.5 - 2.5) / (4.5 - 3.5) x (33 - 0) = -33. The maximum score of 188 is derived as: 100 + (9.0 - 7.0) / (7.0 - 5.5) x (100 - 67) x 2 = 188.

To determine a score for an intermediate value of the criterion, the UCT used linear interpolation between the scores on either side of the given value. So, using the Total to HDL Cholesterol Ratio example in Chart 3 above, if a company uses a Ratio of 5.0, they would receive a score of 50. This is derived as: 67 - (5.5 – 5.0) / (5.5 – 4.5) x (67 – 33) = 50. It could also be derived as 33 + (5.0 – 4.5) / (5.5 – 4.5) x (67 - 33) = 50.

Detailed Results

This subsection will outline the scoring for each of the individual criterion and any special considerations that went into the scoring. At the end of the subsection, we will show how all of the individual results are brought together.

Alcohol and drug abuse (Weight of 1)

This criterion looks at the personal history of alcohol and/or drug use and abuse. Most companies are concerned with how long it has been since alcohol and/or drugs were abused. So, for this criterion, the UCT sought to capture whether alcohol and/or drug abuse was asked about and, if so, the length of time required for the applicant to be abuse free.

The UCT used the scoring structure shown in Table 2 below for alcohol and drug abuse separately and averaged the results.

**Table 2 – Alcohol and Drug Abuse Scoring**

| Score | Description | |
|---|---|---|
| 0 | No alcohol or drug abuse in the last | 20 years |
| 33 | " | 10 years |
| 67 | " | 7 years |
| 100 | " | 5 years |
| 120 | " | 1 year |
| 133 | " | Not asked about |

As described above, 33 represents the most common Super Preferred value and 67 represents the most common Preferred value. The UCT chose 133 as the upper bound, rather than using the formula, because the UCT felt it better reflected the appropriate level for this criterion. Note that when either alcohol or drug abuse were not asked about in the company criterion, the score would be calculated by averaging the score from the one that was asked about, using the scoring in Table 2 above, with 133 (the maximum score that is used when one of the criterion is not asked about by the company).

Blood Pressure (Weight of 3)

The key components of the blood pressure criterion are the systolic and diastolic readings, whether or not the readings are based on an individual treated for hypertension, and the age of the individual. The UCT did not consider whether the reading was a single reading or an average of readings in our algorithm.

The UCT, through some outside research, decided that the diastolic readings would be valued with twice the weight as the systolic values. If the company specific criterion accepts individuals treated for hypertension, the UCT decided to add 2.5 to the diastolic blood pressure score and 5 to the systolic blood pressure score before determining the final score. With respect to age, we created a scoring scale for ages 45 and 65 and assigned the resulting scores equal weight.

To determine the blood pressure score, the UCT decided to use the values and weights shown in Table 3 below. The maximum scores were averaged and the average was used as the maximum score for each systolic and diastolic reading to make the calculation simpler.

**Table 3 – Blood Pressure Scoring**

| Age 45 | | | | Age 65 | | | |
|---|---|---|---|---|---|---|---|
| Score | Systolic | Score | Diastolic | Score | Systolic | Score | Diastolic |
| -33 | 120 | -19.8 | 72 | -33 | 120 | -30 | 77 |
| 0 | 125 | 0 | 75 | 0 | 125 | 0 | 80 |
| 33 | 130 | 33 | 80 | 33 | 130 | 33 | 83.3 |
| 67 | 140 | 67 | 85 | 67 | 140 | 67 | 86.7 |
| 100 | 150 | 100 | 90 | 100 | 150 | 100 | 90 |
| 127 | 152 | 127 | 92 | 127 | 152 | 127 | 92 |
| Weight | 1/6 | | 2/6 | | 1/6 | | 2/6 |

Build (Weight of 2)

With build, the UCT decided to look at several places in the build chart for both males and females to get a better reading on what a particular company was doing. For males, the UCT chose to look at 5'6", 5'10" and 6'2". For females, the UCT chose to look at 5'2", 5'6" and 5'10". The UCT assumed equal weightings among each of the heights for both males and females; however, the UCT assumed a 65/35 split for males/females as the approximate industry average. This is an area that could be modified in the future, allowing a company to input their actual split between males and females.

Tables 4 and 5 below show the scoring of the male and female build values, respectively. Again, the maximum scores were averaged and the average was used as the maximum score was used for each height/weight combination to make the calculation simpler.

**Table 4 – Build (Male Height/Weight) Scoring**

| 5'6" | | 5'10" | | 6'2" | |
|---|---|---|---|---|---|
| Score | Weight | Score | Weight | Score | Weight |
| -33 | 155 | -33 | 175 | -33 | 195 |
| 0 | 165 | 0 | 185 | 0 | 205 |
| 33 | 175 | 33 | 195 | 33 | 215 |
| 67 | 185 | 67 | 210 | 67 | 230 |
| 100 | 195 | 100 | 220 | 100 | 245 |
| 166 | 205 | 166 | 225 | 166 | 250 |
| Weight | 22% | | 22% | | 22% |

**Table 5 – Build (Female Height/Weight) Scoring**

| 5'2" | | 5'6" | | 5'10" | |
|---|---|---|---|---|---|
| Score | Weight | Score | Weight | Score | Weight |
| -22 | 120 | -13.2 | 130 | -16.5 | 150 |
| 0 | 130 | 0 | 140 | 0 | 160 |
| 33 | 145 | 33 | 165 | 33 | 180 |
| 67 | 155 | 67 | 175 | 67 | 195 |
| 100 | 170 | 100 | 185 | 100 | 210 |
| 166 | 180 | 166 | 200 | 166 | 225 |
| Weight | 12% | | 12% | | 12% |

For the astute reader, 3x22% + 3x12% doesn't add up to 100%. The weights of 12% and 22% are rounded percentages and the correct actual percentages are used in the calculation.

The UCT also put together parameters for BMI for those companies that use BMI. The scoring is shown in Table 6 below for both males and females.

**Table 6 – Build (Male and Female BMI) Scoring**

| Score | BMI |
|---|---|
| -66 | 21 |
| 0 | 25 |
| 33 | 27 |
| 67 | 29 |
| 100 | 31 |
| 166 | 33 |

Cholesterol (Weight of 3)

While cholesterol is a common preferred underwriting criterion, some companies use Total Cholesterol, some use the Total to HDL Cholesterol Ratio and still others use both of these measures in their preferred underwriting guidelines. The UCT believes the Ratio to be the better measure. Therefore, scoring is based on the Ratio if it was used, whether or not Total Cholesterol was also used in the individual company criterion. If only Total Cholesterol was used, without use of the Ratio, the scoring is based on Table 8 below; however, an adjustment is made to reach a final Cholesterol score. The adjustment is to weight the score derived from Table 8 by 75% and the maximum value of 188 by 25% to derive the final score when only Total Cholesterol was used.

Another consideration for cholesterol is whether the individual company criterion allows for treated cholesterol. If it does, the following adjustments are applied. When using the Ratio, 0.5 is added to the actual Total to HDL Cholesterol Ratio prior to the scoring. When using Total Cholesterol where treatment is allowed, the actual level of Total Cholesterol is increased by 10 prior to the scoring.

Scoring of the Total Cholesterol to HDL Ratio is shown below in Table 7 and scoring of Total Cholesterol is shown below in Tables 8.

**Table 7 – Total Cholesterol to HDL Scoring**

| Score | Ratio |
|---|---|
| -33 | 2.5 |
| 0 | 3.5 |
| 33 | 4.5 |
| 67 | 5.5 |
| 100 | 7.0 |
| 188 | 9.0 |

**Table 8 – Total Cholesterol Scoring**

| Score | TC |
|---|---|
| -82.5 | 150 |
| 0 | 200 |
| 33 | 220 |
| 67 | 250 |
| 100 | 280 |
| 188 | 320 |

Family history (Weight of 3)

There are five key components to the family history criterion. These are shown in Table 9 below along with their corresponding relative weight.

**Table 9 – Family History Components**

| Component | Weight |
|---|---|
| The number of incidences allowed | 2 |
| Whether the incidences are based on parents or both parents and siblings | 1 |
| The specific age before which the incidences must occur to be considered | 2 |
| Whether family history is based on death from or diagnosis of a particular disease | 2 |
| The type and number of diseases considered | 1 |

In Table 10, the UCT chose to use two-point weights on three categories to emphasize their importance over the other two categories.

For several of these components, there are very limited choices (e.g., the criterion is based on either just the parents or both the parents and siblings). With these limited choices, if one choice was common for the Preferred and Super-Preferred risk classes, for example, it would receive a score of 50, which is the average of the Preferred (67) and Super-Preferred (33) classes.

Scoring for family history is shown below in Tables 10-16.

**Table 10 – Family History (Number of Incidences) Scoring**

| Score | Number of Incidences |
|---|---|
| 33 | 0 |
| 100 | 1 |
| 133 | 2 |

Weight 2/8

**Table 11 – Family History (Parents / Siblings) Scoring**

| Score | Parents / Siblings |
|---|---|
| -17 | Parents and Siblings |
| 67 | Parents only |

Weight 1/8

**Table 12 – Family History (Age) Scoring**

| Score | Age |
|---|---|
| -33 | 70 |
| 0 | 65 |
| 50 | 60 |
| 100 | 55 |
| 133 | 50 |

Weight 2/8

**Table 13 – Family History (Death / Diagnosis) Scoring**

| Score | Death / Diagnosis |
|---|---|
| 0 | Diagnosis |
| 100 | Death |

Weight 2/8

**Table 14 – Family History (Type and Number of Diseases) Scoring**

| Score | Number of Diseases |
|---|---|
| 50 | Both Cardiovascular and Cancer included |
| 117 | Only one of Cardiovascular or Cancer included |

Weight 1/8

A further adjustment is made when diseases in addition to Cardiovascular (CV) and Cancer (CA) are also included. The approach used here is different from that used in the rest of the scoring because this component was refined at a later stage and could not be incorporated into the general structure. If additional diseases are included, the final score from Table 14 is adjusted as shown in Table 15 below.

**Table 15 – Family History (Adjustment to Type and Number of Disease Scoring)**

| Adjustment | Description |
|---|---|
| -8 | Diabetes included |
| -5 | One disease included (other than CV, CA and Diabetes) |
| -9 | Two or more diseases included (other than CV, CA and Diabetes) |

To demonstrate how the Type and Number of Diseases scoring works, let's assume that a particular company's preferred family history criterion does not allow death of a parent prior to a certain age for deaths related to cancer or diabetes. The score would be 117 – 8 = 109. If death due to cardiovascular disease was also included, the score would be 50 – 8 = 42. If the criterion included death due to cancer and respiratory disease, the score would be 117 – 5 = 112. And, finally, if the criterion included death due to cancer, cardiovascular disease, diabetes, respiratory disease and gastrointestinal disease, the score would be 50 – 8 – 9 = 33.

Now let's look at the full family history scoring process. A typical family history criterion may read something like "No incidences of death due to cardiovascular disease or cancer in parents before age 65." Table 16 below shows how this sample criterion would be scored.

**Table 16 – Scoring of Family History Example**

| Component | Score | Weight | | Weighted Score (Score x Weight) |
|---|---|---|---|---|
| Number of incidences | 33 | x 2 | = | 66 |
| Parents / Siblings | 67 | x 1 | = | 67 |
| Age | 0 | x 2 | = | 0 |
| Death / Diagnosis | 100 | x 2 | = | 200 |
| Number of Diseases | 50 | x 1 | = | 50 |
| Sum of Weighted Scores | | | | 383 |
| Sum of Weights | | | | 8 |
| Final Score (Sum of Weighted Scores / Sum of Weights) | | | | 47.9 |

Motor vehicle record (Weight of 2)

Motor vehicle records vary state to state; however, there are several critical components which are publicly available from most states that are used in our scoring of driving record. Those components are moving violations, driving while under the influence of alcohol or drugs (DUI, DWI, etc.) and reckless driving.

For moving violations and DUIs, the scoring is based on both the number allowed and the period of time over which they are allowed. A typical moving violation criterion may read "no more than 3 moving violations in 2 years." A typical DUI criterion may read "no DUIs in the last 5 years." The scoring developed by the UCT is based on these types of statements.

The UCT felt that DUIs were twice as important as moving violations, so we apply a 1/3 weight to the score derived for moving violations and a 2/3 weight to the score derived for DUIs.

If reckless driving was used in the criterion, we decreased the final score by 17.

The scoring for moving violations is shown in Table 17 below. Table 17 shows some extremely high values and this was done to round out the table; however, the UCT does not expect any companies' criterion to be at these higher levels. The maximum score to be used for the driving record criterion in the overall calculation is 150.

**Table 17 – Moving Violation Scoring**

| Number | Number of Violations | | | | |
|---|---|---|---|---|---|
| of Years | 0 | 1 | 2 | 3 | 4 |
| 1 | 50 | 100 | 400 | 1000 | 2000 |
| 2 | 33 | 67 | 100 | 400 | 1000 |
| 3 | 0 | 33 | 67 | 100 | 400 |
| 4 | -17 | 0 | 33 | 80 | 200 |
| 5 | -33 | -17 | 17 | 67 | 150 |

Table 10 below shows the scoring for DUIs. Like moving violations, the UCT does not expect companies to have risk classes that receive the highest scores shown in Table 18.

**Table 18 – DUI Scoring**

| Number | Number of DUIs | |
|---|---|---|
| of Years | 0 | 1 |
| 1 | 250 | 600 |
| 2 | 150 | 400 |
| 3 | 100 | 300 |
| 4 | 75 | 150 |
| 5 | 50 | 100 |
| 6 | 25 | 83 |
| 7 | 0 | 50 |
| 8 | -10 | 20 |
| 9 | -20 | 0 |
| 10 | -30 | -17 |
| Ever | -30 | -17 |

Personal history (Weight of 2)

The personal medical history criteria amongst companies are quite varied. The basic components that the UCT felt were important regarding personal history were whether impairments are allowed, whether substandard flat extras are allowed and how many diseases were specifically excluded.

The UCT tried to simplify the various things that are being asked for in the scoring structure. Scoring for the personal history criterion is shown below in Tables 19 and 20.

**Table 19 – Personal History (Number of Diseases) Scoring**

| Score | Number of diseases recognized |
|---|---|
| 33 | 3 |
| 67 | 2 |
| 100 | 1 |
| 120 | 0 |

**Table 20 – Personal History (Use of Non-medical Flat Extras) Scoring**

| Adjustment | Description |
|---|---|
| +20 | If non-medical flat extras are used |

For purposes of this algorithm, the UCT has assumed that individuals scoring as substandard do not qualify for a preferred rating. Therefore, a statement such as "No substandard risks are allowed" should not be given any value in this rating system. A maximum score of 140 would be given to those who do not utilize this criterion.

Tobacco use (Weight of 2)

For the tobacco criterion, the UCT based the scoring on two factors, whether the smoking definition was based on cigarettes or tobacco, and the number of years the person had to have not smoked. These two components are scored separately and the scores are added together to get the final tobacco criterion score. The scoring for the definition is shown below in Table 21 and the scoring for the number of years is shown below in Table 22. This criterion is only used for the non-tobacco classes since it affects individuals who recently ceased smoking and qualify for a non-tobacco class and has minimal impact on the mortality of individuals in the tobacco classes.

**Table 21 – Tobacco (Definition) Scoring**

| Score | Definition |
|---|---|
| 0 | Tobacco |
| 33 | Cigarettes |

**Table 22 – Tobacco (Number of Years Since Last Smoked / Used Tobacco) Scoring**

| Score | Years |
|---|---|
| 0 | 10 |
| 33 | 5 |
| 67 | 2 |
| 100 | 1 |

Other - Aviation, avocations, citizenship, foreign travel, hazardous activities, residence (Weight of 1)

For the "Other" criterion, the UCT simply counts how many of the other items (aviation, avocations, citizenship, foreign travel, hazardous activities and residence) are used in the preferred underwriting guidelines. However, if the guideline simply says "no ratable _____," then the UCT does not count it because it provides no more protection than not saying anything at all. For purposes of this algorithm, the UCT has assumed that individuals scoring as substandard do not qualify for a preferred rating.

Once the number of "other" items is determined, the scoring for this criterion follows Table 23 below.

**Table 23 – Other Scoring**

| Score | Number of Items Used |
|---|---|
| 0 | 6 |
| 23 | 5 |
| 45 | 4 |
| 67 | 3 |
| 89 | 2 |
| 111 | 1 |
| 133 | 0 |

## Bringing the Results Together

Once each individual criterion is scored, the scores are multiplied by their respective weights. The weighted scores are added together and this total is divided by 19 (the sum of the weights) for non-tobacco users and 17 (the sum of the weights) for tobacco users. The resulting number (rounded to one decimal point) is the score for this particular risk class.

This procedure should be repeated for all risk classes (except the residual standard class), first within the specific product, then for each product and, finally, historically by issue date if the preferred underwriting criteria have changed over time (during the study period). Note that if two products share identical criteria, it is not necessary to go through this process with both products. For valuation purposes, products and/or classes with similar scores could be grouped together; however, the first time through this process, it is recommended that every non-unique class be scored individually.

The residual standard classes are not scored, but rather set at 141 for the residual nonsmoker class and 142 for the residual smoker class. These scores have been calculated assuming the worst possible results for each of the criterion and then weighting the criterion by the weights provided. The UCT felt this was a reasonable approach because most companies do not have restrictions on the residual class other than not having a substandard rating. It was also a practical necessity because the criteria used to determine whether a life is standard or substandard is required to evaluate that limit. This information was not available to the UCT.

Some companies actually have specific criteria for their residual standard class. In cases where the criteria for this class are ignored, this class should be considered the residual standard class and be scored as described in the preceding paragraph. On the other hand, if the criteria for this class are actually used, the company should score this class as described in this report and consider it another class in their preferred class structure. The remaining "standard" risks which did not qualify for this "last" class would form another class, the residual standard class, and this new class would be scored as described in the preceding paragraph.

## Company Scoring

Each company has a unique set of criteria used to determine whether an applicant qualifies for preferred. These criteria vary by risk class and also often by plan. They have also varied historically.

A request was made to all companies contributing mortality data to the 2002-04 SOA data call to provide the preferred underwriting criteria for all classes and all plans, historically, since they began writing preferred. The UCT scored all of the criteria received and then matched it back to the mortality data file submitted by each company to the SOA on an individual record basis. In this call for mortality data, the company was

requested to provide, for every individual record, the specific risk class associated with that record and the total number of risk classes associated with that plan.

A number of discrepancies were found in the submitted data and the UCT set out to reconcile these differences. Some discrepancies were able to be resolved; however, clarification from the company was often necessary. Sometimes the mortality data record was wrong and sometimes the preferred criterion was wrong. Each of the discrepancies was reconciled. Changes to the preferred underwriting criteria were made where appropriate and the UCT provided the corrections for the mortality database in a file to MIB, who is the mortality data handler. The UCT understands that the records containing discrepancies were deleted from the database, rather than being fixed, due to cost considerations.

All of the scoring for individual companies was done in an Excel spreadsheet and is stored at the Society of Actuaries for use in future studies. The spreadsheets were designed so new criteria could easily be added in order to keep historical records for each company. The companies were coded with a 3-digit letter/number combination to keep the identity of the specific companies confidential from the volunteers working with the data. Only the SOA and MIB have the company code key.

## Validation of the Algorithm

The specific qualifying levels used as most common for the Super-Preferred, Preferred, etc. levels were generally based on the knowledge and expertise of the actuaries and underwriters on the UCT. Some further research was done on a few parameters. Also, some of the more difficult decisions went through a fair amount of discussion and debate before a conclusion was reached. While the UCT is comfortable with these decisions, they are just educated opinions which other industry experts can agree or disagree with.

Minimal testing was done by the UCT after the algorithm was completed. Most of the testing of the UCS that was done was completed by the Experience Analysis Team. In general, we found that for each specific company/product, the algorithm produced scores in the order of magnitude that the UCT would have expected (i.e., the Super-Preferred risk class had a lower score than the Preferred risk class, which had a lower score than the Standard risk class). However, when the UCT looked at the mortality resulting from like scores, there was some variation. This could be due to a lack of credibility in some of the data, but also a number of things which the algorithm does not take into account, including but not limited to:

- Exceptions to these criteria
- Target market
- Distribution channel
- Underlying product

Therefore, caution is advised in the use of the UCS as the exclusive indicator of preferred mortality risk. For valuation purposes, the UCT recommends providing a method to allow for some of these potential differences. While the UCT believes that the UCS gives a good general indication of the table to use, it is not the absolute answer for the reasons explained above.

Further detailed analysis of the UCS is included in the Experience Analysis Team report.

How the UCS is used in the development of the new preferred mortality tables is explained in the Valuation Basic Table Team report. The UCT recommends that the score be required to be included in the actuarial memorandum for all preferred risk class programs so the appropriate valuation table to use can more readily be determined.

Note that the UCT intends to create an algorithm for a debit/credit approach to preferred underwriting in 2008.

## Additional Thoughts

This section contains some additional thoughts not covered elsewhere in the report.

Some items may be difficult to score as there could be different interpretations of what is being requested as input. The UCT recommends having some ability to email questions so they can be answered on a timely basis. This will be particularly critical towards year-end if the scoring process is needed to determine the appropriate valuation table to use. Likewise, as certain items may be difficult to score, the UCT recommends that a review process be put in place to make sure companies have interpreted their criteria, as it relates to the algorithm, correctly.

The UCT found it surprising that there were not more lower (i.e., Super-Preferred level) scores. It is certainly possible that our estimate of the most common Super-Preferred levels for some of the criteria could have been off. The UCT recommends that this be looked into the next time this algorithm is reviewed.

It is also recommended that, in the future, as additional preferred criteria are collected from participating companies, this be reviewed for possible enhancements to what is considered most common. Preferred underwriting criteria and qualifying levels will likely continue to evolve over time.

The UCT recommends that a repository be set up for suggested enhancements that can be referred to the next time a group meets to review the algorithm. Our recommendation is that the algorithm be reviewed at least once every five years and that it be reviewed every time a new valuation table is to be introduced (assuming that the intent is to continue to use the algorithm).

The UCT believes that someone should be responsible for watching emerging trends in preferred underwriting. If new criteria become common, they should be incorporated into the algorithm on a timely basis.

Another possible area for enhancement to future versions of the algorithm could be in the differentiation of criteria by age. Currently, we simply average the results of a high and low age for Cholesterol and Blood Pressure levels. This could certainly be enhanced by including criterion levels at additional ages or by developing a full UCS for various ages and then basing the overall score on the individual company's distribution of business. There are many variations that could be considered in the future.

Some thought should be given to any future revisions to the algorithm. While enhancements can and probably should be made over time, how will they be handled from a historical perspective? Can a future change impact a past evaluation and appropriate valuation table? What is the historical impact? Would this original version continue to be used for 2007 or 2008 issues and earlier or be scrapped in favor of any new version? Will changing the relative weight of the values improve the predictive capability of the algorithm? These are just some of the questions that should be addressed as a part of any future reviews of the algorithm. Who will be responsible for future review and enhancements? Who will keep track of these changes?

And finally, there are several items to consider for publication and use of the algorithm. How will the algorithm be published? The UCT recommends that it be secure so the algorithm can't be changed by the user. It is also recommended that a version number (or effective date) automatically be stamped in some way on all output so everyone will know if the most recent version was used. The UCT also recommends that users be directed to a central site to use the algorithm rather than be able to copy it remotely to ensure that the latest version is always used. The UCT recommends that it be stored on only one site so that maintenance and updates are easier. The most likely sites would be the SOA or the Academy, the sponsors of this work.

# Experience Analysis Team Report

## Members of the Experience Analysis Team

Rick Bergstrom, FSA, MAAA, Chair

Mary Bahna-Nolan, FSA, MAAA
Doug Doll, FSA, MAAA
Jeff Dukes, FSA, MAAA
Dieter Gaubatz, FSA, FCIA, MAAA
Anna Hart
Al Klein, FSA, MAAA

SOA Staff:
Jack Luff, FSA, FCIA, MAAA
Korrel Crawford

The team would also like to acknowledge the help of Harry Panjer, FSA, MAAA, Steve Ekblad, FSA, MAAA, and Stuart Klugman, FSA, MAAA.

## Mission

The purpose of the Experience Analysis team was to:

- Review the 2002-04 preferred mortality experience data collected by the Society of Actuaries,
- Make sure there was sufficient data for the Valuation Basic Table (VBT) team to use in their analysis of preferred risks for the 2008 Valuation Basic Table,
- Find additional sources of data where necessary, and
- Compare the preferred underwriting criteria collected by the Underwriting Criteria Team (UCT) and the algorithm the UCT created with the preferred mortality data collected in the 2002-04 SOA data.

## Overview of Experience Analyzed

The data used for this project was collected as part of the annual Society of Actuaries ongoing experience study. The full report is on the SOA website under Research/Experience Studies/Individual Life. The data used for the Experience Analysis work included:

- Preferred data for over $3 trillion face amount exposure with over 13,000 deaths, all in the select period. However, smaller exposure amounts were available for some preferred analyses due to incomplete information on some of the policies.
- Only policies that were part of a multiple preferred class system were included; however, debit/credit preferred structures were excluded.

Expected claims were calculated based on the composite, smoker or nonsmoker versions of the 2001 VBT using the smoking habit information provided in the individual company submissions.

Despite the large volume of data, the data was quite limited when looking at all of the various splits needed to review different preferred class structures. It was determined that only very general conclusions could be drawn from the limited data available through this first collection of preferred data. One conclusion from the review of the data and underwriting criteria algorithm developed by the UCT was that there is a strong indication the preferred risk structures work. On a company-specific basis, the relative mortality among preferred classes is as expected. However, the underwriting criteria within the preferred structures are not the sole determinant of differences in the mortality between companies.

Several unique challenges were identified in this preferred data analysis process:

- The amount of data needed to produce sufficient credibility to evaluate the mortality in a preferred structure is higher than normal studies because of the addition of another dimension in the plan characteristics. To further complicate this, that additional dimension has a wide spectrum of possible values.
- There are some factors related to the preferred structure, which affect the mortality, but are not directly reflected in the Underwriting Criteria Score (UCS). An example of differences among companies in making business decisions is the number and type of exceptions each makes through its preferred class assignments.
- There are also factors affecting mortality, which are not related to the preferred structure. These would include items such as the way each company conducts its business and makes its business decisions, the target market, the distribution system, the expertise of the professional staff and the underwriting standards used in making standard/substandard risk decisions. A company's utilization rate of the Attending Physician's Statements (APS) is another factor which affects a company's overall mortality. It was not practically possible to identify each of these items as a study parameter.
- Since this is the first experience study submission with preferred information, a few companies did not submit the preferred class data in the necessary format. Adjustments were made where possible to the extent they could be identified.

Overall mortality varies by company due to these factors. These factors are what cause the "noise" in the data analysis. Because of differences in overall mortality levels by company, the evaluation of preferred mortality experience by UCS becomes more difficult. As the preferred mortality is evaluated along the mortality risk spectrum using the UCS, the companies contributing at the various parts of that spectrum differ. This difference in mix makes it very difficult to isolate the effect of preferred class risks structures by use of the UCS as the only indicator.

## Underwriting Criteria Score

The data used for this analysis was restricted to issue ages 25 and older, face amounts of $100,000 to $2,500,000 and durations 1 to 10. The face amount cap of $2,500,000 was included to reduce the random variability produced by business with higher face amounts. The minimum issue age and face amount were chosen to be consistent with the type of business for which the final numbers would be used and included 28 companies with $2.1 trillion face amount exposure with 6,280 deaths. Very little UCS data was available beyond duration 10.

A preferred program is defined as the criteria that a company uses to place otherwise standard risks (not substandard from an underwriter's viewpoint) into predefined risk classes. For a given insurer, programs commonly vary by product type, issue period and smoker status.

It is very difficult to compare preferred programs across insurance companies as different criteria and different qualifying levels are used. Moreover, these structures often vary within a company from one product generation to another. The UCS was developed to create a system which could be used to group preferred risk classes that may have different criteria and qualifying levels, but would have similar expected mortality. It was designed as a relative indicator of the expected mortality under the full range of programs. The underwriting criteria algorithm used to produce a UCS was determined by the UCT through an evaluation of industry preferred risk class definitions.

The UCS was determined by the UCT for each risk class of each program of each company that submitted its preferred criteria. Programs on a preferred debit/credit basis were not included in this portion of the study. The data for 28 companies was included in this portion of the study. Some companies only provided preferred criteria for their more recent generations of plans. The UCS was mapped into each individual record of the data provided by the company using their preferred criteria.

The UCS analysis requires that the data be grouped into two different structures on "specific" and "cumulative" bases. These two structures are directly related through using a weight of the amount of business at each point in the risk spectrum.

The "specific" basis shows mortality results for a specific range of UCSs. The "cumulative" basis shows mortality results for a particular UCS and all lower UCSs cumulatively. The purpose of this basis is to include all risks which qualify for the particular risk class, including those which also qualified for even stricter risk classes. The reason for using this approach is to be able to include the experience of all risk classes with expected mortality equal to or lower than the one being studied.

An example may help explain the "cumulative" basis. Assume Company A's best risk class has a UCS of 100 and Company B's best risk class has a UCS of 40 and a second best risk class has a UCS of 100. To only look at Company B's second best risk class with a UCS of 100 would not be a fair comparison to Company A's UCS of 100, because

Company B's mortality experience would only be between a UCS of 40 and 100. By comparing both of Company B's risk classes with Company A's one risk class, the risk profile would be more comparable between the two companies. Using the cumulative approach would accomplish this as the cumulative UCS of 100 would use Company A's best risk class and Company B's best two risk classes.

On the "specific" basis, the better risk class would not be included if it did not qualify for the study grouping criteria on its own merits. In the example above, the specific UCS of 100 would include Company A's best risk class and Company B's second best risk class. The specific analysis of the UCS of 40 would include Company B's best risk class**.**

Initially, the Experience Analysis team looked at the data solely by UCS. Unfortunately, reasonable conclusions could only be drawn by selecting very specific UCS breakpoints. The results varied widely depending upon the choice of breakpoints. The reasons for this are due to the challenges identified earlier in this report. A large increase in data is required before an analysis of this type will have sufficient credibility. Consequently, other alternative types of analysis were needed.

The next approach used was to analyze the results of the UCS data by risk class structure. Appendix E of this report provides a summary of the experience by risk class. It shows the average UCS for males and females and smokers and nonsmokers for each risk class of the various risk class structures (i.e., a 2, 3 and 4 class structure for nonsmokers and a 2 class structure for smokers). Section I provides the results for the "specific" UCS. Section II shows the same numbers on a "cumulative" basis, but with the UCS calculated on a cumulative UCS basis. As described above, these figures include the experience of the stated risk class and all classes with lower mortality expectations for the particular gender, issue age range and smoking status. The cumulative UCS is based on the criteria of the stated risk class of the structure being evaluated, even if the particular policy qualifies for a lower mortality risk class.

Appendix E clearly shows the underwriting algorithm produces UCSs in the direction expected for all of the various risk class structures. However, there is not complete consistency in the results. This could be due to the structure itself, the mix of companies included in the specific structure, the limited data or any of the reasons described earlier in the report. The "Proportion of Business" column is based on expected claim amounts.

It should be noted the experience from the 5-class nonsmokers were not included due to the limited number of contributing companies; however, they were included in the "All" experience.

The "specific" basis results are in the pivot table 'UCT Specific Rpt 2002-04.xls.' The "cumulative" basis results are in the pivot table 'UCT Cumulative Rpt 2002-04.xls.' These pivot tables are available on the Society of Actuaries website. It should be noted the results include only the portion of the information in the pivot tables that is most relevant to this preferred class analysis. The expected mortality for all the tables is 100% of the respective 2001 VBT.

It can be concluded the UCS produces a directionally correct answer with some indication on the relative value by UCS. However, the exact value cannot be determined from these results.

## Additional Analysis

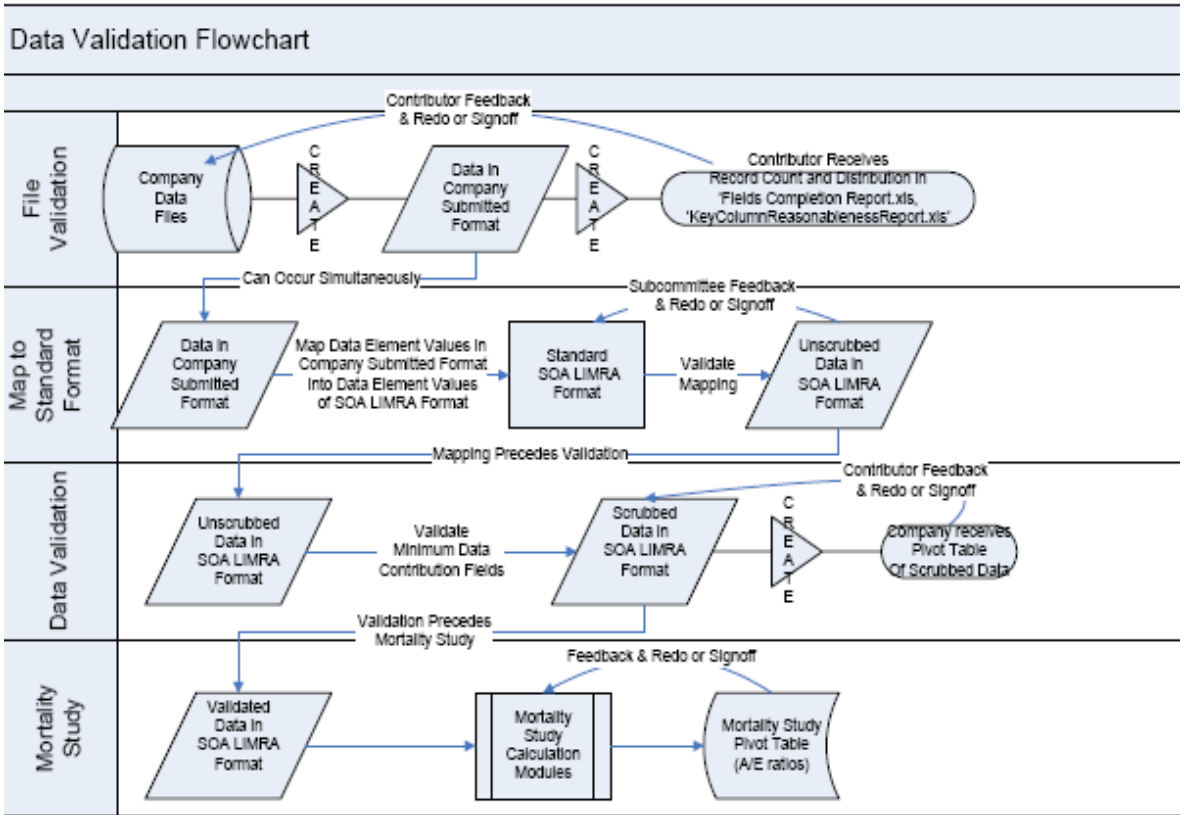
The Individual Life Experience Committee did initial work on preferred mortality using a risk class rank concept. Its report, including additional detail, can be found on the SOA website under Research/Experience Studies/Individual Life.

In this analysis, the data from a company for risk classes comes from the same underwriting program. For example, when looking at the 3 non-smoker class structure, the results of preferred classes 1, 2 and 3 all come from the same programs. This eliminates the noise created by the varying non-preferred structure factors of each of the companies. These results also give an indication of the relative value of the preferred definitions used.

The risk class rank structure used in this analysis was defined as follows. The many different preferred class structures provided were aggregated over all companies into one combined structure with three non-smoker classes (or risk class ranks (RCR)) and two smoker classes. For non-smokers, results in RCR Band 1 are the aggregate results of companies' best-preferred class. Results in RCR Band 3 are the results of companies' residual standard class. Lastly, results for RCR Band 2 are the results for policies that fit into neither Band 1 nor Band 3. For smokers, results are included for RCR Band 1 and RCR Band 3. Results for RCR Band 2 were immaterial as most companies have only a two-class structure for smokers. It should be noted that companies with a preferred class structure for non-smokers, but with just one smoker class, were considered to have risk class rank data only for non-smokers.

Thirty-two out of 35 companies contributed data with preferred risk class information to the Society of Actuaries' 2002-04 intercompany mortality study. This analysis included only data for issue ages greater than or equal to 25, durations up to 15 and face amounts of $100,000 up to $2,500,000. This block has over $3 trillion of face amount exposure and just over 13,000 deaths. The RCR has over twice as much data because the UCS is not available for all of the preferred data.

# Appendix A


Data Validation Flowchart
File Validation
Map to Standard Format
Data Validation
Mortality Study
Contributor Feedback & Redo or Signoff
Company Data Files
CREATE
Data in Company Submitted Format
CREATE
Contributor Receives Record Count and Distribution in 'Fields Completion Report.xls, 'KeyColumnReasonablenessReport.xls'
Can Occur Simultaneously
Subcommittee Feedback & Redo or Signoff
Data in Company Submitted Format
Map Data Element Values in Company Submitted Format Into Data Element Values of SOA LIMRA Format
Standard SOA LIMRA Format
Validate Mapping
Unscrubbed Data in SOA LIMRA Format
Mapping Precedes Validation
Contributor Feedback & Redo or Signoff
Unscrubbed Data in SOA LIMRA Format
Validate Minimum Data Contribution Fields
Scrubbed Data in SOA LIMRA Format
CREATE
company receives Pivot Table of Scrubbed Data
Validation Precedes Mortality Study
Feedback & Redo or Signoff
Validated Data in SOA LIMRA Format
Mortality Study Calculation Modules
Mortality Study Pivot Table (A/E ratios)

## Appendix B

Data Validation Rules as of 05-11-06

Based on review of company results during the Data Validation stage of the Data Validation process, the Data Validation Team has determined that the following data validation rules can be used.

1. If age nearest birthday or age last birthday discrepancy occurs, accept the records' issue age unless it differs from the system calculated age by more than 1.

2. If there is a difference between duration given by the company and duration calculated based on issue date and observation year:
    a. If the duration given by the company equals the calculated duration, accept the record
    b. If the difference is +/- 1, take policies that would have been excluded and set duration to calculated duration.
    c. If the difference is greater than 1 reject the record

3. If death claim amount is not equal to exposure

    a. If death claim amount is less than 95% exposure, exclude.
    b. If death claim amount is greater than or = 95% exposure then set the death claim amount equal to exposure.

4. Smoker & Risk Class Rank problems –
    a. Smoking Status is smoker or nonsmoker and both risk class ranks are filled-in, use the risk class rank associated with the smoker status.
    b. If both the nonsmoker risk class rank fields and the smoker risk class rank fields are filled in and smoker status is not given, reject.

    c. If smoker status is blank and either the nonsmoker risk class fields or the smoker risk class fields are filled in, fill in the appropriate smoker status code.
    d. If smoker status is inconsistent with risk class rank, reject.

5. Internal Codes
    a. If the smoker status is nonsmoker, the number of nonsmoker risk classes is filled in, an internal code is provided for nonsmoker and no nonsmoker risk class rank is filled in then reject with the message of "Decipher internal code".
    b. If the smoker status is smoker, the number of smoker risk classes is filled in, an internal code is provided for smoker and no smoker risk class rank is filled in then reject with the message of "Decipher internal code".

6. Type of Underwriting
   If Type of Underwriting Requirement = ‘Z’ it indicates that it is unknown whether or not they were underwritten and a large number of policies are excluded
   a. If other codes than ‘Z’ are used for this company code, then select random group of policies to show to the company and ask them to determine the underwriting status is ‘Z’ or ‘0’ (Underwritten, but type unknown or unable to subdivide).
      i. If should have been ‘0’, change all to ‘0’
      ii. If some should have been ‘Z’ accept records that have risk class rank information as ‘0’ and reject the other record.
   b. If only ‘Z’ is used for this company code, then ask whether any of the policies submitted were not underwritten.
      i. If the answer is yes, accept records that have risk class rank information by setting the Type of Underwriting Requirement as ‘0’ and reject the other records.
      ii. If the answer is no, then select random group of policies to show to the company and ask them to determine the underwriting status is ‘Z’ or ‘0’ (Underwritten, but type unknown or unable to subdivide).
         1. If should have been ‘0’, change all to ‘0’
         2. If some should have been ‘Z’ accept records that have risk class rank information by setting the Type of Underwriting Requirement as ‘0’ and reject the other records.

7. If both the Premium Class (Substandard Issues) is blank and the Premium Class (Standard Issues) is blank:
   a. And the company has a portion of its policies submitted as substandard, do not exclude.
   b. If the company has none of its policies submitted as substandard, call the company and ask if they submitted any substandard policies
      i. If the answer is no, do not exclude
      ii. If the answer is yes, do not exclude records that have risk class rank fields filled in. Otherwise, exclude.

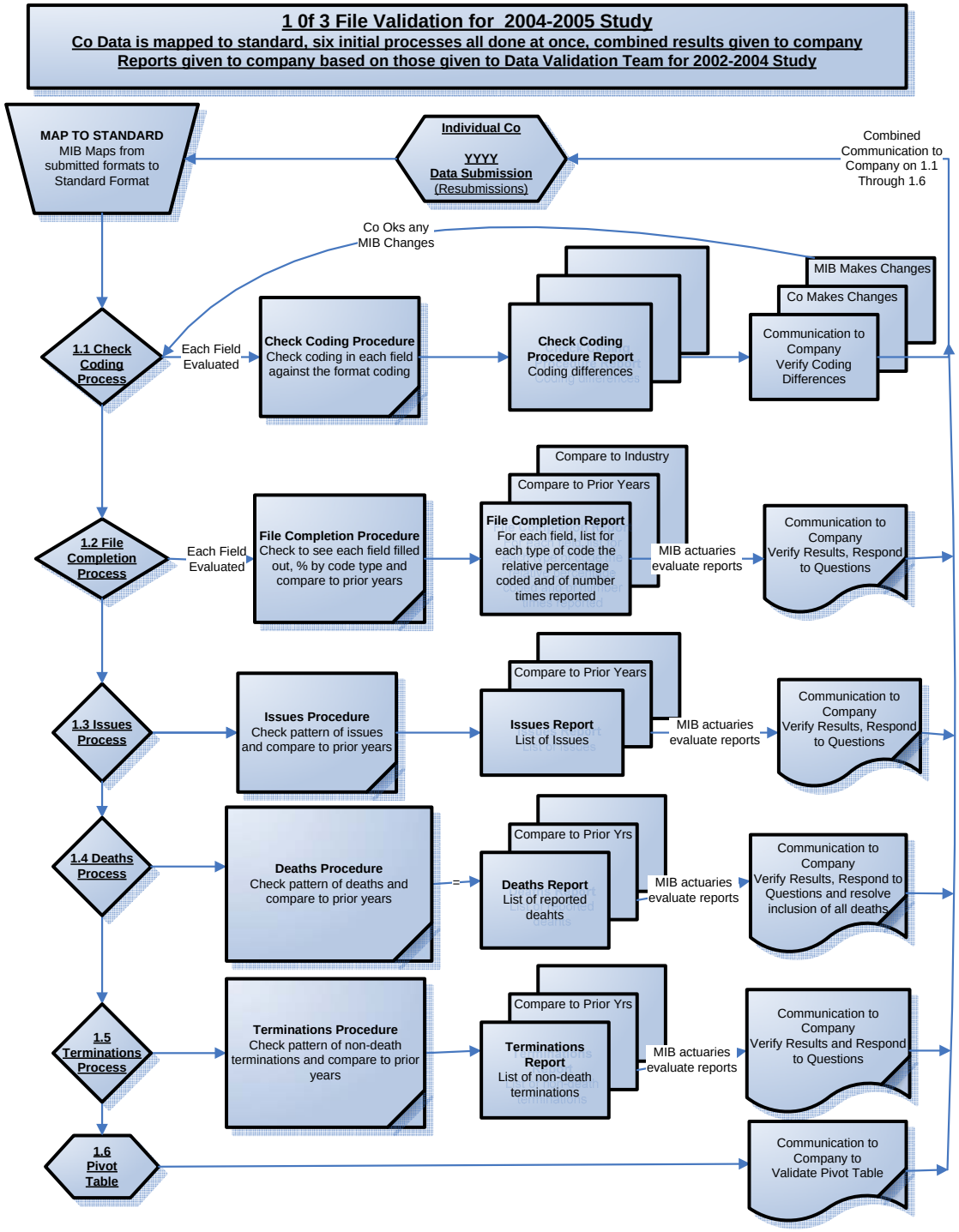
8. Smoker Status before 1980: Unless confirmed by company analysis, if issue date is less than 01-01-1980, set smoker status to unknown.

9. For inforce policies and non-death terminations, set claim amount equal to 0.

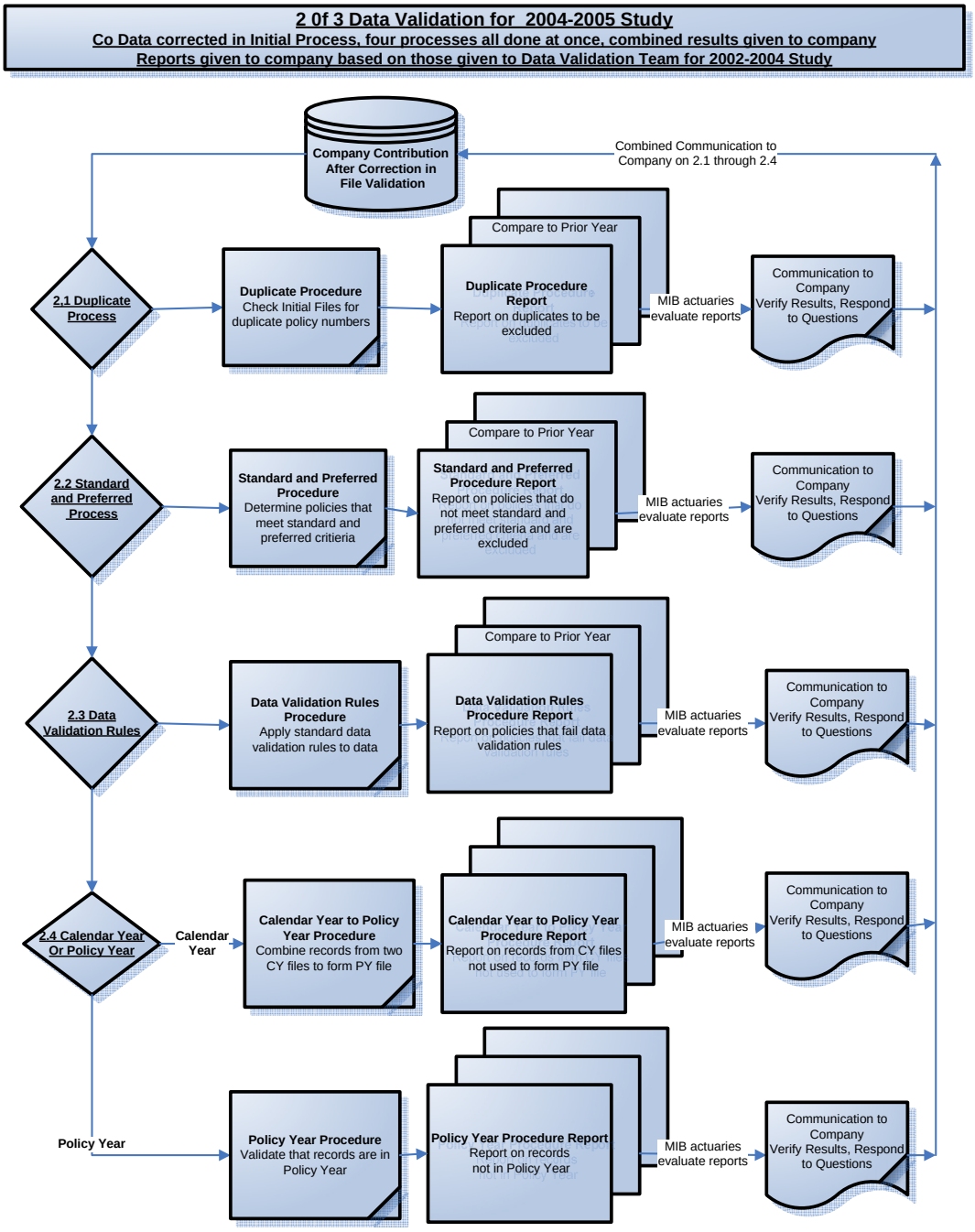
10. If Duration is ‘blank’ and enough information is given to calculate the duration, use the calculated duration.

If Reinsurance Status is ‘blank’ do not exclude record based solely on this information. Note that Reinsurance Status is not on the Minimal Mortality Data Contribution format.

# Appendix C


1 0f 3 File Validation for 2004-2005 Study
Co Data is mapped to standard, six initial processes all done at once, combined results given to company
Reports given to company based on those given to Data Validation Team for 2002-2004 Study
MAP TO STANDARD
MIB Maps from submitted formats to Standard Format
Individual Co
YYYY
Data Submission
(Resubmissions)
Combined Communication to Company on 1.1 Through 1.6
Co Oks any MIB Changes
MIB Makes Changes
Co Makes Changes
1.1 Check Coding Process
Each Field Evaluated
Check Coding Procedure
Check coding in each field against the format coding
Check Coding Procedure Report
Coding differences
Communication to Company
Verify Coding Differences
1.2 File Completion Process
Each Field Evaluated
File Completion Procedure
Check to see each field filled out, % by code type and compare to prior years
Compare to Industry
Compare to Prior Years
File Completion Report
For each field, list for each type of code the relative percentage coded and of number times reported
MIB actuaries evaluate reports
Communication to Company
Verify Results, Respond to Questions
1.3 Issues Process
Issues Procedure
Check pattern of issues and compare to prior years
Compare to Prior Years
Issues Report
List of Issues
MIB actuaries evaluate reports
Communication to Company
Verify Results, Respond to Questions
1.4 Deaths Process
Deaths Procedure
Check pattern of deaths and compare to prior years
Compare to Prior Yrs
Deaths Report
List of reported deahts
MIB actuaries evaluate reports
Communication to Company
Verify Results, Respond to Questions and resolve inclusion of all deaths
1.5 Terminations Process
Terminations Procedure
Check pattern of non-death terminations and compare to prior years
Compare to Prior Yrs
Terminations Report
List of non-death terminations
MIB actuaries evaluate reports
Communication to Company
Verify Results and Respond to Questions
1.6 Pivot Table
Communication to Company to Validate Pivot Table

# Appendix C (con'd…)

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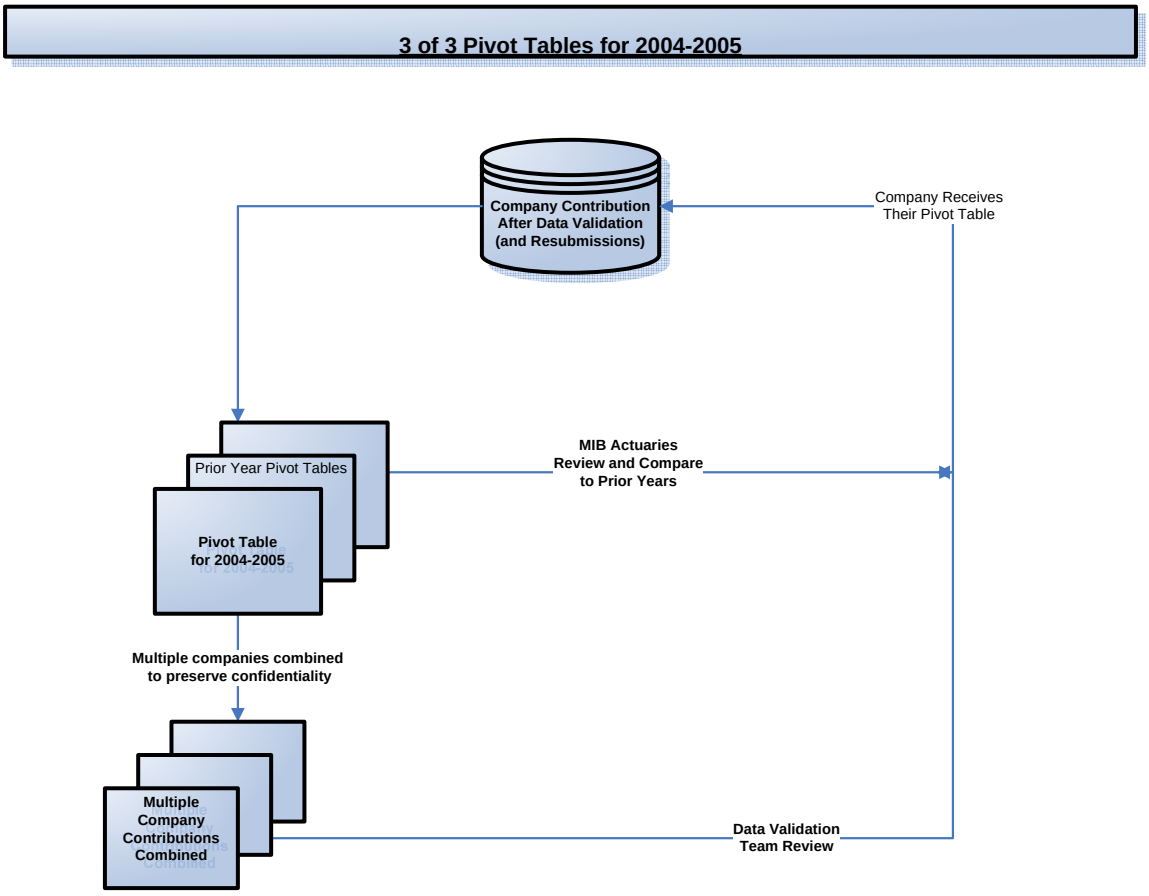
# Appendix C (con'd…)



## Appendix D

The recommended data validation processes for 2004-2005 and later experience studies are given below:

**Recommended Processes for 2004-2005 Studies**

1. Map to Standard Process
   - Converts formats submitted by companies to SOA's Minimal Mortality Contribution Format

2. File Validation Simultaneous Processes (Compare to prior year results). Send details to company and summary to Data Validation Team:
   - Syntax Check
   - File Completion (% of records coded)
   - Issues by Year
   - Deaths by Year and Month (late-reported death check)
   - Non-Death Terminations by Year and Month
   - Pivot Table of Submitted Data

3. Data Validation Simultaneous Processes (Compare to prior year results)
   - Duplicate record check
   - Standard and Preferred Process (excludes rated, converted, continuations under non-forfeiture options and guaranteed or simplified issues)
   - Data Validation Rules Applied (see eleven data validation rules as of 05-11-06)
   - Summary Report (% of records submitted, excluded/rejected, validated by total and deaths)
   - Calendar Year / Policy Year Process (convert calendar year submissions to policy year and produces actual-to-expected ratios)
   - Risk Class Record Process (Pivot table for each company showing the results of policies exposed by duration, # of Risk Classes by Smoker Status, and Class Rank by Smoker Status)

4. Pivot Table Reports Process (based on pivot table of 2002-2004 ILEC Report)
   - Data Validation Team version – results by groups of five companies (groups of five determined from ranking of companies by overall actual to expected ratio by amount)
   - Company-Specific version – only sent to contributing company

# Appendix E – Mortality Experience by Preferred Class
# Issue Ages 25+, Durations 1 – 10, Face Amounts $100K – 2,499K

**I. "Specific" Preferred Class Results**

| | | | | By Amount of Insurance | | | By Number of Policies | | |
|---|---|---|---|---|---|---|---|---|---|
| No. of Classes | Preferred Class | UCS | Proportion of Business | Actual / Expected | Actual Claims | Expected Claims | Actual / Expected | Actual Claims | Expected Claims |
| **Male Non-Smoker** | | | | | | | | | |
| 2 | 1 | 82.9 | 58.8% | 50.8% | 151,667 | 298,775 | 57.8% | 585 | 1012.1 |
| | 2 | 141.0 | 41.2% | 100.0% | 209,249 | 209,218 | 96.9% | 677 | 698.3 |
| 3 | 1 | 53.7 | 38.6% | 51.6% | 135,019 | 261,468 | 53.6% | 386 | 719.9 |
| | 2 | 77.5 | 30.0% | 71.2% | 144,800 | 203,323 | 75.6% | 505 | 668.3 |
| | 3 | 141.0 | 31.4% | 101.9% | 217,059 | 213,058 | 99.0% | 742 | 749.7 |
| 4 | 1 | 53.4 | 47.1% | 40.3% | 73,993 | 183,752 | 47.1% | 228 | 484.1 |
| | 2 | 75.5 | 23.9% | 56.3% | 52,583 | 93,317 | 63.7% | 173 | 271.7 |
| | 3 | 99.0 | 13.0% | 72.2% | 36,612 | 50,699 | 74.2% | 122 | 164.5 |
| | 4 | 141.0 | 16.0% | 85.1% | 53,199 | 62,549 | 89.9% | 188 | 209.2 |
| All** | | | | 66.5% | 1,186,632 | 1,784,409 | 71.7% | 3963 | 5528.8 |
| **Female Non-Smoker** | | | | | | | | | |
| 2 | 1 | 80.3 | 49.9% | 47.3% | 48,663 | 102,840 | 53.4% | 226 | 423.1 |
| | 2 | 141.0 | 50.1% | 86.7% | 89,572 | 103,278 | 85.4% | 288 | 337.1 |
| 3 | 1 | 52.2 | 45.1% | 51.3% | 42,847 | 83,445 | 51.8% | 179 | 345.6 |
| | 2 | 76.4 | 26.7% | 53.9% | 26,633 | 49,402 | 67.3% | 156 | 231.9 |
| | 3 | 141.0 | 28.3% | 100.0% | 52,325 | 52,330 | 97.6% | 236 | 241.9 |
| 4 | 1 | 52.2 | 51.7% | 41.4% | 27,777 | 67,066 | 45.0% | 116 | 257.5 |
| | 2 | 68.6 | 18.5% | 50.0% | 12,029 | 24,052 | 46.5% | 44 | 94.5 |
| | 3 | 93.8 | 12.3% | 60.0% | 9,565 | 15,932 | 69.3% | 48 | 69.3 |
| | 4 | 141.0 | 17.6% | 63.5% | 14,475 | 22,788 | 65.1% | 69 | 106.0 |
| All** | | | | 61.4% | 353,364 | 575,512 | 63.7% | 1481 | 2323.4 |
| **Male Smoker** | | | | | | | | | |
| 2 | 1 | 78.0 | 60.9% | 66.2% | 55,912 | 84,462 | 77.9% | 294 | 377.5 |
| | 2 | 142.0 | 39.1% | 100.7% | 54,621 | 54,223 | 102.5% | 244 | 238.0 |
| 3 | 1 | 105.0 | 74.1% | 76.8% | 11,620 | 15,124 | 64.4% | 36 | 55.9 |
| | 2 | 121.3 | 21.7% | 124.2% | 5,500 | 4,428 | 128.4% | 23 | 17.9 |
| | 3 | 142.0 | 4.2% | 147.7% | 1,265 | 857 | 165.1% | 6 | 3.6 |
| All | | | | 81.0% | 128,918 | 159,094 | 87.0% | 603 | 693.0 |
| **Female Smoker** | | | | | | | | | |
| 2 | 1 | 78.5 | 58.4% | 98.4% | 24,127 | 24,525 | 83.9% | 110 | 131.2 |
| | 2 | 142.0 | 41.6% | 152.1% | 26,566 | 17,470 | 122.6% | 105 | 85.7 |
| 3 | 1 | 105.0 | 79.8% | 31.1% | 1,150 | 3,694 | 47.6% | 9 | 18.9 |
| | 2 | 121.4 | 16.5% | 98.0% | 750 | 765 | 155.7% | 7 | 4.5 |
| | 3 | 142.0 | 3.6% | 118.7% | 200 | 168 | 210.5% | 2 | 1.0 |
| All** | | | | 113.2% | 52,793 | 46,622 | 96.6% | 233 | 241.1 |

** - Amounts in "All" include 5 class non-smoker data which is not shown in detail in this report.

# Appendix E (con'd…)

**II. "Cumulative" Preferred Class Results**

| | | | | By Amount of Insurance | | | By Number of Policies | | |
|---|---|---|---|---|---|---|---|---|---|
| No. of Classes | Preferred Class | UCS | Proportion | Actual / Expected | Actual Claims | Expected Claims | Actual / Expected | Actual Claims | Expected Claims |
| **Male Non-Smoker** | | | | | | | | | |
| 2 | 1 | 82.9 | 58.8% | 50.8% | 151,667 | 298,775 | 57.8% | 585 | 1012.1 |
| | 2 | 141.0 | 100.0% | 71.0% | 360,916 | 507,993 | 73.8% | 1262 | 1710.4 |
| 3 | 1 | 53.7 | 38.6% | 51.6% | 135,019 | 261,468 | 53.6% | 386 | 719.9 |
| | 2 | 76.3 | 68.6% | 60.2% | 279,819 | 464,791 | 64.2% | 891 | 1388.2 |
| | 3 | 141.0 | 100.0% | 73.3% | 496,878 | 677,849 | 76.4% | 1633 | 2137.9 |
| 4 | 1 | 53.4 | 47.1% | 40.3% | 73,993 | 183,752 | 47.1% | 228 | 484.1 |
| | 2 | 75.9 | 71.0% | 45.7% | 126,576 | 277,069 | 53.1% | 401 | 755.8 |
| | 3 | 101.8 | 84.0% | 49.8% | 163,188 | 327,768 | 56.8% | 523 | 920.3 |
| | 4 | 141.0 | 100.0% | 55.4% | 216,387 | 390,317 | 62.9% | 711 | 1129.5 |
| All** | | | | 66.5% | 1,186,632 | 1,784,409 | 71.7% | 3963 | 5528.8 |
| **Female Non-Smoker** | | | | | | | | | |
| 2 | 1 | 80.3 | 49.9% | 47.3% | 48,663 | 102,840 | 53.4% | 226 | 423.1 |
| | 2 | 141.0 | 100.0% | 67.1% | 138,235 | 206,118 | 67.6% | 514 | 760.2 |
| 3 | 1 | 52.2 | 45.1% | 51.3% | 42,847 | 83,445 | 51.8% | 179 | 345.6 |
| | 2 | 75.0 | 71.8% | 52.3% | 69,480 | 132,847 | 58.0% | 335 | 577.5 |
| | 3 | 141.0 | 100.1% | 65.8% | 121,805 | 185,177 | 69.7% | 571 | 819.4 |
| 4 | 1 | 52.2 | 51.7% | 41.4% | 27,777 | 67,066 | 45.0% | 116 | 257.5 |
| | 2 | 73.3 | 70.2% | 43.7% | 39,806 | 91,118 | 45.5% | 160 | 352.0 |
| | 3 | 98.1 | 82.5% | 46.1% | 49,371 | 107,050 | 49.4% | 208 | 421.3 |
| | 4 | 141.0 | 100.1% | 49.2% | 63,846 | 129,838 | 52.5% | 277 | 527.3 |
| All** | | | | 61.4% | 353,364 | 575,512 | 63.7% | 1481 | 2323.4 |
| **Male Smoker** | | | | | | | | | |
| 2 | 1 | 78.0 | 60.9% | 66.2% | 55,912 | 84,462 | 77.9% | 294 | 377.5 |
| | 2 | 142.0 | 100.0% | 79.7% | 110,533 | 138,685 | 87.4% | 538 | 615.5 |
| 3 | 1 | 105.0 | 74.1% | 76.8% | 11,620 | 15,124 | 64.4% | 36 | 55.9 |
| | 2 | 121.3 | 95.8% | 87.6% | 17,120 | 19,552 | 79.9% | 59 | 73.8 |
| | 3 | 142.0 | 100.0% | 90.1% | 18,385 | 20,409 | 84.0% | 65 | 77.4 |
| All | | | | 81.0% | 128,918 | 159,094 | 87.0% | 603 | 693.0 |
| **Female Smoker** | | | | | | | | | |
| 2 | 1 | 78.5 | 58.4% | 98.4% | 24,127 | 24,525 | 83.8% | 110 | 131.2 |
| | 2 | 142.0 | 100.0% | 120.7% | 50,693 | 41,995 | 99.1% | 215 | 216.9 |
| 3 | 1 | 105.0 | 79.8% | 31.1% | 1,150 | 3,694 | 47.6% | 9 | 18.9 |
| | 2 | 121.4 | 96.3% | 42.6% | 1,900 | 4,459 | 68.4% | 16 | 23.4 |
| | 3 | 142.0 | 99.9% | 45.4% | 2,100 | 4,627 | 73.8% | 18 | 24.4 |
| All | | | | 113.2% | 52,793 | 46,622 | 96.6% | 233 | 241.1 |

** - Amounts in "All" include 5 class non-smoker data which is not shown in detail in this report.