Preferred Valuation Basic Table Team

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I - Background and Scope

The objective of the Valuation Basic Table Team (Team), as requested by LHATF, was to produce a set of valuation basic mortality tables (before inclusion of margins necessary to make the table suitable for standard valuation purposes) for individual life insurance products that reflect standard and preferred underwriting criteria. The scope did not include analysis of the mortality experience or development of mortality tables for guaranteed issue or pre-need coverage. This section of the report documents the data, assumptions and process the Team used to develop the 2008 Valuation Basic Table (2008 VBT). The Team began with data and information from the mortality experience analysis and underwriting criteria score analysis as described in the Underwriting Criteria Team Report and the Experience Analysis Team Report.

The 2008 VBT is composed of two aggregate or combined standard and preferred risk tables. The aggregate tables are referred to as the Primary Table and the Limited Underwriting Table. The Team then subdivided the Primary Table into multiple tables to reflect the range of expected mortality from super-preferred to residual standard risk. These multiple tables are referred to as the Relative Risk (RR) Tables.

The underlying data used in developing the 2008 VBT was the Society of Actuaries (SOA) Individual Life Experience Committee's (ILEC) 2002-2004 Intercompany Study (2002-2004 Study or 2002-2004 ILEC) attached in Appendix A of this report. This study included $7.4 trillion in exposure by amount, 75 million in exposure by number of policies and nearly 700,000 death claims from 35 contributing companies, including over 200,000 deaths in the select period and over 495,000 deaths in the ultimate period. In the development of the 2008 VBT, the Team used a subset of the data from the 2002-2004 Study. In total, this resulted in excluding slightly over 54,000 of the 700,000 total deaths. More details regarding the excluded claims and the reasons for the exclusions are documented later in this report. Since testing for smoking or tobacco usage did not become common until the early 1980s, the analysis was performed on a smoker versus non-smoker distinct basis for the first 24 durations only; for durations 26 and later, the analysis was on a uni-smoke basis. Duration 25 values were determined using Whittaker-Henderson graduation between the duration 24 and duration 26 values. Throughout this report, the expected basis used for analysis is the 2001 Valuation Basic Table (2001 VBT) from the Final Report of the SOA's Individual Life Insurance Valuation Mortality Table Task Force. For durations 1 through 25, the expected basis is the 2001 VBT Sex Distinct, Smoker Distinct Tables; for durations 26 and later, the expected basis is the composite 2001 VBT.

The Team began by developing ultimate mortality rates based on the underlying experience. To develop the ultimate mortality rates, the Team:

- Determined which experience, if any, from the 2002-2004 Study to exclude from the analysis;
- Reviewed outside studies and research to determine the most applicable population mortality at the older ages;
- Determined how to augment the 2002-2004 Study experience data with the results of other mortality research;
- Determined the omega rate; and
- Determined the appropriate graduation methodology.

Once the ultimate mortality rates were developed, the Team developed the aggregate select and ultimate tables for male and female, non-smoker and smoker risks (hereafter referred to as the Primary Tables) by determining the following items:

- The issue age limits;
- The select period;
- Which experience, if any, from the 2002-2004 Study to exclude from the analysis;
- How to augment the mortality experience for juveniles;
- How to augment the mortality experience for smoker risks;
- Mortality improvement factors and any additional adjustments to the underlying experience; and
- The appropriate graduation methodology.

Once the Primary Tables were completed, the Team worked to split these aggregate tables into multiple tables that reflect a range of expected mortality from preferred underwriting programs, ranging from super-preferred to residual standard. To do so, the Team determined:

- The number of tables or representative risk classes;
- The relationship between the specific underwriting criteria and the mortality experience for that particular level of underwriting; and
- How quickly the preferred underwriting effects wear off (this is in addition to the wear-off of age and amount requirements from general underwriting).

The Team performed the mortality experience analysis and table development on an age nearest birthday basis. A conversion algorithm, consistent with that used in previous valuation basic table development, was then applied to develop the tables on an age last birthday basis. This algorithm is shown in Appendix J of this report.

II - General Comments on Table Development

The Team developed two aggregate tables, the Primary Table and the Limited Underwriting Table, representing different levels of underwriting and different market segments. The Team felt it was important to maintain two distinct aggregate tables as the underlying experience varied significantly by size and market segment. The variations reflect differences in underwriting at various issue ages and amounts and differences in the marketing approach and distribution at lower amounts. These differences held across gender and smoking status. The actual to expected ratios by amount for various face amount bands are shown in Table 1 below.

Table 1: Actual to Expected Ratios by Amount for Various Face Amount Ranges

Amount Band	Aggregate	MNS	MSM	FNS	FSM
All Amounts	73.8%	68.1%	83.5%	68.9%	89.1%
Under $10,000	99.0	108.3	116.8	95.6	110.9
$10,000 - $24,999	90.4	92.5	102.0	82.7	98.2
$25,000 - $49,999	87.1	88.6	99.6	77.1	91.3
$50,000 - $99,999	78.7	77.7	88.6	71.9	84.3
$100,000 - $249,999	73.4	72.3	81.5	68.2	83.4
$250,000 - $499,999	65.6	63.6	78.7	63.3	82.5
$500,000 - $999,999	63.0	62.3	71.0	60.4	83.5
$1,000,000 - $2,499.999	62.6	59.6	75.9	65.5	96.0
$2,500,000+	67.8	63.5	64.2	74.9	104.4

The Team observed that the variation in experience by amount becomes less pronounced as the block of business ages (i.e., at later attained ages). Chart A shows the convergence of experience by amount for non-smoker risks. The Team observed a similar pattern for smoker risks.

Chart A: Comparison of Actual to Expected Ratios for Ages 60 and Above by Face Amount, Non-Smoker Risks

A/E Ratio by Amount, Non-smoker Risks

Legend: 1-9,999; 10,000-24,999; 25,000-49,999; 50,000-99,999; 100,000-249,999; 250,000+
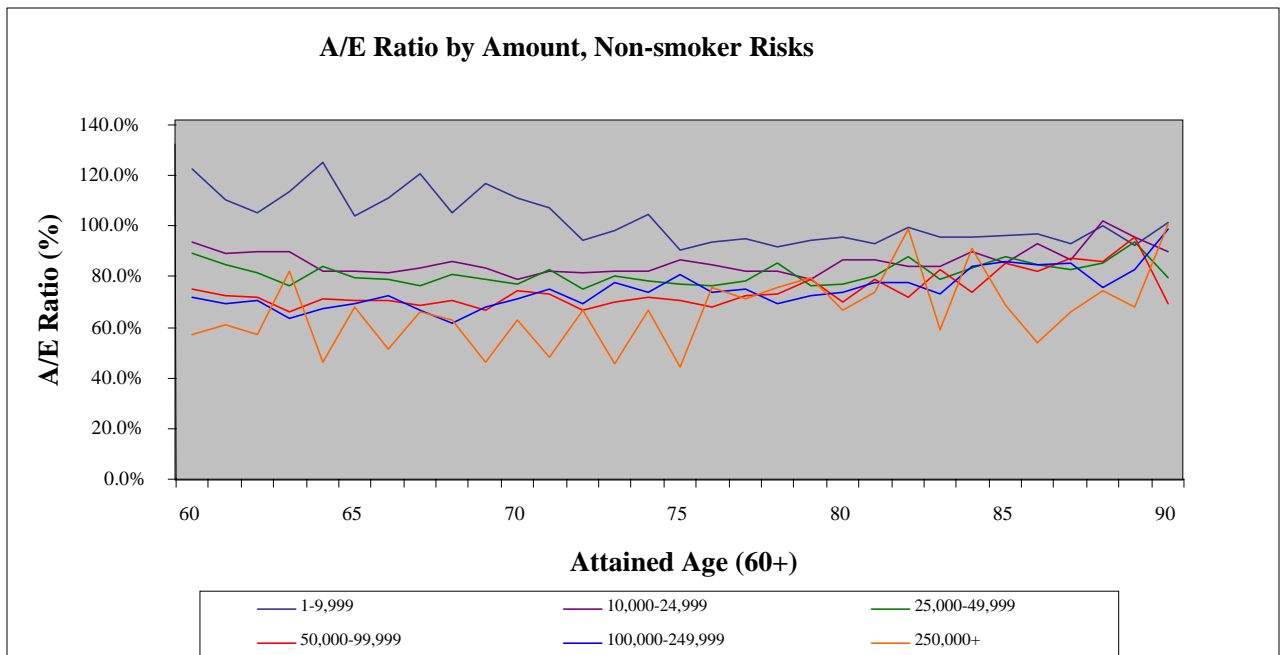
Given that this study includes experience over a large number of durations, the Team believed it made sense to review changes in the cost of living (i.e., purchasing power of a dollar) over the last 25 to 30 years to determine whether to include more experience in the Primary Tables at later durations. The Team used this analysis to determine the face amount in later durations, which could be considered equivalent to a newly issued face amount of $100,000 in 2003. The Consumer Price Index (CPI) and U.S. Average Wage Index (AWI) were used as proxies for the cost of living. The Team reviewed CPI history back to 1913 and the AWI back to 1951. The year-by-year summaries of both the CPI and Annual Wage Index are in Appendix H of this report. The resulting values are shown in Table 2 below.

Table 2: Results of Face Amount Equivalency to $100,000 Analysis by Duration

Duration	Equivalent Face Amount to $100,000 in 2003
1	101,222
2	99,504
3	97,854
4-5	91,754
6-10	77,231
11-15	64,682
16-20	51,962
21-25	39,517
26+	15,430

The result of the above analyses determined that, for the development of the aggregate tables, an expanded approach for face amount bands is justified. Using the information in Table 2, the constraints in which the face amount bands were provided in the study and the average amounts within each face amount band, the Team developed the staggered face amount bands shown in Table 3 below:

Table 3: Breakdown of Experience by Issue Amount Included

Duration	Limited Underwriting Table Issue Ages		Primary Table Issue Ages	
	<70	70+	<70	70+
1-10 (# claims)	$25,000-$99,999 (11,569)	$10,000-$49,999 (3,391)	$100,000-$2,499,999 (16,752)	$50,000-$2,499,999 (2,840)
11-25 (# claims)	$10,000-$49,999 (60,471)	$0 - $24,999 (9,466)	$50,000-$2,499,999 (42,083)	$25,000-$2,499,999 (4,529)
26+ (# claims)	$0 - 24,999 (482,297)	N/A	$25,000-$2,499,999 (12,359)	N/A

The underlying select experience for older issue ages, juveniles and smoker risks was limited. Therefore, the Team used several data sources, graduation techniques and other adjustments to augment the data and develop the final tables, as discussed elsewhere in this report.

The Team made the following additional adjustments to the underlying data to develop the aggregate tables:

- Removed exposures and claims at $2.5 million and above. This was done in order to remove fluctuations from a few high claims. Overall, the removal had a minimal impact to the actual to expected ratio. Including experience for $2.5 million and above, the actual to expected ratio was 72.0% (84.0% by policy count) of the 2001 VBT versus 72.3% (84.0% by policy count) for face amounts excluding amounts at or above $2.5 million. The removal of the experience for these amounts mostly affected exposures in the early durations and at issue ages between 30 and 69. In total, eliminating this band reduced the exposures by $474.3 billion, 104,663 policies and removed 213 claims from the experience.

- Removed exposures and claims below $25,000 for the Primary Table. These exposures and claims were excluded to reflect the risks issued today under fully underwritten programs or for underwriting programs that utilize fluid testing. It is believed that some of the experience in the under $25,000 face amount category was underwritten and issued on a simplified basis and, therefore, not reflective of fully underwritten business.

- For juvenile risks, used the underlying experience for all face amounts at age 0, duration 1, as the Team felt the underwriting for juvenile risks did not vary much by issue amount. The same age 0, duration 1 rate was used for both the Primary and Limited Underwriting Tables. More information on the development of the juvenile rates is in Section III.F of this report.

- Applied a factor of 95% to the underlying experience in durations 11-15 for issue ages between 18 and 79 for the Primary Table, but not the Limited Underwriting Table. This adjustment factor graded linearly to 100% at duration 25. The adjustment factors did not apply to attained ages 90 and above. The Team felt the 5% adjustment was a reasonable proxy to remove the anti-selective mortality often seen in level premium term experience beyond the level premium period and to account for general changes in the underwriting process that have taken place since the policies in the study were originally underwritten. The improvement begins to wear off after the 15th duration as there is less impact from level term plans at these durations in the underlying experience. (Note: The 2002-2004 Study included significantly more term experience than what was included in previous studies. Unfortunately, the data splits between permanent and term products were not fully reliable).

The underlying data becomes sparse and less reliable for ages in the mid to late 80s and beyond. Therefore, population mortality was used to reflect the mortality at the latest attained ages. The Team blended the experience into population mortality beginning in the late 80s. The Team analyzed different sets of population data including:

- Social Security Administration (SSA) data (based on Medicare death records from 2002, projected to 2003);
- Centers for Disease Control (CDC) data (also based on Medicare data);
- Veterans Administration (VA) data (based on 2003 claims); and
- 2003 RP2000 Combined Healthy annuitant mortality experience improved for three years using Scale AA (2003 RP2000 CH).

The timeframes chosen for each of these sources matched the timeframe of the underlying data. Each source had its advantages and disadvantages. No source had significant experience beyond

attained age 95 and each used a different projection method to determine mortality rates for the late attained ages. Although the SSA data is the most conservative (see Charts B and C below), the Team felt it was also the most reliable. (Note: In the charts below, the ILEC data points were adjusted to reflect the exposure within each quinquennial age grouping).

In addition, the Team reviewed papers and research from the SOA 2005 Living to 100 and Beyond Seminar, as well as recent research and study on longevity issues and supercentenarian mortality. Based on this research, the Team decided to create tables with an omega mortality rate of 0.45 beginning at attained age 110. This is a change from past experience tables which have all ended with a mortality rate equal to 1.0.

The population mortality was then defined to be the SSA data up to age 95, graded between SSA data and 0.45 between ages 96 and 110, and 0.45 for ages 110 and above.

Chart B: 2002-2004 ILEC Mortality Experience v. Other Sources, Male Risks, Attained Ages 85-110

Mortality Comparisons, Males, Ages 85-110

2002 SSA	2003 CDC	2003 VA amt
2003 RP2000 CH	2001 VBT Composite	2002-2004 ILEC Ult, Amt

Mortality Comparisons, Females, Ages 85-110
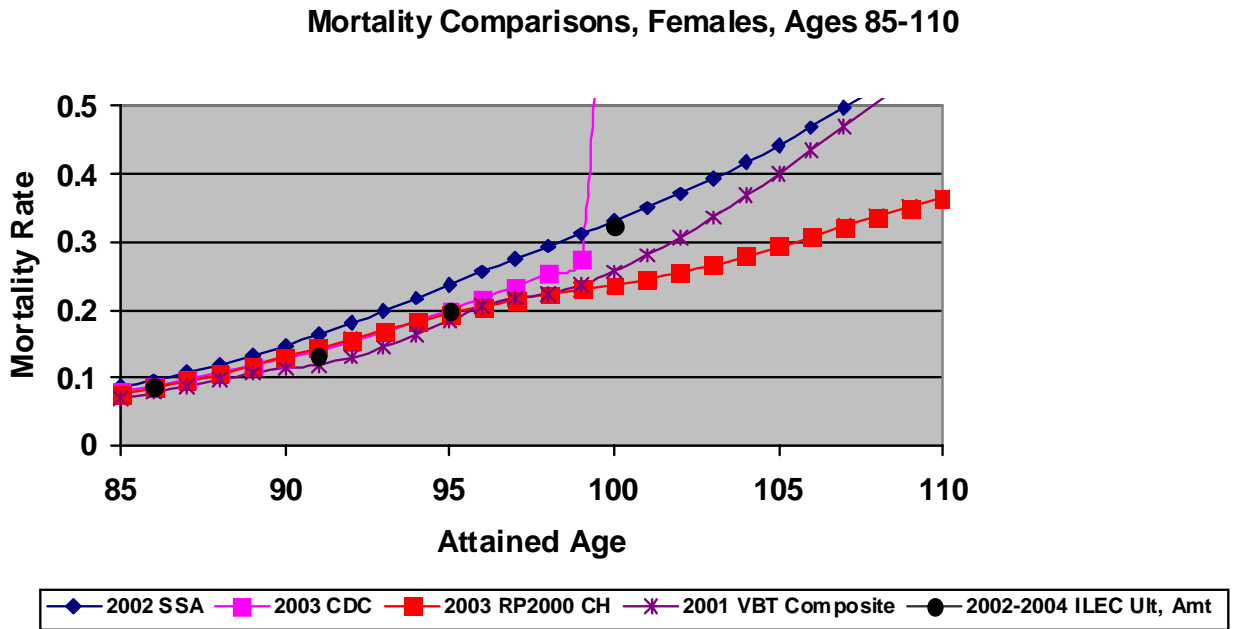
III - Primary Table Development

The Team first developed the ultimate mortality rates using the underlying experience data with the adjustments discussed in Section II. Once the ultimate mortality rates were set, the Team then determined the appropriate select period and select gender distinct and smoker distinct mortality rates. Collectively, these four tables (Male Non-smoker, Female Non-smoker, Male Smoker and Female Smoker) are referred to as the Primary Table.

A. General Comments

The Team focused primarily on actual mortality experience by amount in developing the tables. The Primary Tables were later split into multiple tables (referred to as the Relative Risk Tables or RR Tables) to reflect the range of expected mortality from super-preferred to residual standard risks. More details around the relative risk concept and how the Team used it to develop the RR Tables are discussed in Section IV and further explained in Appendix D of this report.

To develop the Primary Tables, the Team first developed ultimate rates for non-smoker risks. Because the ultimate experience consists primarily of exposures where the smoking status is unknown, the raw mortality was multiplied by 90% to reflect non-smoker mortality. The 90% factor was selected by the Team as a reasonable estimate of the relationship between non-smoker and aggregate mortality.

B. Ultimate Rate Graduation Methodology

The primary graduation method used was Whittaker-Henderson. The focus of the graduation was fit over smoothness. Therefore, the graduation was performed using an order of four and smoothness factor of 10,000. The Team did explore alternative graduation methodologies but felt that Whittaker-Henderson provided the best table, given the nature of the underlying curve we were trying to fit.

In situations where the data was very limited or sparse, Whittaker-Henderson did not always develop a reasonable curve. Therefore, the Team investigated the possibility of using predictive modeling techniques. The Team investigated in detail one particular technique known as Projection Pursuit Regression (PPR). This is an iterative, non-parametric technique that seeks an optimal model for a response variable given a set of predictor variables. In our case, the response variable was either the mortality rate or the A/E ratio versus the 2001 VBT. The predictor variables available in our mortality experience data were age, duration, gender, smoker status and face amount band. More information regarding the PPR method is provided in Appendix I of this report.

Overall, Whittaker-Henderson provided the closest fit to the data; however, the PPR method provided a closer fit at the oldest attained ages for male risks and came closest to the population mortality as defined above. Therefore, the ultimate male non-smoker rates were generated using a combination of the rates resulting from both graduation methods. For male risks, the Team used the following schedule:

Table 4: Blending Between Graduation Methods into Population Mortality, Male Risks

Attained Age	% Whittaker-Henderson	% PPR
<85	100%	0%
85	90%	10%
86	80%	20%
87	70%	30%
88	60%	40%
89	50%	50%
90*	PPR - 0.50 x (AttAge89PPR - AttAge89WH)	
91*	PPR - 0.40 x (AttAge89PPR - AttAge89WH)	
92*	PPR - 0.25 x (AttAge89PPR - AttAge89WH)	
93*	PPR - 0.10 x (AttAge89PPR - AttAge89WH)	
94-106	0%	100%
107+	Population Rates	

*For attained ages 90-93, the Team used the methodology shown above because the Whittaker-Henderson graduation was unreasonable beyond attained age 89.

For female risks, the Team felt the Whittaker-Henderson graduation method provided a closer fit to the underlying experience data than the PPR method. Therefore, only the Whittaker-Henderson method was used to graduate the female rates. The following table shows the weights used to grade between the Whittaker-Henderson and population mortality.

Table 5: Blending Between Graduated Rates and Population Mortality, Female Risks

Attained Age	% Whittaker-Henderson	% Population
<98	100.0%	0.0%
98	87.5%	12.5%
99	75.0%	25.0%
100	62.5%	37.5%
101	50.0%	50.0%
102	37.5%	62.5%
103	25.0%	75.0%
104	12.5%	87.5%
105+	0.0%	100.0%

C. Issue Ages

The issue ages for the 2008 VBT table are age zero to 90. The Team initially believed it made sense to develop tables with issue ages up to 95, but the table relationships were difficult to maintain once we began grading into population mortality. Therefore, the maximum issue age was reduced to age 90.

D. Select Period

In determining the select mortality, the Team first needed to determine the appropriate select period. The Team performed an analysis based on attained age and duration. Sample output from this analysis is shown in Tables 6 and 7 below. Table 8 below summarizes the analysis shown in Tables 6 and 7 for sample ages, providing the initially suggested select periods along with a comparison to the select period in the 2001 VBT. In general, the select period ranged from 20 to 25 years. While there was some variation between male and female risks, the Team did not feel the data was supportive of a select period that varied by gender. Although the analysis suggests a shorter select period might be justified, there was no overwhelming evidence that we should shorten or change the select period from the 25 years used in the 2001 VBT. The final select period does vary slightly from that used in the 2001 VBT. Specifically, the Team defined the select period to be the earlier of 25 years or attained age 90, subject to a minimum select period of two years, regardless of issue age.

Table 6: Sample Select Period Analysis - Male Risks

Actual to Expected Ratio (in %), using the 2001 VBT Ultimate table as expected basis												
Attained Age	Duration (Policy Year)											
	1	2	3	4-5	6-10	11-15	16-20	21-25	Ult	1-5	1-10	1-15
18-29	32.0	35.1	38.1	45.7	91.7	98.5	98.1	107.8	87.8	36.1	43.5	47.9
30-39	18.2	30.6	36.1	47.7	50.3	73.8	93.8	123.0	134.3	32.8	36.3	38.5
40-49	17.0	24.2	35.4	39.8	46.3	63.0	74.7	79.4	105.5	30.4	35.7	39.9
50-59	15.4	27.2	33.4	37.8	45.1	58.3	65.3	70.0	85.0	30.1	35.7	40.3
60-69	13.3	25.3	33.0	32.1	44.3	56.1	62.1	69.6	75.8	27.3	34.8	40.5
70-79	21.2	26.5	36.1	41.2	44.0	56.5	65.1	77.3	82.2	34.7	40.3	47.0
80-89	28.5	11.9	49.9	43.3	44.4	54.8	65.2	72.8	83.6	36.5	41.8	48.0
90+				122.8	76.6	60.4	78.6	64.2	93.4	122.8	79.5	68.7

Table 7: Sample Select Period Analysis - Female Risks

Attained Age	Actual to Expected Ratio (in %), using the 2001 VBT Ultimate table as expected basis											
	Duration (Policy Year)											
Attained Age	1	2	3	4-5	6-10	11-15	16-20	21-25	Ult	1-5	1-10	1-15
18-29	24.5	25.7	50.6	72.8	62.5	113.0	68.5	98.5	109.2	40.8	43.9	49.3
30-39	16.5	24.3	54.7	34.7	50.5	52.7	75.5	98.8	75.8	30.0	35.0	36.5
40-49	12.0	22.9	31.6	37.6	48.2	63.0	68.1	86.1	100.1	27.4	34.5	39.4
50-59	11.7	19.3	29.2	34.8	41.2	53.0	57.7	59.2	74.0	25.9	31.6	36.3
60-69	7.7	20.0	18.3	41.4	46.5	53.7	53.5	59.9	81.2	25.3	34.3	39.3
70-79	17.3	34.0	36.1	46.7	49.2	56.5	59.6	84.2	88.7	37.0	44.2	48.2
80-89	10.4	25.2	24.3	53.0	50.4	57.8	74.4	97.3	108.5	35.2	44.7	49.5
90+				90.3	89.8	91.3	95.5	119.7	115.3	90.3	89.8	90.7

Table 8: Comparison of Observed Select Period to 2001 VBT Select Period

Issue Age	Observed Select Period*		2001 VBT Select Period by Issue Age**					
			Male			Female		
	Male	Female	Composite	NS	SM	Composite	NS	SM
10	22	22	16	16	16	17	17	17
15	20	20	13	12	13	15	15	25
20	25	25	14	17	22	17	11	12
25	25	25	24	23	23	19	19	19
30	25	25	25	25	25	20	24	16
35	24	24	25	25	25	25	25	17
40	23	23	25	25	25	24	25	23
45	23	22	25	25	25	19	25	25
50	22	22	25	25	13	18	25	25
55	22	21	25	25	12	18	25	25
60	22	21	25	25	12	25	25	25
65	22	21	25	25	13	25	25	25
70	21	20	23	25	22	25	25	25
75	19	19	18	21	17	25	25	25
80	14	14	13	19	12	11	24	24
85	9	9	7	19	7	12	19	14
90	4	4	3	14	2	23	23	23
* Observed select period differs from the final select period in the 2008 VBT								
** Defined for issue age X as the last duration for which q[x]+t < q[x-1]+t+1								

E. Select Period Graduation Methodology

As with the ultimate data, the Team's focus in the graduation was fit over smoothness. The Whittaker-Henderson method with an order of four and smoothness factor equal to 10,000 was used to graduate the select period mortality rates. The PPR method was not used to graduate the select period mortality.

Like the older age ultimate data, the older age select data was quite limited. Therefore, the Team made some adjustments to the Whittaker-Henderson generated select mortality as follows:

Table 9: Adjustments to Older Age Select Graduated Mortality Rates

Issue Ages(s)	Duration		
	1	2	3
< 85	No adjustment	No adjustment	No adjustment
85 - 88	No adjustment	$q_x = q_{x-1} + 0.5 \times [(q_{x, dur1} - q_{x-1, dur1}) + (q_{x, dur3} - q_{x-1, dur3})]$	Ultimate q_x x Select Factor *
89	No adjustment	$q_{89, dur2} = 0.65 \times q_{89, dur1} + 0.35 \times q_{89, dur 3}$	Ultimate q_x x Select Factor *
90	$q_{90} = q_{89} \times (q_{89}/q_{88})$	$q_{90, dur2} = 0.60 \times q_{90, dur1} + 0.40 \times q_{90, dur3}$	No select period, all q_x are set to ultimate rates

* Select Factor is linearly interpolated between actual attained age 84 Select Factor and the attained age 90 Select Factor for each duration

F. Juveniles

For juvenile ages (defined herein as less than 18), the underlying data was sparse and resulted in a pattern of mortality rates inconsistent with a more traditional select and ultimate rate structure. The Team felt a 25-year select and ultimate pattern did not make sense for juvenile risks, based on the level of underwriting generally performed at these ages. The actual mortality experience for male issue ages 0-17, durations 1-10 was roughly 78% of the population mortality; for females, the actual mortality experience was 83%. The aggregate tables used the actual experience for all face amounts for issue age 0, duration 1. Beyond that, juvenile mortality was set equal to 78% of the population mortality for males and 83% for females up to attained age 10. Mortality was then graded between population and aggregate table rates between ages 10 and 25. This resulted in no select period for issue ages 10 and under. The population mortality table used was the 2002 Social Security Administration data projected to 2003.

G. Smoker Table Development

The underlying smoker data was quite sparse. As a result, no graduation method generated a table with meaningful relationships between smoker and non-smoker risks at all ages and durations. In addition, the Team reviewed the analysis for smoker mortality used in developing the smoker rates for the 2001 VBT and determined the ratio approach was still appropriate to use. The Team also looked at the smoker to non-smoker mortality ratios that resulted from the PPR graduation method on the smoker and non-smoker experience data. In general, these ratios showed a smooth shape by issue age and duration reasonably consistent with 2001 VBT ratios and the Team's expectations, where Whittaker-Henderson graduation ratios showed anomalous patterns. However, at attained ages 45 to 75, the magnitude of the PPR ratios appeared to significantly understate ratios of raw experience data (by as much as 30%), whereas Whittaker-Henderson ratios appeared to be a better fit. In the end, the Team adjusted the ratios of the PPR smoker to non-smoker data at these central ages to more closely match Whittaker-Henderson magnitudes. The Team also established a maximum ratio of 350% and a minimum ratio of 110%, then re-graduated these adjusted PPR ratios to smooth the adjustments and arrive at a final set of smoker to non-smoker ratios. These ratios were then applied to the non-smoker rates to determine the final smoker rates. Detailed information regarding research on smoker to non-smoker mortality can be found in the Final Report of the Individual Life Insurance Valuation Mortality Task Force 2001 Valuation Basic Table (2001 VBT), Section III, Construction of Smoker Distinct (http://www.soa.org/research/individual-life/final-report-life-insurance-valuation.aspx).

H. Improvement Factors

The resulting mortality tables were then projected forward to the beginning of year 2008. The underlying experience was from 2002-2004, with the midpoint being mid-year 2003. Therefore, a four and a half year improvement factor was applied. To determine the level of the improvement factors, the Team reviewed the documentation supporting the mortality improvement factors used to develop the 2001 VBT, as well as the improvement in the overall population through 2003. The magnitude of recent improvement in the overall population mortality rates was found to be very similar to the improvement used in the development of the 2001 VBT. However, the overall population data showed improvement down to lower ages than the data underlying the 2001 VBT. Both the magnitude and the age at which mortality improvement began to appear for the population was found to be consistent with the industry-wide mortality improvement assumptions summarized in the Society of Actuaries' Mortality Table Construction Survey Report dated June, 2007.

The Team assumed annual mortality improvement as follows:
- For male risks, the improvement factors are 0% up to age 20, and then grade from 0% to 1% between ages 20 and 30. The improvement stays at 1% until age 80 after which it begins to grade back to 0% by attained age 90 (see Table 10 below).
- For female risks, the improvement factors begin at a later age but also wear off by attained age 90. The improvement factors are 0% up to age 35, then grade from 0% to 0.5% between ages 35 and 45, and remain at 0.5% until age 80 after which the factors begin to grade back to 0% by age 90 (see Table 10 below).

Table 10: Mortality Improvement Factors Used to Project Mortality to 2008

Male				Female			
Attained Ages	Per Year Improvement	Factor	4.5 Year Factor	Attained Ages	Per Year Improvement	Factor	4.5 Year Factor
0-20	0.0%	1.000	1.000	0-35	0.00%	1.000	1.000
21	0.1%	0.999	0.996	36	0.05%	0.005	0.998
22	0.2%	0.998	0.991	37	0.10%	0.990	0.996
23	0.3%	0.997	0.987	38	0.15%	0.985	0.993
24	0.4%	0.996	0.982	39	0.20%	0.980	0.991
25	0.5%	0.995	0.978	40	0.25%	0.975	0.989
26	0.6%	0.994	0.973	41	0.30%	0.970	0.987
27	0.7%	0.993	0.969	42	0.35%	0.965	0.984
28	0.8%	0.992	0.965	43	0.40%	0.960	0.982
29	0.9%	0.991	0.960	44	0.45%	0.955	0.980
30-79	1.0%	0.990	0.956	45-79	0.50%	0.950	0.978
80	1.0%	0.990	0.956	80	0.50%	0.950	0.978
81	0.9%	0.991	0.960	81	0.45%	0.955	0.980
82	0.8%	0.992	0.965	82	0.40%	0.960	0.982
83	0.7%	0.993	0.969	83	0.35%	0.965	0.984
84	0.6%	0.994	0.973	84	0.30%	0.970	0.987
85	0.5%	0.995	0.978	85	0.25%	0.975	0.989
86	0.4%	0.996	0.982	86	0.20%	0.980	0.991
87	0.3%	0.997	0.987	87	0.15%	0.985	0.993
88	0.2%	0.998	0.991	88	0.10%	0.990	0.996
89	0.1%	0.999	0.996	89	0.05%	0.995	0.999
90+	0.0%	1.000	1.000	90+	0.00%	1.000	1.000

I. Additional Adjustments

After application of the graduation techniques and improvement factors, the Team reviewed the resulting tables for relationship reasonableness and made manual adjustments to ensure the appropriate relationships held. The Team utilized the following tests:

1. Duration within issue age test: With a few possible exceptions where the experience clearly justifies, such as mortality at young ages, mortality for any given issue age should not decrease with duration since issue. That is,

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

2. Issue age within duration test: With a few possible exceptions where the experience clearly justifies, such as mortality at young ages, mortality for any given duration since issue should not decrease with issue age. That is,

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

3. Attained age test: Mortality for any given attained age should not decrease with duration since issue. That is,

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

4. Gender relationship: In general, female mortality should be less than or equal to male mortality for any given attained age. That is,

$$q_{[x]}^{(female)} \leq q_{[x]}^{(male)}$$

5. Non-smoker to smoker relationship: Non-smoker mortality should be less than or equal to smoker mortality for any given attained age. That is,

$$q_{[x]}^{(non-smoker)} \leq q_{[x]}^{(smoker)}$$

6. Relationship between classes: In a multi-class system, the mortality for the more preferred risk class should be less than or equal to the next preferred risk class mortality for any given attained age. That is,

$$q_{[x]}^{(class\ x)} \leq q_{[x]}^{(class\ x+1)}$$

For both male and female rates, the tests were not enforced for:

1. Ages under 10 or
2. The decline in mortality through the early 30s.

The Team is aware of some smoothing concerns between the select and ultimate rates in the mid 40s. These are a result of the approach the Team used to generate the juvenile mortality rates and have not been modified.

Numerous changes of small magnitude, from .00001 to .00005, were made to bring the rates into compliance with the smoothness tests. These minor changes typically took place at younger ages (i.e., under 25) and early durations.

IV. Relative Risk Table Development

A. General Comments

The Team was charged with developing a complete set of valuation basic mortality tables, reflective of preferred class underwriting programs. Based on the Primary Tables described above, the Team developed a set of Relative Risk (RR) Tables to reflect the various levels of mortality from preferred class underwriting programs.

The creation of the RR Tables was a multiple-step process. First, representative Relative Risk Ratios (RRRs) were generated and applied to the Primary Table mortality rates. This was done separately for males and females. Then, a Preferred Wear-Off Factor was applied for Durations 2 and later, according to the schedule provided in Appendix E of this report. The Preferred Wear-Off Factors are described in greater detail later in this section.

To generate the RRRs, the Team started with data from a subset of the contributors to the 2002-2004 Study. Twenty-eight contributors provided preferred underwriting guidelines in addition to their mortality experience by risk class. This data was put through the underwriting criteria algorithm discussed in the Underwriting Criteria Team Report in the Joint Preferred Mortality Project Interim 2007 Report dated November 11, 2007 to create an Underwriting Criteria Score (UCS). The UCS scores ranged from 26 to 148, with 148 equal to the residual standard class for both non-smoker and smoker risks. After further analysis, the Team felt the experience associated with the UCS scores less than 40 was inconclusive. Therefore, the Team declined to develop a valuation basic table to represent the mortality resulting from these lower UCS scores.

To determine the appropriate number of tables to represent the range of the mortality experience for companies with multiple risk classes beyond smoker and non-smoker, the Team analyzed the distribution of UCS scores by measuring the Relative Risk, i.e., the estimate of the mortality of each UCS mortality class relative to an aggregate mortality assumption. The Team relied on the development and research from a large reinsurer to determine the Relative Risk Ratios (RRRs). A more thorough description of the RRRs and how the Relative Risk Tables (RR Tables) were derived is in Appendix D of this report.

Chart D shows the distribution of the RRRs for the entire group of non-smoker risk classes scored through the Underwriting Criteria Team (UCT) process described in the Underwriting Criteria Team Report in the Joint Preferred Mortality Project Interim 2007 Report dated November 11, 2007. In Chart D, the data points shown on the X-axis represent the mid-points of ranges of RRRs. For example, the bar above the RRR of 70% represents the percentage of classes that have RRRs between 67.5% and 72.5%. The Team's objective was to develop a number of non-smoker tables it believed to be adequate to cover the expected mortality for a significant number of companies. For practicality, a secondary objective of the Team was to have the tables equally

spaced among the range of tables. Based on this distribution of RRRs, the Team decided to develop ten Relative Risk Tables for non-smoker risks, with a minimum table representing a 70% RRR and the maximum table a 160% RRR (i.e., each table represents an increment in the RR of 10).

Chart D: Distribution of Relative Risk Ratios for Non-smoker Risks
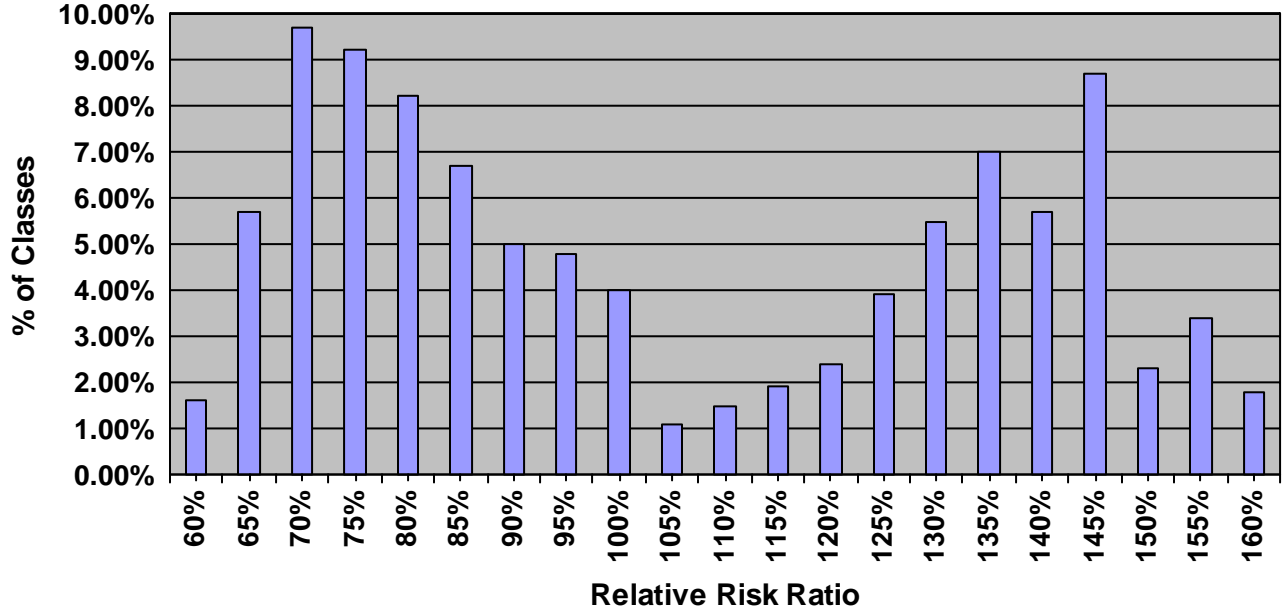
Chart E shows the distribution of the RRRs for the entire group of smoker risk classes scored through the UCT process described in Underwriting Criteria Team Report in the Joint Preferred Mortality Project Interim 2007 Report dated November 11, 2007. Again, the data points shown on the X-axis represent the mid-points of ranges of RRRs. For example, the RRR of 75% represents RRRs that fell between 72.5% and 77.5%. As with the non-smoker risks, the Team's objective was to develop a number of smoker tables it believed to be adequate to cover the expected mortality for a significant number of companies and to have the tables equally spaced among the range of tables. Typically, companies had fewer smoker classes than they had non-smoker classes. Thus, the resulting RRRs are grouped a little more evenly. Based on this distribution of RRRs, the Team decided to develop four Relative Risk Tables for smoker risks, with a minimum table representing a 75% RRR and the maximum table a 150% RRR (i.e., each table represents an increment in the RR of 25).

Chart E: Distribution of Relative Risk Ratios for Smoker Risks
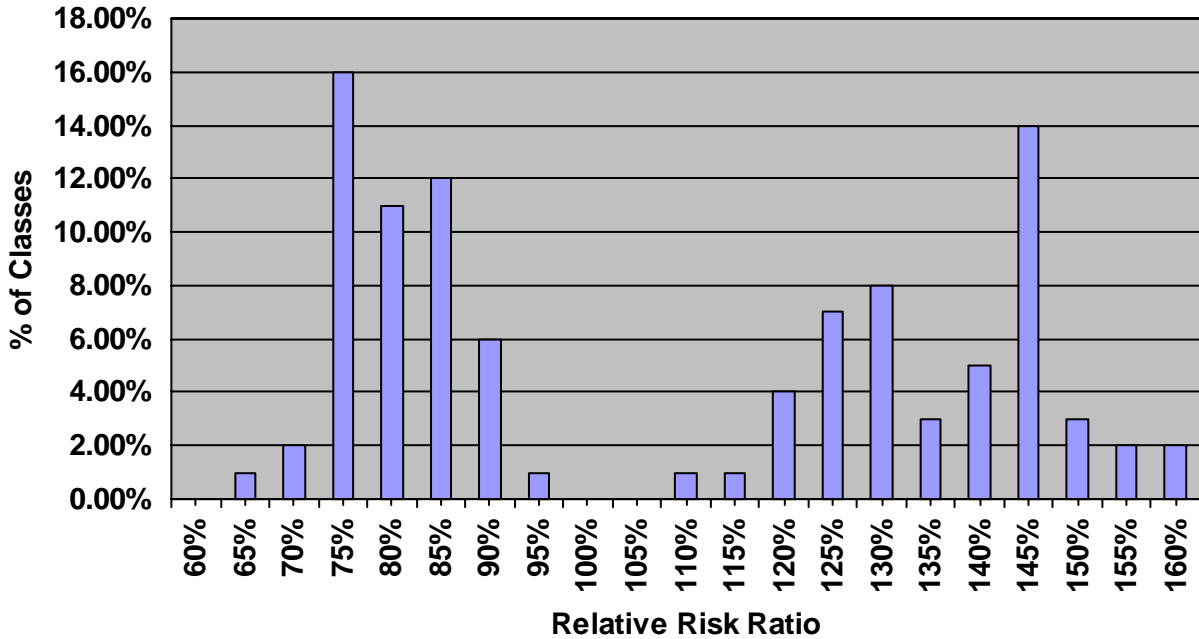
For both non-smoker and smoker risks, the Team decided the overall average mortality for fully underwritten business would be represented by the 100% table (RR100). The RR100 Table corresponded to a specific UCS score of 76 for both smoker and nonsmoker risks when calculated across all population subsets. A complete listing of the RR Tables and the corresponding specific UCS is provided in Table 11 below as well as in Appendix D of this report.

Table 11: Relative Risk Table and Corresponding Specific UCS

Smoking Status	Relative Risk Table (RR Table)	Specific UCS
Non-smoker	70%	36
Non-smoker	80%	51
Non-smoker	90%	64
Non-smoker	100%	76
Non-smoker	110%	87
Non-smoker	120%	98
Non-smoker	130%	106
Non-smoker	140%	113
Non-smoker	150%	119
Non-smoker	160%	123
Smoker	75%	44
Smoker	100%	76
Smoker	125%	103
Smoker	150%	119

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Each RR Table represents the mortality for a specific population subset. For example, the mortality for the RR70 table (i.e., the non-smoker table represented by an RRR of 70) represents the mortality of the population subset with a UCS score of 36. The UCS of 36 was chosen because the weighted average mortality of the population subset with a UCS of 36 is 70% of the weighted average mortality of the population with a UCS of 76 (the RR100 Non-smoker table). However, the individual mortality ratio is not necessarily 70% for each subset. The RR70 table reflects the actual difference for each subset. For example, for male non-smokers issue age 25, the mortality ratio (after adjustment as described below) between the RR70 and RR100 tables is 80%. For male non-smokers issue age 65, the ratio is 65%.

Since the Team decided that the overall industry average mortality would be represented by the 100% table, an anomaly occurs where none of the tables the Team developed exactly match the experience for a given UCS score. While the industry average RR100 Non-smoker table and RR Smoker table most closely match a UCS 76, the actual average RRR for each population subset varies. The actual RRR for male non-smokers, with an issue age of 25 in a class with a specific UCS of 76, is approximately 107%. For issue age 65, the actual RRR is approximately 93%. Therefore, the Team made some additional adjustments to the RR tables to correct for this and some other anomalies. These adjustments are detailed in Appendix D of this report. The Team felt the above approach provided a reasonable compromise between accuracy and simplicity when balancing the desires to have the RR100 Non-smoker and RR100 Smoker table reflect the average industry results and to also reflect the true relationships of the UCS scale for each population subset.

The RRR varied by gender, age and tobacco class. The Team applied the RRRs to the Primary Table mortality in order to generate the respective RR Tables. However, an additional adjustment needed to be made to account for the wear-off of the effects of the preferred underwriting selection criteria. This wear-off is similar to, but different from and in addition to, the wear-off of the age and amount requirements and/or underwriting selection in the underlying Primary Table (i.e., the Primary Table select period). Therefore, the final RR Tables became a function of the Primary Table, the RRR and the Preferred Wear-Off Factors. The Preferred Wear-Off Factors did not vary by RR value. This results in the mortality for the various classes merging as duration and attained age increase. A description of the development of the Preferred Wear-Off Factors and their application is provided below in Section IV.B.

B. Preferred Risk Wear-Off Analysis

Industry and clinical sources were reviewed to determine the appropriate wear-off period for the mortality discount associated with preferred underwriting and also the increased mortality for residual, non-preferred lives. These sources included those used in splitting the 2001 CSO table into preferred tables, as well as new sources. While all of these sources have their limitations, the view of the Team was they all indicated the effects of preferred underwriting persisted for longer than the typical select period and until the high attained ages. For example, the 1979 SOA Blood Pressure study supported this conclusion. Similarly, a July 1994 article published in Product Matters! by Steve Cox titled "Does Preferred Wear Off" shows almost no change in the preferred to residual mortality ratios from durations 1-10 to 11-20 using NHANES and Framingham data. More details on these and other sources can be found in Appendix E of this report.

The team used its own judgment to determine the final shape of the preferred wear-off. Since many of the preferred risk factors address cardiovascular risk, which has varying prevalence by age, the Team believed the preferred wear-off should have a significant attained age component.

There was some discussion as to whether the difference between preferred mortality and residual (i.e., those not qualifying for preferred) at the younger issue ages might actually widen over time. However, this was ultimately not reflected in the table.

There was considerable debate as to the pattern of wear-off by age and duration, particularly at older ages. Some of the Team felt the pattern should wear off quickly and then flatten out. Others felt the wear-off would start gradually and then increase with duration. In the end, the pattern was given a more gradual wear-off reflecting the view that preferred criteria were more predictive of future impairments, whereas traditional underwriting tests are more focused on current impairments so the value of the traditional underwriting wears off more quickly.

In determining the wear-off pattern, the existing 2001 CSO preferred wear-off pattern seemed a logical starting point rather than starting with a blank slate. In reviewing this pattern relative to the research that was reviewed, the Team agreed that preferred discounts should wear-off more slowly for younger issue ages and more quickly for older issue ages. The resulting pattern has little wear-off through attained ages in the 50s, but wears off quickly as attained ages reach the 70s as cardiovascular risk begins to reduce in prominence among insured causes of death. The 2001 CSO pattern has complete wear-off at attained age 95, but the select period for the 2008 VBT, reflecting the wear-off of traditional underwriting, only goes to attained age 90 or a minimum of two years, if later. Therefore, for consistency, the preferred risk differential was also assumed to wear off completely by the same attained age/duration.

The Preferred Wear-Off Factors are the same for all RR Tables. It is assumed that all preferred classes ultimately grade up to standard and all residual classes (i.e., classes with mortality higher than standard) grade down to standard. While several on the Team believed the effects of preferred may not wear-off completely by age 90, the decision to do so was for practical reasons, as the Team wanted the various tables to grade to the same population mortality rates.

C. Choosing a Table

Choosing the appropriate RR Table to use is a multi-step process. First, the UCS for each preferred risk class is determined using the underwriting criteria algorithm described previously in this report. The underwriting criteria algorithm defaults to a UCS of 148 for the highest residual standard class. UCSs for smoker and non-smoker preferred classes are calculated separately.

Next, the average RRR for each class needs to be determined in order to assign the appropriate RR Table to that class. Note the UCS assigned in the first step represents the upper bound score for a given class. So, for a given preferred risk class structure, the average RRR for a given class is dependent not only upon the UCS score of that class, but also upon the UCS for the next lower preferred class in the structure (if any). For example, if the second preferred class in a multi-preferred class structure has a UCS of 80 and the first (best) preferred class in that structure has a UCS of 50, the second class represents UCS risks between 50 and 80. If the second preferred class in a multi-preferred class structure similarly has a UCS of 80, but the first preferred class in this structure has a UCS of 40, the second preferred class represents UCS risks between 40 and 80, resulting in a relatively lower RRR. Similarly, if the first preferred class has a UCS of 80, since it is the lowest preferred class in this structure, it represents all risks with a UCS below 80 and will have a still lower average RRR.

The algorithm and examples below define how to calculate this average RRR, taking into account the UCS of the class, the UCS of the next lower class, and the expected distribution of UCS scores and RRRs across the insured population. The general formula to determine the Class RRR is as follows:

UCS score T: $UCS(T)$
Lower Bound UCS score for Preferred Class: L
Upper Bound UCS score for Preferred Class: U
Cumulative RRR of the UCS: $CUR_{UCS(T)}$
Cumulative Proportion of the UCS: $CUP_{UCS(T)}$

Class Proportion $(CLP^U_L) = CUP_{UCS(U)} - CUP_{UCS(L)}$
Class RRR $(CLR^U_L) = (CUR_{UCS(U)} \times CUP_{UCS(U)} - CUR_{UCS(L)} \times CUP_{UCS(L)}) / CLP^U_L$

All information used in the calculation, other than the company's preferred underwriting criteria which are needed to determine the UCSs, are taken from the UCS/RRR Relationship Table (Appendix D of this report).

The following example illustrates the required calculation. The calculation is provided for a preferred non-smoker risk class (NS2 in the example) with an upper bound UCS of 64 and a lower bound UCS of 32.

Selected Values from Appendix D – UCS/RRR Relationship Table			
Class	**UCS**	**Cumulative RRR**	**Cumulative Proportion**
NS1	32	61.00	10.0150%
NS2	64	75.49	40.1447%
NS3	148	100.00	100.0000%

The corresponding Class RRR (64/32) value is 80.31. The calculation is [(75.49 x .401447)) – (61.00 x .100150)]/[.401447 - .100150]. The corresponding calculation for class NS3 produces a Class RRR of 116.44.

Example Calculation Results			
Class	**UCS**	**Class RRR**	**Class Proportion**
NS1	32	61.00	10.0150%
NS2	64	80.31	30.1297%
NS3	148	116.44	59.8553%

Once the average RRR for a given class is calculated, the final step is to choose the RR table with the RRR factor closest to, but higher than, this average RRR. In the above example, NS1 would use the RR70 Table, NS2 the RR90 Table and NS3 the RR120 Table. These are the tables with the lowest RRR not less than the Class RRR.

D. Use of these Tables and Limitations

The UCS is only a directional indicator of mortality risk. It was qualitatively developed by the UCT, a subcommittee consisting of underwriters and actuaries. Those team members did not have actual experience available to ensure that the UCS provides an accurate relative mortality risk adjustment. Therefore, a translation table was created using the relationship between the UCS and the RRR, which more closely reflects the relative risk over the full spectrum of mortality.

The UCS model was designed to reflect the industry`s average preferred program definitions, with a modest attempt to recognize variations in the definitions by gender and issue age.

The relationship between the UCS and the RRR will vary by characteristics such as gender, issue age and smoking status. The UCS/RRR relationship table was developed based on the portfolio of the overall industry distribution of characteristics. The actual distributions will vary by program. In addition, other factors such as a program's target market and the frequency of exceptions allowed in the underwriting process, will affect the portfolio relationship between UCS and RRR experienced by each company. The relationships in the attached UCS-RRR table assume that no exceptions have been made in the preferred risk classification during the underwriting process. Consequently, it is not expected that each company's results will match the standard relationship. The Team recommends using Table D.1 in Appendix D of this report to calculate the standard RRR on an overall program basis.

The current UCS scoring system was specifically designed for the "knockout" or "edge approach" system. A similar process to handle "debit-credit" types of preferred classification systems will be published separately.

V. Limited Underwriting Table

To develop non-smoker rates for the Limited Underwriting Table, the Team used the same approach it used to develop the Primary Table. For the Primary Table, the PPR graduation method provided meaningful relationships between smoker and non-smoker mortality, but this was not the case for the limited underwriting data. Therefore, to develop the smoker mortality rates for the Limited Underwriting Table, the Team analyzed the relationship between smoker and non-smoker experience underlying the Primary Table, as well as the relative difference between the experience included in the Limited Underwriting Table versus that included in the Primary Table. This analysis included the actual to expected mortality for the first 10 durations only and was done on an aggregate basis across the first 10 durations for all issue ages and genders combined.

As a result, the Team took the following steps to develop the Limited Underwriting smoker tables:

    a. Determine Non-smoker ratio of A/E Low Face over A/E High Face;
    b. Determine Smoker ratio of A/E Low Face over A/E High Face;
    c. Determine Increase Factor as ((b) - 1) / ((a) - 1);
    d. Determine Limited Underwriting Smoker Adjustment Factor as:
       [(Primary Table SM/NS ratio - 1) x Increase Factor] + 1;

    where:
- A/E Low Face is defined as the A/E ratio from the 2002-2004 Study for face amounts $1 to $49,999;
- A/E High Face is defined as the A/E ratio from the 2002-2004 Study for face amounts $100,000 to $2,499,999; and
- Primary Table SM/NS ratio is defined as the smoker mortality rate per 1,000 from the Primary Table divided by the non-smoker mortality rate per 1,000 from the Primary Table.

For example:

A/E_NS (low face):	111.1%	
A/E_NS (high face):		65.1%
A/E_SM (low face):	124.8%	
A/E_SM (high face):		84.2%
Ratio of Primary Table SM mortality rate per 1,000 to the Primary Table NS mortality rate per 1,000 for a female, issue age 50, duration 1:	3.302	

Step 1: Calculate ratio (a) as 1.111/.651 = 1.6973
Step 2: Calculate ratio (b) as 1.248/.842 = 1.4821
Step 3: Calculate Increase Factor (c) as 1.4821 / 1.6973 = 0.691
Step 4: Calculate Limited Underwriting Smoker Adjustment Factor as {(3.302 - 1) x 0.691} + 1 = 2.592

Therefore, in this example, the Non-smoker mortality rate for a female, issue age 50, duration 1 from the Limited Underwriting Table would be multiplied by 2.592 to determine the Smoker mortality rate for a female, issue age 50, duration 1 in the Limited Underwriting Table.

VI. Comparisons to 2001 VBT

The Team compared the resulting 2008 VBT RR100 Non-smoker Table and the RR100 Smoker Table to the 2001 VBT Table. All the comparisons are on an age nearest birthday basis. The ratio of mortality rates between the two tables varies by issue age and duration but, in general, the 2008 VBT RR100 Table results in mortality rates that range between 50% and 120% of the 2001 VBT for the non-smoker risks and between 65% and 130% for the smoker risks. The ratio between the 2008 VBT RR100 Table and the 2001 VBT is generally lower for male risks than for female risks and is generally lower for non-smoker risks than for smoker risks. The slope of the two tables is quite different. The 2008 VBT tables have a flatter slope in the early durations and a steeper slope in the later durations and older ages. The approach used to grade the experience data into population mortality, along with the selection of the SSA 2003 data as the source for population mortality, results in mortality rates above attained age 100, which are higher in the 2008 VBT RR100 Table than the 2001 VBT. (This is not a statement that mortality is worsening at older ages but rather, the impact of grading to population mortality where the data is the least credible.) Additionally, rates for smokers and female risks have a much different slope in the 2001 VBT.

Chart F: Comparison between 2001 VBT & RR100, Male, Nonsmoker, Issue Age 45 ANB
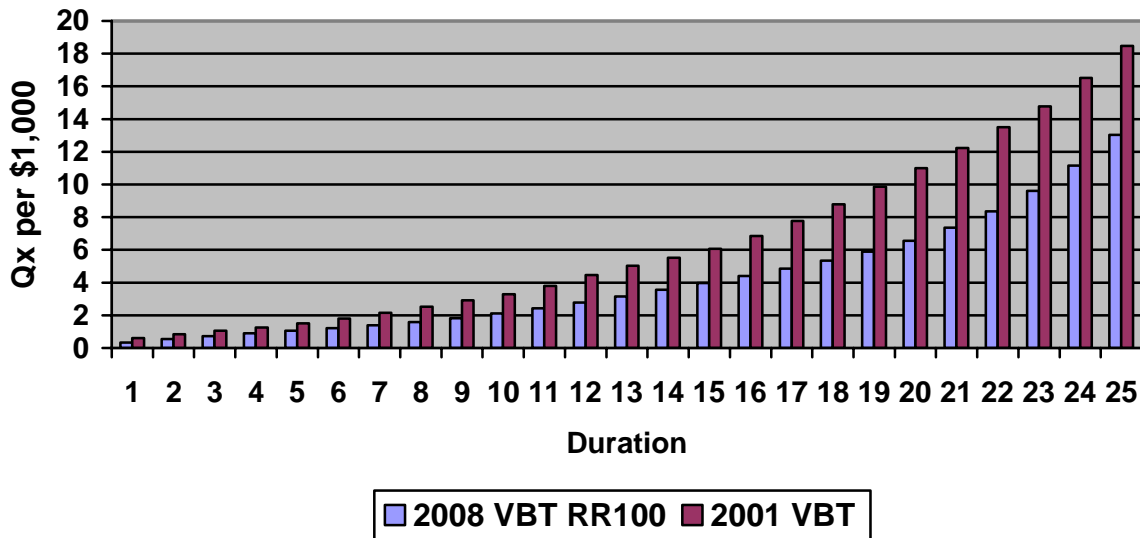
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
2008/2001	55%	64%	66%	60%	71%	102%

Chart G: Comparison between 2001 VBT & RR100, Female, Nonsmoker, Issue Age 45 ANB
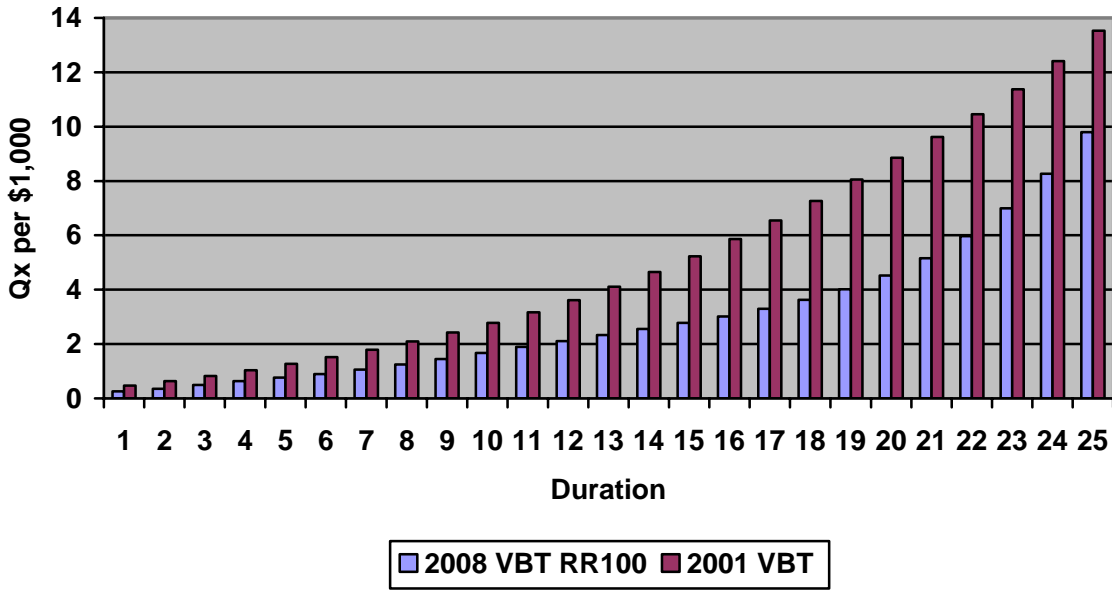
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
2008/2001	55%	60%	53%	51%	72%	109%

Chart H: Comparison between 2001 VBT & RR100, Female, Nonsmoker, Issue Age 75 ANB
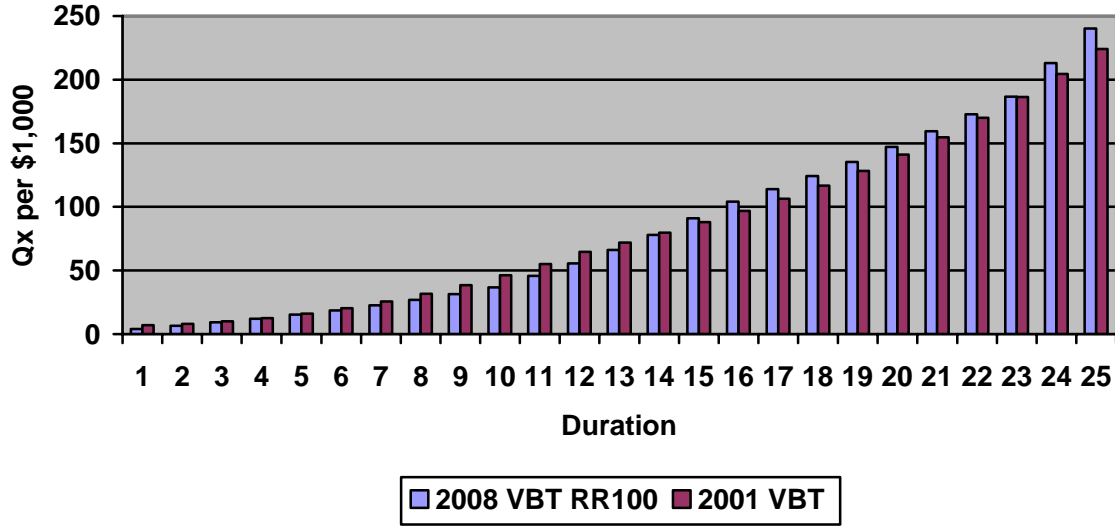
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
2008/2001	56%	79%	103%	104%	107%	109%

Chart I: Comparison between 2001 VBT & RR100, Male, Smoker, Issue Age 60 ANB
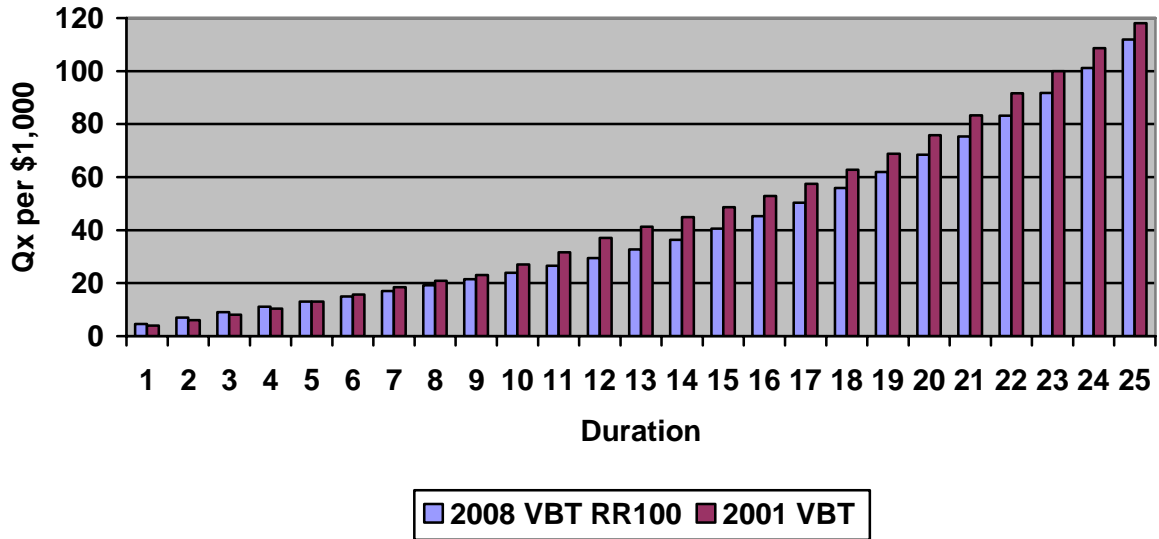
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
2008/2001	116%	88%	83%	90%	95%	112%

In addition to comparing the aggregate, or RR100 Table, the Team compared the other RR tables to the respective tables in the 2001 VBT Preferred Structure Tables. In general, the mortality rates in the 2001 VBT Super-Preferred Non-tobacco Table fall between the 2008 VBT RR70 NS and RR90 NS Table rates. The 2001 VBT Preferred Non-tobacco Table rates are between the 2008 VBT RR100 NS and RR120 NS Tables. The 2001 VBT Residual NT mortality is higher than the mortality in the 2008 VBT RR160 NS Table. The graphs and tables below show the relationship between the 2001 VBT Preferred Structure Tables and the 2008 VBT RR Tables for a Male, Issue Age 55, Non-smoker risk.

Chart J: Comparison between 2001 VBT SPNT & RR70, RR80 and RR90 Tables, Male, Nonsmoker, Issue Age 55 ANB
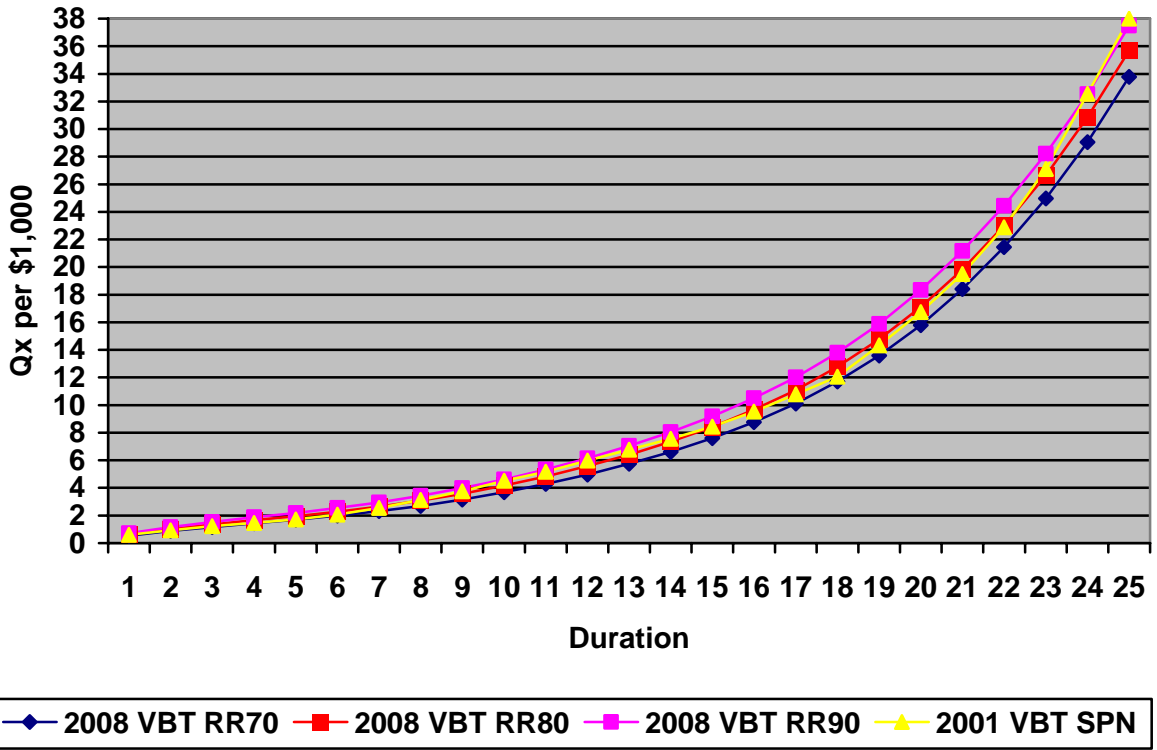
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
RR70 NS	90%	82%	90%	94%	89%	102%
RR80 NS	105%	92%	100%	102%	94%	102%
RR90 NS	118%	102%	109%	110%	99%	102%

Chart K: Comparison between 2001 VBT PNT & RR100, RR110 and RR120 Tables, Male, Nonsmoker, Issue Age 55 ANB
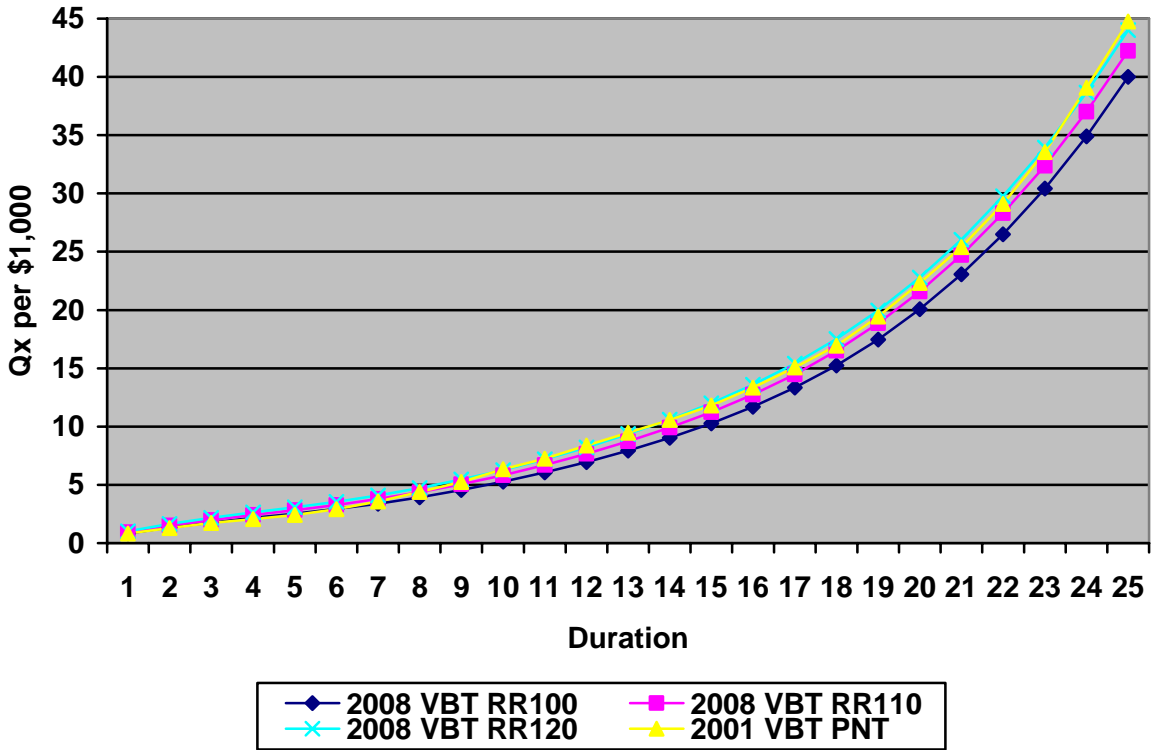
Ratio	Duration					Attained Age 100
	1	10	15	20	25	
RR100 NS	100%	83%	87%	90%	89%	102%
RR110 NS	112%	92%	95%	97%	94%	102%
RR120 NS	123%	99%	102%	102%	98%	102%

Chart L: Comparison between 2001 VBT Residual NT & RR160 Table, Male, Nonsmoker, Issue Age 55 ANB
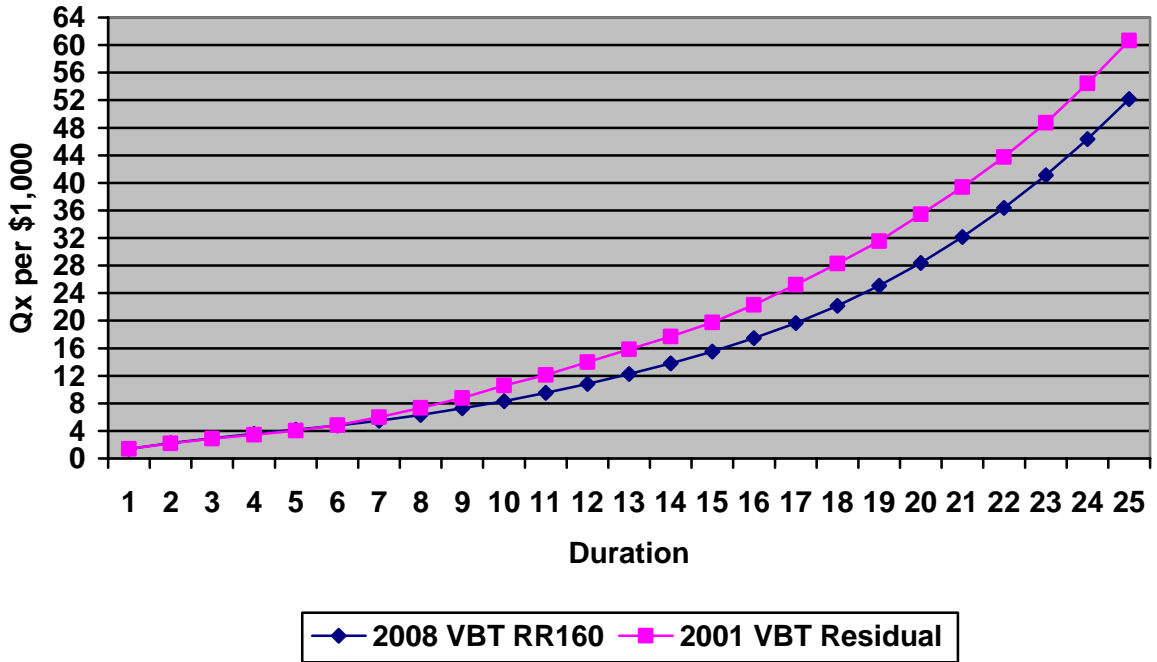
	Duration					
Ratio	**1**	**10**	**15**	**20**	**25**	**Attained Age 100**
2008 RR160 NS/2001 Residual NT	100%	79%	79%	80%	86%	102%

The 2008 VBT Limited Underwriting Table has a much different slope than the 2001 VBT and the 2008 VBT RR100 Table. The early duration mortality in the 2008 VBT Limited Underwriting Table is significantly greater than that in either the 2001 VBT or the 2008 VBT RR100 Table. Over time, the difference in the mortality between the fully underwritten tables and the limited underwriting tables narrows and, in the case with the 2008 VBT RR100 Table, converges. The convergence of mortality is due to the wear-off of the effects of underwriting from the fully underwritten business and the wear-off of the anti-selective mortality in the limited underwriting business. The graph and table below show the comparison for a Male, Issue Age 45, Non-smoker risk between the 2008 VBT Limited Underwriting Table, the 2001 VBT and the 2008 VBT RR100 Table, on an age nearest birthday basis.
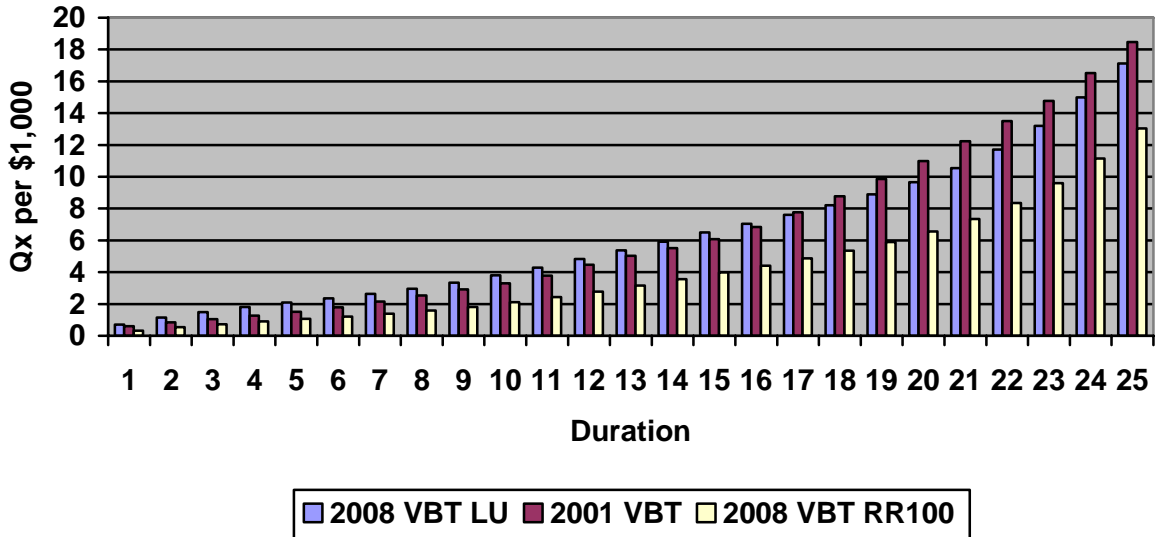
Ratio	Duration					Attained Age 100
	1	**10**	**15**	**20**	**25**	
2008 LU/2001	118%	116%	107%	88%	93%	102%
2008 LU/2008 RR100 NS	215%	181%	163%	147%	131%	100%

VII. MIB Analysis

As a way to validate the tables developed, the Team asked MIB to re-run the 2002-2004 ILEC experience study, replacing the 2001 VBT with the 2008 VBT Primary Table as the expected basis. This was done with the expected all calculated on an age nearest birthday basis, even though some of the exposures were on an age last birthday basis. For most ages (and overall), this had the effect of slightly overstating the actual-to-expected ratios.

Also, the analysis was done only with the ILEC data where the smoking status was known. This limited the results to most, but not all, of the select period. Within this limitation, the analysis was done for all issue ages and face amounts. However, with one exception (under age 25 included), this report only presents results for the data that was used to develop the Primary Table. This set of data is identified in Table 3 of this report.

The result is that data associated with 62,605 deaths were included in the analysis. The overall actual-to-expected ratio by amount of insurance was 98.8%. The ratio by number of policies was 106.8%. Results for the major components of the Primary Table are provided in Table 12 below. More details are given in Appendix K of this report.

Results for issue ages 0-17 and 18-24 are also given, for informational purposes, in Appendix K of this report. Further, the experience for issue ages 0-17 is not separated by smoking status since the mortality rates are the same by smoking status for these ages. Results for issue ages 0-17 are also limited in that data where the smoking status "unknown" was not included.

Table 12: A/E Analysis for 2002-2004 Study with 2008 VBT RR100 as Expected Basis

	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount
	Non-Smoker			**Smoker**			**Total**		
Female	13,530	104.3%	96.8%	3,564	103.1%	101.3%	17,094	104.0%	97.5%
Male	35,208	108.2%	99.0%	10,303	107.0%	99.3%	45,511	107.9%	98.8%
Total	48,738	107.1%	98.5%	13,867	106.0%	100.6%	62,605	106.8%	98.8%

APPENDIX A

Report of the Individual Life Experience Committee (ILEC)
(Released 5/22/07)

Mortality under Standard Individually Underwritten Life Insurance
Between 2002 and 2004 Policy Anniversaries

Introduction

This study is the latest in continuing reports on inter-company mortality experience. The previous report discussed experience over the 2000-01 study period and also examined experience in the five-year period from 1996-2001. Due to data limitations in the 2001-2002 study, results from that study period will not be published. In addition, the actual to expected ratios in the 2000-01 study are materially overstated as problems with certain companies data were recently identified as part of the data validation process implemented for the experience of this study period. As a result, the 2000-01 study has been removed from the SOA website and it is recommended that data from that study not be used. Due to many new contributors in the 2002-2004 study period, comparisons to previous studies are also difficult. As such, experience prior to 2002 will not be discussed and direct comparisons of actual to expected ratios in preceding reports will not be made. Going forward, longer term averages and trends over time will be presented.

Thirty-five companies contributed data to the Society of Actuaries for the 2002-04 study period and 31 companies contributed to both observation years. This is considerably more companies than the number contributing in preceding years, increasing the face amount exposure to over $7.4 trillion. The number of deaths is just over 200,000 in the select period and 495,000 in the ultimate period. The 31 common companies represent 96% of the total exposure.

For the first time, contributors to the Intercompany Study were asked to provide information related to their preferred risk class structure. Further details on this data are described in the Risk Class Rank section below.

Consistent with previous studies, this report examines mortality under standard individually underwritten life insurance and excludes rated, converted, and other guaranteed or simplified issues as indicated by the individual company data submissions. Policies in force under non-forfeiture provisions are also excluded. Due to the higher volume and higher mortality and less stringent underwriting in the lower face amount bands, the definition of standard may not be consistent among the contributing companies.

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The ratios of actual to expected mortality are based on the 2001 Valuation Basic Tables (2001 VBT) which have composite and smoker distinct versions and were based on experience from contributors to the SOA for the 1990-95 study period. The application of the composite or smoker distinct tables in the expected calculations relies on the smoking habit information provided in the individual company submissions. Composite tables apply to policies with unknown smoking habits. The data indicated that many companies currently code all policies issued prior to smoker distinct underwriting as smokers. Therefore, all policies with issue dates prior to 1980 are assumed to be of unknown smoking habit. Inaccuracies may still exist for certain companies, particularly for policies issued in the 1980s. Although high-level summaries are provided at the end of this report, more detailed results are available in Excel pivot table format from the SOA. Results based on the 1975-80 Basic Tables with the Milliman extension are also available in the Excel pivot format. There are two sets of pivot tables reflecting both the aggregate data and preferred only data. These files share a webpage with this report.

Select Period Results Based On 2001 VBT (Appendix A)

Overall, mortality experience in the 25-year select period for the 2002-04 study was 88% of the 2001 VBT by policy and 71% by face amount. The variability between results by policy and by face amount is seen for all breakdowns except results by policy size. Therefore, differences between policy count results and face amount results may be attributed to the mix of business by face amount within individual reporting categories. Policies under $100,000 comprise 58% of the exposure by policy, but only 13% of the exposure by amount. Therefore, overall results on a policy count basis are weighted heavily towards the higher A/E ratios in the lower face amount categories.

The actual to expected ratio for females is slightly higher than for males at 73% (by amount) compared to 71% for males.

By issue age, actual to expected ratios are lowest between ages 25 and 70 at 66% - 75% (by amount). Ratios are much higher (between 85% and 102%) at the younger ages. Mortality at issue ages 70-79 and 80+ is slightly higher at 81% and 73% by amount, respectively.

Mortality ratios are very low in the first duration (60% by amount), but increase in duration 2 and remain relatively flat between durations 2 and 20, except for a sharp increase at duration 3 corresponding with the end of the contestability period. The ratios are 70%, 78%, 73%, 70%, 71%, 72% for durations 2, 3, 4-5, 6-10, 11-15, and 16-20 respectively. The ratio then increases to 80% in durations 21-25.

Mortality ratios by amount steadily decrease with increasing policy size, starting at 107% for policy amounts between $1 and $9,999 and dropping to 63% for policies with face amounts of $500,000 to $2,499,999. The general decreasing trend is assumed to be attributed to increased underwriting at higher face amounts. Although there are only 213 deaths at face amounts of $2,500,000 and above, mortality increased in that segment to 68%. Since the ratio also increased on a policy count basis, results are not explainable by just a few large claims and may be a sign of anti-selection at face amounts $2,500,000 and above.

Non-smoker mortality is 68% of the non-smoker 2001 VBT by amount compared to 85% for smokers using the smoker 2001 VBT. This suggests that non-smoker mortality is improving significantly more than smoker mortality. The ratio for policies with unknown smoking habits is 85% of the composite 2001 ?? VBT.

Mortality is lower in the later study year, dropping from 73% in the 2002-2003 observation year to 70% in the 2003-2004 observation year. The overall mortality ratios are the same for the 31 companies contributing in both observation years suggesting the decrease is not due to a change in the mix of companies.

Ultimate Period Results Based On 2001 VBT (Appendix B)

Overall, ultimate experience (durations 26+) was 89% of the 2001 VBT by face amount. This ratio dropped from 91% to 88% between the 2002-03 and 2003-04 observation years and is the same for the common companies.

Results differ significantly for males and females. Female ultimate mortality is 100% by amount, while male mortality is 87%. Mortality for males is highest between attained ages 30 and 49 at 121-144%. Mortality for females decreases by attained age from 121% at attained ages 25-29 down to 78% at attained ages 50-59. It then increases by attained age hitting 108% at attained ages 90+.

Interestingly, mortality decreases by increasing face amount in the ultimate durations (as it did in the select period) suggesting some impact of underwriting may persist beyond the 25-year select period.

Results By Risk Class Rank Based On 2001 VBT (Appendix C, Appendix D)

For the first time, contributors to the Intercompany Study were asked to provide information related to their preferred risk class structure. In particular, companies were asked to provide a rank for each preferred class policy starting with "1" for the most restrictive preferred class,"2" for the next most restrictive preferred class, up to the total number of classes in their preferred structure. Additionally, companies were asked to provide the total number of preferred classes in their preferred structure. Overall, 32 of the 35 companies contributed data with a preferred structure with at least some data with preferred structure information.

The many different preferred class structures provided were aggregated over all companies into one combined structure with three preferred non-smoker classes (or risk class ranks (RCR)) and two preferred smoker classes. In this report, non-smoker assumes non-tobacco and smokers refer to tobacco users. 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 preferred class structure. It should be noted that companies with a preferred class structure for non-smokers, but one class for smokers have only risk class rank data included for non-smokers.

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 were used in the analysis of preferred mortality. This block has over $3 trillion of exposure and just over 13,000 deaths.

Overall, mortality experience for this block of preferred business was 71% by policy and 67% by amount.

For the non-smoker classes, mortality increases by risk class rank from 54% by amount for best preferred classes, to 64% for classes in the middle ranks, and to 77% for the residual standard group.

For the smoker classes, mortality is 74% by amount for best preferred classes and 96% of that table for the residual group.

As seen in the aggregate data, within each of the risk class ranks, mortality generally decreases with increasing face amount. Differences by risk class rank band persist for the 15 durations included in the study. The drilldowns by RCR band, duration, and face band also follow the same patterns, but individual cell results should be viewed with caution as many of the cells particularly in the higher face amount bands have very few deaths.

The Individual Life Insurance Experience Committee of the Society of Actuaries wishes to thank the following companies that contributed to the 2002-2004 study:

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Allstate Life of New York	New York Life
American Family Life	North American Co-Life/Health
Ameriprise	(NACOLAH)
AmerUs Life	Northwestern Mutual
Columbus Life Insurance	Ohio National
Empire General	Pacific Life Insurance
Farm Bureau Life Insurance	Principal Financial Group
Fidelity Investments	Protective Life
Genworth Financial	Protective Life & Annuity
Government Personnel	Prudential
Hartford Life	State Farm
Horace Mann Insurance	Thrivent Financial
ING	Transamerica Occidental
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Douglas Ingle	Ed Wright

Society of Actuaries Staff Liaison: John A. Luff
MIB Representatives: Leo DiAngelo, Nancy Morse, Jan Palmbach

Appendix A—Select Period Results

	Actual Deaths by Policy	Ratio by Policy*	Ratio by Amount*	Exposure by Policy	% Exposure by Policy	Exposure by Amount (in millions)	% Exposure by Amount	% Expected by Amount
Overall	205,106	88%	71%	54,619,966	100.0%	$7,251,092	100.0%	100.0%
				Issue Age				
0	861	88%	83%	2,816,226	5.2%	$87,455	1.2%	0.1%
1-4	868	93%	85%	2,660,771	4.9%	$94,236	1.3%	0.2%
5-9	953	108%	96%	1,937,019	3.5%	$71,129	1.0%	0.2%
10-17	2,221	116%	102%	2,872,337	5.3%	$107,053	1.5%	0.4%
18-24	4,260	107%	90%	4,516,353	8.3%	$270,491	3.7%	1.0%
25-29	5,873	87%	74%	6,012,954	11.0%	$678,715	9.4%	2.9%
30-34	9,192	80%	69%	7,574,995	13.9%	$1,272,546	17.5%	6.4%
35-39	12,880	80%	66%	7,293,402	13.4%	$1,437,202	19.8%	9.8%
40-49	36,536	81%	66%	10,539,575	19.3%	$2,039,513	28.1%	25.1%
50-59	55,665	87%	72%	5,656,405	10.4%	$893,170	12.3%	25.8%
60-69	57,466	92%	75%	2,310,319	4.2%	$240,262	3.3%	18.6%
70-79	17,057	100%	81%	407,672	0.7%	$52,508	0.7%	7.9%
80+	1,274	95%	73%	21,938	0.0%	$6,812	0.1%	1.7%
				Gender				
Female	85,815	89%	73%	24,717,955	45.3%	$2,353,862	32.5%	26.9%
Male	119,291	88%	71%	29,902,011	54.7%	$4,897,230	67.5%	73.1%
				Duration				
1	2,029	85%	60%	3,800,712	7.0%	$1,046,815	14.4%	3.8%
2	2,931	96%	70%	3,561,666	6.5%	$902,910	12.5%	4.5%
3	3,415	103%	78%	3,115,121	5.7%	$706,379	9.7%	4.5%
4-5	8,940	95%	73%	6,444,262	11.8%	$1,411,620	19.5%	12.2%
6-10	28,708	91%	70%	11,815,504	21.6%	$1,635,792	22.6%	23.9%
11-15	49,377	84%	71%	11,303,165	20.7%	$912,838	12.6%	24.1%
16-20	65,222	83%	72%	9,749,633	17.8%	$522,771	7.2%	21.6%
21-25	44,484	98%	80%	4,829,904	8.8%	$111,965	1.5%	5.5%
				Face Amount Bands				
1-9,999	55,878	107%	107%	3,360,297	6.2%	$16,745	0.2%	1.4%
10,000-24,999	47,380	95%	94%	9,254,949	16.9%	$120,122	1.7%	3.5%
25,000-49,999	30,933	88%	88%	8,209,576	15.0%	$230,181	3.2%	5.7%
50,000-99,999	32,676	79%	79%	10,828,159	19.8%	$600,930	8.3%	13.1%
100,000-249,999	27,868	74%	73%	14,418,312	26.4%	$1,793,760	24.7%	26.1%
250,000-499,999	6,272	66%	65%	5,065,013	9.3%	$1,453,879	20.1%	15.6%
500,000-999,999	2,618	63%	63%	2,315,623	4.2%	$1,286,642	17.7%	13.1%
1,000,000 - 2,499,999	1,268	62%	63%	1,063,392	1.9%	$1,274,547	17.6%	13.9%
2,500,000 +	213	72%	68%	104,643	0.2%	$474,286	6.5%	7.6%
				Smoker Status				
Non-Smoker	114,245	80%	68%	40,901,029	74.9%	$6,513,238	89.8%	80.9%
Smoker	52,859	97%	85%	7,202,742	13.2%	$582,335	8.0%	15.7%
Unknown*	38,002	105%	85%	6,516,195	11.9%	$155,519	2.1%	3.4%
				Observation Year				
2002 - 2003	100,632	90%	73%	26,585,028	48.7%	$3,334,100	46.0%	46.2%
2003 - 2004	104,474	87%	70%	28,034,938	51.3%	$3,916,992	54.0%	53.8%

*Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

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Appendix B-Ultimate Period Results

	Actual Deaths by Policy	Ratio by Policy*	Ratio by Amount*	Exposure by Policy	% Exposure by Policy	Exposure by Amount (in millions)	% Exposure by Amount	% Expected by Amount
Overall	**494,738**	**96%**	**89%**	**20,397,357**	**100%**	**$123,074**	**100%**	**100%**
Observation Year								
2002-2003	246,938	96%	91%	10,180,819	50%	$59,581	48%	48%
2003-2004	247,800	95%	88%	10,216,538	50%	$63,493	52%	52%
Gender								
Female	178,857	103%	100%	8,273,099	41%	$30,407	25%	16%
Male	315,881	92%	87%	12,124,257	59%	$92,667	75%	84%
MALE Only Ultimate Period Data								
Attained Age								
25-29	236	102%	95%	230,545	2%	$1,733	2%	0%
30-34	429	136%	144%	329,356	3%	$1,989	2%	0%
35-39	714	156%	141%	407,272	3%	$2,041	2%	0%
40-49	4,250	135%	121%	1,387,782	11%	$9,238	10%	1%
50-59	14,948	101%	91%	2,717,868	22%	$25,196	27%	6%
60-69	35,391	89%	81%	2,773,929	23%	$24,687	27%	16%
70-79	90,870	97%	88%	2,518,701	21%	$18,485	20%	31%
80-89	129,101	91%	87%	1,513,868	13%	$8,311	9%	35%
90+	39,942	82%	89%	244,937	2%	$987	1%	9%
Face Amount Bands								
1-9,999	251,243	94%	95%	8,298,929	68%	$28,044	30%	37%
10,000-24,999	53,710	87%	87%	3,234,239	27%	$38,477	42%	33%
25,000-49,999	7,049	82%	82%	408,251	3%	$11,580	13%	11%
50,000-99,999	2,761	79%	78%	131,237	1%	$7,335	8%	9%
100,000+	1,118	77%	73%	51,602	0%	$7,231	8%	10%
FEMALE Only Ultimate Period Data								
Attained Age								
25-29	121	125%	121%	203,053	3%	$1,342	4%	0%
30-34	192	112%	106%	279,307	3%	$1,380	5%	0%
35-39	341	113%	102%	344,756	4%	$1,321	4%	0%
40-49	1,930	112%	111%	1,076,702	13%	$4,740	16%	2%
50-59	6,002	81%	78%	1,711,887	21%	$8,168	27%	8%
60-69	12,632	91%	88%	1,365,407	17%	$5,623	19%	13%
70-79	46,495	105%	100%	1,771,544	21%	$4,814	16%	28%
80-89	80,998	105%	106%	1,301,673	16%	$2,635	9%	36%
90+	30,146	102%	108%	218,771	3%	$384	1%	12%
Face Amount Bands								
1-9,999	171,348	103%	102%	7,373,964	89%	$17,376	57%	66%
10,000-24,999	6,071	91%	92%	808,406	10%	$9,180	30%	18%
25,000-49,999	923	97%	97%	65,833	1%	$1,828	6%	6%
50,000-99,999	349	94%	93%	17,592	0%	$969	3%	5%
100,000+	166	104%	107%	7,304	0%	$1,054	4%	6%

*Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

Appendix C- RCR Reports (Issue Ages 25+, Duration <= 15, Face Amt 100K up to 2.5M, Risk Ind = 1)

	Actual Deaths by Policy	Ratio by Policy*	Ratio by Amount*	Exposure by Policy	% Exposure by Policy	Exposure by Amount (in millions)	% Exposure by Amount	% Expected by Amount
Overall	**13,228**	**71%**	**67%**	**11,331,381**		**$3,267,727**		
				Issue Age				
25-29	459	69%	67%	1,319,485	11.6%	$283,547	8.7%	2.6%
30-34	929	71%	66%	2,137,822	18.9%	$594,455	18.2%	6.4%
35-39	1,312	69%	64%	2,307,998	20.4%	$717,702	22.0%	10.3%
40-49	3,561	68%	63%	3,469,676	30.6%	$1,072,375	32.8%	28.5%
50-59	3,597	70%	66%	1,631,189	14.4%	$470,461	14.4%	27.2%
60-69	2,257	77%	70%	400,459	3.5%	$107,081	3.3%	15.3%
70-79	929	81%	79%	59,306	0.5%	$19,804	0.6%	7.7%
80+	184	78%	82%	5,448	0.0%	$2,302	0.1%	1.9%
				Gender				
Female	3,753	68%	67%	4,549,736	40.2%	$1,055,071	32.3%	26.1%
Male	9,475	72%	67%	6,781,645	59.8%	$2,212,656	67.7%	73.9%
				Duration				
1	755	63%	57%	1,875,597	16.6%	$657,563	20.1%	8.1%
2	1,098	72%	65%	1,709,965	15.1%	$557,138	17.0%	9.7%
3	1,294	80%	75%	1,435,288	12.7%	$428,357	13.1%	9.7%
4-5	3,317	74%	70%	2,925,707	25.8%	$887,906	27.2%	27.0%
6-10	4,175	70%	66%	2,425,413	21.4%	$573,068	17.5%	30.3%
11-15	2,589	67%	64%	959,410	8.5%	$163,695	5.0%	15.2%
				Face Amount Bands				
100,000-249,999	8,557	75%	75%	6,096,733	53.8%	$773,961	23.7%	28.1%
250,000-499,999	2,781	66%	66%	3,080,984	27.2%	$870,144	26.6%	24.0%
500,000-999,999	1,229	62%	61%	1,461,221	12.9%	$799,790	24.5%	22.0%
1,000,000 - 2,499,999	661	62%	63%	692,444	6.1%	$823,832	25.2%	25.8%
				RCR Non-smoker				
1 - Best Rank	4,326	60%	54%	5,359,910	47.3%	$1,556,640	47.6%	39.0%
2 - Middle Rank	1,661	68%	64%	1,961,230	17.3%	$655,798	20.1%	15.4%
3 – Residual Standard	5,502	80%	77%	3,328,494	29.4%	$910,410	27.9%	37.1%
				RCR Smoker				
1 - Best Rank	896	77%	74%	413,858	3.7%	$84,699	2.6%	4.6%
3 - Residual Standard	809	95%	96%	256,811	2.3%	$57,495	1.8%	3.8%
				Observation Year				
2002 - 2003	5,954	73%	69%	4,975,012	43.9%	$1,392,780	42.6%	42.7%
2003 - 2004	7,274	69%	65%	6,356,369	56.1%	$1,874,947	57.4%	57.3%

*Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

Appendix D: Detailed RCR Reports

			ILEC 2002-2004 Study – Non-smokers					
Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M								
			Durations Ratios by Amount^					
Ranking RCR Bands		1	2	3	4-5	6-10	11-15	Grand Total
1 Best Rank		35.5%	53.6%	57.4%	58.2%	53.2%	55.6%	53.9%
2 Middle Ranks		54.9%	54.4%	69.5%	69.9%	53.7%	*	63.9%
3 Residual Standard Rank		85.9%	87.4%	96.5%	77.1%	75.8%	68.4%	77.5%
		* Cell has 35 or fewer deaths						

			ILEC 2002-2004 Study – Non-smokers					
Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M								
			Durations Number of Deaths					
Ranking RCR Bands		1	2	3	4-5	6-10	11-15	Grand Total
1 Best Rank		177	342	384	997	1507	919	4326
2 Middle Ranks		200	243	296	741	177	4	1661
3 Residual Standard Rank		271	376	434	1120	1954	1347	5502

			ILEC 2002-2004 Study - Smokers					
Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M								
			Durations Ratios by Amount^					
Ranking RCR Bands		1	2	3	4-5	6-10	11-15	Grand Total
1 Best Rank		54.5%	67.7%	100.5%	84.3%	68.1%	68.3%	74.1%
3 Residual Standard Rank		72.2%	103.3%	113.6%	107.2%	92.8%	80.6%	95.9%

Number of Deaths			ILEC 2002-2004 Study - Smokers					
Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M								
			Durations Number of Deaths					
Ranking RCR Bands		1	2	3	4-5	6-10	11-15	Grand Total
1 Best Rank		50	67	88	214	278	199	896
3 Residual Standard Rank		55	67	84	224	259	120	809

^Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

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	ILEC 2002-2004 Study – Non-smokers – By Face Amount Bands							
	Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M							
		Durations Ratios by Amount^						
Face Amount Bands	**Ranking RCR Bands**	1	2	3	4-5	6-10	11-15	Grand Total
100,000-249,999	1 Best Rank	53.3%	69.8%	71.2%	66.5%	64.5%	61,7%	64.7%
100,000-249,999	2 Middle Ranks	64.9%	61.0%	83.3%	79.3%	61.1%	*	73.0%
100,000-249,999	3 Residual Stand Rank	78.2%	92.3%	96.0%	92.4%	79.7%	74.1%	81.7%
250,000-499,999	1 Best Rank	45.3%	58.0%	61.6%	56.0%	53.1%	59.0%	55.4%
250,000-499,999	2 Middle Ranks	62.7%	64.9%	60.7%	58.0%	68.5%	*	61.4%
250,000-499,999	3 Residual Stand Rank	89.7%	89.8%	103.5%	76.5%	73.7%	68.0%	77.8%
500,000-999,999	1 Best Rank	*	54.9%	*	57.6%	41.8%	48.0%	47.2%
500,000-999,999	2 Middle Ranks	*	55.0%	82.8%	68.0%	*	*	65.5%
500,000-999,999	3 Residual Stand Rank	*	90.1%	83.6%	61.1%	72.5%	78.0%	72.4%
1,000,000-2,499,999	1 Best Rank	*	*	*	54.1%	48.0%	*	46.7%
1,000,000-2,499,999	2 Middle Ranks	*	*	*	73.4%	*	*	58.3%
1,000,000-2,499,999	3 Residual Stand Rank	*	*	*	79.3%	76.3%	*	76.7%
			* Cell has 35 or fewer deaths					

APPENDIX A – ILEC Report con'd…

	ILEC 2002-2004 Study – Non-smokers – By Face Amount Bands							
	Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M							
		Durations Number of Deaths						
Face Amount Bands	**Ranking RCR Bands**	1	2	3	4-5	6-10	11-15	Grand Total
100,000-249,999	1 Best Rank	82	183	224	560	1027	703	2779
100,000-249,999	2 Middle Ranks	100	120	172	435	104	0	931
100,000-249,999	3 Residual Stand Rank	131	204	241	676	1247	1047	3546
250,000-499,999	1 Best Rank	59	89	101	250	327	157	983
250,000-499,999	2 Middle Ranks	58	70	58	148	49	0	383
250,000-499,999	3 Residual Stand Rank	79	96	121	246	409	183	1134
500,000-999,999	1 Best Rank	26	50	33	128	101	40	378
500,000-999,999	2 Middle Ranks	29	35	48	102	19	2	235
500,000-999,999	3 Residual Stand Rank	33	50	46	113	187	87	516
1,000,000-2,499,999	1 Best Rank	10	20	26	59	52	19	186
1,000,000-2,499,999	2 Middle Ranks	13	18	18	56	5	2	112
1,000,000-2,499,999	3 Residual Stand Rank	28	26	26	85	111	30	306

^*Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

APPENDIX A – ILEC Report con'd…

*Expected Basis is 2001 VBT, smoker distinct versions (unknown smoker status uses composite tables)

	ILEC 2002-2004 Study – Smokers – By Face Amount Bands							
	Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M							
		Durations Ratios by Amount						
Face Amount Bands	**Ranking RCR Bands**	1	2	3	4-5	6-10	11-15	Grand Total
100,000-249,999	1 Best Rank	81.1%	94.4%	95.2%	88.3%	79.5%	64.7%	79.4%
100,000-249,999	3 Residual Stand Rank	104.8%	84.3%	107.9%	102.2%	85.8%	86.2%	93.0%
250,000-499,999	1 Best Rank	*	*	*	62.1%	58.0%	*	64.6%
250,000-499,999	3 Residual Stand Rank	*	*	*	105.5%	89.2%	*	95.2%
500,000-999,999	1 Best Rank	*	*	*	*	*	*	62.6%
500,000-999,999	3 Residual Stand Rank	*	*	*	*	*	*	88.7%
1,000,000-2,499,999	1 Best Rank	*	*	*	*	*	*	82.8%
1,000,000-2,499,999	3 Residual Stand Rank	*	*	*	*	*	*	109.0%
			* Cell has 35 or fewer deaths					

APPENDIX A – ILEC Report con'd…

ILEC 2002-2004 Study – Smokers – By Face Amount Bands								
Risk Class Rank Indicator = 1; Issue Ages >= 25; Durations up to 15; Face Amount 100K up to 2.5M								
		Durations Number of Deaths						
Face Amount Bands	**Ranking RCR Bands**	1	2	3	4-5	6-10	11-15	Grand Total
100,000-249,999	1 Best Rank	37	51	63	158	230	174	713
100,000-249,999	3 Residual Stand Rank	42	42	57	153	173	96	563
250,000-499,999	1 Best Rank	8	10	17	32	31	18	116
250,000-499,999	3 Residual Stand Rank	9	17	16	46	51	19	158
500,000-999,999	1 Best Rank	5	4	3	15	11	4	42
500,000-999,999	3 Residual Stand Rank	3	4	6	16	27	1	57
1,000,000-2,499,999	1 Best Rank	0	2	5	9	6	3	25
1,000,000-2,499,999	3 Residual Stand Rank	1	4	5	9	8	4	31

APPENDIX B

POPULATION MORTALITY

SSA Population Mortality Rates per 1,000 (graded to and capped at 0.45 at age 110)

Attained Age	Male	Female
0	7.17	5.96
1	0.49	0.41
2	0.33	0.27
3	0.27	0.20
4	0.21	0.15
5	0.19	0.14
6	0.18	0.14
7	0.16	0.13
8	0.15	0.13
9	0.12	0.12
10	0.11	0.11
11	0.11	0.11
12	0.17	0.13
13	0.28	0.17
14	0.43	0.23
15	0.60	0.30
16	0.76	0.36
17	0.90	0.40
18	1.02	0.43
19	1.12	0.43
20	1.22	0.44
21	1.31	0.45
22	1.37	0.45
23	1.36	0.46
24	1.32	0.47
25	1.27	0.48
26	1.23	0.49
27	1.20	0.51
28	1.20	0.54
29	1.23	0.57
30	1.26	0.61
31	1.30	0.65
32	1.36	0.71
33	1.44	0.78
34	1.54	0.86
35	1.65	0.94
36	1.78	1.03
37	1.93	1.14
38	2.09	1.24
39	2.27	1.36
40	2.46	1.49

41	2.67	1.63
42	2.90	1.76
43	3.17	1.89
44	3.46	2.03
45	3.79	2.18
46	4.14	2.34
47	4.46	2.52
48	4.74	2.69
49	5.00	2.88
50	5.29	3.08
51	5.64	3.33
52	6.06	3.62
53	6.57	3.97
54	7.16	4.38
55	7.83	4.84
56	8.56	5.34
57	9.35	5.88
58	10.18	6.46
59	11.08	7.07
60	12.08	7.76
61	13.20	8.52
62	14.44	9.36
63	15.79	10.27
64	17.29	11.26
65	18.95	12.37
66	20.78	13.60
67	22.76	14.91
68	24.90	16.30
69	27.21	17.81
70	29.84	19.54
71	32.74	21.49
72	35.78	23.55
73	38.92	25.68
74	42.28	27.99
75	46.11	30.68
76	50.50	33.82
77	55.36	37.34
78	60.73	41.28
79	66.71	45.71
80	73.41	50.84
81	80.96	56.69
82	89.43	63.20
83	98.90	70.39
84	109.38	78.38
85	120.88	87.33
86	133.38	97.36
87	146.90	108.57
88	161.44	121.01

89	177.03	134.70
90	193.67	149.61
91	211.37	165.73
92	230.14	183.03
93	249.94	201.47
94	270.76	220.99
95	291.51	240.78
96	311.04	259.92
97	328.89	278.01
98	344.62	294.60
99	357.83	309.27
100	370.51	323.89
101	382.56	338.38
102	393.91	352.66
103	404.45	366.66
104	414.13	380.29
105	422.84	393.48
106	430.54	406.15
107	437.16	418.21
108	442.63	429.58
109	446.92	440.21
110	450.00	450.00
111	450.00	450.00
112	450.00	450.00
113	450.00	450.00
114	450.00	450.00
115	450.00	450.00
116	450.00	450.00
117	450.00	450.00
118	450.00	450.00
119	450.00	450.00
120	450.00	450.00

APPENDIX D

RELATIVE RISK TABLE DEVELOPMENT

I. Relative Risk Ratio (RRR)

Definition
The Relative Risk concept was developed because the Underwriting Criteria Score (UCS) is only a *directional indicator* of the relative mortality of risks from preferred risk plans and it was felt that a better predictor of mortality risks for preferred plans was needed. The RRR is a factor that represents the relationship between the mortality due to the preferred structure at each specific issue age, gender and smoking status and the overall aggregate mortality for that cell subset. The preferred mortality rate is determined by multiplying the RRR by the overall fully underwritten aggregate RR100 mortality rate.

Development of the UCS – RRR Relationship
The limited amount of experience from the 2002-04 experience studies provided insufficient credibility to develop all of the relationships needed for the construction of this table. Consequently, the relationships determined for these tables were heavily supplemented by research from a reinsurer. This research was generally based on reviews of epidemiological studies, blood testing laboratory studies and ongoing calibration of the initial assumptions based on emerging experience.

The relationship between the UCS and the RRR varies by gender, smoking class and issue age. This is due to the varying effect of the preferred criteria on each of these subsets of the population. For example, high blood pressure will have a different effect on expected mortality for younger individuals than on older ones. Likewise, the proportion of individuals who have high blood pressure varies by age.

The relationship between the UCS and the Relative Risk Score (RRS) is based on the average RRR over all of the population subsets. The weight used in the calculation to translate the UCS to a single RRS was the total expected claim amounts in each population subset of insurance issued as standard that was included in the 2002-04 SOA Intercompany Individual Insurance Mortality Study for face amounts of $100,000 and higher. The 2001 VBT was used for the calculation of the expected claims. The end result is that a single UCS is translated into a single RRS. However, as described below, an adjustment is made to partially reflect differences by issue age.

Limitations
While the RRR is an improvement on the UCS for determining the expected rate for a preferred class, it also has some limitations.

As mentioned above, both the UCS and RRS are uni-dimensional scales and based on averages.

The predictive value of preferred risk criteria varies. For example, the marginal value of the blood pressure reading is much higher if it is the only indicator used in the determination of the eligibility for a preferred class than if it is one of nine indicators. The complexity would increase dramatically if this dimension were to be added into the RRS structure.

The overall RRS structure was created to be most accurate in the range of preferred criteria commonly used in current structures. Accuracy will decrease for unusual criteria.

The RRS structure was created using conservative estimates of the expected relative risk differentials indicated by the reinsurer's research. By conservatism in this instance, we mean the

differentials settled upon remain closer to the aggregate mortality than the research would otherwise indicate. It is difficult to assess the specific level of conservatism for any given RR table with respect to the actual mortality experience for a particular UCS due to the lack of data credibility/homogeneity at a detailed UCS level, which in some instances show actual-to-expected ratios and patterns which are directionally inconsistent with expectations.

Due to these limitations and the expected increase in available data over time, ongoing review is vital.

II. Creating the Relative Risk Mortality Tables

General comments
The creation of the Relative Risk (RR) mortality tables was a multiple-step process. First, the representative RRRs were applied to the aggregate fully underwritten mortality rate to create the mortality rates for the 10 preferred non-smoker tables and 4 preferred smoker tables. This was done separately for both males and females. Then, a Preferred Wear-Off Factor was applied to durations 2 and, later, subject to the schedule of Preferred Wear-Off Factors shown in Appendix E of this report. The Preferred Wear-Off Factors were used to reflect the wear-off in the value of the preferred underwriting criteria as the length of time since issue increases. The Preferred Wear-Off Factors did not vary by RR value, which results in the mortality for the various classes merging as duration and attained age increase.

The 10 RR non-smoker tables range from 70% to 160%, by 10% increments. The 4 RR smoker tables range from 75% to 150%, by 25% increments. The labels represent the corresponding RRS.

Three distinct, but related, definitions of the RRR mortality are needed for the following discussion.
- Specific RRR(T) – The RRR that relates to the single UCS with a value of T. It represents the relative mortality that should be expected when the UCS equals a particular value of T;
- Cumulative RRR(T) – The RRR that relates to the UCS group which have a value equal to or less than the specified UCS value of T;
- Class RRR(U/L) – The RRR that relates to the UCS group which have a UCS value equal to or less than the specified UCS value of U, and greater that the specified UCS value of L. This is used in a multi-class structure where the second class, for example, has a Specific UCS of U and the best class has a Specific UCS of L.

The RR Tables and their corresponding Specific UCS are shown in Table D.1 below.

Table D.1 - Relative Risk Table and Corresponding Specific UCS

Smoking Status	Relative Risk Table (RR Table)	Specific UCS
Non-smoker	70%	36
Non-smoker	80%	51
Non-smoker	90%	64
Non-smoker	100%	76
Non-smoker	110%	87
Non-smoker	120%	98
Non-smoker	130%	106
Non-smoker	140%	113
Non-smoker	150%	119
Non-smoker	160%	123
Smoker	75%	44
Smoker	100%	76
Smoker	125%	103
Smoker	150%	119

The Team decided the 100% table would represent the aggregate industry experience table. This is the table that describes the overall average mortality of fully underwritten business. It also represents an average UCS score of 76 when calculated across all population subsets.

Each RR Table represents the mortality for a specific population subset. For example, the mortality for the RR70 table is determined by the mortality of the population subset with a UCS score of 36. The UCS of 36 was chosen because the weighted average mortality of the population subset with a UCS of 36 is 70% of the weighted average mortality of the population with a UCS of 76. However, the individual mortality ratio is not necessarily 70% for each subset. The RR70 table reflects the actual difference for each subset. For example, for male non-smokers issue age 25, the mortality ratio (after adjustment as described below) between the RR70 and RR100 tables is 80%. For male non-smokers issue age 65, the ratio is 65%.

Note, also, the above definitions create an anomaly due to the averaging. While the industry average RR100 Table represents a UCS 76, the actual RRR for each population subset within an underwriting class with a UCS of 76 varies. For example, because more younger individuals are healthy, the actual RRR for male non-smokers with an issue age of 25 in an underwriting class with a UCS of 76 is approximately 107%. For issue age 65, the actual RRR is calculated to be 93%.

Therefore, one additional adjustment was made to all of the RR tables. As mentioned earlier, the population subset specific mortality for the RR100 table was set at 100% of the aggregate mortality for all population subsets, regardless of the true RRR for that subset. All other tables were then adjusted to reflect the difference between the true UCS 76 RRR and aggregate mortality for each issue age and gender due to this adjustment. The adjustment at the extreme tables (i.e., the 70% and the 160% tables) was one-half of the difference between the overall aggregate mortality made for the 100% table. The adjustment for the other tables was a linear interpolation between the full adjustment at the mid-point and the 50% adjustment at the extreme table.

For example, the true RRRs for a male non-smoker with an issue age of 25 are 84.4, 93.3, 107.0 and 159.2 for UCS scores of 70, 80, 100 and 160, respectively. Therefore, the RRR used to construct the RR70 table was 84.4 -.5*(107.0-100.0) = 80.9. The RRR for the 80 table was determined by factor 93.3 -(.5+.5*(93.3-84.4)/(107.0-84.4))*(107.0-100.0) = 88.4. The RRR for

the 100 table is $100 = 107.0 - 1*(107.0-100.0)$. For the RR160 table, the RRR is $155.7 = 159.2 - .5*(107.0-100.0)$.

It was felt the above approach provided a reasonable compromise between accuracy and simplicity when balancing the desires to have the RR100 table reflect the average industry results and to also reflect the true relationships of the UCS scale for each population subset.

	UCS to RRR Conversion Table			
	Cumulative		Specific	
UCS	RRR	Proportion	RRR	Proportion
1	52.07	0.1641%	52.07	0.1641%
2	52.28	0.3348%	52.48	0.1707%
3	52.49	0.5123%	52.89	0.1775%
4	52.71	0.6969%	53.32	0.1846%
5	52.93	0.8888%	53.75	0.1919%
6	53.16	1.0882%	54.18	0.1994%
7	53.39	1.2955%	54.62	0.2073%
8	53.63	1.5109%	55.07	0.2154%
9	53.88	1.7347%	55.53	0.2238%
10	54.13	1.9672%	55.99	0.2325%
11	54.38	2.2086%	56.45	0.2414%
12	54.64	2.4593%	56.93	0.2507%
13	54.91	2.7197%	57.41	0.2604%
14	55.18	2.9901%	57.90	0.2704%
15	55.46	3.2709%	58.39	0.2808%
16	55.74	3.5623%	58.89	0.2914%
17	56.03	3.8648%	59.40	0.3025%
18	56.32	4.1788%	59.92	0.3140%
19	56.62	4.5046%	60.45	0.3258%
20	56.92	4.8425%	60.98	0.3379%
21	57.23	5.1931%	61.51	0.3506%
22	57.55	5.5568%	62.05	0.3637%
23	57.87	5.9339%	62.60	0.3771%
24	58.20	6.3250%	63.15	0.3911%
25	58.53	6.7306%	63.70	0.4056%
26	58.87	7.1510%	64.26	0.4204%
27	59.21	7.5868%	64.82	0.4358%
28	59.56	8.0385%	65.39	0.4517%
29	59.91	8.5066%	65.97	0.4681%
30	60.27	8.9917%	66.54	0.4851%
31	60.63	9.4943%	67.12	0.5026%
32	61.00	10.0150%	67.71	0.5207%
33	61.37	10.5544%	68.30	0.5394%
34	61.75	11.1130%	68.90	0.5586%
35	62.13	11.6915%	69.50	0.5785%
36	62.52	12.2905%	70.11	0.5990%
37	62.91	12.9107%	70.72	0.6202%
38	63.31	13.5527%	71.33	0.6420%
39	63.71	14.2173%	71.95	0.6646%
40	64.12	14.9051%	72.58	0.6878%
41	64.53	15.6169%	73.21	0.7118%
42	64.95	16.3532%	73.85	0.7363%
43	65.37	17.1148%	74.50	0.7616%
44	65.80	17.9023%	75.15	0.7875%

45	66.24	18.7163%	75.81	0.8140%
46	66.68	19.5576%	76.48	0.8413%
47	67.13	20.4268%	77.15	0.8692%
48	67.58	21.3246%	77.83	0.8978%
49	68.04	22.2519%	78.52	0.9273%
50	68.50	23.2093%	79.21	0.9574%
51	68.97	24.1975%	79.91	0.9882%
52	69.44	25.2174%	80.62	1.0199%
53	69.92	26.2697%	81.34	1.0523%
54	70.40	27.3551%	82.07	1.0854%
55	70.89	28.4744%	82.80	1.1193%
56	71.38	29.6284%	83.54	1.1540%
57	71.88	30.8180%	84.29	1.1896%
58	72.38	32.0439%	85.04	1.2259%
59	72.89	33.3069%	85.81	1.2630%
60	73.40	34.6078%	86.58	1.3009%
61	73.92	35.9445%	87.36	1.3367%
62	74.44	37.3147%	88.14	1.3702%
63	74.96	38.7157%	88.94	1.4010%
64	75.49	40.1447%	89.73	1.4290%
65	76.02	41.5988%	90.54	1.4541%
66	76.55	43.0747%	91.35	1.4759%
67	77.07	44.5691%	92.17	1.4944%
68	77.59	46.0784%	93.00	1.5093%
69	78.11	47.5990%	93.83	1.5206%
70	78.63	49.1272%	94.67	1.5282%
71	79.14	50.6592%	95.52	1.5320%
72	79.65	52.1912%	96.37	1.5320%
73	80.15	53.7194%	97.23	1.5282%
74	80.64	55.2399%	98.10	1.5205%
75	81.13	56.7490%	98.97	1.5091%
76	81.61	58.2431%	99.86	1.4941%
77	82.08	59.7185%	100.75	1.4754%
78	82.54	61.1718%	101.64	1.4533%
79	83.00	62.5996%	102.55	1.4278%
80	83.45	63.9989%	103.46	1.3993%
81	83.89	65.3688%	104.38	1.3699%
82	84.32	66.7085%	105.30	1.3397%
83	84.74	68.0174%	106.22	1.3089%
84	85.15	69.2949%	107.14	1.2775%
85	85.55	70.5404%	108.06	1.2455%
86	85.95	71.7535%	108.99	1.2131%
87	86.34	72.9339%	109.92	1.1804%
88	86.72	74.0813%	110.85	1.1474%
89	87.09	75.1954%	111.78	1.1141%
90	87.45	76.2761%	112.71	1.0807%
91	87.80	77.3233%	113.64	1.0472%
92	88.15	78.3370%	114.58	1.0137%

93	88.49	79.3172%	115.52	0.9802%
94	88.82	80.2641%	116.46	0.9469%
95	89.14	81.1779%	117.40	0.9138%
96	89.45	82.0588%	118.34	0.8809%
97	89.76	82.9071%	119.28	0.8483%
98	90.06	83.7231%	120.23	0.8160%
99	90.35	84.5073%	121.17	0.7842%
100	90.63	85.2602%	122.12	0.7529%
101	90.90	85.9825%	123.11	0.7223%
102	91.17	86.6752%	124.16	0.6927%
103	91.43	87.3392%	125.25	0.6640%
104	91.68	87.9752%	126.40	0.6360%
105	91.93	88.5842%	127.61	0.6090%
106	92.17	89.1671%	128.87	0.5829%
107	92.41	89.7246%	130.18	0.5575%
108	92.64	90.2576%	131.56	0.5330%
109	92.87	90.7668%	132.99	0.5092%
110	93.09	91.2531%	134.49	0.4863%
111	93.31	91.7172%	136.05	0.4641%
112	93.52	92.1600%	137.67	0.4428%
113	93.73	92.5822%	139.36	0.4222%
114	93.94	92.9846%	141.12	0.4024%
115	94.14	93.3678%	142.95	0.3832%
116	94.34	93.7327%	144.86	0.3649%
117	94.53	94.0799%	146.84	0.3472%
118	94.72	94.4100%	148.90	0.3301%
119	94.91	94.7238%	151.03	0.3138%
120	95.09	95.0219%	153.25	0.2981%
121	95.27	95.3055%	155.57	0.2836%
122	95.45	95.5757%	157.99	0.2702%
123	95.62	95.8334%	160.52	0.2577%
124	95.79	96.0796%	163.15	0.2462%
125	95.96	96.3152%	165.90	0.2356%
126	96.13	96.5409%	168.76	0.2257%
127	96.30	96.7574%	171.74	0.2165%
128	96.47	96.9654%	174.85	0.2080%
129	96.64	97.1655%	178.10	0.2001%
130	96.81	97.3583%	181.47	0.1928%
131	96.98	97.5443%	184.99	0.1860%
132	97.15	97.7240%	188.66	0.1797%
133	97.32	97.8978%	192.48	0.1738%
134	97.49	98.0661%	196.46	0.1683%
135	97.66	98.2293%	200.60	0.1632%
136	97.83	98.3877%	204.80	0.1584%
137	98.00	98.5416%	209.05	0.1539%
138	98.17	98.6913%	213.36	0.1497%
139	98.35	98.8370%	217.72	0.1457%
140	98.53	98.9789%	222.13	0.1419%

141	98.71	99.1172%	226.59	0.1383%
142	98.89	99.2521%	231.1	0.001349
143	99.07	99.3838%	235.66	0.001317
144	99.25	99.5125%	240.28	0.001287
145	99.43	99.6383%	244.94	0.001258
146	99.62	99.7614%	249.65	0.001231
147	99.81	99.8819%	254.41	0.001205
148	100.00	100.0000%	259.22	0.001181

APPENDIX E

PREFERRED WEAR-OFF FACTORS

The preferred risk wear-off factors chosen by the Team for the RR tables are shown at the end of this appendix. The preferred risk wear-off factors represent the proportion of the preferred risk adjustment that wears off. For example, if the duration 1 mortality for the RR70 table is 70% of the RR100 table, and the wear-off factor in duration 6 is 14%, then the duration 6 mortality for the RR70 table is 100%-30%*(100% - 14%) = 74.2% of the RR100 table.

As noted in Section IV.B of this report, a number of sources were reviewed in developing the preferred risk wear-off factors. This appendix summarizes several of those sources.

The first four ("Alcoholics," "Diabetes," "Cholesterol," and "Does Preferred Wear Off?") are referenced in the report that documents the development of the 2001 CSO Preferred Class Structure Mortality Table. A fifth reference in that report ("Blood Pressure and Urine Abnormalities") was not located; however, the 1979 Blood Pressure Study was reviewed. Additional references that are summarized in this appendix are the 1979 Build Study, two studies on the effect of family history and a study on cholesterol ratios.

The table below compares, for selected issue ages and durations, the wear-off factors chosen for the 2008 VBT to the wear-off factors in the male, super-preferred version of the 2001 VBT table. The 2008 VBT wear-off factors are larger at older ages and early durations. As noted in Section IV.B, the factor pattern was chosen largely by judgment, and the grading off by attained age 90 was chosen to be consistent with the maximum age for the regular underwriting select period.

	2001 VBT (Male Super-Pref)					2008 VBT			
Issue Age	Dur 6	Dur 16	Dur 26	Att. Age	Issue Age	Dur 6	Dur 16	Dur 26	Att. Age
25	0.0%	0.0%	4.0%	50	25	0.0%	0.0%	2.8%	50
35	0.0%	0.0%	34.0%	60	35	0.0%	2.7%	13.0%	60
45	0.0%	0.0%	34.0%	70	45	2.3%	12.6%	32.6%	70
55	0.0%	0.0%	50.0%	80	55	6.7%	27.8%	61.6%	80
65	0.0%	0.0%	84.0%	90	65	14.0%	51.0%	100.0%	90
75	0.0%	36.0%	100.0%	100	75	29.0%	100.0%	100.0%	100
85	34.7%	100.0%	100.0%	110	85	100.0%	100.0%	100.0%	110

ALCOHOLICS[1]

Exposure: 33,653 insurance policies issued from 1952-1976 to persons with a record of alcohol abuse. Experience traced from 1962-1977. Expected mortality was 1963-70 tables. There is very little female exposure. Male results show level A/E ratios by duration beyond 15 years.

Duration	A/E	# Deaths
1-5	243%	356
6-10	220%	393
11-15	215%	340
16-25	231%	259

Observation: The excess mortality is roughly level through duration 20.

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[1] Source: "Alcoholics – Insured Lives U.S.", <u>Medical Risks – Trends in Mortality By Age and Time Elapsed</u>, Association of Life Insurance Medical Directors of America and Society of Actuaries, 1990

DIABETES[2]

Exposure: 3,318 persons who attended clinic 1923-1960 and recently diagnosed with diabetes at first visit. Experience traced to 1964. Expected mortality was 1949-51 Life Tables. Ages less than 30 and 70+ are not shown below because of small exposures.

Duration	Ages 30-49 at Diagnosis				Ages 50-69 at Diagnosis			
	Male		Female		Male		Female	
	A/E	# Deaths	A/E	# Deaths	A/E	# Deaths	A/E	# Deaths
1-5	200%	29	220%	15	100%	111	150%	131
6-10	150%	35	310%	29	130%	177	180%	204
11-15	180%	58	330%	43	120%	167	140%	204
16-20	230%	100	345%	68	100%	132	130%	197

Observation: The excess mortality for issue ages 30-49 is level or increasing, but appears to decrease after duration 10 for ages 50-69.

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[2] Source: "Diabetes – Joslin Clinic", <u>Medical Risks – Trends in Mortality By Age and Time Elapsed</u>, Association of Life Insurance Medical Directors of America and Society of Actuaries, 1990

CHOLESTEROL[3]

Exposures: 5,209 persons ages 30-62 about 1950, followed for 26 years. Expected mortality is "insured lives mortality."

Duration	Mortality for Cholesterol 270 and Higher			
	Male		Female	
	A/E	# Deaths	A/E	# Deaths
1-12	150%	40	149	37
13+	140%	124	103	119

Observation: We include this study because it has been quoted in the past; however, we note that, if the impaired lives are removed from the above table, the number of remaining deaths is only 31 for males and 27 for females – not enough to draw any conclusions about "non-impaired" lives.

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[3] Source: "High Cholesterol – Framingham Study", <u>Medical Risks – Trends in Mortality By Age and Time Elapsed</u>, Association of Life Insurance Medical Directors of America and Society of Actuaries, 1990

ARTICLE: DOES PREFERRED WEAR OFF? [REFERENCES FRAMINGHAM AND NHANES DATA][4]

The author references data from both the Framingham study and the NHANES II study. He splits the experience into "preferred" and "standard" groups using cholesterol, blood pressure and relative weight. The Framingham study started in 1948 covering 5,209 residents over 40 years. NHANES II is one of the National Health and Nutrition Examination Studies conducted by the National Center for Health Statistics. NHANES II tracked 9,250 individuals from 1976-1980 through 1992.

The author calculated the ratio of preferred (residual mortality). Below are the results by sex and smoking status.

Duration	Framingham				NHANES			
	MN	FN	MT	FT	MN	FN	MT	FT
1-10	63%	55%	65%	56%	55%	83%	65%	43%
11-20	66%	50%	64%	55%	66%	51%	70%	37%

The results indicate as much dispersion in the second 10 years as in the first.

For years beyond 20, the author says Framingham data is of questionable credibility and shows mixed results. Male ratios go from 66% to 82%, while females hold steady at 53% (vs. 54% for years 11-20).

As an aside, access to both the Framingham and NHANES data is more limited than in past years (concerns include privacy, and release is predicated upon an ethically acceptable research protocol). While it is possible that the Team could gain access to this data, this was not attempted.

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[4] "Does Preferred Wear Off?", Steve Cox, Product Matters! July, 2004

BLOOD PRESSURE STUDY 1979[5]

Study: Data contributed by 25 insurance companies, policies issued 1950-1971, followed from 1954 to 1972 anniversaries. The study has a large number of deaths. Expected mortality is the 1954-72 basic table. There is a range of initial blood pressures studied, but we summarize just the best three, as follows (there were not enough deaths to show credible female ages 15-39):

A. Systolic < 128, diastolic < 83
B. Systolic 128-137, diastolic 78-87
C. Systolic 138-147, diastolic 83-92

	A/E Ratios (Table S11, S15)								
	Issue Ages 15-39			Issue Ages 40-69					
	Male			Male			Female		
Duration	A	B	C	A	B	C	A	B	C
1-5	86%	101%	149%	83%	106%	128%	92%	96%*	101%*
6-10	85%	116%	165%	82%	109%	137%	88%	109%	111%*
11-15	83%	119%	179%	80%	115%	145%	87%	107%	128%*
16-22	89%	127%	193%	84%	114%	148%	89%	114%	137%*

Observation: The differentials are significant and are widening into duration 16-22.

* Fewer than 200 deaths.

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[5] "Blood Pressure Study 1979", Society of Actuaries and Association of Life Insurance Medical Directors of America, 1980

BUILD STUDY 1979[6]

Study: Data contributed by 25 insurance companies, policies issued 1950-71, followed from 1954 to 1972 anniversaries. The study has a large number of deaths. Expected mortality is the 1954-72 basic table. There is a range of weight bands, expressed as percentages of average (average is computed by sex, height and issue age). "Average" corresponds to a lower than typical preferred criteria today. For example, average for male age 45, 5' 10" is 176 lbs., vs. the UCS criteria for super-preferred (score 33) of 195 lbs. Therefore, the table below compares "average" to the next two classes, as follows:

Avg: Average
+5/15:   5-15% Over Average
+15/25:   18-25% Over Average

	A/E Ratios (Tables S21, S25)								
	Issue Ages 0-31			Issue Ages 40-69					
	Male			Male			Female		
Durations	Avg.	+5/15	+15/25	Avg.	+5/15	+15/25	Avg.	+5/15	+5/25
1-5	93%	99%	104%	95%	102%	105%	89%	98%	104%*
6-10	94%	106%	117%	96%	103%	115%	95%	102%	103%*
11-15	94%	114%	143%	98%	109%	118%	98%	101%	109%*
16-22	94%	123%	147%	97%	109%	121%	100%	101%*	116%*

Observation: The differentials are significant and are widening into direction 16-22.

* Fewer than 200 deaths.

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[6] "Build Study 1979," Society of Actuaries and Association of Life Insurance Medical Directors of America, 1980.

FAMILY HISTORY[7]

Insurance policies issued from 1952-1976 at standard or substandard premium rates (only 2% substandard) with family history of two or more relatives with CV disease diagnosed before age 60. Experience traced from 1962-1977. Expected mortality was 1965-70 table.

Duration	Male		Female	
	A/E	# Deaths	A/E	# Deaths
1-5	165%	500	93%	70
6-10	211%	907	161%	161
11-15	204%	773	101%	77
16-25	157%	383	113%	44

Observation: Male ratios appear to be holding steady through duration 15, and perhaps thereafter. Female results are inconclusive.

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[7] Source: "Family History of Cardiovascular Disease – Insured Lives." Medical Risks – Trends in Mortality By Age and Time Elapsed, Association of Life Insurance Medical Directors of America and Society of Actuaries, 1990

FAMILY HISTORY[8]

Study by American Cancer Society on 49,469 lives, age 75+ in 1959, followed to 1976. "Good" family history is both parents living to age 80. "Poor" is one parent dying before age 70, and the other dying before age 80.

Ages	Death Rate Per 1000					
	Males			**Females**		
	Good	**Poor**	**Ratio**	**Good**	**Poor**	**Ratio**
75-79	60	74	81%	42	51	82%
80-84	94	111	85%	59	84	70%
85-89	148	163	91%	104	125	83%
90-94	202	241	84%	169	187	90%
95-99	293	290	101%	240	258	93%

Observation: Differentials persist into high ages, but appear to be grading off in the 90s.

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[8] Mortality at ages 75 and older in the Cancer Prevention Study (CPSI), by E. A. Lew and L. Garfinkel. CA: A Cancer Journal for Clinicians. July/August 1990. http://caonline.amcancersoc.org

CHOLESTEROL RATIO[9]

Study of 3,490 initially healthy Finnish males, born in 1919 to 1934, initiated in 1964-1973, followed through 2002 (maximum 39 years).

Results are shown for cholesterol ratio groups. Durational results are shown only in a cumulative survivor graph, so we estimated the results. Results are shown for the following groups:

	Cholesterol Ratio	Initial # Lives	Survivorship (estimated)	
			EOY 20	EOY 39
I	< 5.0	234	.92	.72
II	5.1 – 6.0	804	.91	.63
III	6.1 – 7.0	1,170	.88	.60
IV	7.4 – 8.0	720	.88	.57
V	8.1 – 9.0	255	.82	.50

	Calculated Annual qx		Calculated # Deaths	
	Years 1-20	Years 21-39	Years 1-20	Years 21-39
I	.0040	.0130	18	45
II	.0045	.0190	72	225
III	.0060	.0200	140	328
IV	.0060	.0230	86	223
V	.0100	.0260	48	82

The calculated qxs and # Deaths above are calculated from the estimated survivorship factors. Regarding the qxs, differences exist beyond year 20, and the report itself notes that "the survival benefit in the lowest cholesterol group was even accentuated during the last years of the follow-up."

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[9] "Low cholesterol, mortality, and quality of life in old age during a 39-year follow-up." Straudberg, Straudberg, et. Al, Journal of the American College of Cardiology, Vol. 44, No. 5, 2004

2008 VBT Preferred Wear-Off Factors (values are per 100)

Issue Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Ult	Att Age
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	46
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	47
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.7	48
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	49
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.8	50
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.4	51
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.1	52
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.9	53
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.8	5.8	54
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.8	5.7	6.7	55
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.8	5.7	6.6	7.8	56
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.8	5.7	6.6	7.7	9.0	57
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	2.7	3.3	4.0	4.8	5.7	6.6	7.7	8.9	10.2	58
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.1	2.7	3.3	4.0	4.8	5.6	6.6	7.7	8.8	10.1	11.6	59
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.1	2.7	3.3	4.0	4.8	5.6	6.6	7.7	8.8	10.1	11.4	13.0	60
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.6	2.1	2.7	3.3	4.0	4.7	5.6	6.6	7.7	8.8	10.1	11.4	12.9	14.6	61

2008 VBT Preferred Wear-Off Factors (values are per 100)

Issue Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Ult	Att Age
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.6	2.1	2.7	3.3	3.9	4.7	5.6	6.6	7.6	8.8	10.1	11.4	12.9	14.4	16.2	62
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.6	2.1	2.6	3.2	3.9	4.7	5.6	6.6	7.6	8.8	10.0	11.4	12.8	14.4	16.0	17.9	63
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	2.1	2.6	3.2	3.9	4.7	5.6	6.5	7.6	8.8	10.0	11.4	12.8	14.4	16.0	17.7	19.7	64
40	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	2.1	2.6	3.2	3.9	4.7	5.5	6.5	7.6	8.7	10.0	11.3	12.8	14.3	16.0	17.7	19.5	21.7	65
41	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	2.0	2.6	3.2	3.8	4.6	5.5	6.5	7.5	8.7	10.0	11.3	12.8	14.3	15.9	17.7	19.5	21.4	23.7	66
42	0.0	0.0	0.0	0.0	0.0	0.9	1.4	2.0	2.5	3.1	3.8	4.6	5.5	6.4	7.5	8.7	9.9	11.3	12.7	14.3	15.9	17.6	19.5	21.4	23.4	25.8	67
43	0.0	0.0	0.0	0.0	0.9	1.4	1.9	2.5	3.1	3.8	4.5	5.4	6.4	7.5	8.6	9.9	11.2	12.7	14.2	15.9	17.6	19.4	21.3	23.4	25.5	28.0	68
44	0.0	0.0	0.0	0.8	1.3	1.9	2.4	3.0	3.7	4.5	5.4	6.3	7.4	8.6	9.8	11.2	12.6	14.2	15.8	17.6	19.4	21.3	23.3	25.4	27.6	30.3	69
45	0.0	0.0	0.7	1.3	1.8	2.3	2.9	3.6	4.4	5.3	6.3	7.4	8.5	9.8	11.1	12.6	14.1	15.8	17.5	19.3	21.3	23.3	25.4	27.6	29.9	32.6	70
46	0.0	0.6	1.1	1.7	2.2	2.8	3.5	4.3	5.2	6.2	7.3	8.5	9.7	11.1	12.5	14.1	15.7	17.5	19.3	21.2	23.2	25.4	27.6	29.9	32.3	35.1	71
47	0.0	0.6	1.1	1.7	2.3	3.0	3.8	4.7	5.7	6.8	7.9	9.2	10.6	12.0	13.6	15.3	17.0	18.8	20.8	22.8	24.9	27.2	29.5	31.9	34.4	37.7	72
48	0.0	0.6	1.1	1.7	2.5	3.3	4.2	5.1	6.2	7.4	8.7	10.1	11.5	13.1	14.8	16.5	18.4	20.3	22.4	24.5	26.7	29.1	31.5	34.0	36.6	40.4	73
49	0.0	0.6	1.2	1.9	2.7	3.6	4.6	5.7	6.9	8.2	9.6	11.0	12.6	14.3	16.1	17.9	19.9	21.9	24.1	26.3	28.7	31.1	33.6	36.3	39.0	43.1	74
50	0.0	0.6	1.3	2.1	3.1	4.1	5.2	6.4	7.7	9.0	10.5	12.1	13.8	15.6	17.5	19.4	21.5	23.6	25.9	28.3	30.7	33.3	35.9	38.6	41.5	46.0	75
51	0.0	0.7	1.5	2.5	3.5	4.6	5.8	7.1	8.5	10.0	11.6	13.3	15.1	16.9	18.9	21.0	23.2	25.4	27.8	30.3	32.8	35.5	38.3	41.1	44.1	48.9	76
52	0.0	0.8	1.7	2.8	3.9	5.1	6.4	7.8	9.3	10.9	12.6	14.4	16.3	18.3	20.4	22.6	24.9	27.3	29.8	32.4	35.0	37.8	40.7	43.7	46.7	51.9	77
53	0.0	0.9	2.0	3.1	4.3	5.6	7.1	8.6	10.2	11.9	13.7	15.6	17.7	19.8	22.0	24.3	26.7	29.2	31.8	34.5	37.3	40.2	43.2	46.3	49.5	55.1	78
54	0.0	1.0	2.2	3.4	4.7	6.2	7.7	9.3	11.1	12.9	14.8	16.9	19.0	21.2	23.6	26.0	28.5	31.2	33.9	36.7	39.6	42.7	45.8	49.0	52.3	58.3	79
55	0.0	1.1	2.4	3.7	5.2	6.7	8.4	10.1	12.0	14.0	16.0	18.2	20.4	22.8	25.2	27.8	30.4	33.2	36.1	39.0	42.1	45.2	48.5	51.8	55.3	61.6	80
56	0.0	1.3	2.6	4.1	5.7	7.3	9.1	11.0	13.0	15.0	17.2	19.5	21.9	24.4	26.9	29.6	32.4	35.3	38.3	41.4	44.6	47.9	51.3	54.8	58.4	65.0	81
57	0.0	1.4	2.9	4.5	6.1	7.9	9.8	11.8	13.9	16.2	18.5	20.9	23.4	26.0	28.7	31.6	34.5	37.5	40.6	43.9	47.2	50.7	54.2	57.9	61.6	68.6	82
58	0.0	1.5	3.1	4.8	6.7	8.6	10.6	12.7	15.0	17.3	19.8	22.3	25.0	27.7	30.6	33.6	36.6	39.8	43.1	46.5	50.0	53.6	57.3	61.1	65.0	72.2	83
59	0.0	1.6	3.4	5.2	7.2	9.2	11.4	13.7	16.1	18.5	21.1	23.8	26.6	29.5	32.5	35.7	38.9	42.2	45.7	49.2	52.9	56.6	60.5	64.4	68.5	75.9	84
60	0.0	1.8	3.6	5.6	7.7	9.9	12.2	14.7	17.2	19.8	22.6	25.4	28.4	31.4	34.6	37.9	41.3	44.8	48.4	52.1	55.9	59.8	63.8	68.0	72.2	79.6	85
61	0.0	1.9	3.9	6.1	8.3	10.7	13.1	15.7	18.4	21.2	24.1	27.1	30.2	33.4	36.8	40.2	43.8	47.4	51.2	55.1	59.1	63.2	67.4	71.7	76.2	83.5	86
62	0.0	2.1	4.2	6.5	8.9	11.4	14.0	16.8	19.6	22.6	25.6	28.8	32.1	35.5	39.0	42.7	46.4	50.3	54.2	58.3	62.5	66.8	71.2	75.7	80.3	87.5	87
63	0.0	2.2	4.6	7.0	9.6	12.2	15.0	17.9	20.9	24.1	27.3	30.7	34.2	37.8	41.5	45.3	49.2	53.3	57.4	61.7	66.1	70.6	75.2	79.9	84.8	91.6	88
64	0.0	2.4	4.9	7.5	10.2	13.1	16.1	19.2	22.4	25.7	29.1	32.7	36.3	40.1	44.0	48.1	52.2	56.4	60.8	65.3	69.9	74.6	79.5	84.4	89.5	95.7	89
65	0.0	2.6	5.2	8.1	11.0	14.0	17.2	20.5	23.9	27.4	31.0	34.8	38.7	42.7	46.8	51.0	55.4	59.9	64.5	69.2	74.0	79.0	84.1	89.2	94.6	100.0	90
66	0.0	2.8	5.6	8.6	11.8	15.0	18.4	21.9	25.5	29.2	33.1	37.1	41.2	45.4	49.7	54.2	58.8	63.5	68.4	73.3	78.4	83.6	89.0	94.4	100.0	100.0	91
67	0.0	3.0	6.0	9.3	12.6	16.1	19.6	23.4	27.2	31.2	35.3	39.5	43.8	48.3	52.9	57.6	62.5	67.5	72.6	77.8	83.2	88.7	94.3	100.0	100.0	100.0	92
68	0.0	3.2	6.5	9.9	13.5	17.2	21.0	25.0	29.1	33.3	37.6	42.1	46.7	51.5	56.3	61.3	66.5	71.7	77.1	82.7	88.3	94.1	100.0	100.0	100.0	100.0	93
69	0.0	3.4	7.0	10.7	14.5	18.4	22.5	26.7	31.1	35.6	40.2	45.0	49.9	54.9	60.1	65.4	70.8	76.4	82.1	87.9	93.9	100.0	100.0	100.0	100.0	100.0	94
70	0.0	3.7	7.5	11.5	15.5	19.8	24.2	28.7	33.3	38.1	43.0	48.1	53.3	58.7	64.2	69.8	75.5	81.5	87.5	93.7	100.0	100.0	100.0	100.0	100.0	100.0	95
71	0.0	4.0	8.1	12.3	16.7	21.3	25.9	30.8	35.7	40.9	46.1	51.5	57.1	62.8	68.6	74.6	80.7	87.0	93.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96
72	0.0	4.3	8.7	13.3	18.0	22.9	27.9	33.1	38.4	43.9	49.5	55.3	61.3	67.3	73.6	79.9	86.5	93.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97
73	0.0	4.6	9.4	14.3	19.4	24.7	30.1	35.7	41.4	47.3	53.3	59.5	65.9	72.4	79.1	85.9	92.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98
74	0.0	5.0	10.2	15.5	21.0	26.7	32.6	38.6	44.7	51.1	57.6	64.2	71.0	78.0	85.2	92.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99

2008 VBT Preferred Wear-Off Factors (values are per 100)

Issue Age																Duration											Ult	Att Age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
75	0.0	5.5	11.1	16.9	22.8	29.0	35.3	41.8	48.5	55.3	62.3	69.5	76.9	84.4	92.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
76	0.0	6.0	12.1	18.4	24.9	31.6	38.5	45.5	52.7	60.2	67.8	75.5	83.5	91.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	101
77	0.0	6.5	13.2	20.2	27.3	34.6	42.1	49.7	57.6	65.7	74.0	82.5	91.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	102
78	0.0	7.2	14.6	22.2	30.0	38.0	46.2	54.7	63.3	72.2	81.2	90.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	103
79	0.0	8.0	16.2	24.6	33.2	42.1	51.2	60.5	70.0	79.8	89.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	104
80	0.0	8.9	18.0	27.4	37.1	46.9	57.1	67.4	78.0	88.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	105
81	0.0	10.0	20.3	30.9	41.8	52.9	64.3	75.9	87.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	106
82	0.0	11.5	23.2	35.3	47.6	60.3	73.2	86.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	107
83	0.0	13.3	26.9	40.8	55.1	69.7	84.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	108
84	0.0	15.7	31.8	48.3	65.1	82.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	109
85	0.0	19.1	38.6	58.6	79.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	110
86	0.0	24.1	48.9	74.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	111
87	0.0	32.6	65.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	112
88	0.0	50.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	113
89	0.0	50.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	114
90	0.0	50.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	115
																										100.0	116
																										100.0	117
																										100.0	118
																										100.0	119
																										100.0	120
																										100.0	121
																										100.0	122
																										100.0	123
																										100.0	124

APPENDIX H

CPI ANALYSIS

Year	CPI	% Increase	AWI	% Increase	Contrived Wage Index	Start values-- >	100000 FA Compare	2002 Lapse
1913	9.9							5%
1914	10.0	1.01%			852.90	1.29%	2,565	0.94%
1915	10.1	1.00%			863.81	1.28%	2,598	0.99%
1916	10.9	7.92%			951.33	10.13%	2,861	1.04%
1917	12.8	17.43%			1,163.44	22.30%	3,499	1.10%
1918	15.1	17.97%			1,430.85	22.98%	4,303	1.15%
1919	17.3	14.57%			1,697.50	18.64%	5,105	1.21%
1920	20.0	15.61%			2,036.38	19.96%	6,124	1.28%
1921	17.9	-10.50%			1,762.88	-13.43%	5,302	1.35%
1922	16.8	-6.15%			1,624.31	-7.86%	4,885	1.42%
1923	17.1	1.79%			1,661.41	2.28%	4,996	1.49%
1924	17.1	0.00%			1,661.41	0.00%	4,996	1.57%
1925	17.5	2.34%			1,711.12	2.99%	5,146	1.65%
1926	17.7	1.14%			1,736.13	1.46%	5,221	1.74%
1927	17.4	-1.69%			1,698.49	-2.17%	5,108	1.83%
1928	17.1	-1.72%			1,661.03	-2.21%	4,995	1.93%
1929	17.1	0.00%			1,661.03	0.00%	4,995	2.03%
1930	16.7	-2.34%			1,611.33	-2.99%	4,846	2.13%
1931	15.2	-8.98%			1,426.21	-11.49%	4,289	2.25%
1932	13.7	-9.87%			1,246.18	-12.62%	3,748	2.36%
1933	13.0	-5.11%			1,164.73	-6.54%	3,503	2.49%
1934	13.4	3.08%			1,210.57	3.94%	3,641	2.62%
1935	13.7	2.24%			1,245.24	2.86%	3,745	2.76%
1936	13.9	1.46%			1,268.49	1.87%	3,815	2.90%
1937	14.4	3.60%			1,326.86	4.60%	3,990	3.06%
1938	14.1	-2.08%			1,291.50	-2.66%	3,884	3.22%
1939	13.9	-1.42%			1,268.07	-1.81%	3,813	3.39%
1940	14.0	0.72%			1,279.74	0.92%	3,849	3.56%
1941	14.7	5.00%			1,361.58	6.40%	4,095	3.75%
1942	16.3	10.88%			1,551.15	13.92%	4,665	3.95%
1943	17.3	6.13%			1,672.87	7.85%	5,031	4.16%
1944	17.6	1.73%			1,709.98	2.22%	5,142	4.38%
1945	18.0	2.27%			1,759.69	2.91%	5,292	4.61%
1946	19.5	8.33%			1,947.26	10.66%	5,856	4.85%
1947	22.3	14.36%			2,304.91	18.37%	6,932	5.10%
1948	24.1	8.07%			2,542.88	10.32%	7,647	5.37%
1949	23.8	-1.24%			2,502.39	-1.59%	7,526	5.66%
1950	24.1	1.26%			2,542.74	1.61%	7,647	5.95%
1951	26.0	7.88%	2,799.16		2,799.16	10.08%	8,418	6.27%
1952	26.5	1.92%	2,973.32	6.22%	2,973.32		8,942	6.60%
1953	26.7	0.75%	3,139.44	5.59%	3,139.44		9,441	6.94%
1954	26.9	0.75%	3,155.64	0.52%	3,155.64		9,490	7.31%
1955	26.8	-0.37%	3,301.44	4.62%	3,301.44		9,929	7.69%
1956	27.2	1.49%	3,532.36	6.99%	3,532.36		10,623	8.10%

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1957	28.1	3.31%	3,641.72	3.10%	3,641.72	10,952	8.53%
1958	28.9	2.85%	3,673.80	0.88%	3,673.80	11,048	8.97%
1959	29.1	0.69%	3,855.80	4.95%	3,855.80	11,596	9.45%
1960	29.6	1.72%	4,007.12	3.92%	4,007.12	12,051	9.94%
1961	29.9	1.01%	4,086.76	1.99%	4,086.76	12,290	10.47%
1962	30.2	1.00%	4,291.40	5.01%	4,291.40	12,906	11.02%
1963	30.6	1.32%	4,396.64	2.45%	4,396.64	13,222	11.60%
1964	31.0	1.31%	4,576.32	4.09%	4,576.32	13,763	12.21%
1965	31.5	1.61%	4,658.72	1.80%	4,658.72	14,010	12.85%
1966	32.4	2.86%	4,938.36	6.00%	4,938.36	14,851	13.53%
1967	33.4	3.09%	5,213.44	5.57%	5,213.44	15,679	14.24%
1968	34.8	4.19%	5,571.76	6.87%	5,571.76	16,756	14.99%
1969	36.7	5.46%	5,893.76	5.78%	5,893.76	17,724	15.78%
1970	38.8	5.72%	6,186.24	4.96%	6,186.24	18,604	16.61%
1971	40.5	4.38%	6,497.08	5.02%	6,497.08	19,539	17.48%
1972	41.8	3.21%	7,133.80	9.80%	7,133.80	21,454	18.40%
1973	44.4	6.22%	7,580.16	6.26%	7,580.16	22,796	19.37%
1974	49.3	11.04%	8,030.76	5.94%	8,030.76	24,151	20.39%
1975	53.8	9.13%	8,630.92	7.47%	8,630.92	25,956	21.46%
1976	56.9	5.76%	9,226.48	6.90%	9,226.48	27,747	22.59%
1977	60.6	6.50%	9,779.44	5.99%	9,779.44	29,410	23.78%
1978	65.2	7.59%	10,556.03	7.94%	10,556.03	31,745	25.03%
1979	72.6	11.35%	11,479.46	8.75%	11,479.46	34,523	26.35%
1980	82.4	13.50%	12,513.46	9.01%	12,513.46	37,632	27.74%
1981	90.9	10.32%	13,773.10	10.07%	13,773.10	41,420	29.20%
1982	96.5	6.16%	14,531.34	5.51%	14,531.34	43,701	30.74%
1983	99.6	3.21%	15,239.24	4.87%	15,239.24	45,829	32.35%
1984	103.9	4.32%	16,135.07	5.88%	16,135.07	48,523	34.06%
1985	107.6	3.56%	16,822.51	4.26%	16,822.51	50,591	35.85%
1986	109.6	1.86%	17,321.82	2.97%	17,321.82	52,092	37.74%
1987	113.6	3.65%	18,426.51	6.38%	18,426.51	55,415	39.72%
1988	118.3	4.14%	19,334.04	4.93%	19,334.04	58,144	41.81%
1989	124.0	4.82%	20,099.55	3.96%	20,099.55	60,446	44.01%
1990	130.7	5.40%	21,027.98	4.62%	21,027.98	63,238	46.33%
1991	136.2	4.21%	21,811.60	3.73%	21,811.60	65,595	48.77%
1992	140.3	3.01%	22,935.42	5.15%	22,935.42	68,974	51.33%
1993	144.5	2.99%	23,132.67	0.86%	23,132.67	69,568	54.04%
1994	148.2	2.56%	23,753.53	2.68%	23,753.53	71,435	56.88%
1995	152.4	2.83%	24,705.66	4.01%	24,705.66	74,298	59.87%
1996	156.9	2.95%	25,913.90	4.89%	25,913.90	77,932	63.02%
1997	160.5	2.29%	27,426.00	5.84%	27,426.00	82,479	66.34%
1998	163.0	1.56%	28,861.44	5.23%	28,861.44	86,796	69.83%
1999	166.6	2.21%	30,469.84	5.57%	30,469.84	91,633	73.51%
2000	172.2	3.36%	32,154.82	5.53%	32,154.82	96,700	77.38%
2001	177.1	2.85%	32,921.92	2.39%	32,921.92	99,007	81.45%
2002	179.9	1.58%	33,252.09	1.00%	33,252.09	100,000	85.74%
2003	184.0	2.28%	34,064.95	2.44%	34,064.95	102,445	90.25%
2004	188.9	2.66%	35,648.55	4.65%	35,648.55	107,207	95.00%
2005	195.3	3.39%	36,952.94	3.66%	36,952.94	111,130	100.00%
avg 52-05		3.84%		4.92%	127.9%		

avg 14-51   2.81%   3.59%

Duration	
1	101,222
2	99,504
3	97,854
4-5	91,754
6-10	77,231
11-15	64,682
16-20	51,962
21-25	39,517
26+	15,430

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	HALF1	HALF2
1913	9.8	9.8	9.8	9.8	9.7	9.8	9.9	9.9	10.0	10.0	10.1	10.0	9.9		
1914	10.0	9.9	9.9	9.8	9.9	9.9	10.0	10.2	10.2	10.1	10.2	10.1	10.0		
1915	10.1	10.0	9.9	10.0	10.1	10.1	10.1	10.1	10.1	10.2	10.3	10.3	10.1		
1916	10.4	10.4	10.5	10.6	10.7	10.8	10.8	10.9	11.1	11.3	11.5	11.6	10.9		
1917	11.7	12.0	12.0	12.6	12.8	13.0	12.8	13.0	13.3	13.5	13.5	13.7	12.8		
1918	14.0	14.1	14.0	14.2	14.5	14.7	15.1	15.4	15.7	16.0	16.3	16.5	15.1		
1919	16.5	16.2	16.4	16.7	16.9	16.9	17.4	17.7	17.8	18.1	18.5	18.9	17.3		
1920	19.3	19.5	19.7	20.3	20.6	20.9	20.8	20.3	20.0	19.9	19.8	19.4	20.0		
1921	19.0	18.4	18.3	18.1	17.7	17.6	17.7	17.7	17.5	17.5	17.4	17.3	17.9		
1922	16.9	16.9	16.7	16.7	16.7	16.7	16.8	16.6	16.6	16.7	16.8	16.9	16.8		
1923	16.8	16.8	16.8	16.9	16.9	17.0	17.2	17.1	17.2	17.3	17.3	17.3	17.1		
1924	17.3	17.2	17.1	17.0	17.0	17.0	17.1	17.0	17.1	17.2	17.2	17.3	17.1		
1925	17.3	17.2	17.3	17.2	17.3	17.5	17.7	17.7	17.7	17.7	18.0	17.9	17.5		
1926	17.9	17.9	17.8	17.9	17.8	17.7	17.5	17.4	17.5	17.6	17.7	17.7	17.7		
1927	17.5	17.4	17.3	17.3	17.4	17.6	17.3	17.2	17.3	17.4	17.3	17.3	17.4		
1928	17.3	17.1	17.1	17.1	17.2	17.1	17.1	17.1	17.3	17.2	17.2	17.1	17.1		
1929	17.1	17.1	17.0	16.9	17.0	17.1	17.3	17.3	17.3	17.3	17.3	17.2	17.1		
1930	17.1	17.0	16.9	17.0	16.9	16.8	16.6	16.5	16.6	16.5	16.4	16.1	16.7		
1931	15.9	15.7	15.6	15.5	15.3	15.1	15.1	15.1	15.0	14.9	14.7	14.6	15.2		
1932	14.3	14.1	14.0	13.9	13.7	13.6	13.6	13.5	13.4	13.3	13.2	13.1	13.7		
1933	12.9	12.7	12.6	12.6	12.6	12.7	13.1	13.2	13.2	13.2	13.2	13.2	13.0		
1934	13.2	13.3	13.3	13.3	13.3	13.4	13.4	13.4	13.6	13.5	13.5	13.4	13.4		
1935	13.6	13.7	13.7	13.8	13.8	13.7	13.7	13.7	13.7	13.7	13.8	13.8	13.7		
1936	13.8	13.8	13.7	13.7	13.7	13.8	13.9	14.0	14.0	14.0	14.0	14.0	13.9		
1937	14.1	14.1	14.2	14.3	14.4	14.4	14.5	14.5	14.6	14.6	14.5	14.4	14.4		
1938	14.2	14.1	14.1	14.2	14.1	14.1	14.1	14.1	14.1	14.0	14.0	14.0	14.1		
1939	14.0	13.9	13.9	13.8	13.8	13.8	13.8	13.8	14.1	14.0	14.0	14.0	13.9		
1940	13.9	14.0	14.0	14.0	14.0	14.1	14.0	14.0	14.0	14.0	14.0	14.1	14.0		
1941	14.1	14.1	14.2	14.3	14.4	14.7	14.7	14.9	15.1	15.3	15.4	15.5	14.7		
1942	15.7	15.8	16.0	16.1	16.3	16.3	16.4	16.5	16.5	16.7	16.8	16.9	16.3		
1943	16.9	16.9	17.2	17.4	17.5	17.5	17.4	17.3	17.4	17.4	17.4	17.4	17.3		
1944	17.4	17.4	17.4	17.5	17.5	17.6	17.7	17.7	17.7	17.7	17.7	17.8	17.6		
1945	17.8	17.8	17.8	17.8	17.9	18.1	18.1	18.1	18.1	18.1	18.1	18.2	18.0		
1946	18.2	18.1	18.3	18.4	18.5	18.7	19.8	20.2	20.4	20.8	21.3	21.5	19.5		
1947	21.5	21.5	21.9	21.9	21.9	22.0	22.2	22.5	23.0	23.0	23.1	23.4	22.3		
1948	23.7	23.5	23.4	23.8	23.9	24.1	24.4	24.5	24.5	24.4	24.2	24.1	24.1		
1949	24.0	23.8	23.8	23.9	23.8	23.9	23.7	23.8	23.9	23.7	23.8	23.6	23.8		
1950	23.5	23.5	23.6	23.6	23.7	23.8	24.1	24.3	24.4	24.6	24.7	25.0	24.1		
1951	25.4	25.7	25.8	25.8	25.9	25.9	25.9	25.9	26.1	26.2	26.4	26.5	26.0		
1952	26.5	26.3	26.3	26.4	26.4	26.5	26.7	26.7	26.7	26.7	26.7	26.7	26.5		
1953	26.6	26.5	26.6	26.6	26.7	26.8	26.8	26.9	26.9	27.0	26.9	26.9	26.7		
1954	26.9	26.9	26.9	26.8	26.9	26.9	26.9	26.9	26.8	26.8	26.8	26.7	26.9		
1955	26.7	26.7	26.7	26.7	26.7	26.7	26.8	26.8	26.9	26.9	26.9	26.8	26.8		
1956	26.8	26.8	26.8	26.9	27.0	27.2	27.4	27.3	27.4	27.5	27.5	27.6	27.2		
1957	27.6	27.7	27.8	27.9	28.0	28.1	28.3	28.3	28.3	28.3	28.4	28.4	28.1		

Year															
1958	28.6	28.6	28.8	28.9	28.9	28.9	29.0	28.9	28.9	28.9	29.0	28.9	28.9		
1959	29.0	28.9	28.9	29.0	29.0	29.1	29.2	29.2	29.3	29.4	29.4	29.4	29.1		
1960	29.3	29.4	29.4	29.5	29.5	29.6	29.6	29.6	29.6	29.8	29.8	29.8	29.6		
1961	29.8	29.8	29.8	29.8	29.8	29.8	30.0	29.9	30.0	30.0	30.0	30.0	29.9		
1962	30.0	30.1	30.1	30.2	30.2	30.2	30.3	30.3	30.4	30.4	30.4	30.4	30.2		
1963	30.4	30.4	30.5	30.5	30.5	30.6	30.7	30.7	30.7	30.8	30.8	30.9	30.6		
1964	30.9	30.9	30.9	30.9	30.9	31.0	31.1	31.0	31.1	31.1	31.2	31.2	31.0		
1965	31.2	31.2	31.3	31.4	31.4	31.6	31.6	31.6	31.6	31.7	31.7	31.8	31.5		
1966	31.8	32.0	32.1	32.3	32.3	32.4	32.5	32.7	32.7	32.9	32.9	32.9	32.4		
1967	32.9	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	33.4		
1968	34.1	34.2	34.3	34.4	34.5	34.7	34.9	35.0	35.1	35.3	35.4	35.5	34.8		
1969	35.6	35.8	36.1	36.3	36.4	36.6	36.8	37.0	37.1	37.3	37.5	37.7	36.7		
1970	37.8	38.0	38.2	38.5	38.6	38.8	39.0	39.0	39.2	39.4	39.6	39.8	38.8		
1971	39.8	39.9	40.0	40.1	40.3	40.6	40.7	40.8	40.8	40.9	40.9	41.1	40.5		
1972	41.1	41.3	41.4	41.5	41.6	41.7	41.9	42.0	42.1	42.3	42.4	42.5	41.8		
1973	42.6	42.9	43.3	43.6	43.9	44.2	44.3	45.1	45.2	45.6	45.9	46.2	44.4		
1974	46.6	47.2	47.8	48.0	48.6	49.0	49.4	50.0	50.6	51.1	51.5	51.9	49.3		
1975	52.1	52.5	52.7	52.9	53.2	53.6	54.2	54.3	54.6	54.9	55.3	55.5	53.8		
1976	55.6	55.8	55.9	56.1	56.5	56.8	57.1	57.4	57.6	57.9	58.0	58.2	56.9		
1977	58.5	59.1	59.5	60.0	60.3	60.7	61.0	61.2	61.4	61.6	61.9	62.1	60.6		
1978	62.5	62.9	63.4	63.9	64.5	65.2	65.7	66.0	66.5	67.1	67.4	67.7	65.2		
1979	68.3	69.1	69.8	70.6	71.5	72.3	73.1	73.8	74.6	75.2	75.9	76.7	72.6		
1980	77.8	78.9	80.1	81.0	81.8	82.7	82.7	83.3	84.0	84.8	85.5	86.3	82.4		
1981	87.0	87.9	88.5	89.1	89.8	90.6	91.6	92.3	93.2	93.4	93.7	94.0	90.9		
1982	94.3	94.6	94.5	94.9	95.8	97.0	97.5	97.7	97.9	98.2	98.0	97.6	96.5		
1983	97.8	97.9	97.9	98.6	99.2	99.5	99.9	100.2	100.7	101.0	101.2	101.3	99.6		
1984	101.9	102.4	102.6	103.1	103.4	103.7	104.1	104.5	105.0	105.3	105.3	105.3	103.9	102.9	104.9
1985	105.5	106.0	106.4	106.9	107.3	107.6	107.8	108.0	108.3	108.7	109.0	109.3	107.6	106.6	108.5
1986	109.6	109.3	108.8	108.6	108.9	109.5	109.5	109.7	110.2	110.3	110.4	110.5	109.6	109.1	110.1
1987	111.2	111.6	112.1	112.7	113.1	113.5	113.8	114.4	115.0	115.3	115.4	115.4	113.6	112.4	114.9
1988	115.7	116.0	116.5	117.1	117.5	118.0	118.5	119.0	119.8	120.2	120.3	120.5	118.3	116.8	119.7
1989	121.1	121.6	122.3	123.1	123.8	124.1	124.4	124.6	125.0	125.6	125.9	126.1	124.0	122.7	125.3
1990	127.4	128.0	128.7	128.9	129.2	129.9	130.4	131.6	132.7	133.5	133.8	133.8	130.7	128.7	132.6
1991	134.6	134.8	135.0	135.2	135.6	136.0	136.2	136.6	137.2	137.4	137.8	137.9	136.2	135.2	137.2
1992	138.1	138.6	139.3	139.5	139.7	140.2	140.5	140.9	141.3	141.8	142.0	141.9	140.3	139.2	141.4
1993	142.6	143.1	143.6	144.0	144.2	144.4	144.4	144.8	145.1	145.7	145.8	145.8	144.5	143.7	145.3
1994	146.2	146.7	147.2	147.4	147.5	148.0	148.4	149.0	149.4	149.5	149.7	149.7	148.2	147.2	149.3
1995	150.3	150.9	151.4	151.9	152.2	152.5	152.5	152.9	153.2	153.7	153.6	153.5	152.4	151.5	153.2
1996	154.4	154.9	155.7	156.3	156.6	156.7	157.0	157.3	157.8	158.3	158.6	158.6	156.9	155.8	157.9
1997	159.1	159.6	160.0	160.2	160.1	160.3	160.5	160.8	161.2	161.6	161.5	161.3	160.5	159.9	161.2
1998	161.6	161.9	162.2	162.5	162.8	163.0	163.2	163.4	163.6	164.0	164.0	163.9	163.0	162.3	163.7
1999	164.3	164.5	165.0	166.2	166.2	166.2	166.7	167.1	167.9	168.2	168.3	168.3	166.6	165.4	167.8
2000	168.8	169.8	171.2	171.3	171.5	172.4	172.8	172.8	173.7	174.0	174.1	174.0	172.2	170.8	173.6
2001	175.1	175.8	176.2	176.9	177.7	178.0	177.5	177.5	178.3	177.7	177.4	176.7	177.1	176.6	177.5
2002	177.1	177.8	178.8	179.8	179.8	179.9	180.1	180.7	181.0	181.3	181.3	180.9	179.9	178.9	180.9
2003	181.7	183.1	184.2	183.8	183.5	183.7	183.9	184.6	185.2	185.0	184.5	184.3	184.0	183.3	184.6
2004	185.2	186.2	187.4	188.0	189.1	189.7	189.4	189.5	189.9	190.9	191.0	190.3	188.9	187.6	190.2
2005	190.7	191.8	193.3	194.6	194.4	194.5	195.4	196.4	198.8	199.2	197.6	196.8	195.3	193.2	197.4
2006	198.3	198.7	199.8	201.5	202.5	202.9	203.5	203.9	202.9	201.8	201.5	201.8	201.6	200.6	202.6
2007	202.4	203.5	205.4												

We use the national average wage indexing series to index the earnings of individuals for benefit computation purposes. We also use the series to index several amounts that are important to the operation of Social Security's Old-Age, Survivors and Disability program. See the wage data that were used to develop values in this series for years after 1984.

Year	AWI	Annual increase
1951	2,799.16	—
1952	2,973.32	6.22%
1953	3,139.44	5.59%
1954	3,155.64	0.52%
1955	3,301.44	4.62%
1956	3,532.36	6.99%
1957	3,641.72	3.10%
1958	3,673.80	0.88%
1959	3,855.80	4.95%
1960	4,007.12	3.92%
1961	4,086.76	1.99%
1962	4,291.40	5.01%
1963	4,396.64	2.45%
1964	4,576.32	4.09%
1965	4,658.72	1.80%
1966	4,938.36	6.00%
1967	5,213.44	5.57%
1968	5,571.76	6.87%
1969	5,893.76	5.78%
1970	6,186.24	4.96%
1971	6,497.08	5.02%
1972	7,133.80	9.80%
1973	7,580.16	6.26%
1974	8,030.76	5.94%
1975	8,630.92	7.47%
1976	9,226.48	6.90%
1977	9,779.44	5.99%
1978	10,556.03	7.94%
1979	11,479.46	8.75%
1980	12,513.46	9.01%
1981	13,773.10	10.07%
1982	14,531.34	5.51%
1983	15,239.24	4.87%
1984	16,135.07	5.88%
1985	16,822.51	4.26%
1986	17,321.82	2.97%
1987	18,426.51	6.38%
1988	19,334.04	4.93%
1989	20,099.55	3.96%
1990	21,027.98	4.62%
1991	21,811.60	3.73%
1992	22,935.42	5.15%
1993	23,132.67	0.86%
1994	23,753.53	2.68%
1995	24,705.66	4.01%
1996	25,913.90	4.89%
1997	27,426.00	5.84%

1998	28,861.44	5.23%
1999	30,469.84	5.57%
2000	32,154.82	5.53%
2001	32,921.92	2.39%
2002	33,252.09	1.00%
2003	34,064.95	2.44%
2004	35,648.55	4.65%
2005	36,952.94	3.66%

APPENDIX I

Additional Information Regarding Projection Pursuit Regression (PPR) Technique

The PPR technique begins with the overall mean of the response variable and the initial differences between each observation of the response variable and its overall mean. The iterative technique first proceeds by determining an optimal linear combination of the predictor variables from the experience data, which is called a projection, and then determining a function of this projection that minimizes the sum of the weighted squared errors between these initial differences and the value of the function of the projection of predictor variables for each observation in the experience data. This function is called a ridge function, and its shape is unconstrained except that it must be continuous. The residual differences between the initial differences and the ridge function are then calculated, and another projection and corresponding ridge function are determined to minimize the sum of the weighted squared errors between the residuals and the new ridge function values. This process is repeated until the next ridge function fails to improve the fit enough to statistically justify adding it to the model.

Projection pursuit regression has been shown to be an effective tool for analyzing complex data, such as the mortality experience data contributed for this study. It provides a model of the response variable that takes into account all of the predictor variables and their interactions at the same time, and it does not impose any constraints on the form of the relationship between the predictor variables and the response variable.

For our study, we modeled the ultimate duration data separately from the select period data. We defined the ultimate durations to be at or beyond the earlier of duration 26 or attained age 90, except that durations 1 and 2 are always considered to be in the select period. Smoker status was not available at the ultimate durations, so the predictor variables in this model were attained age, gender and face amount band. For the models of A/E ratios versus the 2001 VBT, we weighted the observations by the expected claims on the 2001 VBT basis. For the models of mortality values, we weighted the observations by the exposures divided by the 2001 VBT mortality rate. These weights were determined so the resulting PPR model would approximate the maximum likelihood fit to the observed data. We decided to group all face amounts of $25,000 and higher into one band when we found the models were generating anomalous results at the higher face amount bands. With the ultimate duration face amounts grouped into just three bands (under $10,000, $10,000-$24,999, and $25,000+), the PPR models were reasonably satisfactory and very similar to the results of our Whittaker-Henderson graduation. For the select period data, the predictor variables we used were attained age, duration, gender, smoker status and face amount band.

Age Last Birthday ALGORITHM
2008 VBT
Building ALB Tables

1.   **Naming Convention**.

    The following method is used to identify the 64 specific select and ultimate tables within this memo.

    a. Template.   2008 VBT (Sex Relative Risk Ratio) Smoking Type Basis.
    b. Sex.
       i.   M.   Male.
       ii.   F.   Female.
    c. Relative Risk Ratio (RRR).
       i.   160:   160% RRR.
       ii.   150:   150% RRR.
       iii.   140:   140% RRR.
       iv.   130:   130% RRR.
       v.   120:   120% RRR.
       vi.   110:   110% RRR.
       vii.   100:   100% RRR.
       viii. 90:   90% RRR.
       ix.   80:   80% RRR.
       x.   70:   70% RRR.
       xi.   150:   150% RRR (Smoker).
       xii.   125:   125% RRR (Smoker).
       xiii. 100:   100% RRR (Smoker).
       xiv. 75:   75% RRR (Smoker).
       xv.   LU.   Limited Underwriting Table.
       xvi. PT.   Primary Tables.
    d. Smoking.
       i.   NS.   Non-smoker.
       ii.   SM.   Smoker.
    e. Type.
       i.   S&U. Select & ultimate.
    f. Basis.
       i.   ANB. Age nearest birthday.
       ii.   ALB. Age last birthday.
    g. Example. 2008 VBT (M160) NS U ALB is the male non-smoker table based on an RRR of 160%. This table is just the ultimate portion of the table and is age last birthday for the primary underwriting tables. 2008 VBT (MLU) NS S&U ANB is the select and ultimate portion of the male non-smoker limited underwriting table and is age nearest birthday.

h. Groups of tables. When an item is not identified, all versions of that item are included. For example, 2008 VBT (M) S&U would include all of the select & ultimate tables for males, including non-smoker, smoker, age nearest birthday and age last birthday, primary underwriting and limited underwriting.

2. **Provided tables**.

The starting point for building the age last birthday tables was the respective age nearest birthday table. For example, to determine the 2008 VBT (M100) NS S&U ALB table, the starting point was the 2008 VBT (M100) NS S&U ANB table. Separate ultimate tables were not developed, but can be extracted from the ultimate column of the select and ultimate tables.

3. **2008 VBT S&U ALB**.

Values for these tables are calculated according to the following formulas. The mortality rates per 1000 lives are rounded to two decimal places. Select period values for all issue ages are developed from age nearest birthday rates that are in the same duration. For issue age 90, approximate issue age 91 ANB rates for durations 1 and 2 were created by assuming constant 3rd differences from the issue ages 87-90. Duration 3+ rates are on an ultimate period basis.

a. Select period rates for all issue ages.

$$q\frac{ALB}{[x]+t} = \left\{ \frac{q\frac{ANB}{[x]+t} + \left[\left(1 - q\frac{ANB}{[x]+t}\right) \times q\frac{ANB}{[x+1]+t}\right]}{2 - q\frac{ANB}{[x]+t}} \right\}$$

b. Issue age 91 ANB rate (used to calculate issue age 90 ALB rate only) for durations 1 and 2.

$$q^{ANB}_{\{91\}+t} = 4 * q^{ANB}_{\{90\}+t} - 6 * q^{ANB}_{\{89\}+t} + 4 * q^{ANB}_{\{88\}+t} - 1 * q^{ANB}_{\{87\}+t}$$

c. Other ultimate rates.

$$q\frac{ALB}{x+t} = \left\{ \frac{q\frac{ANB}{x+t} + \left[\left(1 - q\frac{ANB}{x+t}\right) \times q\frac{ANB}{x+t+1}\right]}{2 - q\frac{ANB}{x+t}} \right\}$$

d. Composite rates for young ages. All rates for attained ages 17 and younger are on a composite smoking basis. Smoker and non-smoker rates are the same. Rates for issue ages 10-17, durations 1-7 and attained ages under 17 are set on a select and ultimate basis. The others are set at the ultimate rate calculated from issue age 0 rates.

The calculation of the attained age 17 select and ultimate ALB rates used a composite issue age 18 ANB rate. This age 18 ANB rate was extrapolated from attained ages 15-17 by assuming a constant 2nd difference at each duration. This ensured that the attained age 17 rates remained on a composite basis.

Age 0 ALB rates were set at 87.67% and 84.37% of age 0 ANB rates for females and males, respectively. This was based on an analysis of 2003 population age 0 rates. It was assumed that insurance coverage begins after 15 days and that 50% of issues would occur at age 15 days. The other 50% of issues occurred evenly throughout the remainder of the first year.

4. **Ultimate Tables**.

Separate ultimate versions of the tables were not developed, but can be extracted from the ultimate column of the respective select and ultimate tables.

**Analysis of 2002-04 ILEC Data
Using 2008 Primary Table**

(See Section VII of this report for Details)

	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount
Overall	62,605	106.8%	98.8%
		Gender	
Female	17,094	104.0%	97.5%
Male	45,511	107.9%	98.8%
		Smoking Status	
Non-Smoker	48,738	107.1%	98.5%
Smoker	13,867	106.0%	100.6%
		Female by Smoking Status	
Non-Smoker	13,530	104.3%	96.8%
Smoker	3,564	103.1%	101.3%
		Male by Smoking Status	
Non-Smoker	35,208	108.2%	99.0%
Smoker	10,303	107.0%	99.3%

Issue Age Summary

	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount
Female Non-Smoker			
0-17*	196	89.5%	93.8%
18-24	311	85.7%	94.4%
25-69	10,440	105.1%	97.4%
70+	3,090	101.7%	95.1%
Female Smoker			
0-17*	196	89.5%	93.8%
18-24	77	98.1%	92.5%
25-69	3,066	105.0%	103.8%
70+	498	92.7%	89.1%
Male Non-Smoker			
0-17*	499	97.4%	94.9%
18-24	747	110.5%	98.9%
25-69	32,171	108.5%	99.5%
70+	3,037	104.9%	92.9%
Male Smoker			
0-17*	499	97.4%	94.9%
18-24	219	113.2%	96.2%
25-69	9,803	108.0%	101.7%
70+	500	90.5%	74.3%

*Non-smoker + Smoker

Issue Age

	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount
Female Non-Smoker			
25-29	621	100.8%	103.3%
30-34	1,135	105.4%	93.6%
35-39	1,402	101.3%	93.0%
40-49	2,813	107.6%	98.4%
50-59	2,202	106.5%	102.5%
60-69	2,267	104.2%	94.7%
70-79	2,670	103.4%	100.7%
80+	420	91.7%	76.9%
Female Smoker			
25-29	141	109.6%	97.3%
30-34	260	99.6%	90.5%
35-39	446	115.0%	108.2%
40-49	866	99.5%	99.7%
50-59	704	101.2%	105.6%
60-69	649	112.7%	108.5%
70-79	465	96.6%	91.6%
80+	33	59.4%	66.9%
Male Non-Smoker			
25-29	1,373	102.0%	93.0%
30-34	2,597	110.4%	98.2%
35-39	3,446	106.4%	96.8%
40-49	8,410	109.5%	100.3%
50-59	9,508	109.1%	100.9%
60-69	6,837	108.2%	99.6%
70-79	2,850	106.4%	94.3%
80+	187	85.8%	82.9%
Male Smoker			
25-29	405	104.4%	106.0%
30-34	879	109.8%	106.0%
35-39	1,299	109.3%	97.9%
40-49	3,180	109.5%	98.4%
50-59	2,917	113.0%	109.9%
60-69	1,123	92.5%	92.3%
70-79	475	93.2%	80.6%
80+	25	58.6%	35.7%

Duration

	Actual Deaths by Policy	A/E Ratio by Policy	A/E Ratio by Amount
	Female Non-Smoker		
1	218	84.7%	75.0%
2	347	99.2%	91.7%
3	439	109.3%	100.4%
4-5	1,148	101.8%	95.2%
6-10	2,587	97.9%	92.6%
11-15	4,802	108.4%	100.2%
16-20	3,588	105.5%	103.4%
21-25	401	110.2%	115.9%
	Female Smoker		
1	45	99.5%	76.0%
2	69	115.2%	121.2%
3	70	102.6%	88.5%
4-5	202	108.4%	125.6%
6-10	470	101.8%	94.1%
11-15	1,263	107.3%	107.8%
16-20	1,304	100.4%	95.5%
21-25	141	88.7%	87.8%
	Male Non-Smoker		
1	623	99.0%	86.1%
2	922	107.4%	92.3%
3	1,056	112.9%	99.9%
4-5	2,814	104.9%	96.5%
6-10	5,714	101.8%	94.9%
11-15	10,785	112.4%	103.5%
16-20	11,720	109.8%	105.5%
21-25	1,574	100.3%	95.5%
	Male Smoker		
1	159	100.8%	81.8%
2	203	101.4%	102.3%
3	246	114.4%	115.3%
4-5	572	103.7%	97.9%
6-10	1,149	99.8%	93.7%
11-15	3,039	115.1%	106.8%
16-20	4,186	106.1%	101.8%
21-25	749	97.7%	91.4%