High Face Amount Mortality Study

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1. BACKGROUND AND ACKNOWLEDGMENTS

1.1. Background

Milliman was hired by the Society of Actuaries (SOA) to provide high face amount mortality data from a mortality study Milliman recently completed. High face amounts are defined as $1 million and higher. The information in the following tables was taken or derived from the data collected and used to produce the Milliman Industry Mortality Study and Analysis (MIMSA). Twenty-nine companies supplied mortality experience data over 10 study years (2000-09) for MIMSA; however, not all companies supplied data for all years. No adjustments were made to the data for incurred but not reported (IBNR) claims. Data was collected in 2010 so 2009 experience may have more IBNR claims than the other study years.

In MIMSA, a request was made to have companies identify their business written under a table shave program. Only a few companies provided this data so it was not included in the MIMSA data to protect the identity of the companies providing it. Other than this, all data provided was used for MIMSA and is, therefore, used in this report. This report is based on fully underwritten standard ordinary business; therefore, substandard, term conversion, simplified issue, guaranteed issue and not underwritten business are excluded from the data used in this report. Fully underwritten standard ordinary business includes business with medical, paramedical and nonmedical underwriting. All other MIMSA data was used, including post-level term business.

Mortality exposure used in this high face amount study consisted of $7.6 trillion of face amount and $14.8 billion in paid claims. The standard ordinary portion of the MIMSA study across all face amounts covered was $23.4 trillion of mortality exposure and $53.7 billion in paid claims. Thus, the high face amount study consists of 32.6 percent of the total MIMSA standard ordinary mortality exposure and 28.6 percent of total paid claims.

Exposure by policy included in this high face amount study was 4.9 million policies and approximately 7,700 policy death claims. The standard ordinary portion of the MIMSA study across all policies included 144 million policies and 1.3 million policy death claims. Thus, the high face amount study consists of 3.4 percent of the total MIMSA standard ordinary exposure by number of policies and 0.6 percent by number of policy death claims. The exposures and number of claims for each specific item being studied may vary.

When references are made to expected mortality, the SOA 2008 Valuation Basic Table (2008 VBT) sex and smoker distinct primary tables are used. The age last or age nearest birthday distinction was made based on the underlying data of each participating company.

To understand the results and draw some conclusions when comparing the actual claims to the expected, it is useful to know some details on the creation of the 2008 VBT. The full explanation of 2008 VBT development can be found on the Society of Actuaries website at http://www.soa.org/research/experience-study/ind-life/valuation/2008-vbt-report-tables.aspx. Some specific highlights include:

- The table used actual experience from SOA's Individual Life Experience Committee's (ILEC) 2002-04 Intercompany Study (2002-04 Study or 2002-04 ILEC) up until age 85.

- At the higher ages, the actual mortality was graded into a population table. The Social Security Administration (SSA) data (based on Medicare death records from 2002, projected to 2003) was used for this.

- The graduation to SSA mortality began at age 85 and ended at age 107 for males and ran from 98 to 105 for females. In addition to this, population mortality was graduated between the SSA rates beginning at age 96 and 0.45 for ages 110 and above.

- The select period used was the earlier of 25 years or attained age 90, subject to a minimum select period of two years, regardless of issue age.

1.2. Acknowledgments

2. EXECUTIVE SUMMARY

2.1. Mortality Results

The overall actual-to-expected mortality ratio for the high face amount policies was 82 percent by face amount and 84 percent by policy count. Expected was based on the 2008 VBT primary tables.

There was not a smooth progression of A/E ratios by study year, even when the data for the companies that did not participate in all years were removed. Results by both count and amount were worst in 2008 (91 percent A/E ratio by amount) and 2005 (89 percent A/E ratio by amount).

By issue year, the average face amount of the high face amount business was highest in the 1980-89 and 2000-09 issue year groups ($1.59 million) but lower in 1990-99 ($1.51 million). The average face was lowest in the issue years prior to 1980, as would be expected.

The results by policy size show a marked drop in exposure once the contract size exceeds $2.5 million. Policy sizes down to $100,000 were studied. The A/E ratios generally decreased by both amount and count as the policy size increased. However, it was found that on term and variable/equity index policies, A/E ratios actually increased beginning at $1 million. This was due to nonmedical causes of death.

Almost 85 percent of the exposure by issue age was between 30 and 59. The average face amount generally increased with increasing issue age; the highest average face amount was $3.16 million at issue ages 70-79. Except for issue ages 0-29, the A/E ratios by amount decreased as the issue age group increased. The use of population mortality as the expected mortality at the older ages in the 2008 VBT may be the reason for the low A/E ratios of 55 percent and 65 percent by face and count, respectively, at age 80 and above.

The results by duration showed a spike in A/E ratio in duration 3. The A/E ratio was 93 percent by face amount and 97 percent by policy count.

While there is substantially more male (78 percent) than female (22 percent) exposure by face amount, as would be expected, the average policy size was very similar and actually higher for females ($1.57 million for males and $1.58 million for females). Males have a lower A/E ratio than females, but this may be due to the fit of the underlying table rather than indicating a difference in mortality results between males and females.

Nonsmokers have substantially more of the exposure (95 percent) than smokers (4 percent) but have a slightly lower average face amount ($1.57 million) than smokers ($1.58 million). Similar to the gender results, the exposure relationship followed expectations while the average face amount relationship was unexpected.

By product type, term had the largest exposure (56 percent by face amount). Term and variable/equity indexed products had the highest A/E ratios at 91 percent by face amount for both product types. Other and whole life had the best A/E ratios by amount at 62 percent and 74 percent, respectively.

The analysis by risk class was divided into two structures, 3:2 and 2:1. The number to the left of the colon represents how many nonsmoker risk classes and the number to the right of the colon represents how many smoker risk classes the product had. All combinations were placed into one of these two structures for analysis purposes. One item in the risk class results that stood out was the average face amount. Typically one would expect the best risk classes to have the highest average face amounts. However, the results showed that for all multiple class structures (smoker and nonsmoker), the standard class had the highest average size. One reason may be that the wealthy can afford the level of coverage they desire and are not constrained by their risk class rates. Another interesting observation regarding average size is that the 3:2 structure had a lower average size ($1.52 million) than the 2:1 structure ($1.72 million). This is surprising in that the 3:2 structure business was typically written more recently where we would expect the average sizes to be higher.

The A/E ratios by preferred class were generally lower the better the class, as would be expected. By both face amount and policy count, the A/E ratio for the one-smoker risk class was lower than both of the A/E ratios for the two-smoker risk classes. One would have expected this ratio to fall between those of the two-smoker class. This is likely due to a different mix of companies and experience in each of these groupings.

By issue age and duration, the highest A/E ratio was at issue ages 40-49, duration 1 (142 percent) and the lowest A/E ratio was at issue age 80+, duration 3 (42 percent). In general, the other lower A/E ratios were at the younger and older issue ages, durations 1-2.

The gender, smoking status and risk class results mostly mimicked the risk class findings. In the 3:2 structure, the male best preferred nonsmoker class and the two-smoker classes had higher A/E ratios by face amount than the females. This was the opposite of the male/female results in general and in total.

2.2. Cause of Death Results

Cause of death was studied by policy count and the results were determined by dividing the number of claims for a specific cause by all the total number of claims for all causes. Overall, cancer (37.1 percent) was the leading cause of death and cardiovascular disease (21.8 percent) was the second leading cause of death. The next most common causes were other (non-motor vehicle-related) accidents (6.9 percent), suicide (6.1 percent) and respiratory (6.1 percent). These results differ from the overall MIMSA results, which looked at all policy sizes. Here, the top five causes of death were cardiovascular, cancer, respiratory, other, and mental and nervous. The high net worth policies had less cardiovascular disease-related claims and more suicides and other accidental deaths.

Some possible reasons for the differences between the entire MIMSA study and the $1 million and higher policies may be:
- Higher face amounts receive more scrutiny during the underwriting process and the life insurance industry is better at underwriting for cardiovascular disease than cancer.
- Those who can afford the higher face amount policies live riskier lifestyles than the general population and therefore have more accidental deaths.
- Those who can afford the higher face amount policies live more stressful lives and commit suicide more frequently.
- Those who intend to commit suicide may buy as high an amount as permitted.

The following are a few other observations:
- Nonmedical causes made up a higher percentage of claims in the more recent issue years. This is not surprising as underwriting screens for current medical conditions thus lowering the possibility of early duration claims due to medical reasons.
- The percentage of Nonmedical causes of death was greater for the high face amount policies than for those under $1 million.
- Suicide rates increased as policy size increased.
- Nonmedical causes of death were more common at the younger ages and Medical claims were more common at the older ages, which is not surprising. The crossover point occurs in the late 20s to early 30s for the general population and approximately 10 years earlier than for the high face amount insured group. Underwriting likely delays this crossover for the insured population.
- Females had higher Medical causes of death than males, while males had higher Nonmedical causes than females. Cancer was still the leading cause for both genders.
- Smokers had higher percentages of cancer, cardiovascular and respiratory claims than nonsmokers.
- By product type, Nonmedical causes were higher for term and variable/equity index. More specifically, other accidents were significantly higher on both term and variable/equity index than the other lines of business.
- By risk class, other accidents and suicides were higher for the better risk classes, likely due to underwriting pushing those with more medical risks to the other risk classes.

3. DISCLAIMERS

3.1. Data Reliance

In performing the analysis, Milliman relied on data and information provided by the participants to a study it conducted. Milliman tested key elements for general reasonableness and consistency, and worked with each participant to resolve any data issues that were found. As a final step in the data review, Milliman provided a summary report to the participant and requested that the participant approve the data to be used in the study. Beyond this, Milliman did not perform any additional reviews of the data or detailed audits. Milliman has, therefore, relied upon each participant to provide accurate and complete data. If the underlying data or other information provided by the participant to Milliman was inaccurate or incomplete, then the results of the analysis will likewise be inaccurate or incomplete.

3.2. Report Usage

This report is intended solely for educational purposes and presents information of a general nature. It is not intended to guide or determine any specific individual situation and persons should consult qualified professionals before taking specific actions. Neither the authors, the Project Oversight Group, their employers nor the Society of Actuaries shall have any responsibility or liability to any person or entity with respect to damages alleged to have been caused directly or indirectly by the content or the use/misuse of this report.

3.3. Limitations

In going through the report, please keep in mind that while this study has a large amount of exposure, the results may not be representative of the full industry. Also, the results may not be applicable to certain situations for a variety of reasons. Finally, please remember that these are historical results and the past may not be reflective of what will happen in the future.

4. REPORT FORMAT

The report is primarily split into two broad sections—actual-to-expected mortality and cause of death.

Section 5, the first of the two key sections, focuses on the exposure and actual-to-expected mortality ratios on nine single-decrement variables. These variables are:

- Study year
- Issue year
- Face amount
- Issue age
- Duration

- Gender
- Smoking class
- Product type
- Risk class

It also contains information on two multiple-decrement variables:

- Issue age and duration
- Gender, smoking status and risk class

The exposures and A/E ratios are presented based on both face amount and policy count. For this section, blue table headings and chart colors are used when using face amount as the exposure measure. Green is used when policy count is the exposure measure. Relationships among the variables, exposures and A/E ratios are noted throughout the report.

Section 6, the second of the key sections of this report, presents information based on cause of death. The number of claims for each cause and the percentage of claims for each cause relative to the total claims from all known causes are shown for each variable. For this analysis, there are eight single-decrement variables. They are:

- Study year
- Issue year
- Face amount
- Attained age

- Gender
- Smoking class
- Product type
- Risk class

The top causes of death are separated by Medical and Nonmedical. The Medical charts are shown in shades of red while Nonmedical causes are illustrated in shades of purple.

Section 7 of the report contains the conclusions.

Appendix A contains the cause of death details by policy count for readers interested in those values.

Appendix B shows additional investigation into the exposure and A/E ratios by face amount for gender, risk class and smoking status.

5. MORTALITY EXPERIENCE

5.1. Study Year

Experience by Face Amount

Figure 5.1.1 shows the mortality experience by face amount for study years from 2000 through 2009. It contains all MIMSA standard ordinary business with face amounts of $1 million and higher.

Figure 5.1.1. Study Year: Mortality Results by Amount
Policy Size ≥ $1M

Study Year	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
2000	199,327	1.52	274	354	77
2001	289,943	1.55	442	554	80
2002	361,978	1.55	592	718	82
2003	419,736	1.54	667	851	78
2004	666,386	1.55	1,164	1,430	81
2005	817,719	1.55	1,601	1,800	89
2006	1,063,501	1.58	1,967	2,430	81
2007	1,238,044	1.60	2,363	2,934	81
2008	1,217,962	1.58	2,927	3,216	91
2009	1,359,762	1.58	2,831	3,784	75
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

The exposure by face amount generally increases by study year, ranging from $0.2 trillion in 2000 to $1.4 trillion in 2009. Fifty percent of the business is in 2007-09.

In MIMSA, 16 of the 29 contributing companies provided data for all study years. Figure 5.1.2 provides a comparison of exposure by face amount for the 16 companies that included exposure for all study years to all 29 participating companies.

Figure 5.1.2. Study Year: Mortality Exposure by Amount
Policy Size ≥ $1M
($Millions)
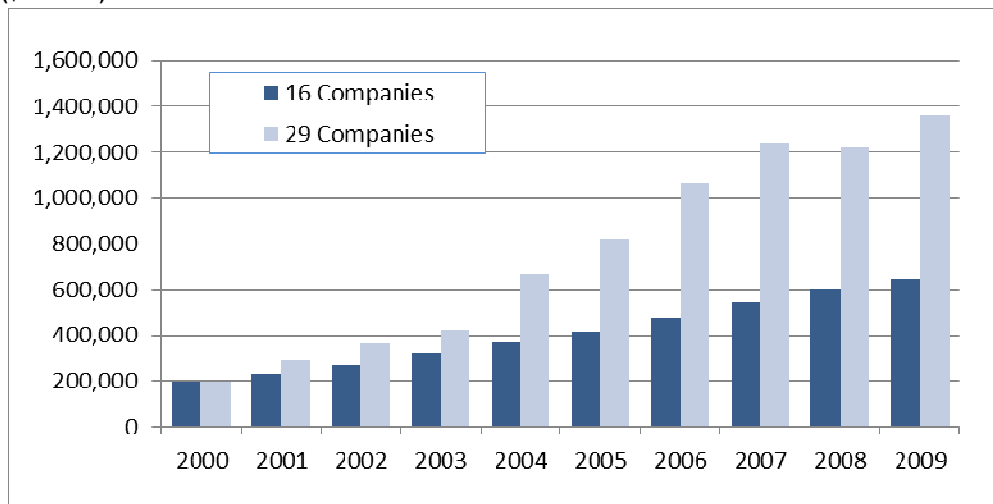
The 29-company exposure did not have as smooth a progression by study year as the 16-company exposure since the remaining 13 companies entered and left the study at different times. Because the 16 companies that provided data for all study years only covered 54 percent of the full exposure and 49 percent of the policy death claims, the following analysis will be on results for all 29 companies.

The average face amount remained relatively constant by study year but did exhibit a slight upward trend over time. This can be seen by comparing the average face amount for study years 2000-05 ($1.54 million) to the average face amount for study years 2006-09 ($1.58 million).

While 2009 had the highest *expected* amount of claims at $3.8 billion, study year 2008 had the highest amount of *actual* claims at $2.9 billion. The average actual claim was $1.92 million, and the average expected claim amount was $1.97 million.

The overall A/E ratio was 82 percent. The A/E ratios by study year were relatively flat, ranging from 77-82 percent in most years. The two exceptions were policy year 2005, which was 89 percent and policy year 2008, at 91 percent. On the other hand, 2009 had the best experience with 75 percent. Delayed reporting of claims and improvements in mortality and underwriting may have led to this better early duration mortality.

Experience by Policy Count

Figure 5.1.3 shows the mortality experience by study year relative to policy count. It covers the same study years and face amounts as Figure 5.1.1.

Figure 5.1.3. Study Year: Mortality Results by Policy Count
Policy Size ≥ $1M

Study Year	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
2000	131,425	174	208	84
2001	187,475	273	318	86
2002	233,378	355	406	87
2003	272,235	395	474	83
2004	430,341	654	785	83
2005	528,307	876	970	90
2006	672,394	1,037	1,246	83
2007	774,584	1,215	1,453	84
2008	771,060	1,367	1,540	89
2009	858,477	1,359	1,759	77
Total	**4,859,675**	**7,705**	**9,158**	**84**

Of the 4.9 million policies, only 2.7 percent were from study year 2000. The percentages increased with each subsequent study year, with 2009 ultimately making up 17.7 percent of exposure count. This pattern is similar to that by amount.

Also similar to the results by amount, 2009 had the highest *expected* number of claims (1,759) and study year 2008 had the highest *actual* number of claims (1,367). The total number of claims was 7,705.

The average A/E ratio was 84 percent. This is higher than the A/E ratio by amount, which indicates the average claim amount is slightly below the overall average face amount and the higher face amounts generally have better experience.

Five of the 10 study years had A/E ratios that fell in the narrow range of 83-84 percent. Study years 2005 (90 percent) and 2008 (89 percent) had the highest A/E ratios. Study year 2009 had the lowest at 77 percent, again possibly due to the delayed reporting of claims.

Figure 5.1.4 shows the A/E ratios both by face amount and policy count.

Figure 5.1.4. Study Year: A/E Ratios
Policy Size ≥ $1M
(%)
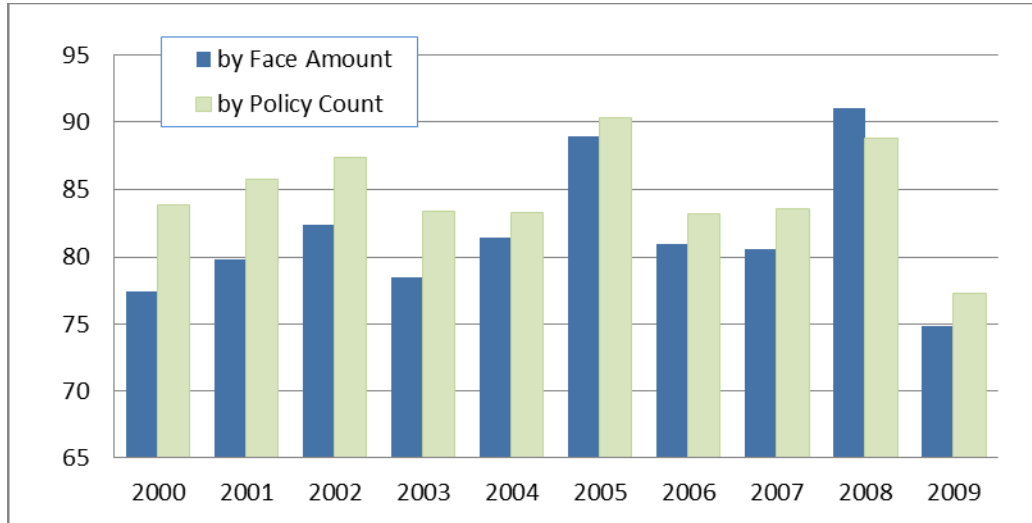
Overall, the A/E ratios by policy count were slightly higher than, but followed a similar pattern to, those by face amount. As already mentioned, 2005 and 2008 had the highest A/E ratios, both by face amount and policy count. Study year 2008 was the only situation where the A/E ratio was higher by face amount than by policy count, meaning average claims were higher than the overall average face amount for that study year.

5.2. Issue Year

Experience by Face Amount

Figure 5.2.1 shows the mortality experience by issue year relative to exposure by face amount. This table covers contracts with face amounts of $1 million plus in four issue year groups—pre-1980 issues, and issues in the 1980s, 1990s and 2000s.

Figure 5.2.1. Issue Year: Mortality Results by Amount
Policy Size ≥ $1M

Issue Year	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
<1980	4,202	1.43	73	155	47
1980-89	164,623	1.59	1,722	2,033	85
1990-99	1,865,831	1.51	5,991	7,009	85
2000-09	5,599,701	1.59	7,043	8,872	79
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

Figure 5.2.2 contains the exposure by issue year group.

Figure 5.2.2. Issue Year: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
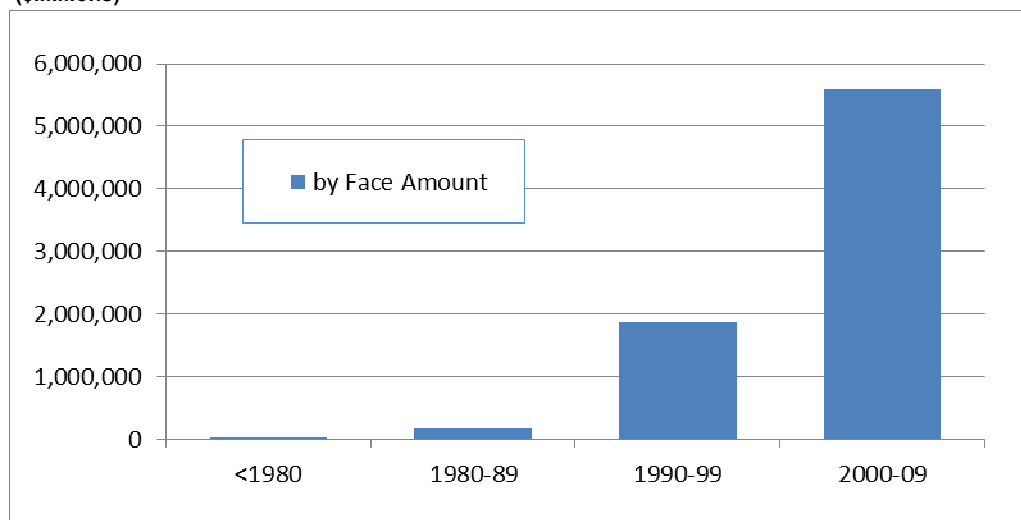
Of the $7.6 trillion of face exposure, $5.6 trillion, or 73 percent, was from issue years 2000 through 2009. This would be expected due to earlier issue year contracts lapsing, surrendering, maturing or terminating due to claim. Only contracts that were in force during the study years (2000-09) were included in this data.

The average face amount varied from $1.43 million in the pre-1980s data to $1.59 million in the 1980s and 2000s. The '90s had a slightly lower average for the high face amount contracts at $1.51 million.

For this analysis, the A/E ratio was lowest for the pre-1980 issues at 47 percent. This is substantially lower than the MIMSA findings (over all policy sizes) for pre-1980 issues and may be due to the limited exposure. As will be illustrated in the duration analysis to follow, the A/E ratios for durations 20 years and up were lower than the overall

results. The A/E mortality ratio was 85 percent for the '80s and '90s. MIMSA results show slightly higher results for these periods. The 2000s' A/E ratio of 79 percent in this report was lower than the previous two decades. This could be a result of outstanding claims that have yet to be resolved, tightening of underwriting and/or a larger proportion of early duration experience. Early duration experience is typically better than that reflected in the underlying table due to good underwriting and the smoothing out of the effects of the contestable period in duration 3 leading to higher tabular mortality in the early durations. Directionally, these results are similar to the overall MIMSA results.

Experience by Policy Count

Figure 5.2.3 shows the mortality experience by issue year relative to policy count. It covers the same issue year groupings and face amounts as Figure 5.2.1.

Figure 5.2.3. Issue Year: Mortality Results by Policy Count
Policy Size ≥ $1M

Issue Year	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
<1980	2,943	53	101	52
1980-89	103,599	903	1,051	86
1990-99	1,232,805	3,485	4,007	87
2000-09	3,520,329	3,264	3,998	82
Total	**4,859,675**	**7,705**	**9,158**	**84**

Of the 4.9 million of policy count, 72 percent, or 3.5 million policies, were in the 2000s.

Figure 5.2.4 shows the A/E ratios both by face amount and policy count.

Figure 5.2.4. Issue Year: A/E Ratios
Policy Size ≥ $1M
(%)
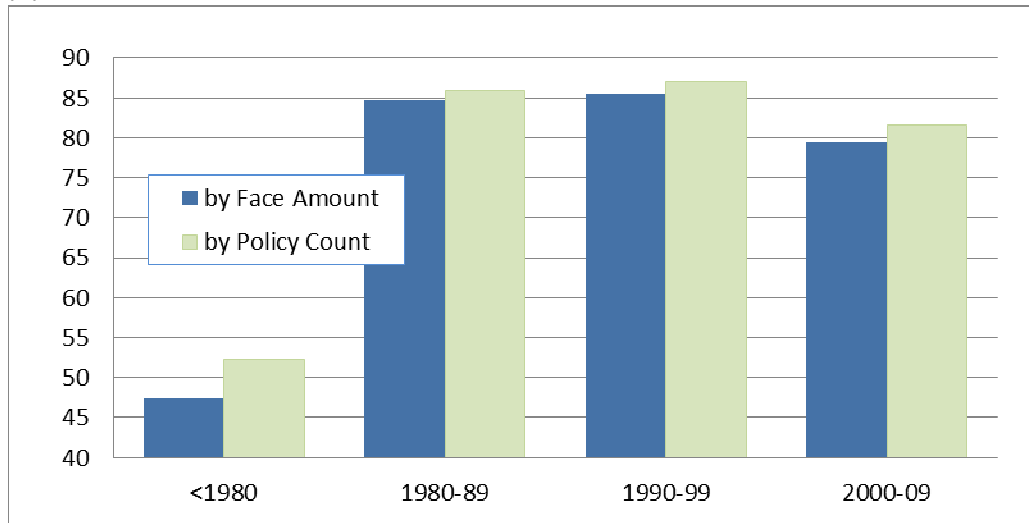
The A/E ratios by policy count were higher than, but follow a similar pattern to, those by face amount.

5.3. Policy Size

Experience by Face Amount

Figure 5.3.1 shows the mortality experience by policy size relative to the exposure by face amount. This table covers all policy sizes including those down to $100,000. There are seven size groupings—three below the $1 million level and four above.

Figure 5.3.1. Policy Size: Mortality Results by Amount
Policy Size ≥ $100K

Policy Size	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
$100K To <$250K	4,226,043	0.13	10,942	11,716	93
$250K To <$500K	4,668,454	0.29	7,294	8,499	86
$500K To <$1M	4,946,488	0.56	6,728	8,043	84
$1M To <$2.5M	5,241,775	1.20	8,026	9,527	84
$2.5M To <$5M	1,039,472	3.14	2,680	3,237	83
$5M To <$10M	730,796	5.70	2,418	2,933	82
$10M+	622,315	14.09	1,705	2,373	72
Total	**21,475,343**	**0.34**	**39,793**	**46,327**	**86**

Figure 5.3.2 shows the exposure by face amount. The black bars ($100K to <$1M) represent data only shown in the sections of this report referring to policy size.

Figure 5.3.2. Policy Size: Exposure by Face Amount
Policy Size ≥ $100K
($Millions)
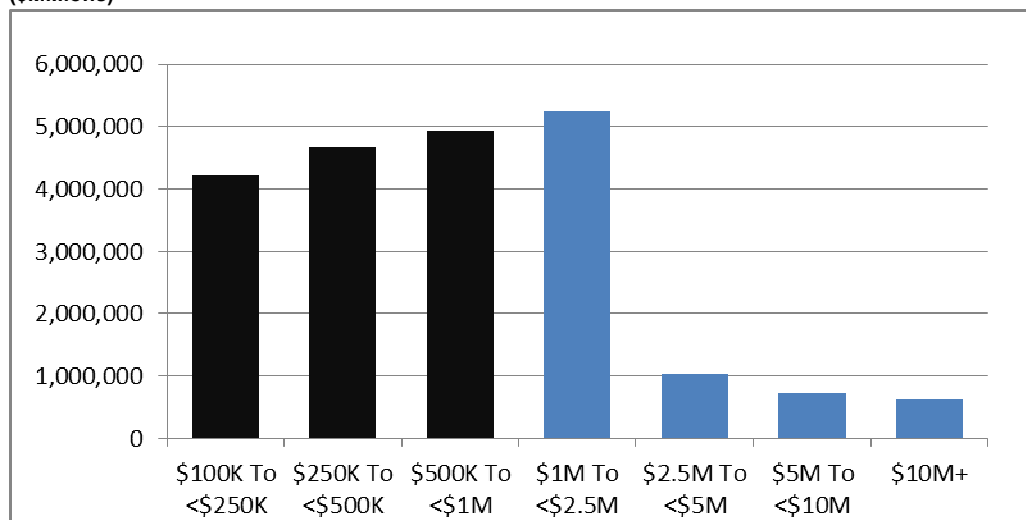
$13.8 trillion (64.5 percent) of the policy size exposure is less than the $1 million threshold. Each of the first four lower groupings contain 20-25 percent of the exposure while each of the three higher groupings make up only 3-5 percent. The chart above shows the magnitude of the marked exposure drop at $2.5 million.

The average A/E ratio by face amount was 86 percent when including face amounts of $100,000 and higher but dropped to 82 percent when analyzing face amounts of $1 million and higher. Several possible explanations for this difference include:

- At these higher face amounts, underwriting is typically stricter.
- The wealthier insureds typically have access to better health care.
- If more policies qualify for the best preferred risk classes at the higher face amounts than at the lower face amounts, the higher face amount A/E ratio should be lower. Further investigation was done to see if this was driving the lower A/E ratios. This showed that the high face amount policies did not have more lives qualifying for the better preferred classes. Appendix B provides the results of this additional investigation.
- Random fluctuation in distributions (e.g., by age, gender, etc.) may also cause this difference.

The $1 million to $2.5 million group would have been expected to have a lower A/E ratio than the $500,000 to $1 million group, but the two groups had the same A/E ratio. One driver is likely the fact that a larger percentage of face amount exposure for the $500,000 to $1 million group was found in the best risk class than was found for the $1 million to $2.5 million group, as is shown in Appendix B.

For the bands studied for policies of above $1 million, there was a nominal decrease in A/E ratios, except in the $10 million and higher band, where there was a more substantial decrease from the lower band.

It should be noted that MIMSA found that for certain products (term and variable/equity indexed life), experience worsens above the $1 million level. This poor experience was due to large early duration claims with Nonmedical causes of death.

Experience by Policy Count

Figure 5.3.3 shows the mortality experience by policy size relative to policy count. It covers the same policy size groupings as Figure 5.3.1.

Figure 5.3.3. Policy Size: Mortality Results by Policy Count

Policy Size	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
$100K To <$250K	32,956,879	85,533	90,661	94
$250K To <$500K	16,181,900	24,281	28,190	86
$500K To <$1M	8,910,874	11,590	13,813	84
$1M To <$2.5M	4,356,311	6,337	7,485	85
$2.5M To <$5M	331,030	826	1,004	82
$5M To <$10M	128,157	413	496	83
$10M+	44,177	129	173	75
Total	**62,909,328**	**129,109**	**141,821**	**91**

Including contract sizes down to $100,000 increased the policy count exposure nearly 13 fold to 62.9 million policies.

Figure 5.3.4 shows the A/E ratios by policy size and count. A/E ratios by face amount are shown in black and blue. A/E ratios by policy count are shown in gray and green. Black and gray ($100K to <$1M) results represent data only shown in the sections of this report referring to policy size.

Figure 5.3.4. Policy Size: A/E Ratios
Policy Size ≥ $100K
(%)
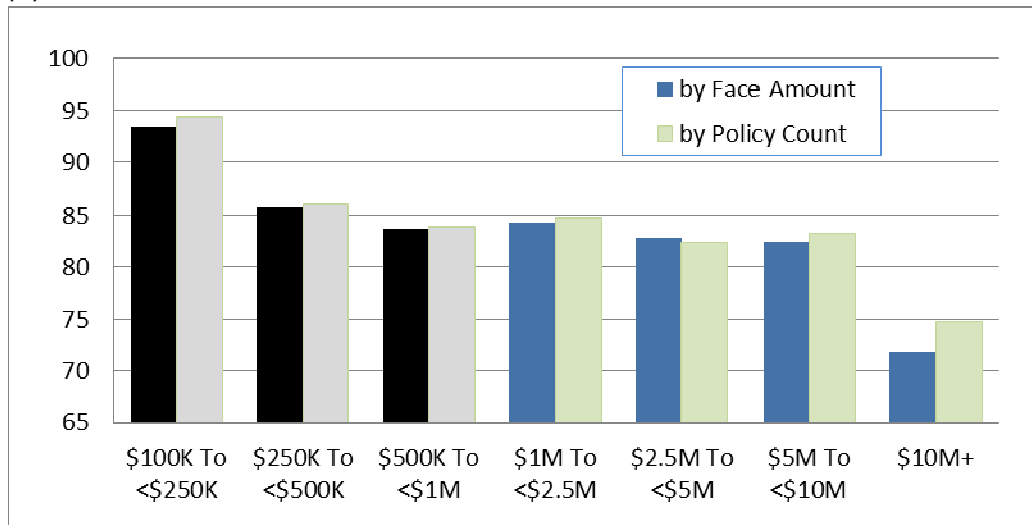
The A/E ratios by policy count were generally higher than and within 1-3 percent of those by face amount. For example, at $10 million or more, the A/E ratio by face amount (72 percent) was 3 percent lower than by policy count (75 percent). The one exception was for the $2.5 million to $5 million band where the A/E by policy count was less than that by face amount. Also, the pattern of A/E ratios by policy count was less consistent than those by face amount, rising for the $1 million to $2.5 million and the $5 million to $10 million bands.

5.4. Issue Age

Experience by Face Amount

Figure 5.4.1 shows the mortality experience by issue age relative to exposure by face amount. This table covers face amounts of $1 million and higher. Issue age groups are 0-29, then 10-year intervals (from issue age 30 through issue age 79) and 80+.

Figure 5.4.1. Issue Age: Mortality Results by Amount
Policy Size ≥ $1M

Issue Age	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
0-29	470,464	1.36	162	193	84
30-39	2,758,958	1.39	1,302	1,440	90
40-49	2,507,009	1.58	2,562	2,940	87
50-59	1,170,547	1.82	3,212	3,696	87
60-69	411,478	2.17	3,013	3,598	84
70-79	260,006	3.16	3,480	4,211	83
80+	55,896	3.14	1,099	1,991	55
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

Figure 5.4.2 shows the exposure by face amount for the issue age groups.

Figure 5.4.2. Issue Age: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
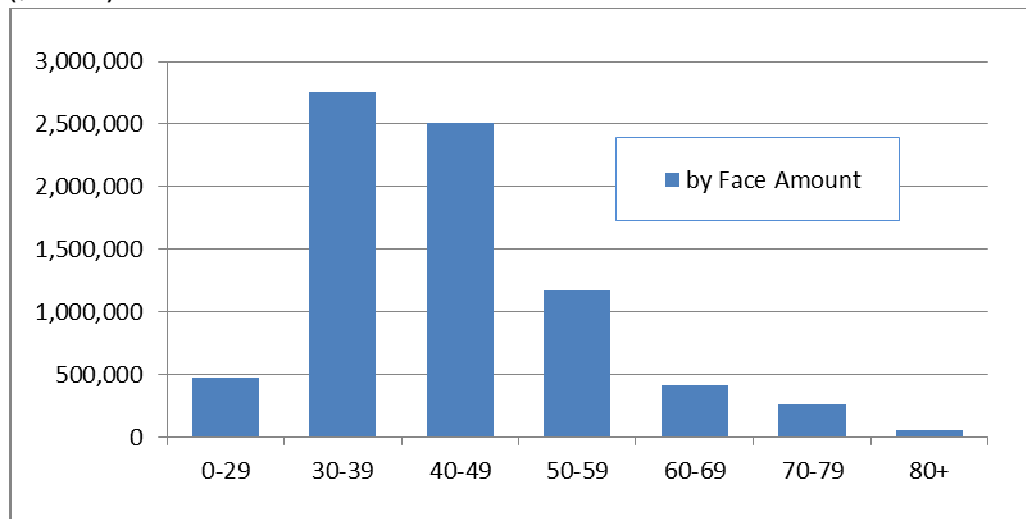
The highest exposures are found in the "working age" groups where the insurance need is the highest—to support family, cover mortgage obligations and aid in college tuition payments. These three groups, covering ages 30-59, make up $6.4 trillion and 84 percent of the exposure.

Figure 5.4.3 shows the average face amount for the issue age groups.

Figure 5.4.3. Issue Age: Average Face
Policy Size ≥ $1M
($Millions)
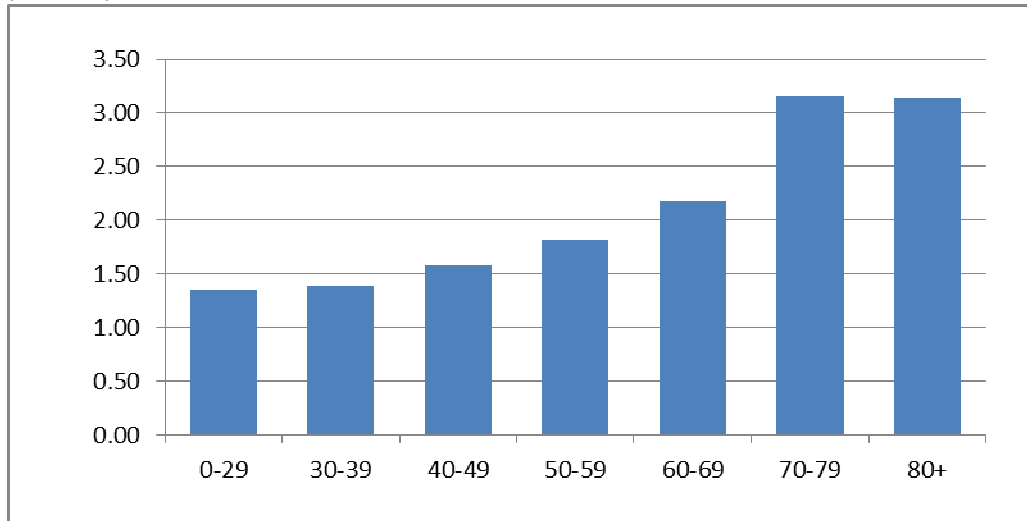
As insureds age and have higher net worth, the average face increases steadily. The average face doubles from $1.58 million in the issue age 40-49 group to $3.16 million in the issue age 70-79 group where it caps out.

All issue age groups had A/E ratios higher than the average of 82 percent, except for the issue age group 80+, which had an A/E ratio of 55 percent. At first glance and with the low exposure for the age 80+ group, this fact seems counterintuitive. The substantial difference between the actual and the expected mortality at ages 80+ is enough to offset the total of the smaller differences found in all the younger age groups. The 2008 VBT graded into SSA population mortality as described in Section 1. This population mortality may prove to be higher than the insured mortality and play a role in the low A/E ratio at age 80 and above.

Contracts issued at these older ages are becoming more common but are generally still rare as most insurance needs would have been planned for earlier in life. Insurance companies generally scrutinize these cases more thoroughly to make sure there is a financial need. Also, with health conditions often deteriorating at 80+, less individual applicants are able to qualify for coverage.

Excluding the youngest age group, the remainder of the A/E mortality ratios improved (decreased) as the issue ages increase. This may be attributable to advances in medicine and to stricter underwriting requirements at higher ages and higher face amounts.

Experience by Policy Count

Figure 5.4.4 shows the mortality experience by issue age relative to policy count. It covers the same issue age groups as Figure 5.4.1.

Figure 5.4.4. Issue Age: Mortality Results by Policy Count
Policy Size ≥ $1M

Issue Age	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
0-29	346,806	109	138	79
30-39	1,987,318	901	1,031	87
40-49	1,591,745	1,577	1,867	84
50-59	644,425	1,718	2,017	85
60-69	189,246	1,520	1,770	86
70-79	82,344	1,409	1,606	88
80+	17,791	471	728	65
Total	**4,859,675**	**7,705**	**9,158**	**84**

By count, the key working age groups (30-59) account for 4.2 million contracts and nearly 90 percent of the exposure.

Figure 5.4.5 shows the A/E ratios for the exposure measured by face amount and policy count.

Figure 5.4.5. Issue Age: A/E Ratios
Policy Size ≥ $1M
(%)
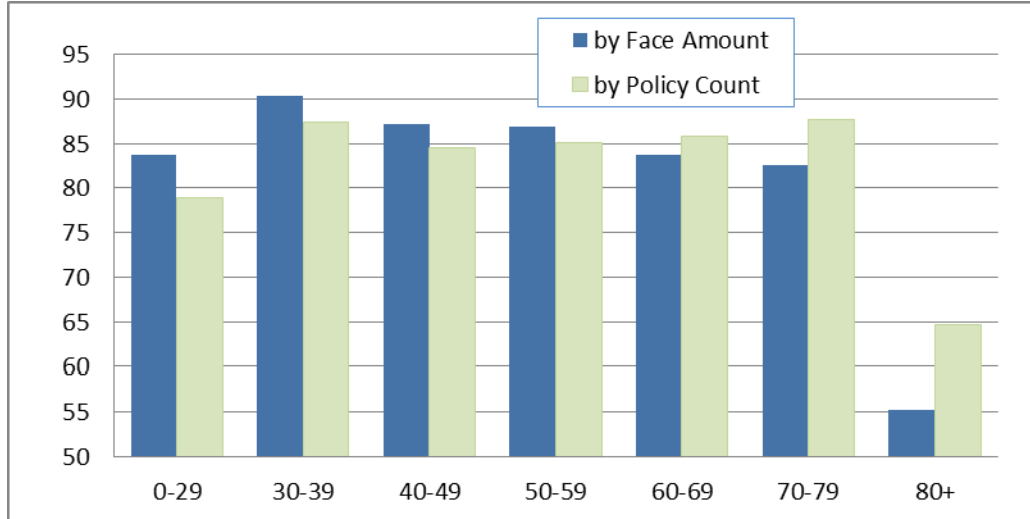
For the A/E ratios, the pattern by count was slightly different from the pattern by face amount as illustrated above. By face amount, except for issue ages 0-29, the A/E ratios between 30-39 and 80+ decrease. By policy count, the A/E ratios increase between issue ages 40-49 and 70-79. While issue ages 80+ had the lowest A/E ratios, the A/E ratio by policy count was substantially higher than that by face amount. There are no A/E ratios above 100 percent by face amount or policy count, so it seems the 2008 VBT tables are conservative for the high net worth arena.

5.5. Policy Duration

Experience by Face Amount

Figure 5.5.1 shows the mortality experience by policy duration relative to exposure by face amount. The duration groups mimic those found in the MIMSA report. This table covers the high face amount policy sizes of $1 million and greater.

Figure 5.5.1. Policy Duration: Mortality Results by Amount
Policy Size ≥ $1M

Duration	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
1	1,457,582	1.62	700	1,071	65
2	1,226,044	1.61	1,110	1,459	76
3	1,009,437	1.59	1,483	1,600	93
4-5	1,493,250	1.56	2,510	2,952	85
6-10	1,780,668	1.52	4,162	5,249	79
11-15	452,399	1.52	2,517	2,857	88
16-20	158,045	1.56	1,465	1,736	84
21-25	47,858	1.72	691	879	79
26+	9,073	1.49	190	266	72
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

Figure 5.5.2 shows the exposure by face amount with the first five years grouped into one category.

Figure 5.5.2. Policy Duration: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
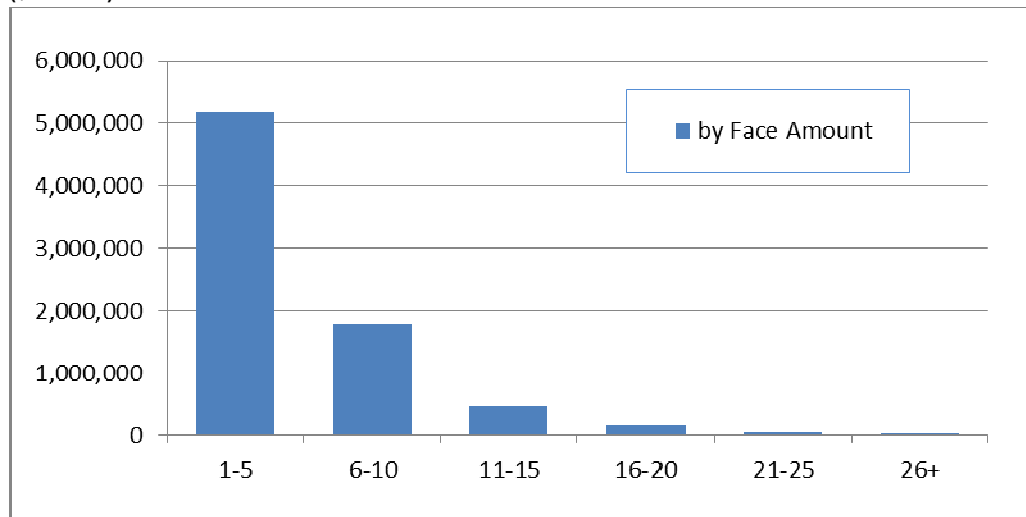
Of the $7.6 trillion face amount exposure, $7.0 trillion, or 91.3 percent, is in the first 10 policy years. Deaths, lapses and terminations reduce exposure over time. Various elements can impact the lapse and conversion rates such as interest rates, new product development, client life changes, economic factors and agent behavior.

The average face generally declines by duration as would be expected since the more recent business (with generally higher face amounts) are weighted more heavily in the earlier durations. However, there was an increase in average size for durations 16-20 and 21-25. In fact, durations 21-25 had the highest average size among the duration groups at $1.72 million.

The lowest A/E ratio was in the first policy year, which is likely due to the smoothing of the duration 3 results in the underlying table resulting in higher duration 1 and 2 rates. The highest was in year 3, which is when the contestability and suicide exclusion periods end. This spike in year 3, seen in many industry studies, was graduated out of the 2008 VBT and is one reason the spike exists in the A/E ratios at this duration in this study. The A/E ratios for durations 6-25 ranged from 79-88 percent. For durations 26+, the A/E ratio dropped to 72 percent, indicating that the later duration experience may be particularly good, the 2008 VBT may be too high at the latest durations or the select period may be longer than 25 years.

The MIMSA report suggests that the 2008 VBT may not fit recent experience in spots. These findings were validated against the SOA 2005-07 experience study. In particular, the areas MIMSA pointed out include two areas—the third and ultimate durations.

Experience by Policy Count

Figure 5.5.3 shows the mortality experience by policy duration relative to policy count and uses the same duration groups as Figure 5.5.1.

Figure 5.5.3. Policy Duration: Mortality Results by Policy Count
Policy Size ≥ $1M

Duration	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
1	902,371	321	458	70
2	762,488	466	617	75
3	635,304	677	696	97
4-5	959,147	1,199	1,397	86
6-10	1,168,111	2,345	2,818	83
11-15	297,229	1,408	1,633	86
16-20	101,106	837	946	89
21-25	27,811	354	428	83
26+	6,108	98	165	59
Total	**4,859,675**	**7,705**	**9,158**	**84**

Of the $4.9 million policies, $4.4 million, or 91.1 percent, is in the first 10 policy years similar to the face amount values.

Figure 5.5.4 compares the A/E ratios by policy count and face amount.

Figure 5.5.4. Policy Duration: A/E Ratios
Policy Size ≥ $1M
(%)
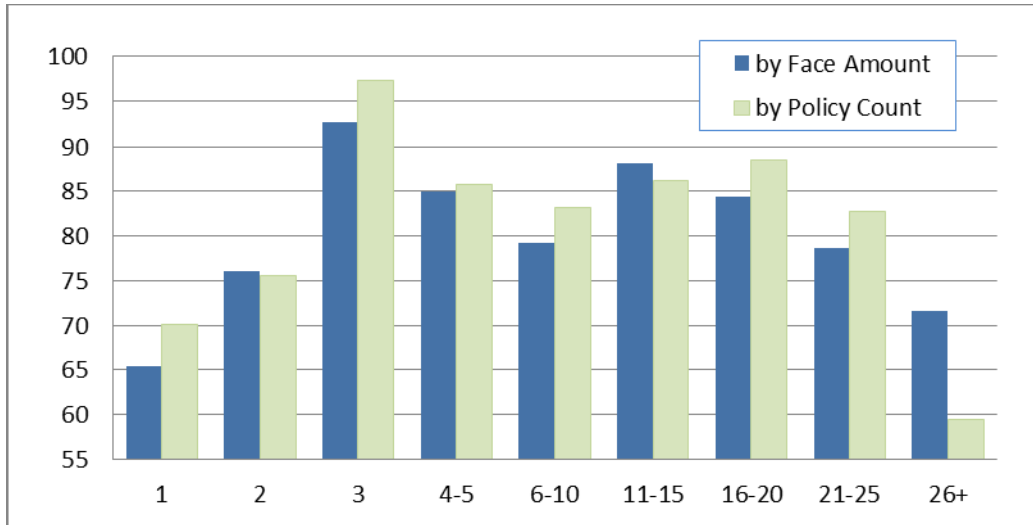
The A/E ratios by policy count followed a very similar pattern to those by face amount. When the first five durations are grouped, the average A/E mortality ratio is 82 percent by face amount and 84 percent by policy count. A/E ratios by policy count exceed those by face amount in six out of nine duration groups.

5.6. Gender

Experience by Face Amount

Figure 5.6.1 shows the gender mortality experience by face amount. Unisex contracts are excluded from this data. This table covers the high face amount policy sizes of $1 million and higher.

Figure 5.6.1. Gender: Mortality Results by Amount
Policy Size ≥ $1M

Gender	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Male	5,944,993	1.57	10,142	12,763	79
Female	1,687,201	1.58	4,681	5,289	89
Total	**7,632,194**	**1.57**	**14,823**	**18,052**	**82**

Figure 5.6.2 is a pie chart comparing male to female exposure by face amount.

Figure 5.6.2. Gender: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
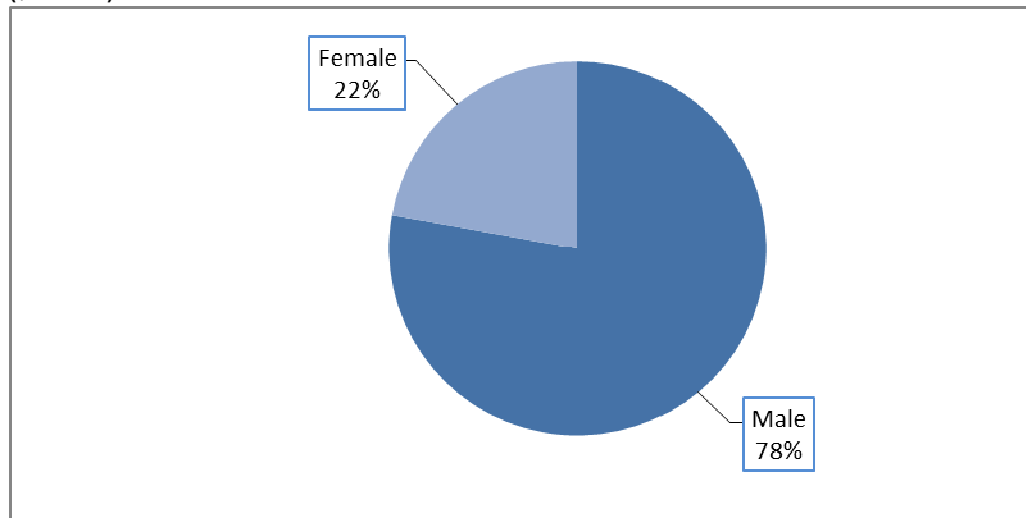
Over three-quarters of the exposure by amount were written on males, $5.9 trillion and 78 percent. Since the male is still generally the main breadwinner in the family, this is not surprising. In fact, for issue years 2000-04, MIMSA, which shows gender at all policy sizes, the split was 68 percent male and 32 percent female. For the more recent issue years 2005-09, the split shifted slightly and was 66 percent male and 34 percent female. This is likely due to the fact that females purchased lower face amount contracts in the past and now more females are in the workforce and have a need for insurance coverage because they are important contributors to the family finances.

The average face for the two genders is essentially the same for these high face amount contracts, indicating that this face amount differential appears to disappear for the higher face amounts.

The A/E ratios were quite different between the sexes. Males were substantially better than expected at 79 percent while females were also better, but not by nearly as much at 89 percent. This may be indicative of an issue with the fit of the underlying expected table rather than a true difference in results between males and females.

Experience by Policy Count

Figure 5.6.3 shows the mortality experience by policy size relative to policy count.

Figure 5.6.3. Gender: Mortality Results by Policy Count
Policy Size ≥ $1M

Gender	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Male	3,793,335	5,456	6,699	81
Female	1,065,301	2,245	2,450	92
Total	**4,858,636**	**7,701**	**9,149**	**84**

The exposure by policy count was 78 percent male and 22 percent female, nearly the same as the exposure by face amount. In MIMSA at all face levels, 55 percent were male while 45 percent were female, again a reflection of males typically purchasing higher face amount policies on average.

Figure 5.6.4 compares the A/E ratios by policy count and face amount for each gender.

Figure 5.6.4. Gender: A/E Ratios
Policy Size ≥ $1M
(%)
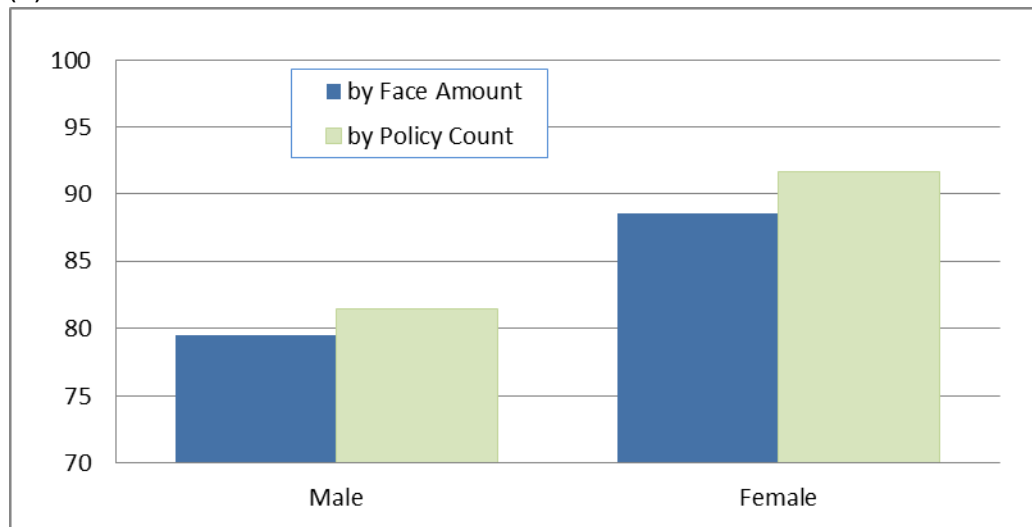
The A/E ratios by count for males and females at 81 percent and 92 percent, respectively, follow a similar pattern but higher level from those by face amount (at 79 percent and 89 percent) as shown above.

5.7. Smoking Status

Experience by Face Amount

Figure 5.7.1 shows the mortality experience by smoking status relative to exposure by face amount. For the purposes of this report, a smoker and a tobacco user are considered to be the same. Unknown is used for contracts that did not differentiate between smokers and nonsmokers. Most of these are pre-1980 policy issues, before the smoker/nonsmoker distinction began for most companies.

Figure 5.7.1. Smoking Status: Mortality Results by Amount
Policy Size ≥ $1M

Smoking Status	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Nonsmoker	7,251,914	1.57	13,297	16,170	82
Smoker	307,520	1.58	1,372	1,634	84
Unknown	74,924	1.38	161	266	60
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

Figure 5.7.2 is a pie chart comparing the smoking status exposure by face amount.

Figure 5.7.2. Smoking Status: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
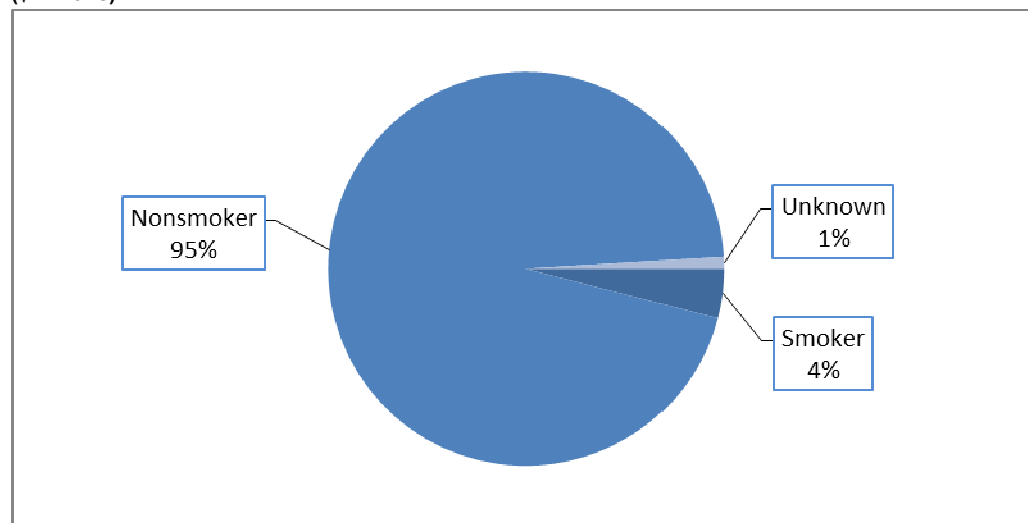
Of the insureds in this study, 95 percent are classified as nonsmokers and 4 percent smokers, while 1 percent falls into the unknown category. If looking at all policy sizes, rather than just $1 million plus, one would observe a higher percentage of smokers since smokers tend to purchase coverage with smaller face amounts.

However, for those smokers who purchase larger face amounts, the average face amount is similar to the nonsmoker face amount ($1.57 million versus $1.58 million). The unknown class is lower at $1.38 million.

The A/E ratios were very similar, 84 percent for smokers and 82 percent for nonsmokers. The unknown category was only at 60 percent. The unknown category uses a blended expected mortality that assumes 75 percent nonsmoker and 25 percent smoker rather than using the preliminary 2008 VBT uni-smoke table. If the actual ratio in the unknown category was more like the 95 percent nonsmoker and 5 percent smoker, the A/E ratio would likely change to something higher and closer to the range for the other two classes. The true smoker percentage was likely

somewhere between the 25 percent expected assumption and the 5 percent exposure assumption. The unknown category would likely have a higher percentage of smokers than the smoker distinct exposure because smokers are not penalized with higher rates. With an adjustment to the smoker/nonsmoker distribution assumption for the unknown category, the A/E ratio would likely be closer to the average than the 60 percent shown.

The ratio of smoker-to-nonsmoker mortality for the high face amount results was approximately 240 percent.

Experience by Policy Count

Figure 5.7.3 shows the mortality experience by smoking status relative to policy count.

Figure 5.7.3. Smoking Status: Mortality Results by Policy Count
Policy Size ≥ $1M

Smoking Status	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Nonsmoker	4,611,526	6,815	8,074	84
Smoker	194,039	775	905	86
Unknown	54,111	115	179	64
Total	**4,859,675**	**7,705**	**9,158**	**84**

Figure 5.7.4 compares the A/E ratios by policy count and face amount for each smoking class.

Figure 5.7.4. Smoking Status: A/E Ratios
Policy Size ≥ $1M
(%)
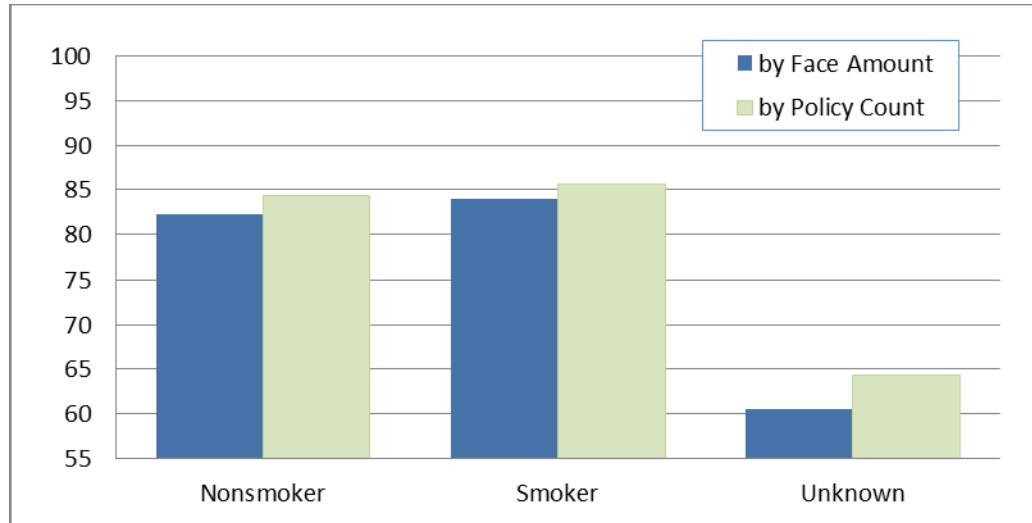
Policy count follows the same exposure and mortality patterns as the face amount results for the smoking status categories, with the A/E ratios being higher by policy count than by face amount.

5.8. Product Type

Experience by Face Amount

Figure 5.8.1 shows the mortality experience by face amount for the product types used in MIMSA. This table includes policies with face amounts of $1 million or greater.

Figure 5.8.1. Product Type: Mortality Results by Amount
Policy Size ≥ $1M

Product Type	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Term	4,286,020	1.43	3,521	3,866	91
Whole Life	730,326	1.71	2,795	3,802	74
UL	1,093,783	2.24	6,049	7,316	83
Variable/EI Life	1,014,998	1.77	1,739	1,921	91
Other	509,231	1.37	725	1,165	62
Total	**7,634,358**	**1.57**	**14,830**	**18,069**	**82**

Certain product types needed to be combined for MIMSA either due to the limited volume of data or to protect the identity of some companies. However, further combinations were made for this report to match the product types from the last high face amount study. The product types included in this analysis are:
- Term, which includes level term, annually renewable term (ART), return of premium (ROP) and other term products;
- Whole life, which includes participating (par), non-par, single premium and interest sensitive whole life;
- Universal life (UL), which includes cash accumulation, secondary guarantee and current assumption UL;
- Variable life and equity indexed (EI) life, which includes variable universal life, variable life and EI life; and
- Other, which includes product types not covered above and product types covered above that needed to be moved to protect the identity of the company.

The pie chart in Figure 5.8.2 shows the exposure by product type.

Figure 5.8.2. Product Type: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)
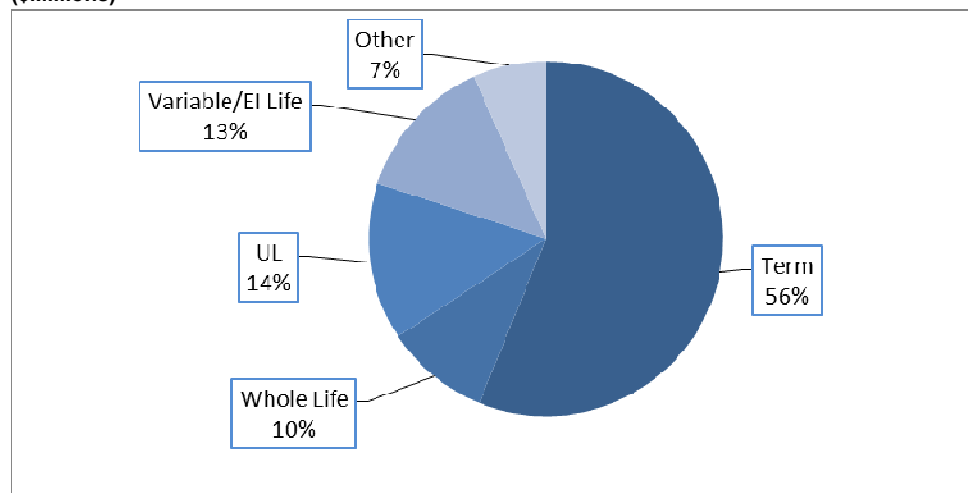
Term has over half of the exposure by face amount at $4.3 trillion (56 percent). UL, the variable/EI group, whole life and other follow with 14 percent, 13 percent, 10 percent and 7 percent, respectively, based on the dollar values shown in the table. The 1998 Manulife high face amount study also had term with the highest exposure at 89 percent.

Figure 5.8.3 shows the average face amount by product type for contracts with face amounts of $1 million or more.

Figure 5.8.3. Product Type: Average Face Policy Size ≥ $1M ($Millions)
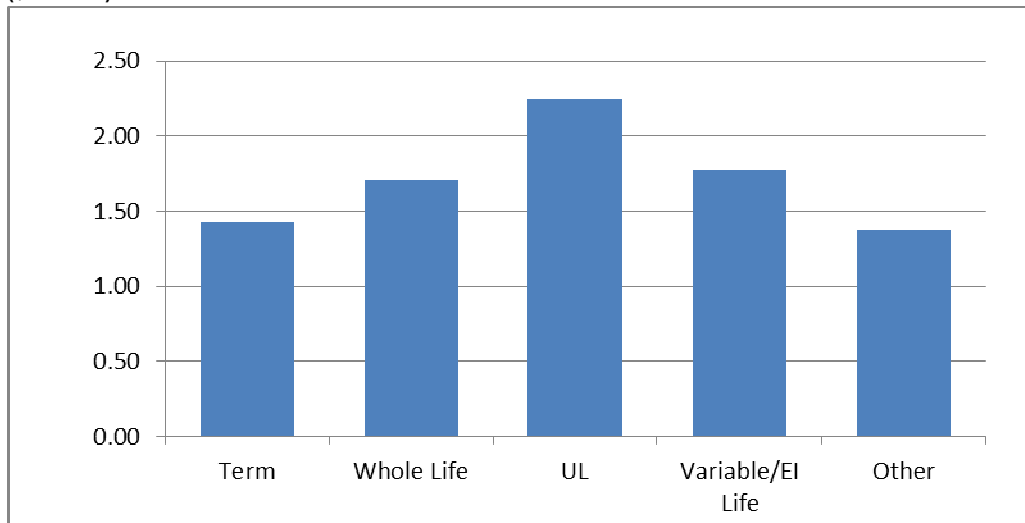
The average face amounts vary by product type. Term and other had the lowest at $1.43 million and $1.37 million, respectively. The universal life contracts had the highest average face at $2.24 million.

The A/E ratios were also quite varied. The whole life and other product categories had substantially better than average A/E ratios at 74 percent and 62 percent, respectively. Both term and variable/EI life had A/E ratios of 91 percent. UL was near the average of 82 percent. All were better than expected (2008 VBT) as has been the case throughout this report. The reason for the term and variable/EI life experience being worse than the others was due to some large early duration claims with Nonmedical causes of death as previously mentioned in Section 5.3.

Experience by Policy Count

Figure 5.8.4 shows the mortality experience by product type relative to policy count. It covers the same products as Figure 5.8.1.

Figure 5.8.4. Product Type: Mortality Results by Policy Count Policy Size ≥ $1M

Product Type	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Term	3,001,751	2,259	2,562	88
Whole Life	427,391	1,547	2,062	75
UL	487,212	2,672	2,996	89
Variable/EI Life	572,114	838	960	87
Other	371,209	389	578	67
Total	**4,859,676**	**7,705**	**9,157**	**84**

Term accounts for 62 percent of the exposure. The variable group is second with 12 percent, followed by UL at 10 percent. UL is second and variable/EI life is third by face amount. Whole life and the other product categories have 9 percent and 8 percent of the exposure by policy count, respectively.

Figure 5.8.5 compares the A/E ratios by policy count and face amount for each smoking class.

Figure 5.8.5. Product Type: A/E Ratios
Policy Size ≥ $1M
(%)
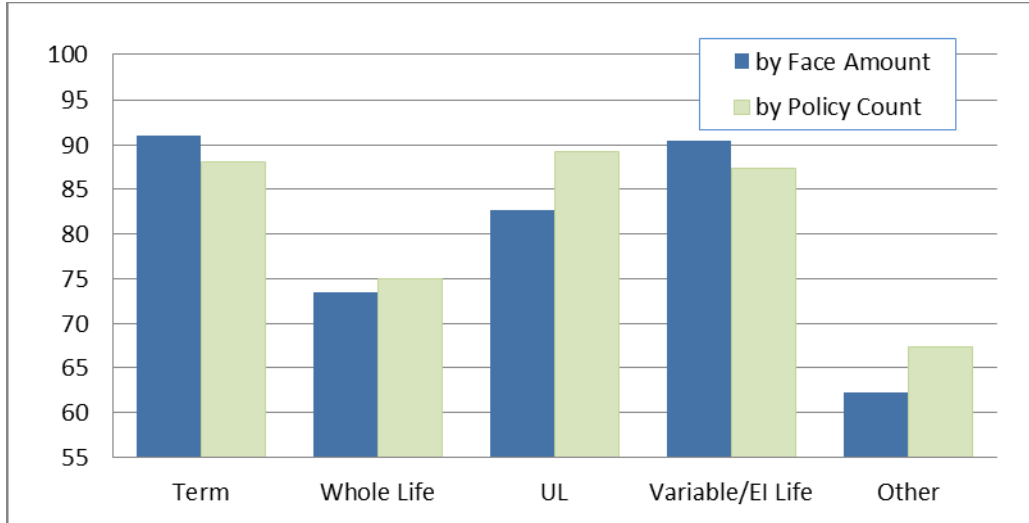
The A/E ratios by count for whole life and other were again substantially below the average of 84 percent at 75 percent and 67 percent, respectively. The rest were more similar by policy count than was the case by face amount, ranging from 87-89 percent. Term and the variable group had A/E ratios by amount greater than those by policy count.

5.9. Risk Class

Experience by Face Amount

Splitting of smokers and nonsmokers into various preferred versus standard risk classes did not come to market until 1987 for some companies. By the early 1990s, virtually all U.S. life insurance companies utilized preferred risk classes so as not to be selected against. For purposes of this report, it was assumed that preferred risk classes began after 1986 only. This section contains two different analyses, besides analyses by face amount and policy count. The first is called 2:1 Risk Class, which refers to two nonsmoker classes (Preferred NS and Standard NS) and one smoker class (Standard SM). The second analysis is for the 3:2 Risk Class, which refers to three nonsmoker classes (Preferred Best NS, Preferred NS and Standard NS) and two smoker classes (Preferred SM and Standard SM).

It is possible that a company's product may have their nonsmokers included in the first analysis and their smokers in the second (i.e., 2:2) and vice versa (i.e., 3:1). Any product with one smoker class would have the smokers included in the 2:1 analysis. Any product with two smoker classes would have the smokers included in the 3:2 analysis. Any product with two nonsmoker classes would have the nonsmokers included the 2:1 analysis. Any product with three or more nonsmoker classes would have the nonsmokers included in the 3:2 analysis. The best class would be assigned to the Best Preferred Nonsmoker (NS) class, the lowest standard NS class would be assigned to the Standard NS class, and the rest of the nonsmokers would be assigned to the Preferred NS class.

Figures 5.9.1 and 5.9.2 illustrate the mortality experience by face amount for the 2:1 risk class group and the 3:2 risk class group, respectively. This table includes policies issued in 1987 and beyond with face amounts of $1 million or greater.

Figure 5.9.1. 2:1 Risk Class: Mortality Results by Amount
Policy Size ≥ $1M

Risk Class / Smoking Status	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Preferred NS	1,115,812	1.69	1,980	2,950	67
Standard NS	653,657	1.79	3,132	3,511	89
Standard SM	136,493	1.64	764	951	80
Total	**1,905,962**	**1.72**	**5,876**	**7,411**	**79**

Figure 5.9.2. 3:2 Risk Class: Mortality Results by Amount
Policy Size ≥ $1M

Risk Class / Smoking Status	Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Best Preferred NS	2,197,204	1.45	1,366	2,045	67
Preferred NS	1,583,814	1.57	1,731	1,880	92
Standard NS	991,583	1.60	1,877	2,049	92
Preferred SM	97,827	1.48	231	231	100
Standard SM	60,890	1.60	212	212	100
Total	**4,931,318**	**1.52**	**5,417**	**6,418**	**84**

For this high face amount data, 27.0 percent of the nonsmoker (NS) exposure is written in the two NS risk class group and 73.0 percent is in the three or more NS risk class group. For the smokers, 46.2 percent is in the one smoker class group and 53.8 percent is in the two.

Figures 5.9.3 and 5.9.4 are pie graphs of the exposure by risk class for the 2:1 and 3:2 groups.

Figure 5.9.3. 2:1 Risk Class: Exposure by Face Amount Policy Size ≥ $1M ($Millions)
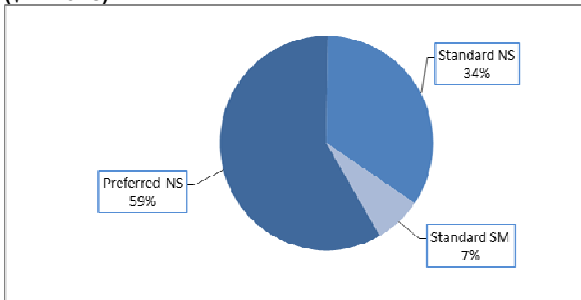
Figure 5.9.4. 3:2 Risk Class: Exposure by Face Amount Policy Size ≥ $1M ($Millions)
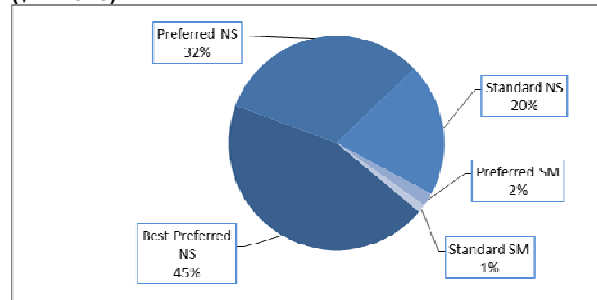
The high face amount data has the majority of the business written in the best class available, 59 percent in preferred NS for the 2:1 split and 45 percent in the best preferred NS in the 3:2 split. Notice how the smoker class drops in exposure as the risk class changes evolved, from 7 percent for the one class to 3 percent for the two-class category.

Figures 5.9.5 and 5.9.6 show the average face by risk class status for the 2:1 and 3:2 groups, respectively.

Figure 5.9.5. 2:1 Risk Class: Average Face Amount Policy Size ≥ $1M ($Millions)
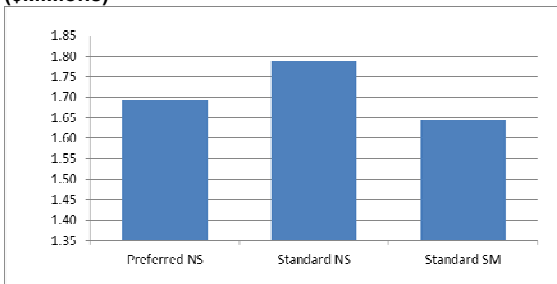
Figure 5.9.6. 3:2 Risk Class: Average Face Amount Policy Size ≥ $1M ($Millions)
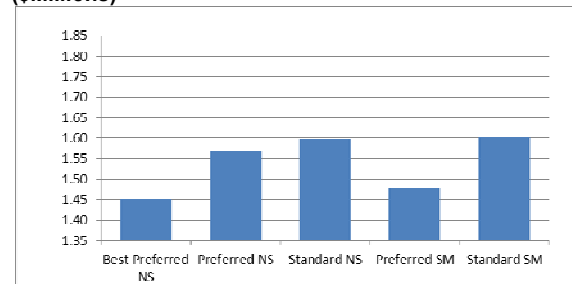
Two unexpected patterns are shown in the average face amount charts. First, the overall average face amount is higher for the 2:1 structure than the 3:2 structure. This is surprising in that the 3:2 structure business was typically written more recently, where we would expect the average sizes to be higher. Second, the standard classes tend to have higher average face amounts than the other risk classes. One possible explanation for the higher average face for the standard classes may relate to the fact that the wealthy individuals are not constrained by premium rates, thus are able purchase the desired level of insurance. This may not be the case for the lower face amount contracts.

The expected mortality basis is the same for all the nonsmoker classes whether listed as best, preferred or standard. The same is true for the expected mortality for the two-smoker class group. The A/E ratios by face amount for the best NS classes were both coincidentally 67 percent for the two- and three-NS risk classes. The standard and, in the 3:2 group, preferred NS risk class A/E ratios were also relatively consistent in the range from 89 percent to 92 percent. For the smokers, the one class had an A/E ratio of 80 percent while both of the two-smoker classes had an A/E ratio of 100 percent.

One would expect the one-class structure to be between the best and worst classes of the two-class structure; however, these are two distinct sets of data. In the 2:1 structure, the smoker class A/E ratio of 80 percent versus the standard NS class A/E ratio of 89 percent does not necessarily imply that the smoker mortality is better than the nonsmoker mortality because the smoker A/E ratio was based on the smoker mortality rates and the nonsmoker A/E ratio was based on the nonsmoker mortality rates.

Experience by Policy Count

Figures 5.9.7 and 5.9.8 show the mortality experience by risk class type 2:1 and 3:2 respectively, relative to policy count. They cover the same risk classes as Figures 5.9.1 and 5.9.2.

Figure 5.9.7. 2:1 Risk Class: Mortality Results by Policy Count
Policy Size ≥ $1M

Risk Class / Smoking Status	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Preferred NS	659,078	1,015	1,465	69
Standard NS	365,702	1,508	1,626	93
Standard SM	83,001	426	529	81
Total	**1,107,781**	**2,949**	**3,620**	**81**

Figure 5.9.8. 3:2 Risk Class: Mortality Results by Policy Count
Policy Size ≥ $1M

Risk Class / Smoking Status	Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Best Preferred NS	1,513,791	787	1,177	67
Preferred NS	1,010,236	881	983	90
Standard NS	620,353	872	853	102
Preferred SM	66,192	123	143	86
Standard SM	38,000	135	117	116
Total	**3,248,571**	**2,798**	**3,273**	**85**

The relative exposure by policy count was very similar to the exposure by face amount across all risk classes.

Figures 5.9.9 and 5.9.10 compare the A/E ratios by policy count and face amount for each risk class group.

Figure 5.9.9. 2:1 Risk Class: A/E Ratios
Policy Size ≥ $1M
(%)
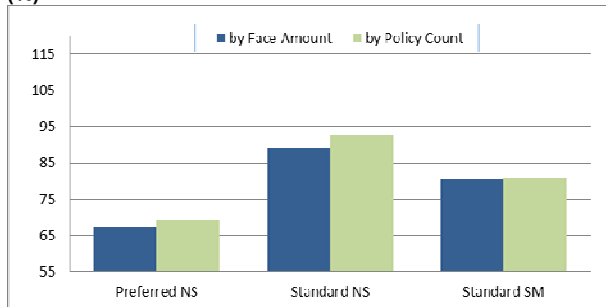
Figure 5.9.10. 3:2 Risk Class: A/E Ratios
Policy Size ≥ $1M
(%)
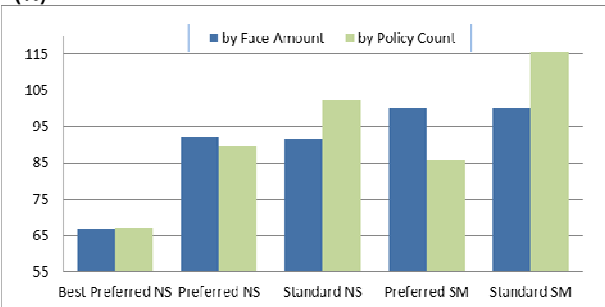
The A/E ratios for the 2:1 risk class group were very similar by face amount and policy count. This was not the case with the 3:2 risk class group. The A/E ratios by policy count performed more like one might expect, with lower A/E ratios for the better risk classes. By both face amount and policy count, the A/E ratio for the one-smoker risk class was outside the A/E ratios for the two-smoker risk classes. This is likely due to a different mix of companies and experience in each of these groupings.

5.10. Issue Age and Duration

Experience by Face Amount

Figures 5.10.1-5.10.4 contain multiple decrement tables by issue age and duration groups for exposure, actual claims, expected claims and A/E ratios based on policy size, respectively. A blank value indicates that no contract was issued for that particular cell. A value of zero means the value rounds to zero or no death occurred for that particular cell. For A/E ratio tables, cells that are not considered credible are shown in regular font and will be given little attention. These cells contain less than 30 actual claims. The actual number of policy death claims can be found in Figure 5.10.7.

Figure 5.10.1. Issue Age and Duration: Exposure by Face Amount
Policy Size ≥ $1M
($Millions)

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	94,473	75,674	59,859	84,374	98,352	34,601	15,613	5,239	2,279	470,464
30-39	549,196	462,377	378,050	553,608	620,528	137,020	44,553	11,193	2,433	2,758,958
40-49	459,217	387,199	324,808	494,739	620,997	153,703	49,102	15,013	2,231	2,507,009
50-59	206,132	172,915	147,088	229,754	293,620	76,971	30,177	12,199	1,691	1,170,547
60-69	70,844	59,270	49,326	75,083	98,925	37,737	15,899	3,981	412	411,478
70-79	64,100	56,258	40,597	43,814	40,989	11,549	2,443	228	27	260,006
80+	13,619	12,352	9,709	11,879	7,256	819	257	4		55,896
Total	1,457,582	1,226,044	1,009,437	1,493,250	1,780,668	452,399	158,045	47,858	9,073	7,634,358

There were no contracts in this data issued to an individual older than 79 past the 25th duration. The exposure by amount decreases for all ages as the contracts age due to lapse, surrender or death.

Figure 5.10.2. Issue Age and Duration: Actual Claims by Face Amount
Policy Size ≥ $1M
($Millions)

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	18	18	18	22	38	20	20	5	4	**162**
30-39	64	111	157	295	356	149	99	49	22	**1,302**
40-49	221	247	226	463	752	337	162	113	39	**2,562**
50-59	107	204	272	544	873	468	392	259	94	**3,212**
60-69	59	133	212	280	828	685	557	228	31	**3,013**
70-79	181	259	477	587	981	740	218	37	0	**3,480**
80+	51	139	120	319	335	118	17	0		**1,099**
Total	700	1,110	1,483	2,510	4,162	2,517	1,465	691	190	**14,830**

Figure 5.10.3. Issue Age and Duration: Expected Claims by Face Amount
Policy Size ≥ $1M
($Millions)

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	26	22	19	29	41	23	16	8	9	**193**
30-39	121	146	143	248	417	190	105	45	25	**1,440**
40-49	156	207	231	467	938	468	262	153	57	**2,940**
50-59	156	214	244	511	1,074	572	450	369	106	**3,696**
60-69	128	169	192	412	984	793	594	265	62	**3,598**
70-79	345	478	482	726	1,187	694	254	38	8	**4,211**
80+	140	222	288	559	608	117	55	1		**1,991**
Total	**1,071**	**1,459**	**1,600**	**2,952**	**5,249**	**2,857**	**1,736**	**879**	**266**	**18,069**

Figure 5.10.4. Issue Age and Duration: A/E Ratio by Face Amount
Policy Size ≥ $1M
(%)

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	70	79	94	74	**91**	87	126	65	44	**84**
30-39	**53**	**76**	**110**	**119**	85	78	**94**	**110**	87	**90**
40-49	**142**	**119**	98	**99**	80	72	62	**74**	70	**87**
50-59	**69**	**95**	111	106	81	82	87	70	89	**87**
60-69	46	**79**	110	68	84	86	94	86	50	**84**
70-79	**52**	**54**	99	81	83	107	86	97	0	**83**
80+	36	**62**	42	57	55	101	31	0		**55**
Total	**65**	**76**	**93**	**85**	**79**	**88**	**84**	**79**	**72**	**82**

The highest A/E ratio was in duration 1 for the 40-49 age group at 142 percent. Of the cells with at least 30 claims, the age 80+ group at duration 3 had the lowest A/E ratio at 42 percent.

Figure 5.10.5 shows the A/E ratios graphically by face amount. The 0-29 age group was left off the graphs because all but one duration had less than 30 claims. The A/E ratios at the older issue ages with longer durations drop to zero because very few (or no) insureds were left in the study.

Figure 5.10.5. Issue Age and Duration: A/E Ratio by Face Amount
Policy Size ≥ $1M
(%)
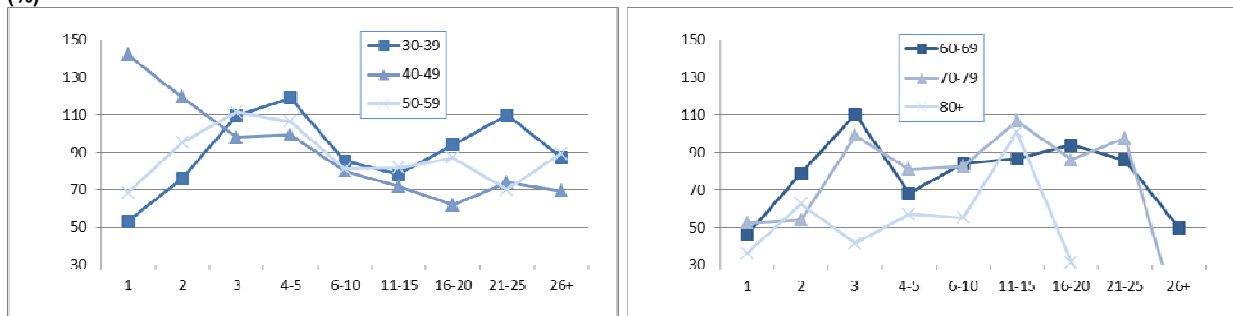
The primary outliers in these graphs are issue ages 40-49 at durations 1-2 (higher than the other issue ages); issue ages 80+ at durations 3-10 (lower than the other issue ages); issue ages 40-49 at durations 16-20 (lower than the other issue ages); and issue ages 30-39 at durations 21-25 (higher than the other issue ages).

Experience by Policy Count

Figures 5.10.6-5.10.9 contain multiple decrement tables by issue age and duration for exposure, actual claims, expected claims and A/E mortality ratio based on policy count, respectively. These tables are set up the same as those for the face amount analysis.

Figure 5.10.6. Issue Age and Duration: Exposure by Policy Count
Policy Size ≥ $1M

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	72,566	57,672	45,080	62,117	68,223	23,981	11,572	3,915	1,680	346,806
30-39	390,313	330,224	271,858	401,781	452,058	99,286	32,193	7,897	1,708	1,987,318
40-49	280,692	239,066	203,157	315,916	409,374	102,197	31,462	8,411	1,471	1,591,745
50-59	108,988	92,373	79,550	126,645	168,828	45,076	16,292	5,647	1,024	644,425
60-69	29,712	25,074	21,370	33,834	48,716	20,251	8,247	1,833	211	189,246
70-79	16,255	14,513	11,341	14,853	17,929	6,046	1,285	108	13	82,344
80+	3,845	3,566	2,948	4,001	2,983	392	55	1		17,791
Total	902,371	762,488	635,304	959,147	1,168,111	297,229	101,106	27,811	6,108	4,859,675

As was mentioned previously, there were no contracts in this data issued to an individual older than 79 past the 25th duration. The exposure by count decreases for all ages as the contracts age due to lapse, surrender or death.

Figure 5.10.7 was used to identify those cells with less than 30 claims. In the A/E ratio table, these cells are formatted using regular typeface and will not be discussed while the others use boldface and are the focus of the observations.

Figure 5.10.7. Issue Age and Duration: Actual Claims by Policy Count
Policy Size ≥ $1M

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	9	8	15	15	32	13	10	4	3	109
30-39	51	75	109	179	262	111	65	34	15	901
40-49	96	130	142	271	519	221	121	52	25	1,577
50-59	74	84	147	252	497	278	214	139	33	1,718
60-69	27	47	92	161	391	376	294	110	22	1,520
70-79	49	69	129	193	473	357	124	15	0	1,409
80+	15	53	43	128	171	52	9	0		471
Total	321	466	677	1,199	2,345	1,408	837	354	98	7,705

Figure 5.10.8. Issue Age and Duration: Expected Claims by Policy Count
Policy Size ≥ $1M

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	
0-29	19	16	14	21	28	16	11	6	7	**138**
30-39	85	103	102	178	302	137	76	31	17	**1,031**
40-49	95	127	143	296	615	305	165	83	39	**1,867**
50-59	82	114	131	280	612	330	238	165	65	**2,017**
60-69	53	71	83	185	487	423	312	124	32	**1,770**
70-79	85	120	130	238	514	365	133	18	4	**1,606**
80+	40	66	93	200	260	57	11	0		**728**
Total	458	617	696	1,397	2,818	1,633	946	428	165	**9,158**

Figure 5.10.9. Issue Age and Duration: A/E Ratio by Policy Count
Policy Size ≥ $1M
(%)

Issue Age	Duration									Total
	1	2	3	4-5	6-10	11-15	16-20	21-25	26+	Total
0-29	47	49	107	71	**114**	82	88	70	44	**79**
30-39	**60**	**73**	**107**	**101**	**87**	**81**	**86**	**110**	86	**87**
40-49	**102**	**103**	**99**	**92**	**84**	**72**	**74**	**63**	64	**84**
50-59	**90**	**74**	**112**	**90**	**81**	**84**	**90**	**84**	50	**85**
60-69	51	**66**	**111**	**87**	**80**	**89**	**94**	**89**	69	**86**
70-79	**58**	**58**	**99**	**81**	**92**	**98**	**93**	83	0	**88**
80+	38	**80**	**46**	**64**	**66**	**91**	79	0		**65**
Total	**70**	**75**	**97**	**86**	**83**	**86**	**89**	**83**	**59**	**84**

The highest A/E ratio (114 percent) was in durations 6-10 for the 0-29 issue age group. The lowest A/E ratio with at least 30 claims was 46 percent in duration 3 of the 80+ issue age group.

Figure 5.10.10 shows the A/E ratios graphically by policy count. Again, the 0-29 age group was left off the graphs because all but one duration had less than 30 claims. The A/E ratios at the older issue ages with longer durations drop to zero because very few (or no) insureds were left in the study.

Figure 5.10.10. Issue Age and Duration: A/E Ratio by Policy Count
Policy Size ≥ $1M
(%)
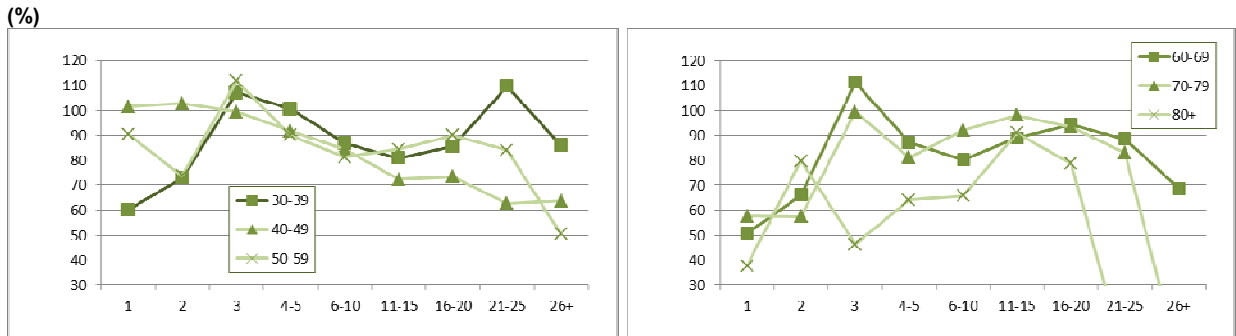
The primary outliers in these graphs are issue ages 40-49 at durations 1-2 (higher than the other issue ages); issue ages 80+ at duration 3 (lower than the other issue ages); issue ages 30-39 at durations 21-25 (higher than the other issue ages); and issue ages 40-49 at durations 21-25 (lower than the other issue ages).

5.11. Gender, Smoking Status and Risk Class

Experience by Face Amount

Figures 5.11.1 and 5.11.2 contain multiple decrement tables by gender, smoking status, and the 2:1 and 3:2 risk class groups. Each table shows the exposure, average face, actual claims, expected claims and A/E mortality ratio based on policy size. The risk classes follow the rules specified in Section 5.9. Since all cells have at least 30 actual claims, font changes were not made for the A/E ratios in this section.

Figure 5.11.1. Gender and 2:1 Risk Class: Mortality Results by Amount
Policy Size ≥ $1M

Gender	Smoking Status	Risk Class	Mortality By Amount				
			Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Male	Nonsmoker	Preferred	808,039	1.65	1,198	1,882	64
		Standard	509,202	1.75	1,865	2,279	82
	Smoker	Standard	94,620	1.58	428	622	69
Female	Nonsmoker	Preferred	307,769	1.83	782	1,068	73
		Standard	144,429	1.92	1,266	1,233	103
	Smoker	Standard	40,362	1.81	332	315	105
Total			1,904,421	1.72	5,871	7,398	79

Figure 5.11.2. Gender and 3:2 Risk Class: Mortality Results by Amount
Policy Size ≥ $1M

Gender	Smoking Status	Risk Class	Mortality By Amount				
			Exposure ($Millions)	Average Face ($Millions)	Actual Claims ($Millions)	Expected Claims ($Millions)	A/E Ratio (%)
Male	Nonsmoker	Best Pref	1,652,852	1.49	1,103	1,604	69
		Preferred	1,318,991	1.57	1,361	1,485	92
		Standard	808,629	1.56	1,290	1,421	91
	Smoker	Preferred	76,907	1.44	172	167	103
		Standard	48,246	1.54	145	139	104
Female	Nonsmoker	Best Pref	544,304	1.35	263	441	60
		Preferred	264,726	1.57	370	395	94
		Standard	182,849	1.77	587	627	94
	Smoker	Preferred	20,916	1.64	59	64	92
		Standard	12,644	1.91	67	73	92
Total			4,931,064	1.52	5,417	6,417	84

Figures 5.11.3 and 5.11.4 show the face amount exposure for each risk class group.

Figure 5.11.3. Exposure by Face Amount: Gender and 2:1 Risk Class
Policy Size ≥ $1M
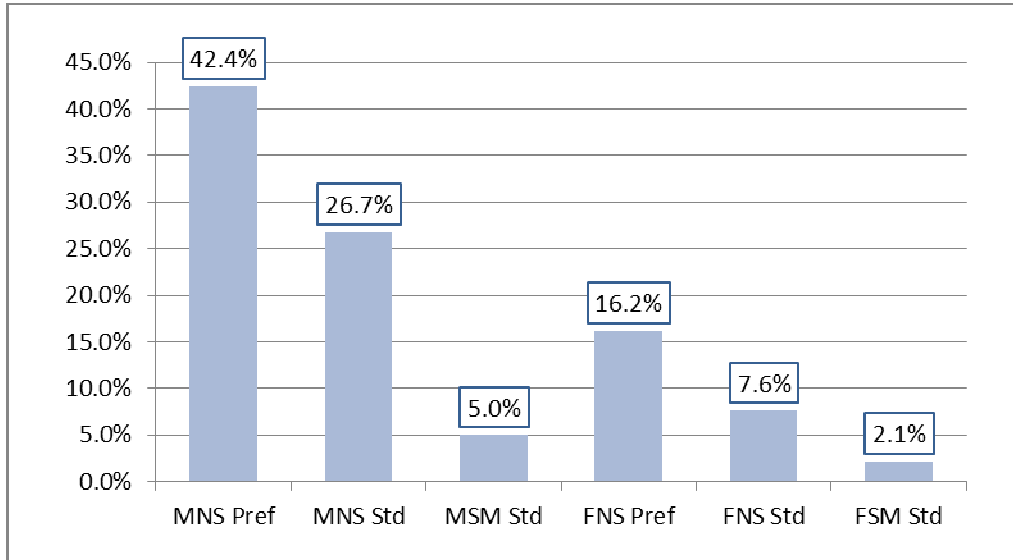
Figure 5.11.4. Exposure by Face Amount: Gender and 3:2 Risk Class
Policy Size ≥ $1M
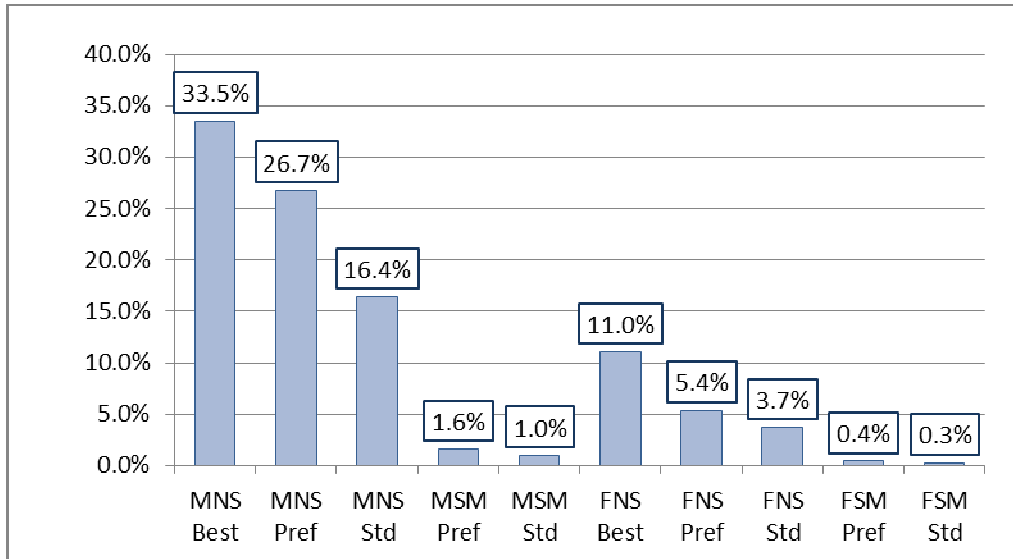
The male top preferred nonsmoker risk class has the greatest exposure at $808 billion (42 percent) for the 2:1 risk group and nearly $1.7 trillion (34 percent) for the 3:2 risk group. The one-class smoker group as a percentage of the total exposure was 7 percent ($135 billion) while the two-class smoker group was 3 percent ($159 billion), over a 50 percent difference in overall exposure. For the 3:2 risk group, the female best NS represents more than 50 percent of the female exposure (53 percent) while the male counterpart represents less than 50 percent of the male exposure (42 percent). Overall, the charts show that as the risk classes become riskier and premium rates increase accordingly, the exposure declines as well.

The average face amounts were in the range of $1.35 million to $1.92 million. For the 2:1 group, females had higher average face amounts than males across all risk classes. For the 3:2 group, this was the case in three of the five groups—female standard NS and both SM classes. In general, it is unusual for the more expensive risk classes to have higher average face amounts than the less expensive, more preferred risk classes. It is also unusual for females

to have higher average face amounts than males. Both situations occur in this study. Although not the expected results, they follow what was seen in the gender results in Section 5.6 and the smoking status results in Section 5.9 when combined. This is an identifiable difference between the high face amount contracts in this study and the all face amount contracts found in MIMSA.

Another unusual observation is that the average face amount for the 2:1 group ($1.7 million), typically older issues, has a higher average face amount than the 3:2 group ($1.5 million). As previously mentioned, one possible explanation for the unexpected average face amounts result may be that the wealthy individuals are not constrained by premium rates and purchase the desired level of protection. The wealthy can afford the higher rates if placed in a risk class less than the best, women can afford and happen to desire more coverage, and the older contracts in this study preferred higher coverage amounts as well.

The A/E ratios by face amount are combined with the A/E ratios by policy count and are shown in Figures 5.11.7 and 5.11.8.

Experience by Policy Count

Figures 5.11.5 and 5.11.6 show the mortality experience by gender, smoking status and risk class type 2:1 and 3:2 respectively, relative to policy count. They cover the same risk classes as Figures 5.11.1 and 5.11.2.

Figure 5.11.5. Gender, Smoking Status and 2:1 Risk Class: Mortality Results by Policy Count
Policy Size ≥ $1M

Gender	Smoking Status	Risk Class	Mortality By Amount			
			Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Male	Nonsmoker	Preferred	490,985	680	984	69
		Standard	290,479	885	1,061	83
	Smoker	Standard	60,027	251	359	70
Female	Nonsmoker	Preferred	168,089	335	482	70
		Standard	75,204	622	565	110
	Smoker	Standard	22,290	173	164	105
Total			1,107,074	2,946	3,615	81

Figure 5.11.6. Gender, Smoking Status and 3:2 Risk Class: Mortality Results by Policy Count
Policy Size ≥ $1M

Gender	Smoking Status	Risk Class	Mortality By Amount			
			Exposure	Actual Claims	Expected Claims	A/E Ratio (%)
Male	Nonsmoker	Best Pref	1,110,167	632	952	66
		Preferred	841,097	734	814	90
		Standard	517,134	669	634	106
	Smoker	Preferred	53,437	92	110	84
		Standard	31,374	94	84	112
Female	Nonsmoker	Best Pref	403,604	155	225	69
		Preferred	169,112	147	169	87
		Standard	103,188	203	219	93
	Smoker	Preferred	12,753	31	33	93
		Standard	6,626	41	33	125
Total			3,248,492	2,798	3,272	86

The relative exposure by policy count was very similar to that by face amount across all cells.

Figures 5.11.7 and 5.11.8 compare the A/E ratios by policy count and face amount for each risk class group.

Figure 5.11.7. 2:1 Risk Class: A/E Ratios
Policy Size ≥ $1M
(%)
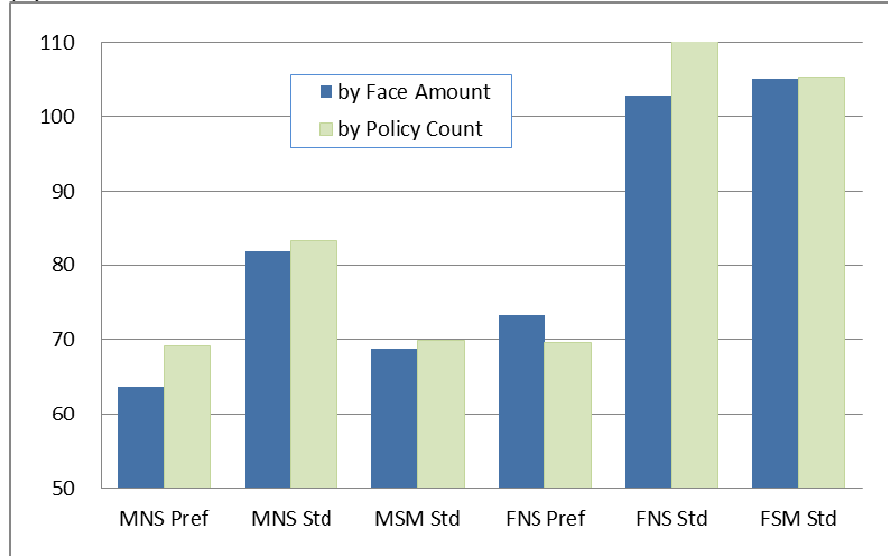
Since the expected mortality is the same for both preferred and standard nonsmokers, the A/E mortality ratio for the preferred risk classes should be lower than the standard if the underwriting process is working properly. For the 2:1 analysis, the A/E ratios for the preferred NS are lower than the A/E ratios for the standard NS class for both male and female.

The A/E ratios for the 2:1 risk class group were very similar by face amount and policy count. The largest differences were found with male preferred nonsmokers (64 percent vs. 69 percent) and female standard nonsmokers (103 percent vs. 110 percent). The A/E mortality ratio was generally smaller for the face amount measure, indicating the average claim is smaller than the overall average policy size.

Figure 5.11.8. 3:2 Risk Class: A/E Ratios
Policy Size ≥ $1M
(%)
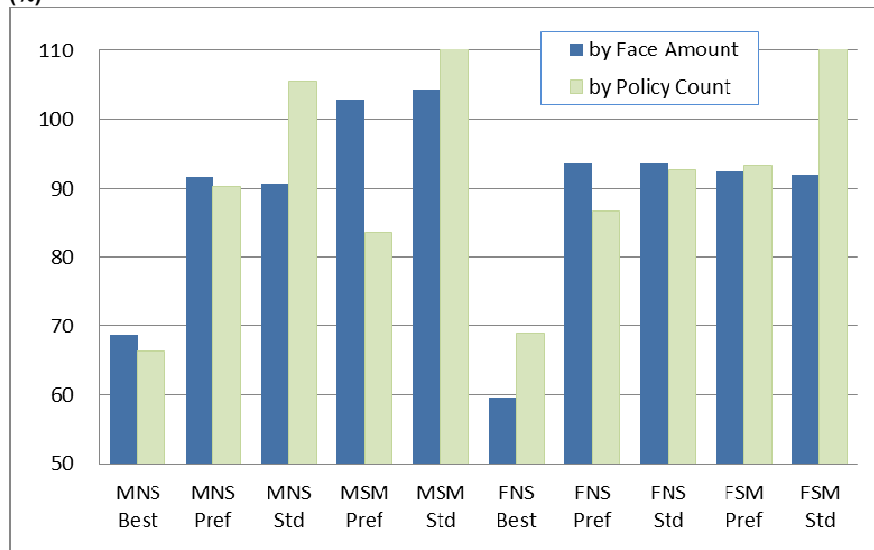
The 3:2 risk class group did not follow the expected pattern of A/E mortality ratios when face amount was the measure. For both males and females, while the best preferred NS class A/E ratio was lowest, as would be expected, the next two NS A/E ratios were flat. The SM A/E ratios were also flat. Also, the male best NS and the two male smoking classes had higher A/E ratios than the female counterparts, which was not the case anywhere else.

The NS and SM A/E ratios by policy count for both males and females increased by class as would be expected.

6. CAUSE OF DEATH

6.1. Total

The cause of death (COD) information is illustrated in this section of the report. Cause of death is studied by single-decrement variables—study year, issue year, attained age, gender, smoker status, product type and risk class.

The causes of death shown in Figure 6.1.1 are also shown in all subsequent figures. They are split between Medical, Nonmedical and Other (medical and nonmedical) causes. The 11 Medical causes in all figures are listed in the overall rank order shown in Figure 6.1.1. Childbirth also includes death caused by pregnancy complications or congenital issues. Other accidents represent all non-motor vehicle accidents. Other represents all other known causes of death not otherwise listed. Only known causes of death are included in these figures. All COD analysis is based on policy count.

The cause of death percentages throughout all of Section 6 will be in bold print if the number of claims for the cell is 30 or more. Cells with less than 30 claims are not considered credible, are shown in regular type and will not be emphasized in this analysis.

Figure 6.1.1 shows the overall policy count and percentage for each cause of death over the 10-year study period. It also shows the percentage for each cause of death for 2006 population data from the 2009 National Vital Statistics Reports.[1]

Figure 6.1.1. Total: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Count	Study Percentage	Population Percentage
Medical			
Cancer	1,635	**37.1%**	**23.7%**
Cardiovascular	961	**21.8%**	**28.5%**
Respiratory	268	**6.1%**	**9.3%**
Mental & Nervous	168	**3.8%**	**3.8%**
Stroke	157	**3.6%**	**5.7%**
Digestive	64	**1.5%**	**1.5%**
Infectious	48	**1.1%**	**2.8%**
Genitourinary	37	**0.8%**	**1.9%**
Childbirth	22	0.5%	**1.1%**
Diabetes & Metabolic	20	0.5%	**3.1%**
Blood & Immune	12	0.3%	**0.2%**
Nonmedical			
Motor Vehicle Accidents	138	**3.1%**	**1.9%**
Other Accidents	305	**6.9%**	**3.1%**
Suicide	270	**6.1%**	**1.4%**
Homicide	51	**1.2%**	**0.8%**
Other			
Other	246	**5.6%**	**11.4%**
Total	**4,402**	**100.0%**	**100.0%**

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[1] Melonie Heron, Donna L. Hoyert, Sherry L. Murphy, Jiaquan Xu, Kenneth D. Kochanek, and Betzaida Tejada-Vera, "Deaths: Final Data for 2006," *National Vital Statistics Reports* 57, no. 14 (April 17, 2009): http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_14.pdf. The population percentage was derived from the number of deaths in 2006 for 113 specific causes.

Cancer was the leading cause of death during the 10-year study period for high face amount contracts at 37.1 percent (1,635 claims). Cardiovascular was the second leading COD for the high face amounts at 21.8 percent (961 claims). Other accidents were the third leading COD at 6.9 percent (305 claims). The fourth and fifth leading CODs were suicide (6.1 percent and 270 claims) and respiratory (6.1 percent and 268 claims).

There are several differences between the population data provided and the high face amount contracts. Cardiovascular disease is the population's leading cause of death followed by cancer. The top five population causes of death are Medically related while the high face business has two Nonmedical causes in its top five. The larger percentage of Other causes in the population table may be due to unknown causes.

The high face amount results are also substantially different from those when the face amounts under $1 million were included. The MIMSA report showed the overall top five causes of death to be, in order, cardiovascular disease, cancer, respiratory, other, and mental and nervous. In addition to the reversal of cancer and cardiovascular as the top two causes, the other big differences were in suicide (with $1 million and above face amounts representing a substantially higher percentage—over six times that for all face amounts) and other accidents (with $1 million and above face amounts also being a multiple of that for all face amounts).

Some possible explanations may be:
- Higher face amounts receive more scrutiny during the underwriting process and the life insurance industry is better at underwriting for cardiovascular disease than cancer.
- Those who can afford the higher face amount policies may lead riskier lifestyles than the general population and therefore have more accidental deaths.
- Those who can afford the higher face amount policies live more stressful lives and commit suicide more frequently.
- Those who intend to commit suicide may buy as high an amount as permitted.

Figure 6.1.2 shows the overall Medical, Nonmedical and Other causes split by percentage of claims.

Figure 6.1.2. Overall: Percentage of Medical, Nonmedical and Other Causes Policy Size ≥ $1M
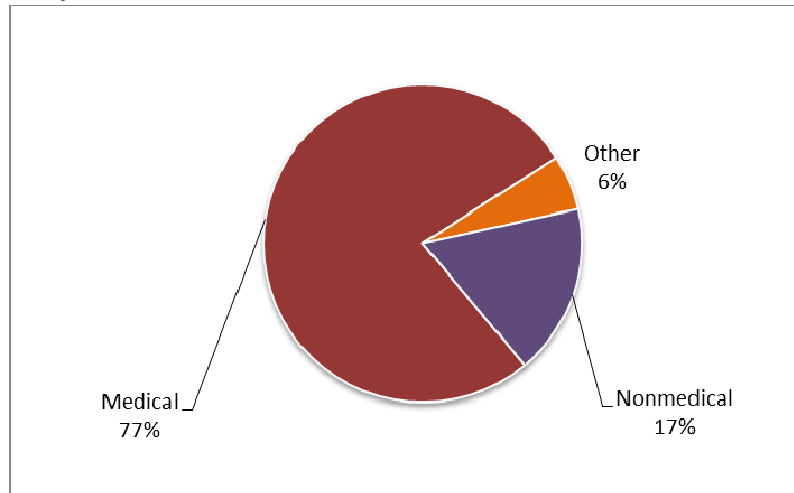
Medical causes represent 77 percent of the total known causes of death over the 10-year study period.

Figures 6.1.3 and 6.1.4 show a further breakdown of the Medical and Nonmedical categories, respectively.

Figure 6.1.3. Overall:
Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M
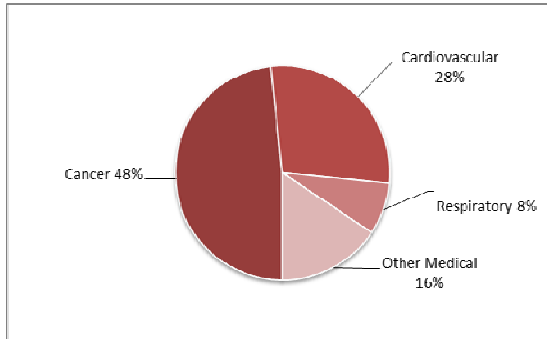
Figure 6.1.4. Overall:
Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
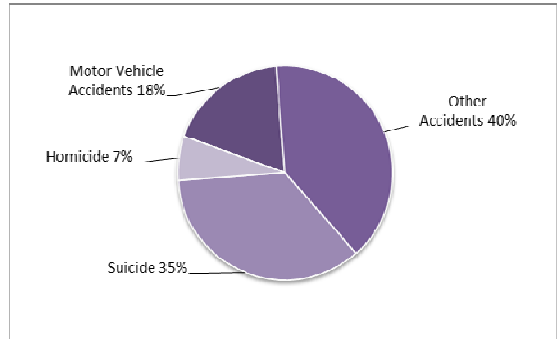
Note the Other category, which contains both medical and nonmedical causes and makes up 5.6 percent of the causes, is not included in either pie chart. Also note that the percentages for each chart individually sum to 100 percent and are relative to the total Medical or total Nonmedical causes of death as appropriate.

The charts show that cancer and cardiovascular represent more than 75 percent of the total Medical-related claims and that other accidents and suicides represent 75 percent of the Nonmedical-related claims.

6.2. Study Year

Figure 6.2.1 lists the percentage of claims by cause and study year along with the total claims by study year.

Figure 6.2.1. Study Year: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Study Year										Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Cancer	31.0%	26.1%	32.7%	36.2%	40.7%	40.8%	33.1%	38.9%	38.6%	36.2%	37.1%
Cardiovascular	21.0%	25.2%	23.8%	18.6%	23.5%	22.3%	20.3%	22.0%	23.6%	19.8%	21.8%
Respiratory	5.0%	2.5%	5.4%	3.7%	5.1%	4.3%	11.0%	4.7%	6.3%	6.7%	6.1%
Mental & Nervous	2.0%	0.0%	0.7%	2.7%	2.1%	3.3%	3.3%	5.5%	3.5%	5.5%	3.8%
Stroke	8.0%	0.8%	5.4%	4.8%	3.0%	5.2%	3.7%	3.2%	3.6%	2.2%	3.6%
Digestive	0.0%	0.0%	0.7%	0.5%	2.4%	1.6%	1.0%	1.6%	1.2%	2.2%	1.5%
Infectious	1.0%	1.7%	2.7%	2.1%	0.9%	1.0%	1.6%	0.7%	1.0%	0.8%	1.1%
Genitourinary	0.0%	0.0%	0.0%	0.0%	0.9%	0.2%	1.6%	1.5%	0.8%	0.9%	0.8%
Childbirth	0.0%	3.4%	0.0%	0.0%	0.3%	0.4%	1.0%	0.4%	0.4%	0.3%	0.5%
Diabetes & Metabolic	0.0%	0.8%	0.0%	0.0%	1.5%	0.4%	0.0%	1.0%	0.4%	0.1%	0.5%
Blood & Immune	0.0%	0.8%	0.7%	0.0%	0.0%	0.2%	0.4%	0.4%	0.4%	0.0%	0.3%
Motor Vehicle Accidents	4.0%	1.7%	1.4%	7.4%	2.4%	3.1%	3.5%	3.2%	2.9%	2.8%	3.1%
Other Accidents	7.0%	10.9%	10.9%	9.6%	7.8%	5.8%	7.3%	5.9%	5.8%	7.2%	6.9%
Suicide	6.0%	8.4%	6.1%	5.9%	4.2%	5.0%	6.1%	5.2%	6.3%	7.8%	6.1%
Homicide	1.0%	5.0%	0.7%	1.1%	0.6%	1.6%	1.6%	0.9%	0.4%	1.5%	1.2%
Other	14.0%	12.6%	8.8%	7.4%	4.5%	4.9%	4.5%	4.7%	4.6%	5.9%	5.6%
Total Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Count	100	119	147	188	332	515	508	678	932	883	4,402

Figure 6.2.2 shows the grouped percentages for Medical, Nonmedical and Other causes of death by study year.

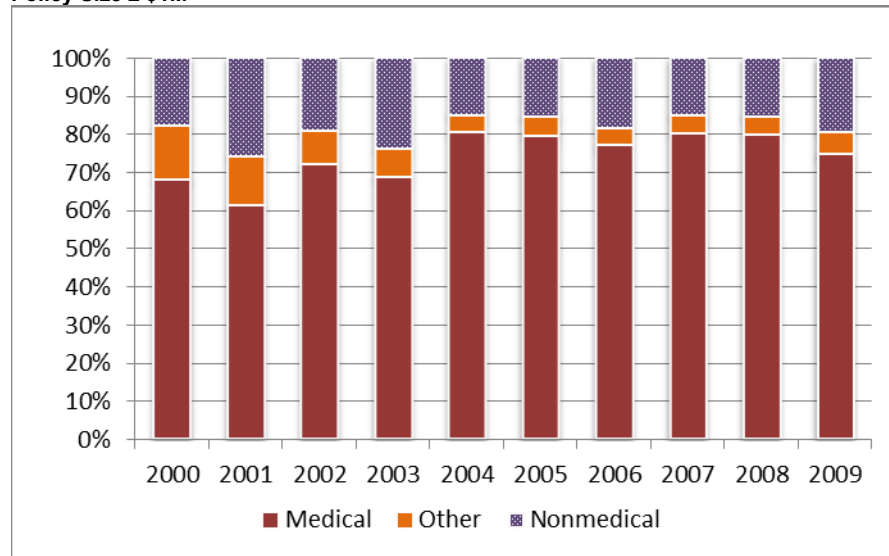**Figure 6.2.2. Study Year: Percentage of Medical, Nonmedical and Other Causes of Death**
Policy Size ≥ $1M

Medical, Nonmedical and Other causes have a relatively consistent pattern from 2004 and beyond with Medical reasons accounting for 75-80 percent of the claims, Nonmedical approximately 15-20 percent and Other causes around 5 percent. The data on claims in 2000 through 2003 is more limited, but here both Nonmedical and Other causes represented larger proportions of the total causes of death than the later study years.

One can speculate the bump up in 2001 Nonmedical claims was due to the 9/11 tragedy. These claims make up approximately 1.8 percent of the population homicides in 2001. One can also assume that most of the deaths were insured individuals based on demographics of passenger planes and resident workers in the twin towers.

With respect to specific causes, while not fully credible, mental and nervous generally increased in prevalence over the study period. Causes of death that had distinct peaks during these study years included cancer (2004-05), cardiovascular (2001) and respiratory (2006). Some of these peaks can be seen in the charts below.

Figures 6.2.3 and 6.2.4 show a further breakdown of the Medical and Nonmedical categories, respectively.

Figure 6.2.3. Study Year: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M
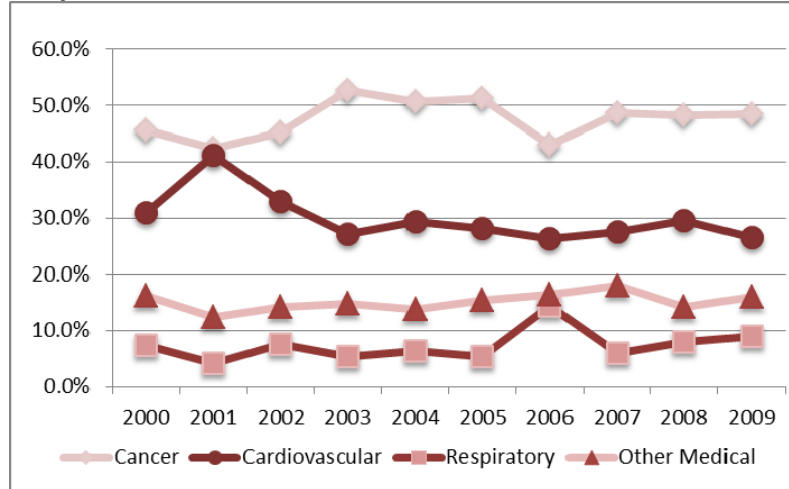
For Medical causes, the percentage of claims due to cancer dropped in 2001 as did respiratory and other medical. For all study years, MIMSA with all face amounts had more cardiovascular claims than cancer claims. This is one key difference from the high face contracts where cancer claims out-numbered cardiovascular causes for all years.

Figure 6.2.4. Study Year: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
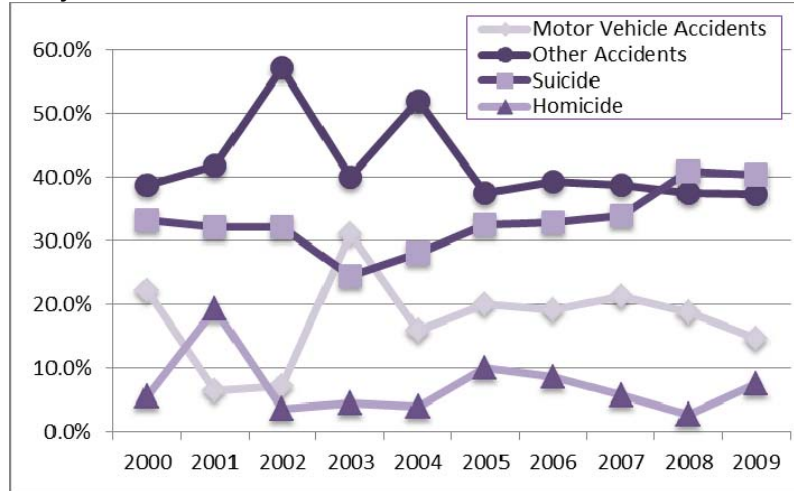
For Nonmedical causes in 2003, the percentage of motor vehicle claims jumped to over four times the prior year's percentage, but the number of motor vehicle claims was small in these years. A noticeable increase in the suicide percentage occurs in study years 2008 and 2009, which may be a result of poor economic times.

The cause of death percentages in MIMSA for motor vehicle accidents, suicides and other accidents were substantially lower than those for the high face amount contracts.

Appendix A contains tables with the number of claims by cause for each of the variables studied.

6.3. Issue Year

Figure 6.3.1 shows cause of death results by issue year for face amounts of $1 million and over. This study only included contracts in force during the study period so early year exposure was limited as was shown in Section 5.2.

Figure 6.3.1. Issue Year: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Issue Year				
	<1980	1980-89	1990-99	2000-09	Total
Cancer	18.9%	**36.2%**	**38.5%**	**36.3%**	**37.1%**
Cardiovascular	21.6%	**26.9%**	**21.7%**	**20.5%**	**21.8%**
Respiratory	13.5%	**6.5%**	**7.4%**	**4.4%**	**6.1%**
Mental & Nervous	8.1%	4.5%	**4.5%**	**2.8%**	**3.8%**
Stroke	8.1%	**5.6%**	**3.5%**	**3.0%**	**3.6%**
Digestive	0.0%	2.6%	1.4%	1.3%	**1.5%**
Infectious	2.7%	1.5%	**1.5%**	0.5%	**1.1%**
Genitourinary	2.7%	1.3%	1.1%	0.4%	**0.8%**
Childbirth	0.0%	0.2%	0.9%	0.2%	0.5%
Diabetes & Metabolic	2.7%	0.6%	0.3%	0.5%	0.5%
Blood & Immune	0.0%	0.4%	0.4%	0.2%	0.3%
Motor Vehicle Accidents	0.0%	0.6%	1.5%	**5.8%**	**3.1%**
Other Accidents	0.0%	3.2%	**5.5%**	**9.7%**	**6.9%**
Suicide	2.7%	1.1%	**5.5%**	**8.4%**	**6.1%**
Homicide	0.0%	0.4%	0.6%	**2.1%**	**1.2%**
Other	18.9%	**8.7%**	**6.0%**	**4.0%**	**5.6%**
Total Percentage	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Count	**37**	**539**	**1,989**	**1,837**	**4,402**

Even though the 1990s have less exposure than the 2000s, it is not unreasonable that there are more claims in the 1990s (1,989) than the 2000s (1,837) because these policies have been exposed longer.

Figure 6.3.2 shows the grouped percentages for Medical, Nonmedical and Other causes of death by issue year.

Figure 6.3.2. Issue Year: Percentage of Medical, Nonmedical and Other Causes of Death
Policy Size ≥ $1M
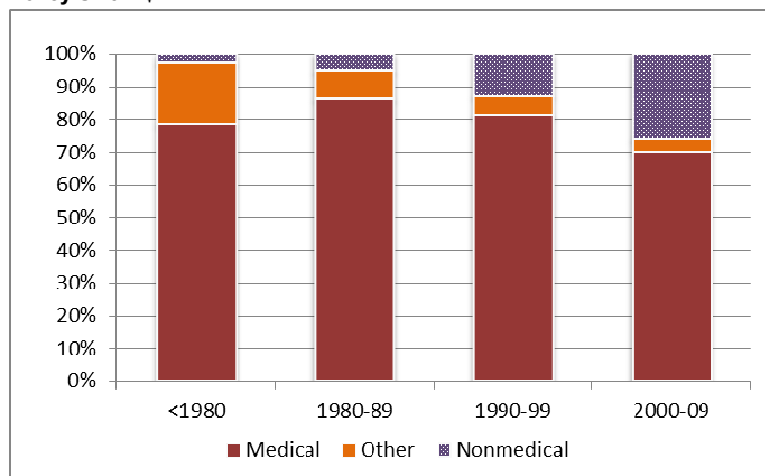
One would expect a higher percentage of Nonmedical claims in the more recent issue years than the Medical claims due to underwriting. The 2000s had approximately 26 percent Nonmedical claims while the 1980s experienced about 5 percent. Many medical conditions become more prominent as underwriting wears off over time.

Figures 6.3.3 and 6.3.4 show more details for the Medical and Nonmedical categories, respectively.

Figure 6.3.3. Issue Year: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M
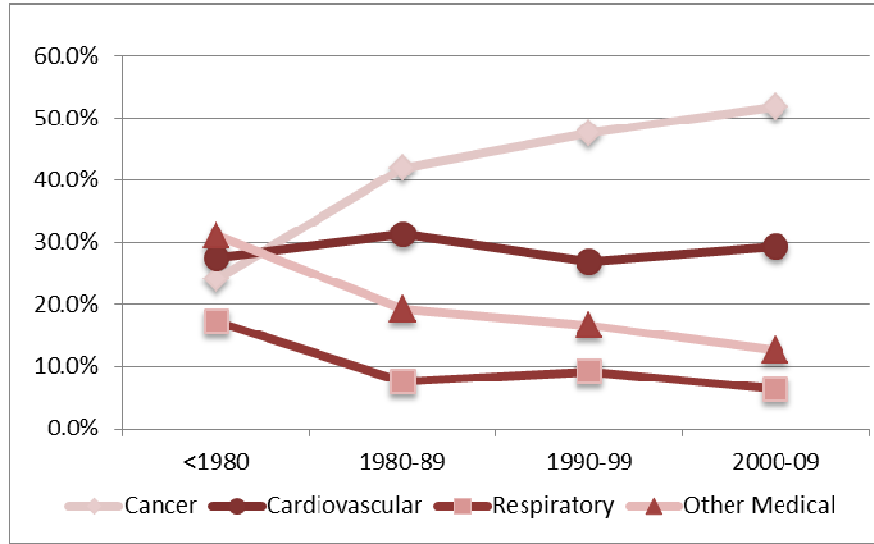
Despite more limited data, Figure 6.3.3 shows that cancer was not the leading cause of death prior to 1980, cardiovascular disease was. After 1980, cancer claims increased significantly more than the other leading Medical causes of death.

Figure 6.3.4. Issue Year: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
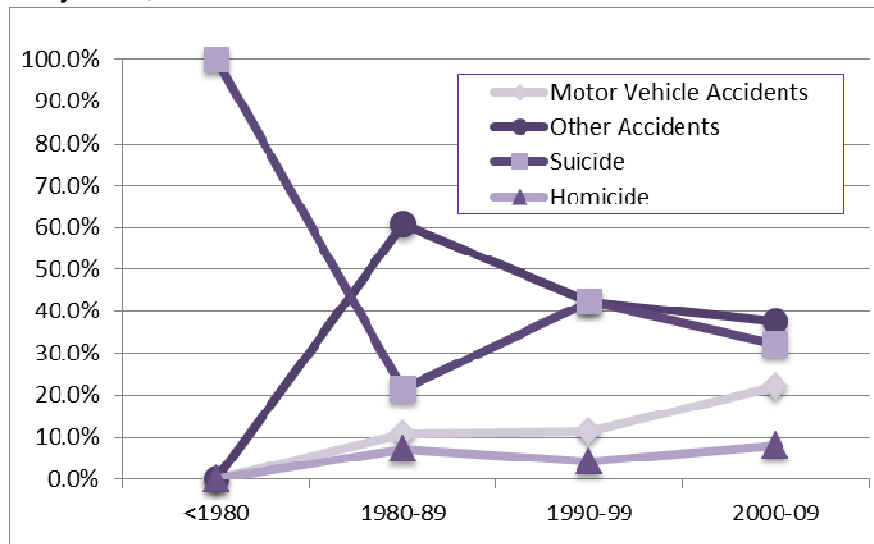
The percentage of motor vehicle accidents and homicides nearly doubled for Nonmedical causes of death from 1990-99 to 2000-09. The pre-1990 data contained very few Nonmedical deaths.

Figure A.1.2 in Appendix A shows the number of claims by issue year groups for each cause of death.

6.4. Policy Size

Figure 6.4.1 lists the causes of death by seven policy size bands. Policy sizes of $100,000 and higher are studied in this analysis.

Figure 6.4.1. Policy Size: Cause of Death Percentage and Count
Policy Size ≥ $100K

Cause of Death	Policy Size							
	$100K To <$250K	$250K To <$500K	$500K To <$1M	$1M To <$2.5M	$2.5M To <$5M	$5M To <$10M	$10M+	Total
Cancer	36.8%	37.3%	36.2%	36.8%	37.9%	40.8%	42.6%	36.9%
Cardiovascular	25.4%	23.2%	23.1%	21.9%	21.1%	22.0%	23.4%	24.6%
Respiratory	8.5%	6.6%	5.8%	5.8%	7.8%	7.2%	4.3%	7.8%
Mental & Nervous	4.4%	4.4%	4.1%	3.8%	4.5%	3.6%	2.1%	4.3%
Stroke	3.3%	3.4%	3.4%	3.4%	5.2%	3.1%	4.3%	3.3%
Digestive	2.3%	1.8%	1.5%	1.5%	1.3%	1.3%	0.0%	2.1%
Infectious	1.8%	1.5%	1.5%	1.2%	0.9%	0.4%	0.0%	1.7%
Genitourinary	1.3%	1.1%	0.9%	0.9%	0.7%	0.0%	0.0%	1.2%
Childbirth	0.1%	0.0%	0.2%	0.5%	0.9%	0.4%	0.0%	0.1%
Diabetes & Metabolic	0.9%	0.6%	0.6%	0.5%	0.7%	0.0%	0.0%	0.8%
Blood & Immune	0.2%	0.2%	0.2%	0.3%	0.0%	0.4%	0.0%	0.2%
Motor Vehicle Accidents	2.7%	3.5%	4.2%	3.2%	3.1%	1.3%	4.3%	3.0%
Other Accidents	3.5%	5.8%	6.5%	6.9%	7.8%	6.7%	4.3%	4.4%
Suicide	2.7%	4.4%	5.6%	6.2%	5.2%	5.8%	8.5%	3.5%
Homicide	0.6%	0.8%	1.2%	1.2%	0.2%	1.8%	0.0%	0.7%
Other	5.6%	5.6%	5.2%	6.0%	2.7%	4.9%	6.4%	5.6%
Total Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Count	56,131	15,945	7,214	3,686	446	223	47	83,692

Figure 6.4.2 shows the grouped percentages for Medical, Nonmedical and Other causes of death by policy size groupings. The black and gray bars ($100K to <$1M) represent data only shown in the sections of this report referring to policy size.

Figure 6.4.2. Policy Size: Percentage of Medical, Nonmedical and Other Causes of Death
Policy Size ≥ $100K
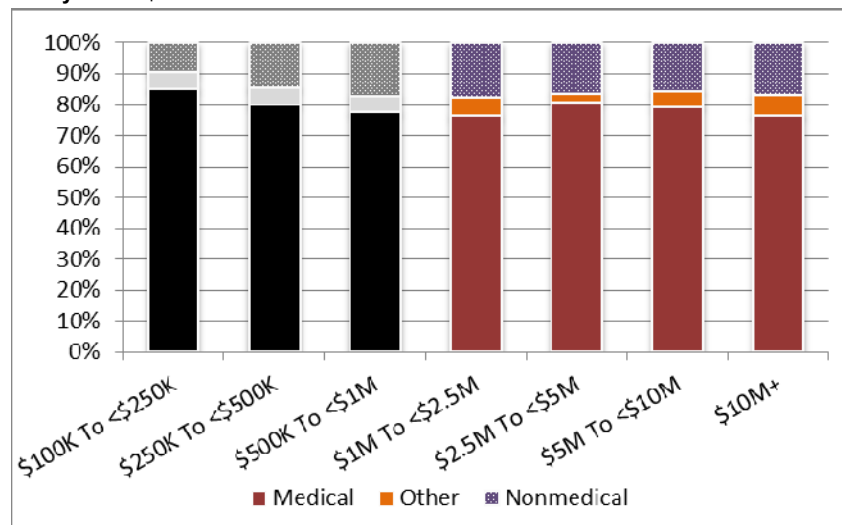
There appears to be a slight decrease in Medical causes of death as policy size increases up to $2.5 million. At $2.5 million, the Medical causes bump up slightly and then continue to decline as the contract sizes increase. From $500,000 and above, the Medical causes account for 76.5 percent to 80.9 percent of claims while the Nonmedical account for 15.7 percent to 17.6 percent. Below $500,000, Nonmedical causes only account for 9.5 percent to 14.6 percent. This may indicate that the higher face amount individuals can afford better health care and/or have riskier lifestyles. It may also be indicative of tighter underwriting at the larger face amounts.

With respect to looking at specific causes of death above and below $1 million:
- Cancer is the leading cause above $1 million, likely due to cancer being more difficult to underwrite than other impairments.
- Cardiovascular is the leading cause below $1 million, similar to general population mortality.
- Other accidents and suicides are higher above $1 million, likely due to a combination of riskier lifestyles, anti-selection by those contemplating suicide and stricter underwriting of medical issues above $1 million.

Figures 6.4.3 and 6.4.4 show more details for the Medical and Nonmedical categories, respectively by policy size. The black and gray lines and data points ($100K to <$1M) represent data only shown in the sections of this report referring to policy size.

Figure 6.4.3. Policy Size: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $100K
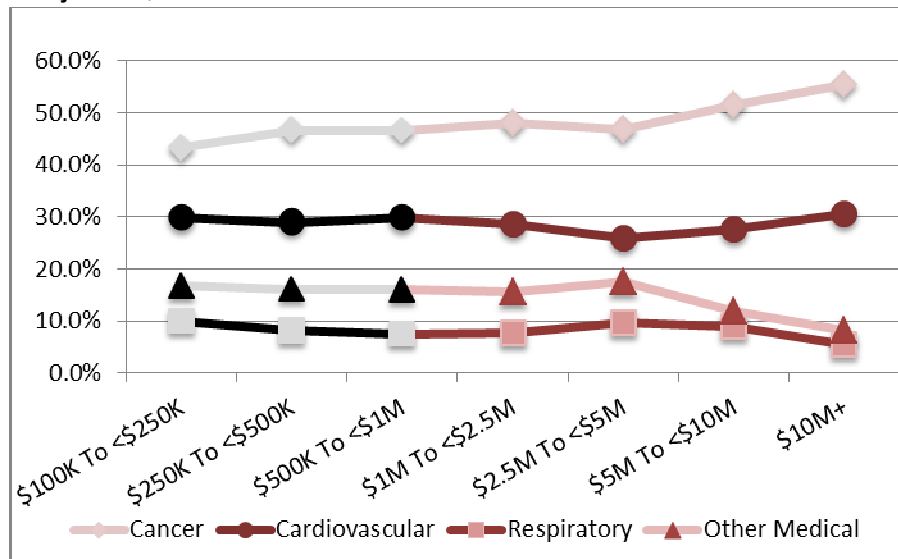
Cancer is the leading cause of death for all policy size bands listed, with cardiovascular-related causes second. The percentages for cancer are generally increasing as the policy size increases. The implication is that having a higher net worth may not provide one any better ability to beat cancer. It may also indicate that while tighter underwriting is used at the higher face amounts, the underwriting for cancer is not as strong as it is for other potential impairments.

Figure 6.4.4. Policy Size: Percentage for Nonmedical Causes of Death
Policy Size ≥ $100K
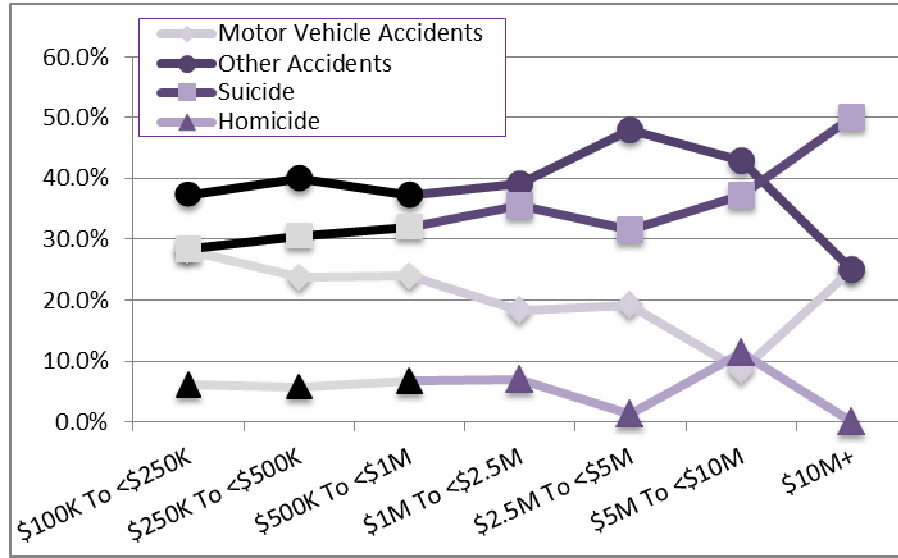
For the Nonmedical causes, other accidents are the leading cause of death in all size bands except for the $10 million plus band where suicide is the leading Nonmedical cause. The second highest Nonmedical cause of death is suicide. In general, as policy size increases, the suicide percentage also increases.

In Appendix A, Figure A.1.3 lists the causes of death by policy size based on the number of claims.

6.5. Attained Age

Figure 6.5.1 provides the percentage by cause of death according to the attained age at death. Total number of claims by each attained age group is also included.

Figure 6.5.1. Attained Age: Cause of Death Percentage and Count
Policy Size ≥ $1M

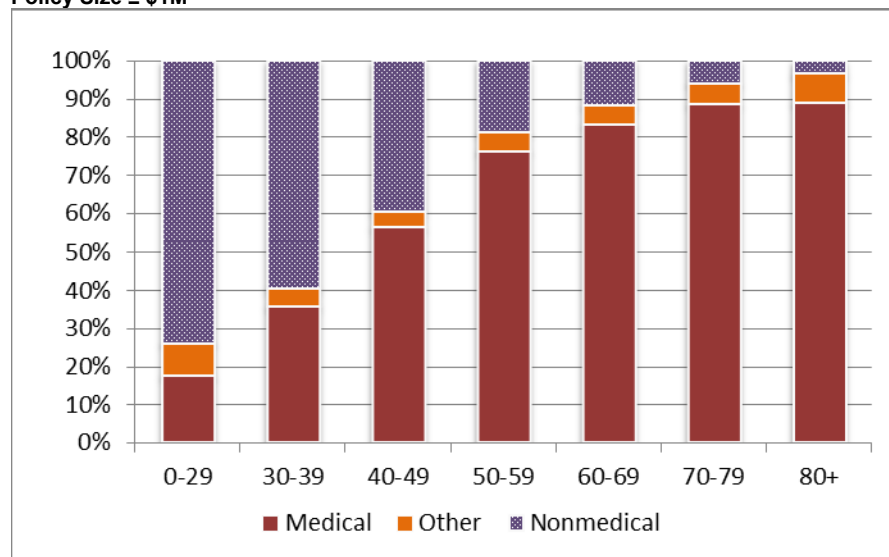| Cause of Death	Attained Age							
	0-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Cancer	8.7%	**19.4%**	**29.8%**	**42.9%**	**49.3%**	**45.0%**	**26.8%**	**37.1%**
Cardiovascular	4.3%	10.5%	**16.2%**	**22.9%**	17.5%	20.9%	31.6%	21.8%
Respiratory	0.0%	1.2%	2.1%	2.6%	**5.4%**	**8.7%**	11.3%	6.1%
Mental & Nervous	0.0%	1.6%	2.5%	1.6%	2.9%	**4.1%**	7.6%	3.8%
Stroke	0.0%	0.4%	2.7%	1.8%	3.1%	**3.9%**	6.5%	3.6%
Digestive	0.0%	1.2%	0.7%	1.8%	1.7%	1.6%	1.5%	1.5%
Infectious	0.0%	0.4%	1.0%	1.0%	1.2%	1.0%	1.5%	1.1%
Genitourinary	0.0%	0.4%	0.4%	0.1%	0.7%	1.6%	1.4%	0.8%
Childbirth	4.3%	0.4%	0.4%	1.0%	0.9%	0.1%	0.1%	0.5%
Diabetes & Metabolic	0.0%	0.0%	0.0%	0.4%	0.3%	1.2%	0.5%	0.5%
Blood & Immune	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.4%	0.3%
Motor Vehicle Accidents	8.7%	**13.4%**	**8.2%**	2.6%	1.8%	0.8%	0.5%	**3.1%**
Other Accidents	30.4%	**23.9%**	**14.3%**	**6.2%**	**4.6%**	3.3%	2.8%	**6.9%**
Suicide	21.7%	**17.4%**	**14.3%**	**8.5%**	**5.0%**	1.8%	0.2%	**6.1%**
Homicide	13.0%	4.9%	3.0%	1.6%	0.4%	0.0%	0.0%	**1.2%**
Other	8.7%	4.9%	4.2%	**4.9%**	**5.1%**	**5.6%**	7.6%	**5.6%**
Total Percentage	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Count	**23**	**247**	**672**	**837**	**766**	**826**	**1,031**	**4,402**

Figure 6.5.2 groups the Medical, Nonmedical and Other causes of death and provides the total percentages by attained age.

Figure 6.5.2. Attained Age: Percentage of Medical, Nonmedical and Other Causes of Death
Policy Size ≥ $1M

There is a correlation between cause of death and attained age. At the younger ages, Nonmedical causes dominate, accounting for approximately 74 percent of claims in the 0-29 attained age group. Medical causes become greater than Nonmedical causes between the 30s and 40s. The percentage of claims due to Nonmedical causes continues to

decrease while the percentage for Medical causes increases. At the highest attained ages, Medical causes account for nearly 89 percent of claims.

By individual cause, the causes of death that generally increase by attained age are cancer, cardiovascular, respiratory, mental and nervous, and stroke. Causes of death that decrease by attained age include pregnancy/childbirth, motor vehicle accidents, other accidents, suicide and homicide.

Figures 6.5.3 and 6.5.4 compare the high face amount (HFA) Medical, Nonmedical and Other causes of death percentages to that of the general population in a table and a line graph, respectively. The population data was taken from publically available data found in the National Vital Statistics Reports on the Centers for Disease Control and Prevention (CDC) website.[2]

Figure 6.5.3. Attained Age: Percentage of Medical, Nonmedical and Other Causes of Death
High Face Amount versus Population Data
Policy Size ≥ $1M

Cause of Death	Attained Age							
	0-29	30-39	40-49	50-59	60-69	70-79	80+	Total
HFA Medical	17.4%	35.6%	56.1%	76.2%	83.2%	88.5%	88.9%	77.1%
Population Medical	39.8%	45.7%	66.8%	80.0%	87.3%	88.0%	84.4%	81.4%
HFA Nonmedical	73.9%	59.5%	39.7%	18.9%	11.7%	5.9%	3.5%	17.4%
Population Nonmedical	46.8%	41.1%	21.1%	9.9%	4.2%	2.6%	2.3%	7.1%
HFA Other	8.7%	4.9%	4.2%	4.9%	5.1%	5.6%	7.6%	5.6%
Population Other	13.4%	13.2%	12.1%	10.0%	8.5%	9.4%	13.3%	11.4%

In the line graph below, the darker colors represent the population data while the lighter counterparts illustrate the high face amount data.

Figure 6.5.4. Attained Age: Percentage of Medical, Nonmedical and Other Causes of Death
High Face Amount versus Population Data
Policy Size ≥ $1M
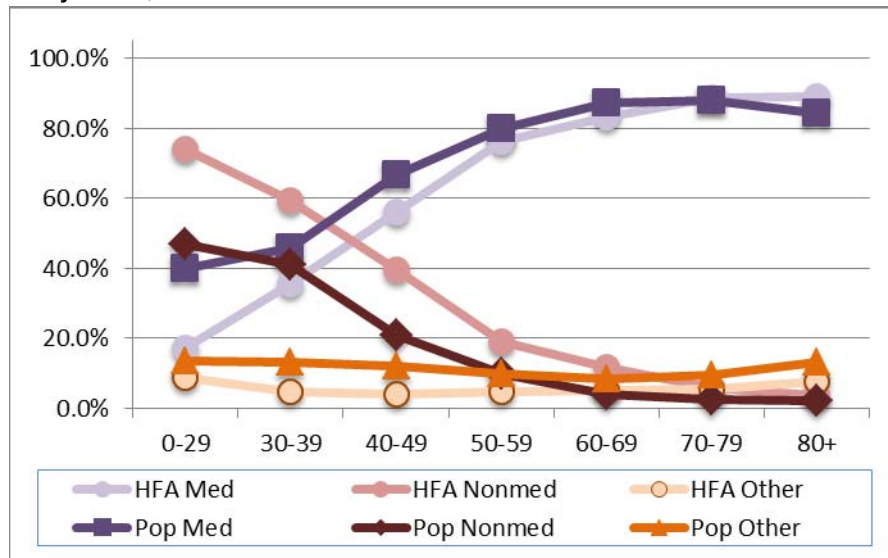
This graph shows a number of interesting things:

- The percentages for Medical causes of death were higher for the general population than the high face amount insured population until age 70 and above where they dipped below the insured group. Underwriting

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[2] Heron, et al. "Deaths: Final Data for 2006." The values were derived from the number of deaths in 2006 for 113 specific causes.

is likely the reason for the younger ages having a lower percentage of Medical claims. Some of the Other causes of death, which increase at age 70 and above for both data sets (more so for the population data), may be unidentified Medical causes.

- The high face amount insured group consistently had a greater percentage of Nonmedical causes of death over the general population. Again, this is likely due to the benefit of underwriting screening for many of the Medical causes in the early years following underwriting. Note that it may also be due to higher Nonmedical claims.

- The general population percentages of Other causes were consistently higher than those of the high face insured group. One reason may be that tracking for cause of death is more lax for the general population than for the insured population, thus more of the general population deaths would be undefined and fall into the Other category.

- The population cross-over from Nonmedical to Medical occurred between attained ages in the late 20s and early 30s. For the high face amount group, this cross-over occurred between the late 30s and early 40s, approximately 10 years later. Underwriting for medical causes is again likely one of the reasons for this difference.

Figures 6.5.5 and 6.5.6 show the top Medical and Nonmedical categories, respectively by attained age group.

Figure 6.5.5. Attained Age: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M
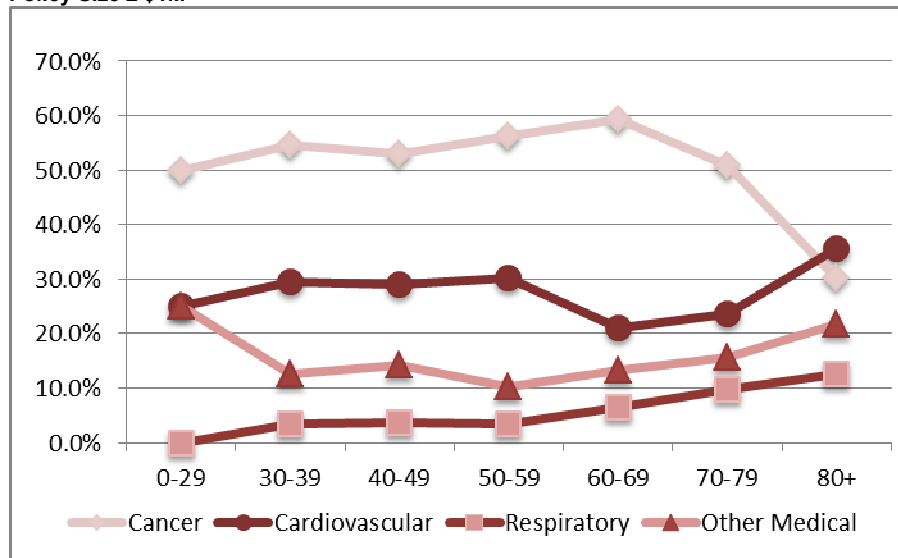
Cancer reached its peak percentage in the 60-69 age range and then declines sharply. The percentages for most all of the other Medical reasons rise after this point.

Figure 6.5.6. Attained Age: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
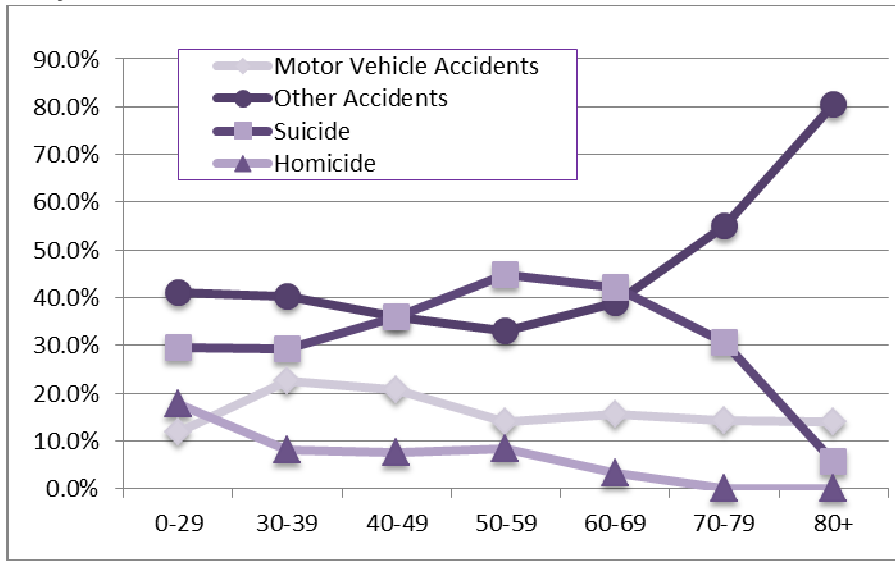
The percentage of suicides relative to all causes of death declines as insureds age, as shown in Figure 6.5.1. When observing the Nonmedical causes only, the suicide percentages tend to increase up to ages 50-59 and then decline steadily as shown above. Other accidents dominate the Nonmedical causes of death for the two oldest age groups. This may be due to an increase in the number of falls as people age, resulting in life-threatening injuries.

Figure A.1.4 in Appendix A contains a table of the number of claims for all causes by attained age groupings.

6.6. Gender

Figure 6.6.1 lists the percentage by cause of death and gender. The total numbers of high face amount male and female claims are also shown.

Figure 6.6.1. Attained Age: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Gender		
	Male	Female	Total
Cancer	35.7%	40.9%	37.1%
Cardiovascular	21.3%	23.1%	21.8%
Respiratory	5.3%	8.2%	6.1%
Mental & Nervous	3.1%	5.6%	3.8%
Stroke	3.1%	4.7%	3.6%
Digestive	1.4%	1.7%	1.5%
Infectious	1.0%	1.4%	1.1%
Genitourinary	0.8%	0.8%	0.8%
Childbirth	0.5%	0.5%	0.5%
Diabetes & Metabolic	0.6%	0.2%	0.5%
Blood & Immune	0.2%	0.5%	0.3%
Motor Vehicle Accidents	3.8%	1.5%	3.1%
Other Accidents	8.4%	3.0%	6.9%
Suicide	7.8%	1.9%	6.1%
Homicide	1.3%	0.7%	1.2%
Other	5.7%	5.2%	5.6%
Total Percentage	**100.0%**	**100.0%**	**100.0%**
Total Count	**3,179**	**1,223**	**4,402**

Cancer and cardiovascular dominate as the two leading causes of death for both males and females. For males, Nonmedical reasons (other accidents and suicide) have the third and fourth highest percentages at 8.4 percent and 7.8 percent, respectively. For females, three more Medical reasons (respiratory disease, mental and nervous disorders, and stroke) account for the next highest percentages at 8.2 percent, 5.6 percent and 4.7 percent before the Nonmedical other accidents complete the sixth spot at 3.0 percent. For males, respiratory was fifth at 5.3 percent and motor vehicle accidents were sixth at 3.8 percent.

Besides the higher Nonmedical top causes of deaths for males, another significant finding from this table is the large percentage for the cancer cause of death for females, 40.9 percent. This may be part of what is driving the relatively higher female mortality experience, as shown in Section 5.6.

Figure 6.6.2 sums the Medical, Nonmedical and Other causes of death percentages by gender.

**Figure 6.6.2. Gender: Percentage of Medical, Nonmedical and Other Causes of Death
Policy Size ≥ $1M**
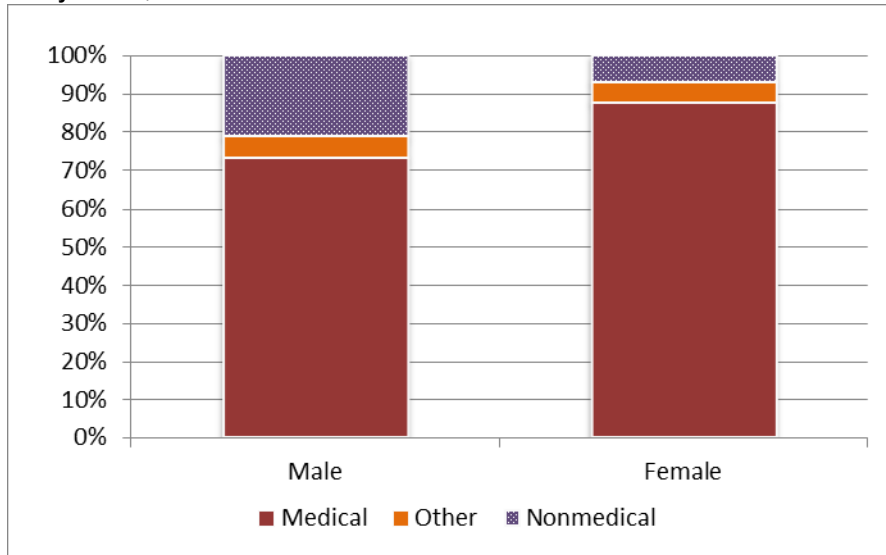
This graph shows visually what was just discussed, that males had higher Nonmedical causes of death than females. In fact, males had three times the percentage of female Nonmedical causes of death at 21.3 percent versus a female percentage of 7.1 percent

Figures 6.6.3 and 6.6.4 show the top Medical and Nonmedical categories, respectively, by gender.

**Figure 6.6.3. Gender: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M**
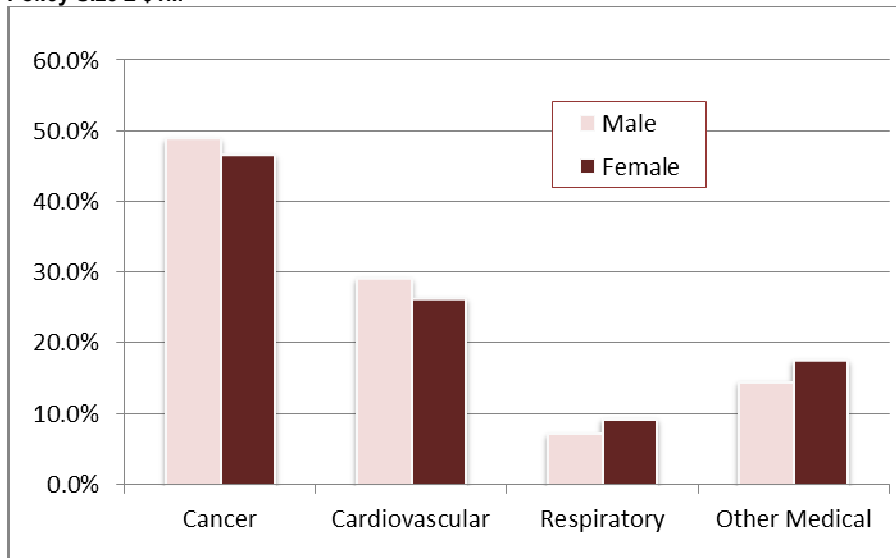
Females had a higher percentage than males of cancer, cardiovascular and respiratory diseases, mental and nervous disorders, and stroke (the top five Medical causes of death) relative to all causes of death as shown previously in Figure 6.6.1. When comparing only Medical causes of death as shown above in Figure 6.6.3, males have a higher percentage of cancer and cardiovascular disease than females. The Nonmedical causes of death for males decrease their overall Medical cause of death percentages.

Figure 6.6.4. Attained Age: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
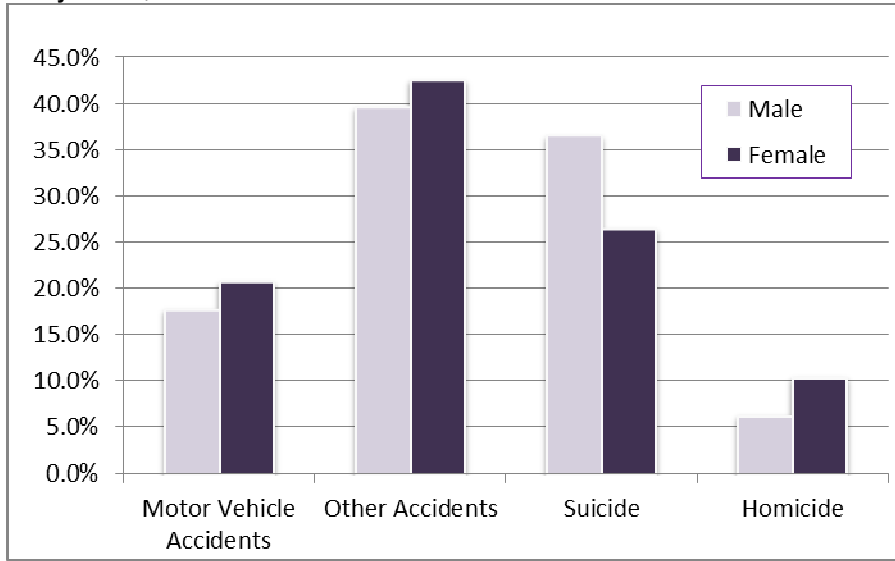
Males had at least double the percentage of females in the top four Nonmedical causes of death shown back in Figure 6.6.1. The percentage of male suicides was four times higher than the female percentage. When observing Nonmedical causes of death only, the relative comparisons change. Females continue to have a lower percentage of suicides than males, while having a higher percentage in all other Nonmedical causes as shown in Figure 6.6.4. Males and females have the same rank order or pattern of Nonmedical causes of death with other accidents being the highest, followed by suicide, motor vehicle accidents and homicide.

Appendix A shows the number of claims by cause for each gender in Figure A.1.5.

6.7. Smoking Status

Figure 6.7.1 shows the percentages by cause of death and total number of claims for each smoking status.

Figure 6.7.1. Smoking Status: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Smoking Status			
	Non Smoker	Smoker	Unknown	Total
Cancer	**37.0%**	**40.8%**	20.3%	**37.1%**
Cardiovascular	**21.8%**	**22.2%**	23.7%	**21.8%**
Respiratory	**5.7%**	9.1%	8.5%	**6.1%**
Mental & Nervous	3.9%	2.7%	8.5%	**3.8%**
Stroke	3.4%	4.2%	6.8%	**3.6%**
Digestive	1.5%	1.3%	1.7%	**1.5%**
Infectious	1.0%	1.6%	1.7%	**1.1%**
Genitourinary	0.7%	1.1%	5.1%	**0.8%**
Childbirth	0.4%	1.3%	0.0%	0.5%
Diabetes & Metabolic	0.5%	0.2%	0.0%	0.5%
Blood & Immune	0.3%	0.0%	0.0%	0.3%
Motor Vehicle Accidents	3.3%	**2.0%**	1.7%	**3.1%**
Other Accidents	7.3%	**4.4%**	1.7%	**6.9%**
Suicide	6.4%	**4.2%**	1.7%	**6.1%**
Homicide	1.3%	0.2%	1.7%	**1.2%**
Other	5.5%	4.7%	16.9%	**5.6%**
Total Percentage	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Count	**3,892**	**451**	**59**	**4,402**

The unknown smoking status had very little experience so no comments will be made regarding those results.

Figure 6.7.2 sums the Medical, Nonmedical and Other causes of death percentages by smoking status.

Figure 6.7.2. Smoking Status: Percentage of Medical, Nonmedical and Other Causes of Death
Policy Size ≥ $1M
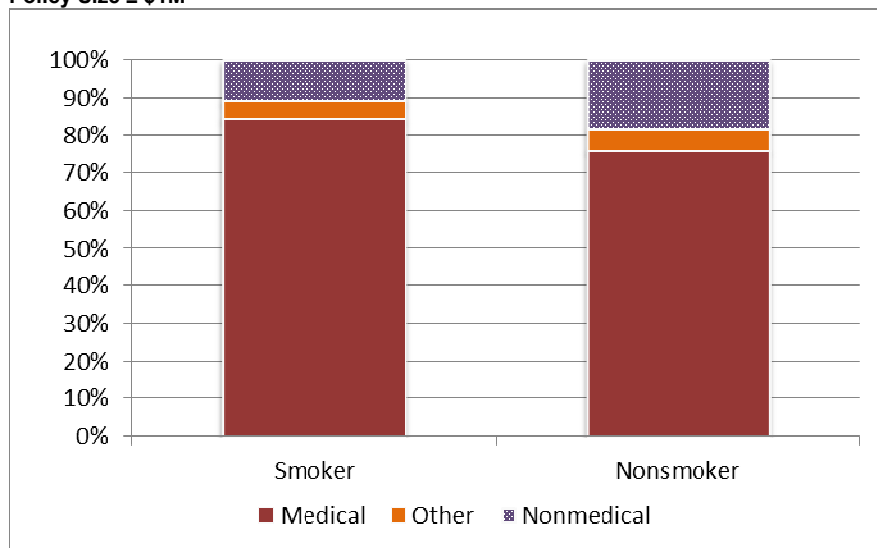
Smokers had a higher percentage of Medical causes of death nonsmokers. This is not surprising as smoking tends to lead to medical problems.

Figures 6.7.3 and 6.7.4 show the top Medical and Nonmedical categories, respectively by smoking status.

Figure 6.7.3. Smoking Status: Percentage for Top 3 Medical Causes of Death
Policy Size ≥ $1M
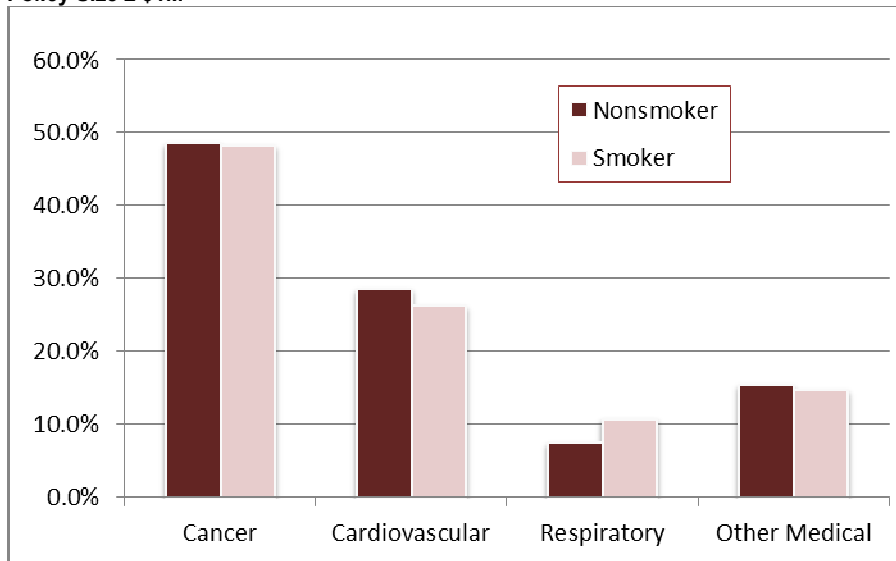
Cancer and cardiovascular disease were the leading causes of death for both the smoker and nonsmoker classes. Respiratory is the only Medical cause of death where smokers have a higher percentage than nonsmokers.

Figure 6.7.4. Smoking Status: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
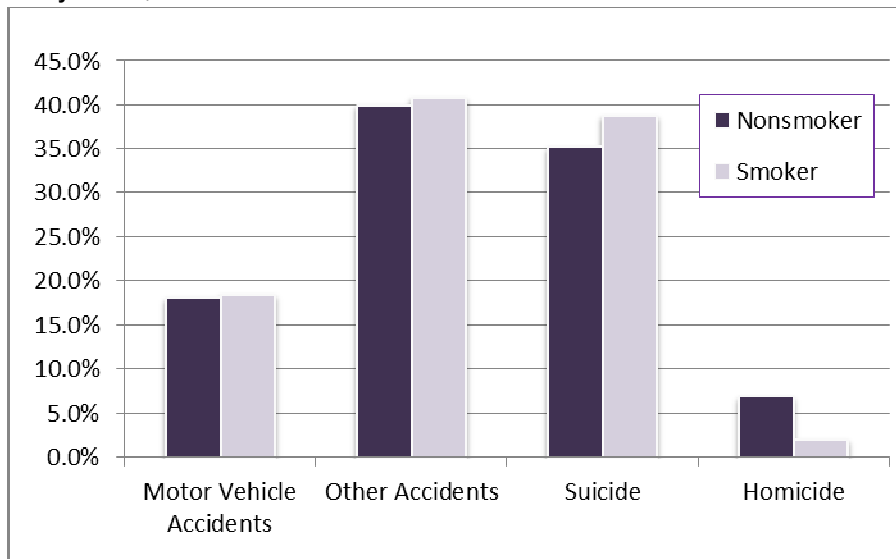
Smokers and nonsmokers have essentially the same rank order of Nonmedical causes of death. Homicide is the only Nonmedical cause of death where smokers have a lower percentage than nonsmokers.

Figure A.1.6 in Appendix A shows the number of claims by cause and smoking status.

6.8. Product Type

Figure 6.8.1 shows the percentage of cause of death by product type including the total number of claims. A description of the products can be found in Section 5.8.

Figure 6.8.1. Product Type: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	Product Type					Total
	Term	Whole Life	UL	VUL / EIL	Other	
Cancer	37.7%	35.6%	36.8%	36.9%	41.6%	37.1%
Cardiovascular	17.1%	23.6%	25.7%	21.4%	20.3%	21.8%
Respiratory	2.5%	7.0%	9.6%	6.8%	2.2%	6.1%
Mental & Nervous	1.9%	4.8%	5.4%	3.9%	1.9%	3.8%
Stroke	1.7%	4.5%	4.8%	3.0%	3.8%	3.6%
Digestive	0.7%	1.5%	1.8%	1.5%	2.8%	1.5%
Infectious	0.5%	0.8%	1.6%	1.1%	2.5%	1.1%
Genitourinary	0.4%	1.5%	1.1%	0.4%	0.3%	0.8%
Childbirth	0.1%	0.0%	0.2%	0.0%	5.6%	0.5%
Diabetes & Metabolic	0.2%	0.7%	0.3%	1.3%	0.0%	0.5%
Blood & Immune	0.2%	0.2%	0.2%	0.6%	0.3%	0.3%
Motor Vehicle Accidents	5.9%	1.6%	2.0%	2.0%	3.8%	3.1%
Other Accidents	10.4%	5.0%	3.4%	10.5%	7.2%	6.9%
Suicide	13.2%	1.8%	2.3%	6.5%	6.9%	6.1%
Homicide	2.6%	0.3%	0.5%	1.3%	0.6%	1.2%
Other	4.9%	11.3%	4.1%	3.0%	0.3%	5.6%
Total Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Count	1,262	1,019	1,259	542	320	4,402

Once again, cancer and cardiovascular disease are the leaders in cause of death for all product lines. Term has a significantly higher suicide percentage than the other product lines. If an individual is contemplating suicide at issue, one would likely purchase term as it provides the most coverage per dollar of premium. Term also has a high percentage of other accidents. Some of these may actually be suicides that appear as accidents. Finally, term has a lower percentage of cardiovascular claims than the other product lines. This may be due to the good life underwriting and limited term of coverage. In other words, the coverage is typically not in force long enough for the cardiovascular claims to materialize as they do after many years with permanent coverage. The lower cardiovascular percentage may also be due to the increased level of Nonmedical deaths.

Figure 6.8.2 sums the Medical, Nonmedical and Other causes of death percentages by product type.

Figure 6.8.2. Product Type: Percentage of Medical, Nonmedical and Other Causes of Death Policy Size ≥ $1M
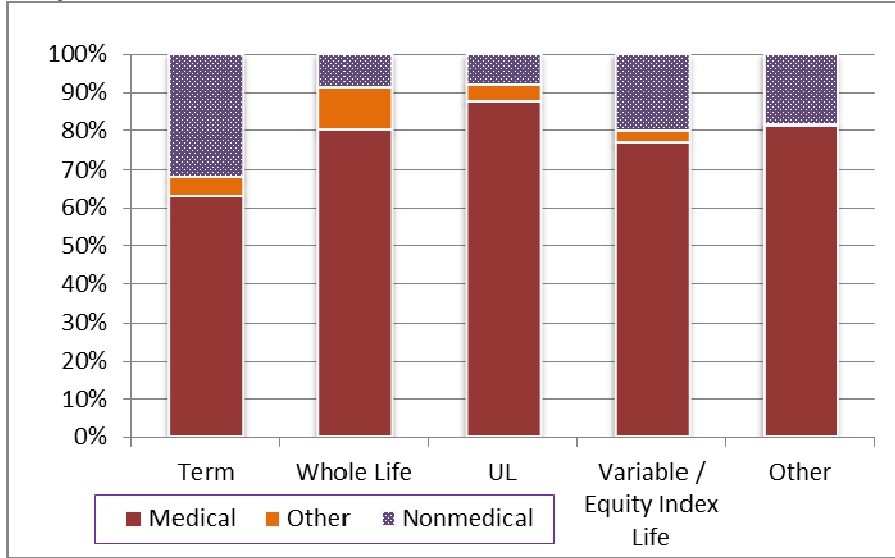
It is likely due to term insurance's short-term nature that the Nonmedical causes of death have a higher percentage than the other products. UL has the largest percentage of Medical claims.

Figures 6.8.3 and 6.8.4 show the top Medical and Nonmedical categories, respectively, by product type.

Figure 6.8.3. Product Type: Percentage for Top 3 Medical Causes of Death Policy Size ≥ $1M
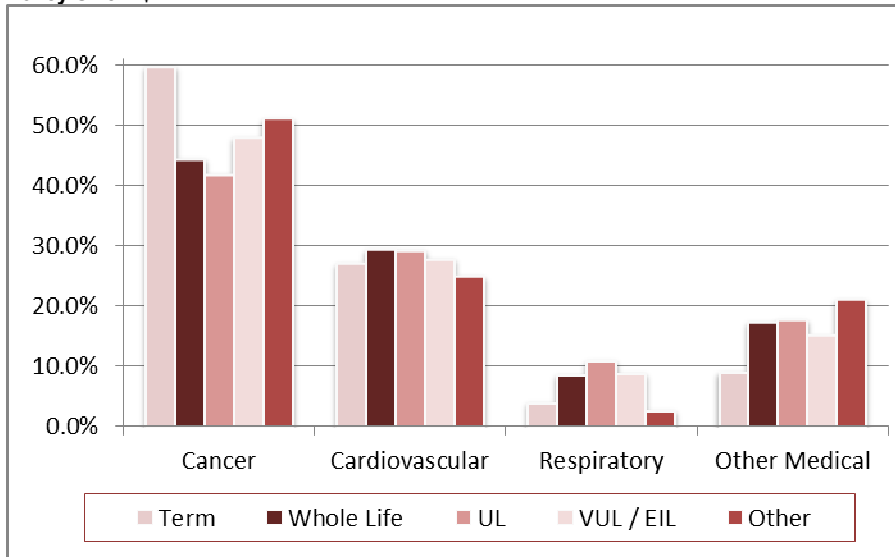
All of the products have a similar pattern for the Medical causes of death—cancer is leading cause, with cardiovascular and respiratory second and third, respectively. By product, cancer accounts for nearly 60 percent of the Medical-related deaths for term while accounting for approximately 40 percent for universal life.

Figure 6.8.4. Product Type: Percentage for Nonmedical Causes of Death
Policy Size ≥ $1M
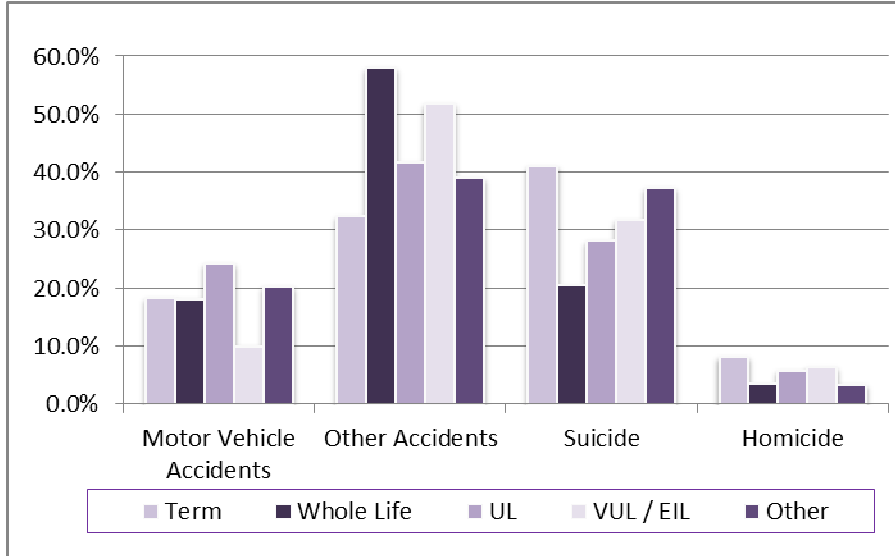
Other accidents have the highest percentage of Nonmedical causes of death for all product types except term. For term, other accidents are also very high, but suicides are the leading cause of death. Suicides represent 13.2 percent of all causes of death (Figure 6.8.1) for term and over 40 percent of term's Nonmedical causes of death (Figure 6.8.4). Suicides are the second leading cause for all other product types with motor vehicle accidents third for all product types.

Figure A.1.7 in Appendix A shows the number of claims by cause for each product type and was used to derive the percentages found in Figure 6.8.1.

6.9. Risk Class

Figures 6.9.1 and 6.9.2 show the percentages by cause of death and total number of claims for two sets of risk class groups, 2:1 and 3:2, as described in Section 5.9.

Figure 6.9.1. 2:1 Risk Class: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	2:1 Risk Class			
	Preferred Nonsmoker	Standard Nonsmoker	Standard Smoker	Total
Cancer	**38.5%**	**32.5%**	**42.3%**	**36.1%**
Cardiovascular	**16.7%**	**25.2%**	**19.9%**	**21.3%**
Respiratory	**5.5%**	**7.2%**	11.6%	**7.2%**
Mental and Nervous	4.1%	**5.2%**	3.7%	**4.6%**
Stroke	3.5%	**4.1%**	5.0%	**4.0%**
Digestive Disease	2.1%	1.7%	0.8%	**1.7%**
Infectious Disease	0.8%	1.2%	2.1%	1.1%
Genitourinary Disease	0.8%	0.8%	1.7%	0.9%
Childbirth	0.0%	0.2%	2.5%	0.5%
Diabetes & Metabolic	0.5%	1.3%	0.0%	0.8%
Blood & Immune	0.0%	0.1%	0.0%	0.1%
Motor Vehicle Accidents	3.2%	2.0%	0.4%	**2.2%**
Other Accidents	**7.9%**	**7.3%**	2.9%	**6.9%**
Suicide	**7.6%**	2.2%	2.9%	**4.4%**
Homicide	0.6%	1.4%	0.4%	1.0%
Other	**8.2%**	**7.4%**	3.7%	**7.2%**
Total Percentage	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Count	**657**	**848**	**241**	**1,746**

Cancer had the highest cause of death percentage for all three risk classes, but the smokers were the highest at 42.3 percent. The biggest differences between the nonsmoker classes were the preferred nonsmoker class having higher cancer (38.5 percent vs. 32.5 percent) and suicides (7.6 percent vs. 2.2 percent) and lower cardiovascular claims (16.7 percent vs. 25.2 percent) than the standard nonsmoker class.

Figure 6.9.2. 3:2 Risk Class: Cause of Death Percentage and Count
Policy Size ≥ $1M

Cause of Death	3:2 Risk Class					
	Best Preferred Nonsmoker	Preferred Nonsmoker	Standard Nonsmoker	Preferred Smoker	Standard Smoker	Total
Cancer	**42.2%**	**35.6%**	**37.8%**	**40.2%**	39.1%	**38.6%**
Cardiovascular	**14.5%**	**20.0%**	**23.8%**	20.7%	27.5%	**20.1%**
Respiratory	1.9%	4.1%	3.6%	7.6%	4.3%	**3.6%**
Mental and Nervous	1.9%	2.7%	2.4%	0.0%	4.3%	**2.3%**
Stroke	2.6%	2.5%	1.6%	4.3%	1.4%	**2.3%**
Digestive Disease	0.7%	0.5%	1.8%	0.0%	0.0%	0.9%
Infectious Disease	0.5%	0.5%	0.8%	0.0%	1.4%	0.6%
Genitourinary Disease	0.2%	0.5%	0.2%	0.0%	0.0%	0.3%
Childbirth	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%
Diabetes & Metabolic	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%
Blood & Immune	0.5%	0.2%	0.2%	0.0%	0.0%	0.3%
Motor Vehicle Accidents	6.4%	**7.0%**	4.0%	5.4%	4.3%	**5.7%**
Other Accidents	**8.3%**	**10.2%**	**8.7%**	8.7%	7.2%	**9.0%**
Suicide	**14.0%**	**9.1%**	**9.7%**	7.6%	5.8%	**10.4%**
Homicide	3.3%	2.9%	0.6%	0.0%	0.0%	**2.0%**
Other	3.1%	3.9%	4.6%	5.4%	4.3%	**4.0%**
Total Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Count	422	441	495	92	69	1,519

Cancer had the highest cause of death percentage across all five risk classes. Best preferred nonsmokers had the highest of the five at 42.2 percent followed by the two smoker classes. Cardiovascular was the second leading cause and this cause of death percentage increases as the risk class requirements decrease.

For the nonsmoker risk classes, the cause of death that increased from the best risk class to the worst was cardiovascular and the cause of death that decreased from the best risk class to the worst was homicide.

Figures 6.9.3 and 6.9.4 sum the Medical, Nonmedical and Other causes of death percentages by risk class groups.

Figure 6.9.3. 2:1 Risk Class: Percentage of Medical, Nonmedical and Other Causes of Death Policy Size ≥ $1M
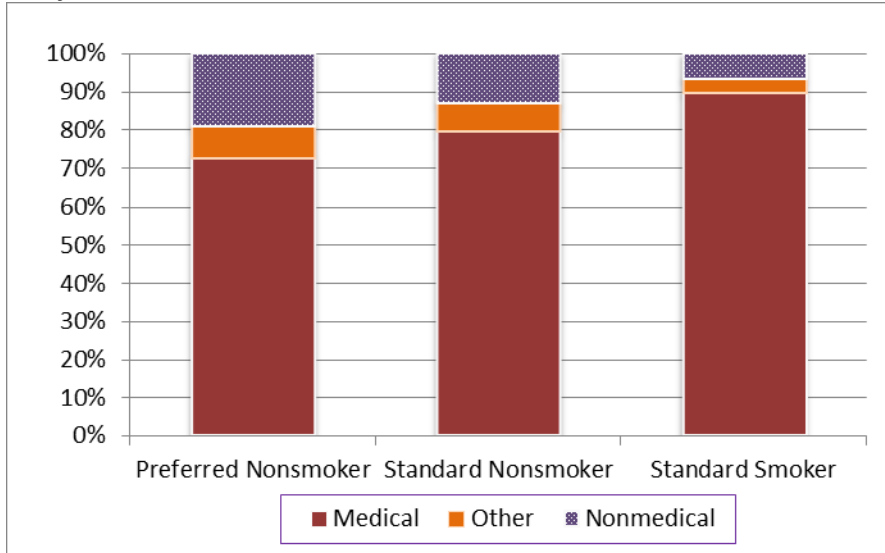
Figure 6.9.4. 3:2 Risk Class: Percentage of Medical, Nonmedical and Other Causes of Death Policy Size ≥ $1M
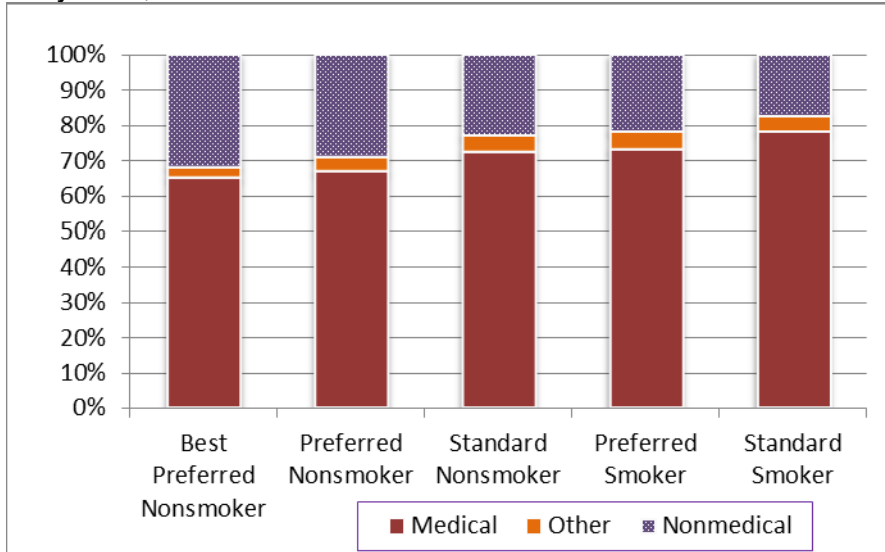
In both of the above graphs, the Medical causes of death increased from the best risk class to the worst. The Nonmedical causes do just the opposite.

Figures 6.9.5 through Figures 6.9.8 show the top Medical and Nonmedical categories, respectively by risk class groups.

Figure 6.9.5. 2:1 Risk Class: Medical Causes
Policy Size ≥ $1M
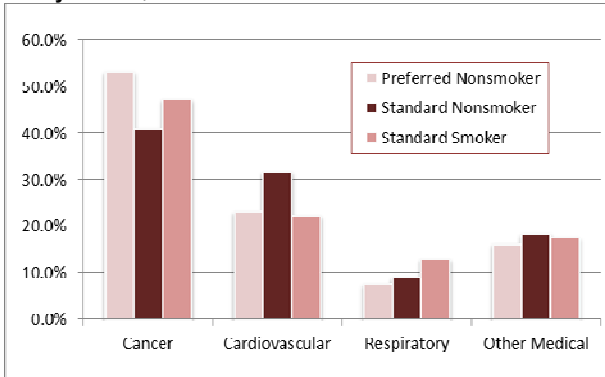
Figure 6.9.6. 2:1 Risk Class: Nonmedical Causes
Policy Size ≥ $1M
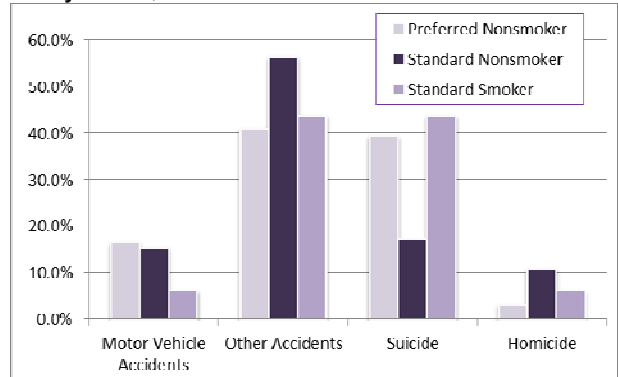
Figure 6.9.7. 3:2 Risk Class: Medical Causes
Policy Size ≥ $1M
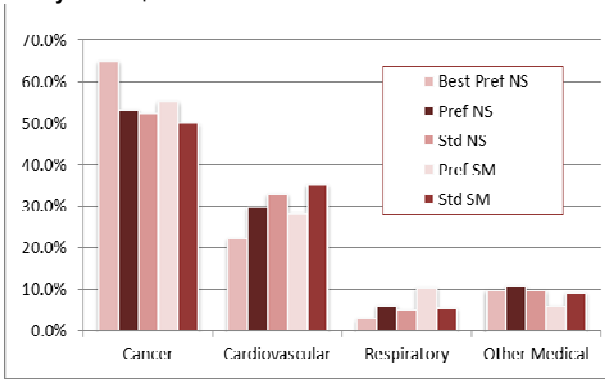
Figure 6.9.8. 3:2 Risk Class: Nonmedical Causes
Policy Size ≥ $1M
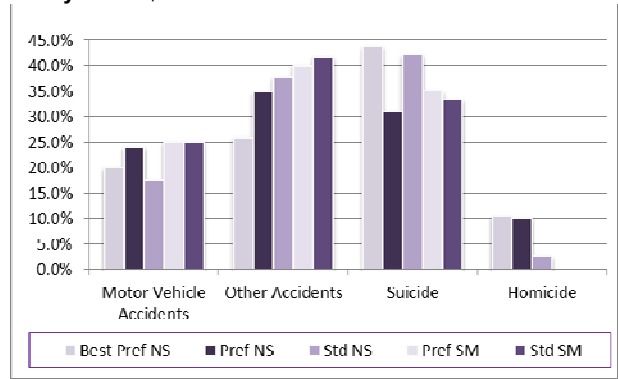
In the 3:2 risk class group, the best preferred class had the lowest percentage for all risk classes for cardiovascular disease and respiratory-related claims but the highest percentage of suicides. For Nonmedical causes of death in 2:1 and 3:2, other accidents and suicides were the leading causes across all risk classes.

Figures A.1.8 and A.1.9 in Appendix A show the number of claims by cause for risk class group.

7. CONCLUSION

This report utilized data from a recent large industry study conducted by Milliman, called MIMSA. Higher face amounts were defined as life insurance contracts of $1 million and higher. The higher face amount contracts had lower A/E ratios (82 percent by face amount and 84 percent by policy count) than the MIMSA study, which included all contract sizes (87 percent by face amount and 97 percent by policy count).

The following provides a summary of the findings for the high face amount contracts.

- While the reader may have expected to see improving A/E ratios by study year, the results were not smooth nor consistently decreasing, with the worst years being in 2005 and 2008.

- The A/E ratios generally decreased by both amount and count as the policy size increased. However, it was found that on term and variable/equity index policies, A/E ratios actually increased beginning at $1 million. This was due to nonmedical causes of death.

- While there is substantially more male (78 percent) than female (22 percent) exposure by face amount, as would be expected, the average policy size was very similar and actually higher for females ($1.57 million for males and $1.58 million for females). Males have a lower A/E ratio than females, but this may be due to the fit of the underlying table rather than indicating a difference in mortality results between males and females.

- Nonsmokers have substantially more of the exposure (95 percent) than smokers (4 percent) but have a slightly lower average face amount ($1.57 million) than smokers ($1.58 million). Similar to the gender results, the exposure relationship followed expectations while the average face amount relationship was unexpected.

- By cause of death, cancer was the leading cause of death, unlike population and MIMSA results where cardiovascular disease was the leading cause. Suicides were also much higher than in MIMSA and the population data.

- For term, cancer represented about 60 percent of all Medical causes and suicide represented about 40 percent of all Nonmedical causes of death. These percentages were much higher than on other product lines.

- The percentage of Nonmedical causes of death was greater for the high face amount policies than for both the population data and MIMSA. This may be due to higher stress levels, riskier lifestyles and better access to medical care.

Results were not always as might have been expected. These issues should continue to be monitored in future studies. In addition, more multiple-decrement mortality analysis should be considered for the next study. This may allow a better understanding of some of the drivers of the data. For example, adding gender to any of the single-decrement tables may provide some insight into trends in smoking habits, medical improvements and lifestyle differences between men and women. For cause of death, a study by duration may also prove insightful.

The reader may have different observations on the data provided and reach different conclusions from those presented. If so, the authors would be very interested in hearing about these perspectives. Please contact either the Society of Actuaries or the authors directly to provide feedback or ask questions.

The authors would like to thank the Society of Actuaries for the opportunity to provide this data and analysis and the members of Project Oversight Group (POG) for their insightful suggestions to help shape this report.

A. Appendix A

Figure A.1.1. Study Year: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Study Year										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Cancer	31	31	48	68	135	210	168	264	360	320	1,635
Cardiovascular	21	30	35	35	78	115	103	149	220	175	961
Respiratory	5	3	8	7	17	22	56	32	59	59	268
Mental & Nervous	2		1	5	7	17	17	37	33	49	168
Stroke	8	1	8	9	10	27	19	22	34	19	157
Digestive			1	1	8	8	5	11	11	19	64
Infectious	1	2	4	4	3	5	8	5	9	7	48
Genitourinary					3	1	8	10	7	8	37
Childbirth		4			1	2	5	3	4	3	22
Diabetes & Metabolic		1			5	2		7	4	1	20
Blood & Immune		1	1			1	2	3	4		12
Motor Vehicle Accidents	4	2	2	14	8	16	18	22	27	25	138
Other Accidents	7	13	16	18	26	30	37	40	54	64	305
Suicide	6	10	9	11	14	26	31	35	59	69	270
Homicide	1	6	1	2	2	8	8	6	4	13	51
Other	14	15	13	14	15	25	23	32	43	52	246
Total	**100**	**119**	**147**	**188**	**332**	**515**	**508**	**678**	**932**	**883**	**4,402**

Figure A.1.2. Issue Year: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Issue Year				Total
	<1980	1980-89	1990-99	2000-09	
Cancer	7	195	766	667	1,635
Cardiovascular	8	145	432	376	961
Respiratory	5	35	147	81	268
Mental & Nervous	3	24	89	52	168
Stroke	3	30	69	55	157
Digestive		14	27	23	64
Infectious	1	8	30	9	48
Genitourinary	1	7	21	8	37
Childbirth		1	18	3	22
Diabetes & Metabolic	1	3	6	10	20
Blood & Immune		2	7	3	12
Motor Vehicle Accidents		3	29	106	138
Other Accidents		17	109	179	305
Suicide	1	6	109	154	270
Homicide		2	11	38	51
Other	7	47	119	73	246
Total	**37**	**539**	**1,989**	**1,837**	**4,402**

Figure A.1.3. Policy Size: Number of Claims by Cause of Death
Policy Size ≥ $100K

Cause of Death	Policy Size							
	$100K To <$250K	$250K To <$500K	$500K To <$1M	$1M To <$2.5M	$2.5M To <$5M	$5M To <$10M	$10M+	Total
Cancer	20,676	5,947	2,609	1,355	169	91	20	30,867
Cardiovascular	14,234	3,693	1,666	807	94	49	11	20,554
Respiratory	4,754	1,045	421	215	35	16	2	6,488
Mental & Nervous	2,477	697	297	139	20	8	1	3,639
Stroke	1,845	535	248	125	23	7	2	2,785
Digestive	1,268	280	111	55	6	3		1,723
Infectious	1,010	238	109	43	4	1		1,405
Genitourinary	735	170	63	34	3			1,005
Childbirth	46	7	12	17	4	1		87
Diabetes & Metabolic	495	103	42	17	3			660
Blood & Immune	113	24	11	11		1		160
Motor Vehicle Accidents	1,507	551	300	119	14	3	2	2,496
Other Accidents	1,988	926	466	253	35	15	2	3,685
Suicide	1,511	709	401	230	23	13	4	2,891
Homicide	325	135	84	46	1	4		595
Other	3,147	885	374	220	12	11	3	4,652
Total	56,131	15,945	7,214	3,686	446	223	47	83,692

Figure A.1.4. Attained Age: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Attained Age							
	0-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Cancer	2	48	200	359	378	372	276	1,635
Cardiovascular	1	26	109	192	134	173	326	961
Respiratory		3	14	22	41	72	116	268
Mental & Nervous		4	17	13	22	34	78	168
Stroke		1	18	15	24	32	67	157
Digestive		3	5	15	13	13	15	64
Infectious		1	7	8	9	8	15	48
Genitourinary		1	3	1	5	13	14	37
Childbirth	1	1	3	8	7	1	1	22
Diabetes & Metabolic			0	3	2	10	5	20
Blood & Immune			1	2	2	3	4	12
Motor Vehicle Accidents	2	33	55	22	14	7	5	138
Other Accidents	7	59	96	52	35	27	29	305
Suicide	5	43	96	71	38	15	2	270
Homicide	3	12	20	13	3			51
Other	2	12	28	41	39	46	78	246
Total	23	247	672	837	766	826	1,031	4,402

Figure A.1.5. Gender: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Gender		
	Male	Female	Total
Cancer	1,135	500	1,635
Cardiovascular	678	283	961
Respiratory	168	100	268
Mental & Nervous	99	69	168
Stroke	99	58	157
Digestive	43	21	64
Infectious	31	17	48
Genitourinary	27	10	37
Childbirth	16	6	22
Diabetes & Metabolic	18	2	20
Blood & Immune	6	6	12
Motor Vehicle Accidents	120	18	138
Other Accidents	268	37	305
Suicide	247	23	270
Homicide	42	9	51
Other	182	64	246
Total	**3,179**	**1,223**	**4,402**

Figure A.1.6. Smoking Status: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Smoking Status			
	Non Smoker	Smoker	Unknown	Total
Cancer	1,439	184	12	1,635
Cardiovascular	847	100	14	961
Respiratory	222	41	5	268
Mental & Nervous	151	12	5	168
Stroke	134	19	4	157
Digestive	57	6	1	64
Infectious	40	7	1	48
Genitourinary	29	5	3	37
Childbirth	16	6		22
Diabetes & Metabolic	19	1		20
Blood & Immune	12			12
Motor Vehicle Accidents	128	9	1	138
Other Accidents	284	20	1	305
Suicide	250	19	1	270
Homicide	49	1	1	51
Other	215	21	10	246
Total	**3,892**	**451**	**59**	**4,402**

Figure A.1.7. Product Type: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	Product Type					
	Term	Whole Life	UL	VUL / EIL	Other	Total
Cancer	476	363	463	200	133	1,635
Cardiovascular	216	240	324	116	65	961
Respiratory	32	71	121	37	7	268
Mental & Nervous	24	49	68	21	6	168
Stroke	22	46	61	16	12	157
Digestive	9	15	23	8	9	64
Infectious	6	8	20	6	8	48
Genitourinary	5	15	14	2	1	37
Childbirth	1		3		18	22
Diabetes & Metabolic	2	7	4	7		20
Blood & Immune	3	2	3	3	1	12
Motor Vehicle Accidents	74	16	25	11	12	138
Other Accidents	131	51	43	57	23	305
Suicide	166	18	29	35	22	270
Homicide	33	3	6	7	2	51
Other	62	115	52	16	1	246
Total	**1,262**	**1,019**	**1,259**	**542**	**320**	**4,402**

Figure A.1.8. 2:1 Risk Class: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	2:1 Risk Class			
	Preferred Nonsmoker	Standard Nonsmoker	Standard Smoker	Total
Cancer	253	276	102	631
Cardiovascular	110	214	48	372
Respiratory	36	61	28	125
Mental and Nervous	27	44	9	80
Stroke	23	35	12	70
Digestive Disease	14	14	2	30
Infectious Disease	5	10	5	20
Genitourinary Disease	5	7	4	16
Childbirth	0	2	6	8
Diabetes & Metabolic	3	11	0	14
Blood & Immune	0	1	0	1
Motor Vehicle Accidents	21	17	1	39
Other Accidents	52	62	7	121
Suicide	50	19	7	76
Homicide	4	12	1	17
Other	54	63	9	126
Total	**657**	**848**	**241**	**1,746**

Figure A.1.9. 3:2 Risk Class: Number of Claims by Cause of Death
Policy Size ≥ $1M

Cause of Death	3:2 Risk Class					
	Best Preferred Nonsmoker	Preferred Nonsmoker	Standard Nonsmoker	Preferred Smoker	Standard Smoker	Total
Cancer	178	157	187	37	27	586
Cardiovascular	61	88	118	19	19	305
Respiratory	8	18	18	7	3	54
Mental and Nervous	8	12	12	0	3	35
Stroke	11	11	8	4	1	35
Digestive Disease	3	2	9	0	0	14
Infectious Disease	2	2	4	0	1	9
Genitourinary Disease	1	2	1	0	0	4
Childbirth	0	1	0	0	0	1
Diabetes & Metabolic	0	1	0	0	0	1
Blood & Immune	2	1	1	0	0	4
Motor Vehicle Accidents	27	31	20	5	3	86
Other Accidents	35	45	43	8	5	136
Suicide	59	40	48	7	4	158
Homicide	14	13	3	0	0	30
Other	13	17	23	5	3	61
Total	**422**	**441**	**495**	**92**	**69**	**1,519**

B. Appendix B

Section 5.3 discussed the A/E ratios by policy size and pointed out some unexpected results. To better understand these results, a few more queries were run on the data. Figure B.1.1 shows the exposure by face amount for the three nonsmoker risk classes at face amounts of $100,000 and higher, shown by male and female and in total.

Figure B.1.1. Three Nonsmoker Risk Classes: Exposure Percentage by Face Amount
Policy Size ≥ $100K

Exposure by Face Amount	Male			Female			Total		
	Best Pref NS	Pref NS	Std NS	Best Pref NS	Pref NS	Std NS	Best Pref NS	Pref NS	Std NS
$100K To <$250K	33%	32%	35%	47%	27%	26%	40%	30%	31%
$250K To <$500K	39%	32%	29%	55%	25%	20%	45%	29%	26%
$500K To <$1M	44%	34%	22%	61%	25%	14%	49%	31%	20%
$1M To <$2.5M	45%	34%	21%	60%	25%	15%	48%	32%	19%
$2.5M To <$5M	43%	36%	21%	47%	29%	24%	43%	35%	22%
$5M To <$10M	38%	37%	25%	39%	31%	30%	38%	36%	26%
$10M+	37%	39%	24%	37%	33%	31%	37%	37%	26%
Grand Total	42%	34%	24%	55%	26%	19%	46%	31%	23%

Females qualify for the best risk class more frequently than males in all policy size bands except at $10 million and higher, where both had 37 percent of the nonsmoker distribution. Males have a higher percentage than females in the preferred and standard risk classes until $2.5 million. At this point, females have a higher percentage of standard than males.

As the policy size bands increased, one might expect the percentage qualifying for the best risk class to follow suit. This table shows this was only the case up to the $1 million mark in total but not beyond. At the $1 million break point, the risk class splits were nearly identical and as the bands increased, the exposure actually declined for the best preferred risk class, the preferred was relatively stable and the standard increased slightly. This may be influenced by the older ages having the highest average face amounts.

Figure B.1.2 shows the A/E ratios that correspond to the exposures shown above.

Figure B.1.2. Three Nonsmoker Risk Classes: A/E Ratio by Face Amount
Policy Size ≥ $100K

A/E Ratios by Face Amount	Male			Female			Total			
	Best Pref NS	Pref NS	Std NS	Best Pref NS	Pref NS	Std NS	Best Pref NS	Pref NS	Std NS	Total NS
$100K To <$250K	77%	97%	124%	77%	98%	105%	77%	97%	118%	96%
$250K To <$500K	68%	89%	116%	74%	77%	96%	70%	86%	111%	85%
$500K To <$1M	62%	87%	109%	68%	85%	98%	64%	86%	107%	79%
$1M To <$2.5M	64%	90%	111%	73%	85%	93%	66%	89%	106%	81%
$2.5M To <$5M	86%	101%	99%	43%	65%	87%	76%	94%	95%	87%
$5M To <$10M	76%	96%	84%	51%	102%	113%	70%	98%	93%	86%
$10M+	67%	84%	49%	45%	120%	82%	60%	95%	62%	73%
Grand Total	68%	91%	103%	67%	90%	96%	68%	90%	101%	82%

Figure B.1.2 provides another explanation for why the A/E ratios remained steady as the policy size increased above the $1 million mark (except above $10 million). Several cells show preferred NS A/E ratios that exceed the standard A/E ratios, in particular males from $2.5 million and higher and females at $10 million and higher. One can speculate that possibly exceptions were made to offer the preferred rates. The underwriting needs to be adjusted to better reflect preferred experience, or further investigation should be done to understand these anomalies.

The smokers only make up 3 percent of the business in the 3:2 risk class group. When breaking this into smaller segments, the credibility of the cells becomes limited and the variance in results is high and not meaningful, thus data for smokers was not included in this appendix.