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# 2005-2017 Structured Settlement Mortality Experience Report

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# 2005-2017 Structured Settlement Mortality Experience Report

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# 2005-2017 Structured Settlement Mortality Experience Report

This report describes the results of the latest intercompany study of mortality experience under Structured Settlement annuities. Structured Settlement annuities consist primarily of workers compensation, individual long-term disability claims, and lawsuit settlements that provide a life-contingent income to the injured or related parties. Such periodic and deferred payments have been encouraged and even mandated in some states as a means of controlling costs under malpractice claims and ensuring the monies will be available in future years and not squandered as could happen with lump sum payments.

Because the settlement annuity market is considerably smaller than other insurance annuity markets, all contributors' data are very important. For example, the data contributed by some companies contained as little as one death. Only by combining the data of many companies could we hope to construct a database from which we could derive statistically reliable information.

In lieu of printed tables, the four Microsoft Excel files (two for standard lives, one by count and one by amount, and two for substandard lives, one by count and one by amount) published with this report provide pivot tables that access the databases. These pivot tables can be modified to provide alternate breakdowns and information of interest to the individual user. Data for this report were collected in 2019 for the study years 2005-2017.

Also, an Excel file is published with this report providing pivot tables which access the mortality rates of the various tables used as expected bases in this study.

Such a large study period may seem atypical for a mortality experience study; however, because Structured Settlement annuities is a niche market, it was deemed necessary to collect as much data as possible for greater credibility.

An explanation of the exposure calculations with diagrams is available in Appendix A. This is provided to enable readers to draw comparisons of experience derived by different methods than used in this study to their own experience results.

Also an Excel file is published with this report that shows how exposures and expecteds are calculated. This includes the actual death count and reserve death amount. Dividing the actual death count (or amount) by the expected death count (or amount) produces the A/E ratio by count (or amount).

The 6 cases in the Excel file include three cases issued before the study period (before 01/01/2005): one remained in force throughout the study (IBRI), one died (IBTD), and another terminated other than by death (IBTO). The other three were issued during the study (after 01/01/2005): one remained in force until the end of the study (IDRI), one died (IDTD), and another terminated other than by death (IDTO).

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## Section 1: Introduction

The primary purposes of the study are to:

1. Compare emerging structured settlement experience to that assumed in current statutory valuation bases, both standard and substandard.

2. For substandard business, analyze the experience using the rated-age basis and the "true age plus constant extra death" (CED) basis.

3. Help provide a basis for actuaries to assess mortality in this unique line of business where mortality tables based on traditional payout annuities may not be representative of this distinct population.

4. Potentially use as a basis for an experience table and possibly a valuation table.

No assessment has been made concerning the applicability of this experience for other purposes. In developing this report, the SOA relied upon data and information supplied by the participating company contributors. For each contributor, this information includes, but is not limited to, the data submission for mortality experience and the responses to follow-up questions.

## Section 2: Background

Experience is available by amount and by contract. However, not all companies were able to provide data by amount. The data for standard and substandard lives are available with many breakdowns as described in Section 3.

This study compared, separately for standard and substandard lives, actual to expected (A/E) mortality based on annuity valuation tables (1983 IAM, Annuity 2000, and 2012 IAM) and the Social Security Administration (SSA) tables during the study period. The SSA tables used in this study are from the Social Security 2019 Trustees Report (2019 Trustees Report).

In addition, for substandard business, a comparison of actual-to-expected mortality was made based on the "constant extra death (CED) method," which is the minimum valuation standard as prescribed in NAIC Actuarial Guideline IX-A.

This is the sixth such study sponsored by the Society of Actuaries and its Individual Annuity Experience Committee. This study is based on experience during the study years 2005 through 2017. Although this study overlaps some previous studies, it is based on a new collection of data in order to attract a larger amount of experience and, thus, greater credibility.

The first study, published in the Transactions of the Society of Actuaries 1991-92 Reports, included experience through calendar year 1989. The second study, published in the Transactions of the Society of Actuaries 1995-96 Reports, included experience through calendar year 1993. The third study, available on the SOA website, looked at experience through calendar year 1997. The fourth study, available on the SOA website, combined the experience of years 2000-2004 collected in 2005, and the experience of years 2005-2008 collected in 2009. Finally, the fifth study, available on the SOA website, looked at the experience of years 2009-2013 collected in 2016.

Structured settlements do not necessarily have annuity payments in all years. In addition, payments may vary substantially from year to year. Therefore, instead of using annual income, we used the statutory reserve for weighting the "by amount" computations. However, not all companies were able to provide the statutory reserves for all contracts.

The study data only reflects contracts providing life contingent payments. We excluded certain-only business because there would likely be an underreporting of deaths on such business, plus there is no real reason to study mortality on contracts for which mortality has no financial relevance. When an annuitant dies during the certain period of a contract providing life contingent payments within a certain period, the remaining payments made during the certain period are excluded from the study.

Some adjustments were made to the data for the "by amount" analysis. If a record had missing reserves, an algorithm was applied to populate the record with imputed reserves. First, if a policy had a missing reserve for a particular year, then the algorithm looked at the same policy in the next policy year or for whichever policy year it had a reserve, and used that reserve for that year with the missing reserve. This was the "back-fill" approach.

Then, if there was no reserve in future years, a "pull-forward" approach was used. The pull-forward approach is similar except that, instead of using a future year's reserve, it uses a past year's reserve to fill in the missing future reserves.

Lastly, the algorithm used the company's median reserve amount that it had submitted for other policies if the algorithm didn't find any past or future year with a reserve. This median reserve was derived before applying the back-fill and pull-forward approaches for other policies. Out of all the companies that submitted records without reserves, the algorithm adjusted less than 1% of their records.

## Section 3: Format of the Data

This study was performed on a calendar year basis. Contributing companies received an analysis of their own experience; otherwise, individual company experience is not made public. Rather, all experience is combined and made available by contract (count) and amount. The data are available with the following breakdowns:

| | |
|---|---|
| Underwriting Group: | Standard, Substandard |
| Gender: | Male, Female |
| Experience Year: | 2005 to 2017 |
| Issue Age Group: | 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, 86-90, 91-95, 96-100 |
| Duration: | 1 to 45 |
| Attained Age Group: | 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, 86-90, 91-95, 96-100, 101+ |
| Rated Issue Age Group: | 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, 86-90, 91-95, 96-100 |
| Rated Attained Age Group: | 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, 86-90, 91-95, 96-100, 101+ |
| Size of Rate-up in Years: | 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81+ |

Benefit Class:

**Single life only**: Annuity with payments made during the lifetime of the annuitant.

**Single life with period certain**: Annuity with payments made during the lifetime of the annuitant, but with a minimum certain period, such as 10 or 20 years. If the annuitant dies before the end of the certain period, the payments are continued or paid as a lump sum to the designated beneficiary.

**Single life with cash refund**: Annuity with payments during the lifetime of the annuitant, but with a minimum of the sum of the premiums paid. If the annuitant dies before the sum of the payments equal the sum of the premiums paid, the difference is paid in cash to the designated beneficiary.

**Single life with installment refund**: Annuity with payments during the lifetime of the annuitant, but with a minimum of the sum of the premiums paid. If the annuitant dies before the sum of the payments equal the sum of the premiums paid, the difference is paid in installments, equal to the annuity payments, to the designated beneficiary.

**Temporary single life:** Annuity with payments made until the annuitant reaches a certain age, such as 65, or until the death of the annuitant, whichever comes first.

# Section 4: Standard Lives

## 4.1 DEATHS

This study includes 17,814 deaths among standard lives. Not all companies were able to provide the statutory reserves used for weighting the "by amount" computations. The total death amount provided represents $1,314,053,349. Although the current study has more comprehensive data than the previous ones, the number of deaths is much lower than in the most recent Individual Payout Annuity study which included 260,000 deaths. Accordingly, considerable care must be taken in the interpretation of the results.

General background information on mortality experience credibility is available in Appendix 2 of the Educational Note published by the Canadian Institute of Actuaries, "Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies," Committee on Life Insurance Financial Reporting, Canadian Institute of Actuaries, July 2002.

**Table 1**

| DEATHS AND DEATH AMOUNT BY CALENDAR YEAR | | |
|---|---|---|
| Year | Actual Deaths | Actual Death Amount ('000) |
| **2005** | 650 | $55,443 |
| **2006** | 720 | $50,389 |
| **2007** | 746 | $56,195 |
| **2008** | 1,204 | $84,848 |
| **2009** | 1,283 | $79,990 |
| **2010** | 1,373 | $104,840 |
| **2011** | 1,481 | $118,563 |
| **2012** | 1,567 | $110,130 |
| **2013** | 1,625 | $116,704 |
| **2014** | 1,652 | $117,907 |
| **2015** | 1,765 | $135,459 |
| **2016** | 1,844 | $137,422 |
| **2017** | 1,904 | $146,163 |
| **TOTAL** | **17,814** | **$1,314,053** |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

**4.2 EXPOSURE**

The study includes 1,455,806 contract years of experience for standard lives. Not all companies were able to provide the statutory reserves used for weighting the "by amount" computations. The total amount exposed represents $187,479,562,048. The current study includes much more exposure than the previous studies.

The average exposure per study year is just over 110,000 contracts, while the average amount exposed per study year is almost $15,000M. The following table provides the exposure by number of contracts exposed and by amount exposed for each calendar year of the study.

**Table 2**

| # OF CONTRACTS EXPOSED AND AMOUNT EXPOSED BY CALENDAR YEAR | | |
|---|---|---|
| **Year** | **# of Contracts Exposed** | **Amount Exposed ('000)** |
| **2005** | 71,904 | $8,729,947 |
| **2006** | 74,498 | $9,131,789 |
| **2007** | 77,034 | $9,534,045 |
| **2008** | 104,115 | $12,981,369 |
| **2009** | 110,989 | $14,427,133 |
| **2010** | 115,054 | $15,067,328 |
| **2011** | 119,491 | $15,352,454 |
| **2012** | 122,778 | $15,801,368 |
| **2013** | 125,504 | $16,212,714 |
| **2014** | 128,617 | $16,588,777 |
| **2015** | 132,344 | $17,138,304 |
| **2016** | 135,868 | $18,244,308 |
| **2017** | 137,610 | $18,270,026 |
| **TOTAL** | **1,455,806** | **$187,479,562** |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

## 4.3 ISSUE AGE

The age distribution for this business differs greatly from the retirement annuity business. As can be seen in the following table and graph, the peak issue age group is at ages 41-45 with 142,171 contracts exposed. The number of contracts exposed shows a rapid decline in issues after age 50. By contrast, ages under 50 are usually sparsely represented in retirement annuity mortality studies.

**Table 3**

| DATA BY ISSUE AGE GROUP | | | | |
|---|---|---|---|---|
| Issue Age Group | Actual Deaths | # of Contracts Exposed | Actual Death Amount ('000) | Amount Exposed ('000) |
| 0-5 | 105 | 78,665 | $33,192 | $18,073,369 |
| 6-10 | 189 | 116,364 | $37,000 | $24,428,656 |
| 11-15 | 202 | 98,191 | $38,905 | $18,131,944 |
| 16-20 | 324 | 107,294 | $50,182 | $16,546,864 |
| 21-25 | 445 | 100,146 | $62,025 | $15,034,814 |
| 26-30 | 693 | 101,845 | $80,158 | $15,600,731 |
| 31-35 | 872 | 117,344 | $101,344 | $16,472,121 |
| 36-40 | 1,247 | 134,844 | $130,685 | $16,333,383 |
| 41-45 | 1,678 | 142,171 | $158,363 | $15,591,459 |
| 46-50 | 1,949 | 133,210 | $159,779 | $12,439,084 |
| 51-55 | 2,308 | 117,809 | $145,636 | $8,755,952 |
| 56-60 | 2,576 | 96,354 | $126,741 | $5,528,534 |
| 61-65 | 2,555 | 65,016 | $98,688 | $2,875,975 |
| 66-70 | 1,478 | 31,920 | $48,763 | $1,087,445 |
| 71-75 | 695 | 9,885 | $23,828 | $381,707 |
| 76-80 | 300 | 3,288 | $10,183 | $132,496 |
| 81-85 | 131 | 1,082 | $5,193 | $43,891 |
| 86-90 | 52 | 305 | $2,160 | $13,494 |
| 91-95 | 14 | 70 | $1,208 | $7,578 |
| 96-100 | 1 | 3 | $20 | $65 |
| TOTAL | 17,814 | 1,455,806 | $1,314,053 | $187,479,562 |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

**Graph 1**



# of Contracts Exposed by Issue Age Group

Although the current study has more comprehensive data than the previous ones, the number of deaths remains relatively low. Accordingly, considerable care must be taken in the interpretation of the results.

## 4.4 GENDER

As shown in the following tables, the exposure by gender is about 50-50 by amount and 52.5% male and 47.5% female by contract. However, the death data is 59% male by amount and 56% male by contract. These results are similar to those of prior studies. The higher proportion of male deaths relative to their exposure is caused by higher mortality rates for males as compared to females of similar ages.

As stated before, structured settlements do not necessarily have annuity payments in all years. In addition, payments may vary substantially from year to year. Therefore, instead of using annual income, we used the statutory reserve for weighting the "by amount" computations. The "by amount" data reflected only the total number of records with a reserve amount submitted since not all companies were able to provide the statutory reserves used for weighting the "by amount" computations.

**Table 4.1**

| DATA BY GENDER - BY COUNT | | | | |
|---|---|---|---|---|
| Gender | Actual Deaths | % | # of Contracts Exposed | % |
| Male | 10,010 | 56.2% | 764,502 | 52.5% |
| Female | 7,804 | 43.8% | 691,304 | 47.5% |
| TOTAL | 17,814 | | 1,455,806 | |

**Table 4.2**

| | DATA BY GENDER - BY AMOUNT | | | |
|---|---|---|---|---|
| Gender | Actual Death Amount ('000) | % | Amount Exposed ('000) | % |
| Male | $778,960 | 59.3% | $94,528,776 | 50.4% |
| Female | $535,093 | 40.7% | $92,950,786 | 49.6% |
| TOTAL | $1,314,053 | | $187,479,562 | |

## 4.5 EXPECTED BASES

As will be seen, mortality experience under structured settlement annuities does not fit well with any assumed mortality under individual annuity valuation tables. For example, the 2012 IAM Basic Table was derived from experience for immediate annuities, annuitizations, and life settlement options of individual life insurance and annuity death claims. The experience excluded substandard annuities, structured settlement annuities, and variable payout annuities. To develop values for ages below 50, the 1994 GAM Table was used.

The NAIC's Standard Valuation Law requires a mortality improvement projection for mortality rates beyond 2012. Because some experience used in this study is after 2012, an adjustment has been made to project the mortality rates in the 2012 IAM Table with projection scale G2 for comparison to this period experience. The projection scale G2 was applied to the 2012 IAM mortality rates, forward and backward, for each of the study years relative to the 2012 baseline.

The SSA Tables used in this study are the Social Security Administration Tables obtained from the 2019 Trustees Report. Three expected bases are used with the SSA Tables. The first one uses each study year SSA Table, the second uses the 2011 SSA Table, corresponding to the midpoint of the 2005 to 2017 study years, while the third uses the average of the 2005 to 2017 SSA Tables.

The table below shows the mortality bases available in the data. The term "period" below implies that it's a valuation table.

**Table 5**

| | EXPECTED BASES | | | | |
|---|---|---|---|---|---|
| Mortality Table | Valuation Margin | Projection | Base | Gender | Source |
| 1983 IAM Table | Included | None | ANB | Gender distinct | SOA website |
| 2000 Annuity | Included | None | ANB | Gender distinct | SOA website |
| 2012 IAM Basic Table | None | None | ANB | Gender distinct | SOA website |
| 2012 IAM Basic G2 Table | None | G2 | ANB | Gender distinct | SOA website |
| 2012 IAM Period Table | Included | None | ANB | Gender distinct | SOA website |
| 2012 IAM Period G2 Table | Included | G2 | ANB | Gender distinct | SOA website |
| 2005-2017 SSA Tables by Year | None | None | ANB | Gender distinct | SSA website |
| 2011 SSA Table (2005-17 midpoint) | None | None | ANB | Gender distinct | SSA website |
| 2005-2017 SSA Tables Average | None | None | ANB | Gender distinct | SSA website |

For simplicity, the expected bases used in the following pages of the Report will be:

The 1983 IAM Table, The 2000 Annuity Table, The 2012 IAM Period with G2 Table, and the 2011 SSA Table (2005-2017 midpoint).

### 4.6  GLOBAL A/E RATIOS

The following table displays actual deaths, expected deaths, and A/E ratios for each expected basis described earlier. The results are shown by contract and by amount. A/E ratios are higher by amount than by count under all expected bases.

**Table 6**

| A/E RATIO BY EXPECTED BASIS | | | | |
|---|---|---|---|---|
| **Expected Bases** | **Actual Deaths** **17,814** **Expected Deaths** | **A/E Ratio** | **Actual Death Amount ('000)** **$1,314,053** **Expected Death Amount ('000)** | **A/E Ratio** |
| 1983 IAM | 12,552 | 141.9% | $874,506 | 150.3% |
| 2000 Annuity | 10,394 | 171.4% | $715,038 | 183.8% |
| 2012 IAM Period with G2 Scale | 8,335 | 213.7% | $567,031 | 231.7% |
| 2011 SSA (midpoint) | 15,542 | 114.6% | $1,127,704 | 116.5% |
| **NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations. | | | | |

The more recent valuation table has lower mortality rates and, thus, a higher A/E ratio. None of these tables fit the experience very well; the SSA table comes closest, but it may not be a usable table for projecting forward. An implication of this is that, in theory, structured settlement business should have its own mortality table.

## 4.7  A/E RATIOS BY STUDY YEAR

The results can also be broken down by study year, which gives some idea of both the trend and the level of random fluctuation.

**Graph 2.1**
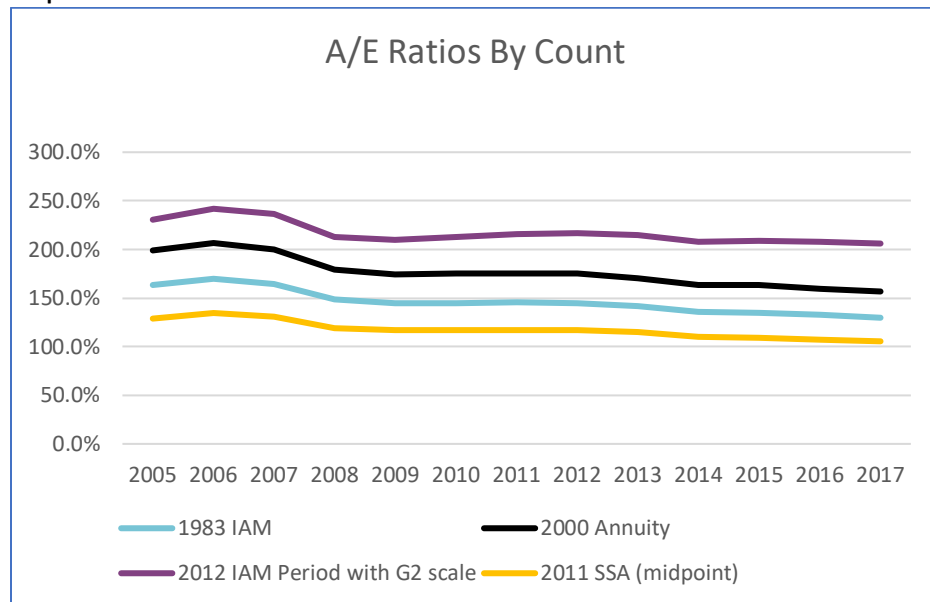


**Graph 2.2**
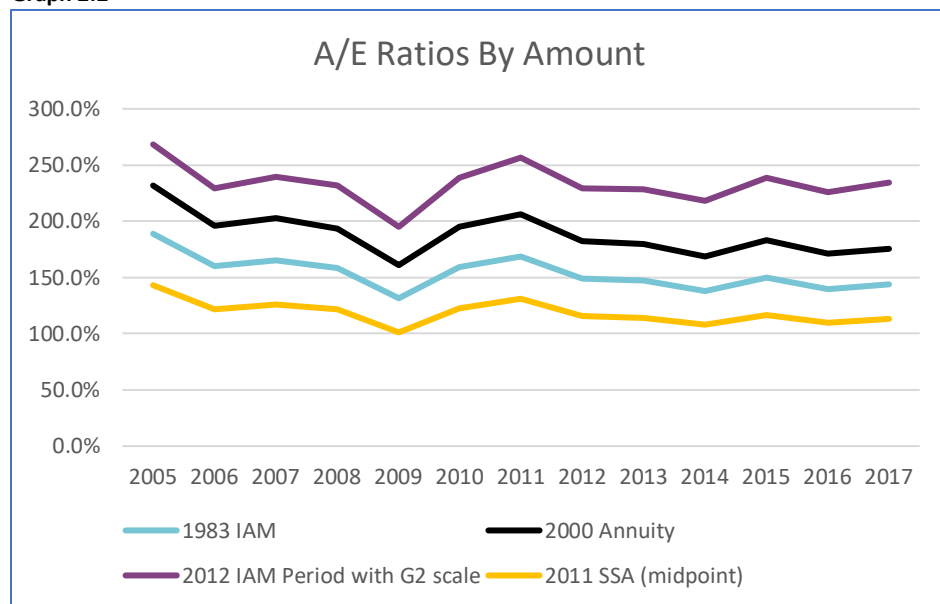


By count, the ratio increases from 2005 to 2006 and decreases from 2006 to 2008. After 2008, the ratios relative to the 2012 IAM Period with G2 scale do not decrease as much as the other ratios do because of the G2 improvement scale. The results by amount have higher year-by-year volatilities. Actual-to-expected ratios relative to the annuity valuation tables are well over 100%, indicating that reserves based on those tables may be excessive. As stated above, this is to be expected given those valuation tables are designed for individual annuity purchasers, a much more select population than this one.

The SSA Tables produce the A/E ratios closest to 100% over the whole study period, by count and by amount.

### 4.8 A/E RATIOS BY GENDER

A/E ratios by gender, shown next in Table 7, are lower for males under the 1983 IAM expected basis by both count and amount. However, under the 2012 IAM expected basis, A/E ratios are lower for females by both count and amount. And, as stated before, the A/E ratios are higher by amount than by count and this is true by gender also.

**Table 7**

| A/E RATIOS BY GENDER | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **# of Deaths** | | | **Death Amount ('000)** | | | |
| **Expected Bases** | **10,010** | **7,804** | **17,814** | **$778,960** | **$535,093** | **$1,314,053** | |
| | **By Count** | | | **By Amount** | | | |
| | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** | |
| 1983 IAM | 141.4% | 142.6% | 141.9% | 145.8% | 157.2% | 150.3% | |
| 2000 Annuity | 178.6% | 162.9% | 171.4% | 185.5% | 181.4% | 183.8% | |
| 2012 IAM Period with G2 scale | 235.9% | 190.8% | 213.7% | 247.2% | 212.4% | 231.7% | |
| 2011 SSA (midpoint) | 118.5% | 110.0% | 114.6% | 118.5% | 113.7% | 116.5% | |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

### 4.9 A/E RATIOS BY ISSUE AGE GROUP

For the 2012 IAM expected basis, the A/E ratios by issue age group in Tables 8.1 and 8.2 below show a steady decline after the issue age group 21-30. This holds true whether the A/E ratios are expressed by count or by amount. For the other expected bases and by count only, there is a small bump at issue age group 71-80.

Again, the global A/E ratios are mostly higher by amount than by count. However, this is true only for issue age groups 0-10 and 61-70. For all other issue age groups, the A/E ratios are lower by amount than by count and for all expected bases.

**Table 8.1**

| A/E RATIOS BY ISSUE AGE GROUP - BY COUNT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **# of Deaths** | | | | | | | | | |
| **Expected Bases** | **294** | **526** | **1,138** | **2,119** | **3,627** | **4,884** | **4,033** | **995** | **198** | **17,814** |
| | **0-10** | **11-20** | **21-30** | **31-40** | **41-50** | **51-60** | **61-70** | **71-80** | **81+** | **Grand Total** |
| 1983 IAM | 334.2% | 318.6% | 275.3% | 195.1% | 158.7% | 126.7% | 111.6% | 115.1% | 109.2% | 141.9% |
| 2000 Annuity | 363.8% | 385.7% | 352.6% | 246.7% | 197.0% | 153.1% | 131.7% | 133.8% | 124.9% | 171.4% |
| 2012 IAM Period with G2 Scale | 429.7% | 444.5% | 458.9% | 311.8% | 254.9% | 197.7% | 159.2% | 154.7% | 131.8% | 213.7% |
| 2011 SSA (midpoint) | 210.8% | 193.5% | 188.1% | 142.8% | 125.0% | 105.9% | 94.4% | 96.3% | 88.4% | 114.6% |

**Table 8.2**

| Expected Bases | Death Amount ('000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $70,192 | $89,087 | $142,183 | $232,029 | $318,142 | $272,377 | $147,451 | $34,011 | $8,581 | $1,314,053 |
| | 0-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | 81+ | Grand Total |
| 1983 IAM | 355.7% | 313.4% | 229.6% | 166.4% | 139.3% | 117.0% | 118.1% | 109.4% | 108.6% | 150.3% |
| 2000 Annuity | 387.8% | 381.9% | 293.3% | 209.2% | 172.4% | 142.1% | 140.8% | 128.9% | 124.2% | 183.8% |
| 2012 IAM Period with G2 Scale | 452.9% | 439.7% | 382.7% | 263.2% | 219.6% | 183.7% | 175.2% | 153.9% | 130.8% | 231.7% |
| 2011 SSA (midpoint) | 219.5% | 190.8% | 155.9% | 120.8% | 108.6% | 97.3% | 100.6% | 93.5% | 87.9% | 116.5% |

**NOTE:** The "by amount" data reflects only the total number of records with a reserve amount submitted since not all companies were able to provide the statutory reserves used for weighting the "by amount" computations.

### 4.10    A/E RATIOS BY ATTAINED AGE GROUP

The following table contains the number of deaths, the number of contracts exposed, the death amount, and the exposure amount underlying the A/E ratios shown for each attained age group in Tables 10.1 and 10.2.

**Table 9**

| Attained Age Group | Actual Deaths | # of Contracts Exposed | | Actual Death Amount ('000) | Amount Exposed ('000) |
|---|---|---|---|---|---|
| **DATA BY ATTAINED AGE GROUP** | | | | | |
| **0-5** | 0 | 4,088 | | $0 | $815,882 |
| **6-10** | 5 | 18,734 | | $975 | $3,544,262 |
| **11-15** | 16 | 37,651 | | $6,436 | $6,976,529 |
| **16-20** | 67 | 58,819 | | $18,234 | $10,935,563 |
| **21-25** | 147 | 78,586 | | $27,266 | $14,738,973 |
| **26-30** | 156 | 89,084 | | $24,343 | $16,733,028 |
| **31-35** | 222 | 91,290 | | $37,944 | $16,541,133 |
| **36-40** | 293 | 94,657 | | $41,837 | $15,010,105 |
| **41-45** | 473 | 112,150 | | $54,987 | $15,828,703 |
| **46-50** | 811 | 138,061 | | $97,237 | $17,518,671 |
| **51-55** | 1,237 | 156,765 | | $126,976 | $18,383,949 |
| **56-60** | 1,565 | 158,249 | | $145,556 | $17,246,822 |
| **61-65** | 1,834 | 139,371 | | $151,363 | $13,888,653 |
| **66-70** | 2,103 | 108,288 | | $157,266 | $9,478,132 |
| **71-75** | 2,029 | 71,371 | | $133,878 | $5,277,376 |
| **76-80** | 2,080 | 46,664 | | $117,879 | $2,737,451 |
| **81-85** | 2,103 | 30,704 | | $95,365 | $1,254,742 |
| **86-90** | 1,661 | 15,581 | | $51,431 | $442,684 |
| **91-95** | 780 | 4,819 | | $19,928 | $108,371 |
| **96-100** | 208 | 798 | | $4,583 | $16,925 |
| **101+** | 24 | 80 | | $569 | $1,608 |
| **TOTAL** | **17,814** | **1,455,806** | | **$1,314,053** | **$187,479,562** |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

Only attained age groups that have at least 400 deaths are considered credible. Therefore, considerable care must be taken in the interpretation of the results.

A/E ratios in Table 10.1 exceed 100% relative to the valuation tables (the first three expected bases). They consistently decrease for attained age groups 31-40 and higher, but never decrease below 100% even at the higher ages, as was the case in the prior studies. A/E ratios decrease below 100% relative to the 2011 SSA Table for attained age groups 81-90 and 91+. However, by amount, as shown in Table 10.2, the pattern is not as clear.

Based on this study's overall distribution of business, each valuation table appears sufficient because its A/E ratio is greater than 100%, even at the highest ages.

**Table 10.1**

| A/E RATIOS BY ATTAINED AGE GROUP - BY COUNT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Expected Bases** | **# of Deaths** | | | | | | | | |
| | **391** | **515** | **1,284** | **2,802** | **3,937** | **4,109** | **3,764** | **1,012** | **17,814** |
| | **0-30** | **31-40** | **41-50** | **51-60** | **61-70** | **71-80** | **81-90** | **91+** | **Grand Total** |
| 1983 IAM | 316.2% | 346.1% | 248.2% | 183.9% | 146.5% | 124.3% | 112.4% | 112.9% | 141.9% |
| 2000 Annuity | 331.0% | 437.0% | 325.9% | 233.7% | 182.2% | 149.4% | 131.5% | 127.7% | 171.4% |
| 2012 IAM Period with G2 Scale | 385.3% | 457.4% | 442.0% | 304.8% | 222.9% | 204.5% | 158.1% | 134.2% | 213.7% |
| 2011 SSA (midpoint) | 190.0% | 204.0% | 169.8% | 133.2% | 115.8% | 107.4% | 97.4% | 89.3% | 114.6% |

**Table 10.2**

| A/E RATIOS BY ATTAINED AGE GROUP - BY AMOUNT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Expected Bases** | **Death Amount ('000)** | | | | | | | | |
| | **$77,255** | **$79,781** | **$152,224** | **$272,532** | **$308,629** | **$251,756** | **$146,796** | **$25,080** | **$1,314,053** |
| | **0-30** | **31-40** | **41-50** | **51-60** | **61-70** | **71-80** | **81-90** | **91+** | **Grand Total** |
| 1983 IAM | 334.7% | 321.4% | 230.8% | 165.8% | 127.6% | 116.7% | 123.6% | 126.0% | 150.3% |
| 2000 Annuity | 350.5% | 403.6% | 301.9% | 209.5% | 158.1% | 140.4% | 145.8% | 142.7% | 183.8% |
| 2012 IAM Period with G2 Scale | 409.5% | 423.9% | 406.5% | 271.9% | 190.9% | 192.6% | 177.9% | 149.5% | 231.7% |
| 2011 SSA (midpoint) | 201.4% | 189.1% | 156.0% | 118.9% | 100.0% | 100.5% | 107.8% | 99.5% | 116.5% |

**NOTE:** The "by amount" data reflects only the total number of records with a reserve amount submitted since not all companies were able to provide the statutory reserves used for weighting the "by amount" computations.
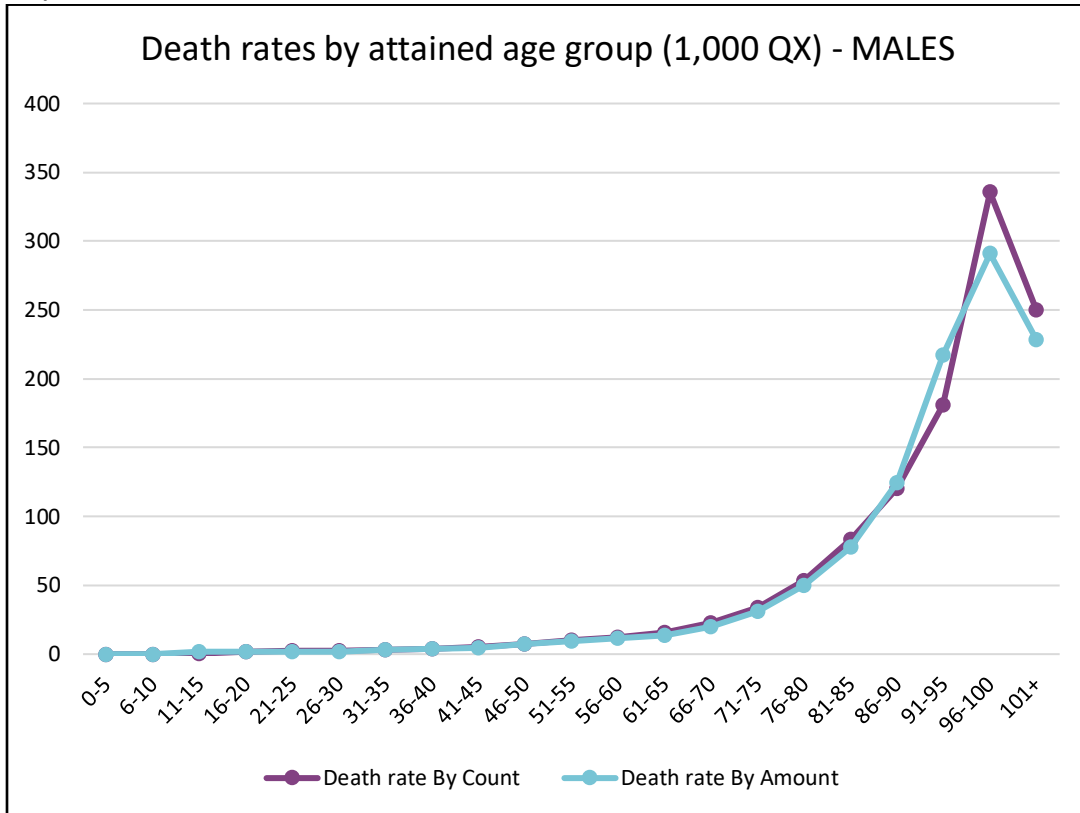
The following table and graphs show the death rates by count and by amount for males and females using the actual experience.

**Table 10.3**

| DEATH RATES BY ATTAINED AGE GROUP (1,000 QX) | | | | |
|---|---|---|---|---|
| **Attained Age Group** | **Death Rate by Count** | | **Death Rate by Amount** | |
| | **Male** | **Female** | **Male** | **Female** |
| 0-5 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6-10 | 0.000 | 0.536 | 0.000 | 0.543 |
| 11-15 | 0.464 | 0.384 | 1.518 | 0.307 |
| 16-20 | 1.523 | 0.715 | 1.909 | 1.408 |
| 21-25 | 2.283 | 1.427 | 1.926 | 1.771 |
| 26-30 | 2.249 | 1.214 | 2.017 | 0.859 |
| 31-35 | 3.246 | 1.527 | 3.265 | 1.238 |
| 36-40 | 3.820 | 2.256 | 3.763 | 1.705 |
| 41-45 | 5.371 | 2.848 | 4.267 | 2.624 |
| 46-50 | 7.263 | 4.214 | 7.314 | 3.769 |
| 51-55 | 9.896 | 5.486 | 9.089 | 4.812 |
| 56-60 | 11.987 | 7.366 | 11.313 | 5.701 |
| 61-65 | 15.473 | 10.363 | 13.538 | 8.318 |
| 66-70 | 22.734 | 15.584 | 19.588 | 13.693 |
| 71-75 | 33.881 | 22.859 | 30.750 | 20.307 |
| 76-80 | 53.630 | 37.214 | 49.564 | 37.356 |
| 81-85 | 83.370 | 59.801 | 77.775 | 74.696 |
| 86-90 | 120.050 | 100.576 | 124.696 | 110.908 |
| 91-95 | 180.676 | 155.104 | 217.310 | 170.378 |
| 96-100 | 335.570 | 243.451 | 290.914 | 265.687 |
| 101+ | 250.000 | 307.692 | 228.477 | 382.848 |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

**Graph 3.1**



Death rates by attained age group (1,000 QX) - MALES

**Graph 3.2**



Death rates by attained age group (1,000 QX) - FEMALES
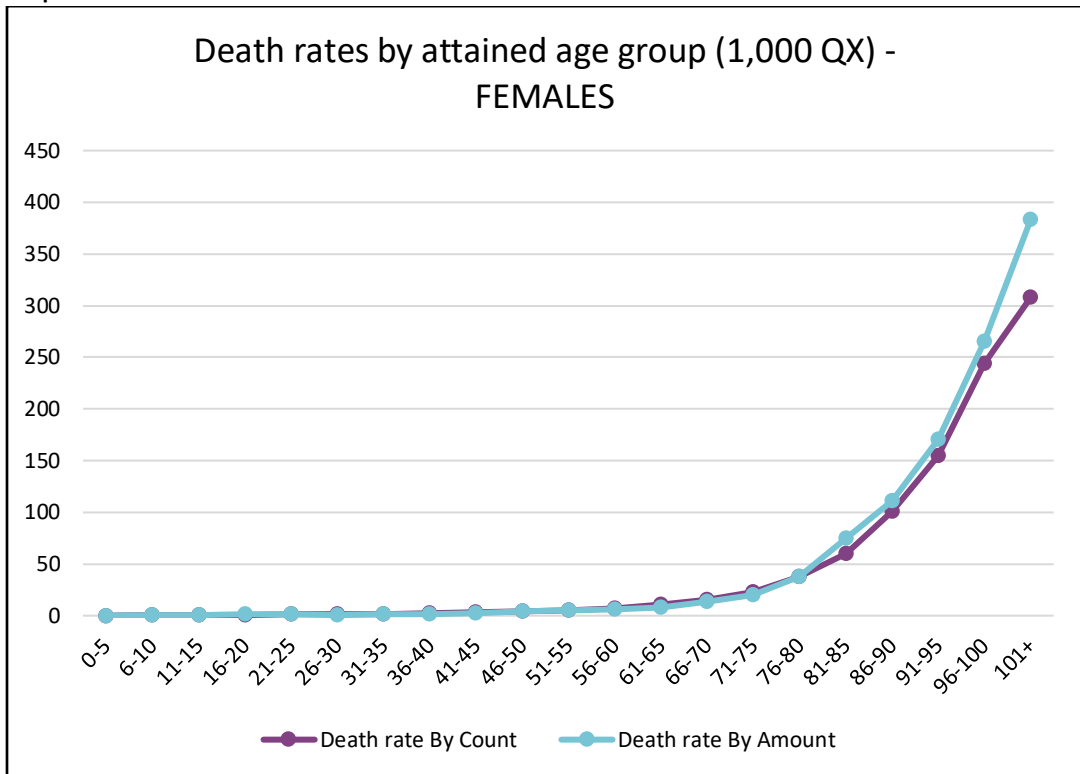
Death rates are very similar by count and by amount up to attained age group 86-90 for males and 76-80 for females.

In Appendix B, by count, the actual and expected death rates by attained age group are being shown. This enables the reader to compare the evolution of the death rates across attained age groups for both males and females.

### 4.11    A/E RATIOS BY DURATION

By count, A/E ratios in Table 11.1 exceed 100% relative to the valuation tables (the first three expected bases). They generally increase by duration up to durations 11-20, and then decrease up to durations 31+. By amount, A/E ratios in Table 11.2 exceed 100% relative to the valuation tables. The A/E ratios are much more stable by amount, particularly at durations 16+.

As stated before, structured settlements do not necessarily have annuity payments in all years. In addition, payments may vary substantially from year to year. Therefore, instead of using annual income, we used the statutory reserve for weighting the "by amount" computations. The "by amount" data reflects only the total number of records with a reserve amount submitted.

**Table 11.1**

| A/E RATIOS BY DURATION - BY COUNT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Expected Bases** | **# of Deaths** | | | | | | |
| | **1,671** | **1,611** | **1,948** | **3,531** | **4,764** | **3,382** | **907** | **17,814** |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **Grand Total** |
| 1983 IAM | 125.0% | 142.0% | 155.5% | 155.4% | 138.5% | 135.6% | 146.0% | 141.9% |
| 2000 Annuity | 155.8% | 174.4% | 189.2% | 187.3% | 165.6% | 162.0% | 174.7% | 171.4% |
| 2012 IAM Period with G2 Scale | 201.2% | 221.6% | 234.2% | 230.1% | 204.4% | 202.6% | 220.2% | 213.7% |
| 2011 SSA (midpoint) | 97.0% | 110.8% | 122.6% | 125.7% | 113.9% | 111.7% | 119.7% | 114.6% |

**Table 11.2**

| A/E RATIOS BY DURATION - BY AMOUNT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Expected Bases** | **Death Amount ('000)** | | | | | | |
| | **$94,226** | **$100,453** | **$147,917** | **$274,871** | **$354,779** | **$265,681** | **$76,126** | **$1,314,053** |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **Grand Total** |
| 1983 IAM | 142.0% | 125.6% | 137.5% | 157.8% | 157.9% | 153.4% | 156.9% | 150.3% |
| 2000 Annuity | 176.0% | 154.5% | 168.3% | 192.9% | 192.7% | 187.0% | 190.6% | 183.8% |
| 2012 IAM Period with G2 Scale | 223.0% | 194.8% | 208.9% | 239.4% | 242.1% | 240.7% | 248.5% | 231.7% |
| 2011 SSA (midpoint) | 107.3% | 95.4% | 104.4% | 121.4% | 123.9% | 121.4% | 124.6% | 116.5% |

## 4.12    A/E RATIOS OF ATTAINED AGE GROUPS BY DURATION

The following tables show the number of deaths and the A/E ratios of Attained Age Groups by Duration. Table 12.2 provides A/E ratios relative to the 2012 IAM Period with G2 scale, while Table 12.3 provides A/E ratios relative to the 2011 SSA (midpoint).

**Table 12.1**

| NUMBER OF DEATHS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 341 | 328 | 325 | 463 | 442 | 242 | 49 | **2,190** |
| **51-60** | 520 | 366 | 356 | 508 | 555 | 376 | 121 | **2,802** |
| **61-70** | 518 | 460 | 511 | 741 | 879 | 636 | 192 | **3,937** |
| **71-80** | 216 | 291 | 439 | 944 | 1,205 | 801 | 213 | **4,109** |
| **81+** | 76 | 166 | 317 | 875 | 1,683 | 1,327 | 332 | **4,776** |
| **TOTAL** | **1,671** | **1,611** | **1,948** | **3,531** | **4,764** | **3,382** | **907** | **17,814** |

**Table 12.2**

| A/E RATIO RELATIVE TO 2012 IAM PERIOD WITH G2 SCALE - BY COUNT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 342.2% | 396.8% | 406.7% | 510.3% | 485.8% | 475.9% | 502.1% | **434.1%** |
| **51-60** | 252.6% | 258.1% | 291.5% | 329.2% | 341.2% | 363.8% | 412.8% | **304.8%** |
| **61-70** | 159.2% | 198.5% | 229.8% | 237.5% | 239.4% | 259.4% | 307.0% | **222.9%** |
| **71-80** | 156.3% | 182.8% | 211.4% | 204.8% | 205.4% | 219.3% | 232.7% | **204.5%** |
| **81+** | 123.9% | 148.9% | 158.7% | 169.5% | 149.9% | 146.7% | 151.7% | **152.3%** |
| **TOTAL** | **201.2%** | **221.6%** | **234.2%** | **230.1%** | **204.4%** | **202.6%** | **220.2%** | **213.7%** |

**Table 12.3**

| A/E RATIO RELATIVE TO 2011 SSA (MIDPOINT) - BY COUNT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 142.1% | 167.2% | 172.3% | 215.1% | 200.9% | 188.1% | 191.2% | **180.4%** |
| **51-60** | 109.2% | 112.5% | 128.8% | 147.0% | 150.8% | 155.8% | 172.4% | **133.2%** |
| **61-70** | 81.2% | 102.7% | 121.5% | 126.6% | 125.6% | 131.6% | 153.0% | **115.8%** |
| **71-80** | 79.5% | 94.1% | 112.3% | 111.0% | 109.0% | 112.0% | 116.6% | **107.4%** |
| **81+** | 77.6% | 94.6% | 101.5% | 107.7% | 94.2% | 91.0% | 93.8% | **95.6%** |
| **TOTAL** | **97.0%** | **110.8%** | **122.6%** | **125.7%** | **113.9%** | **111.7%** | **119.7%** | **114.6%** |

**Graph 4.1**
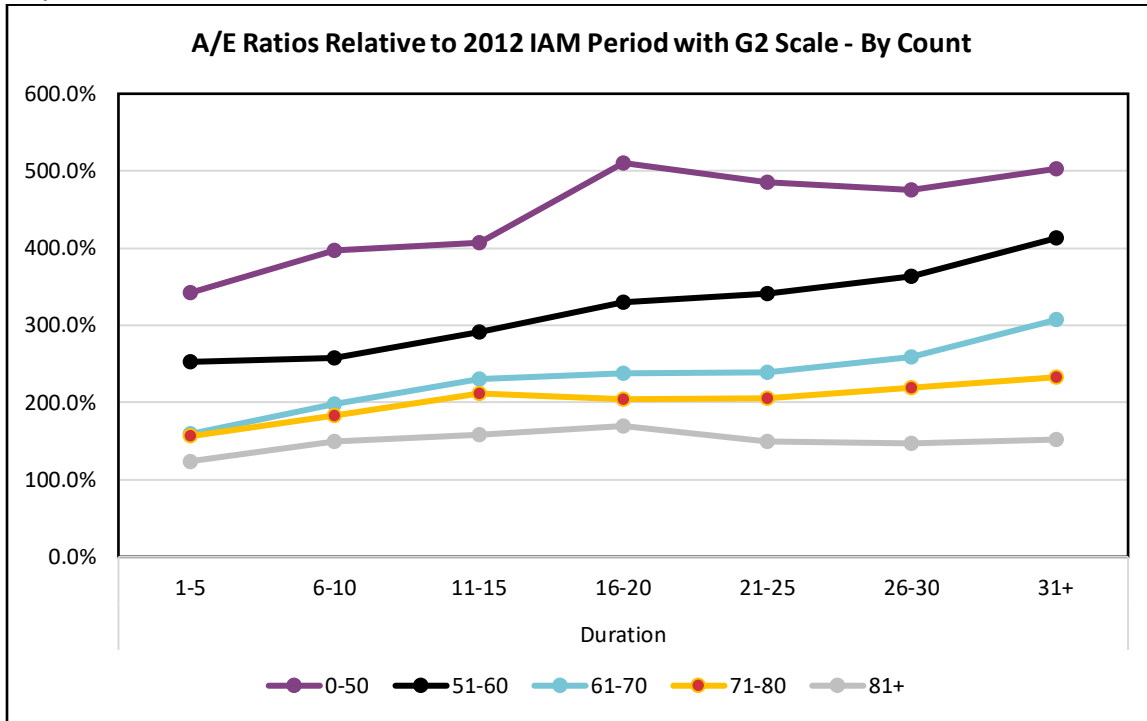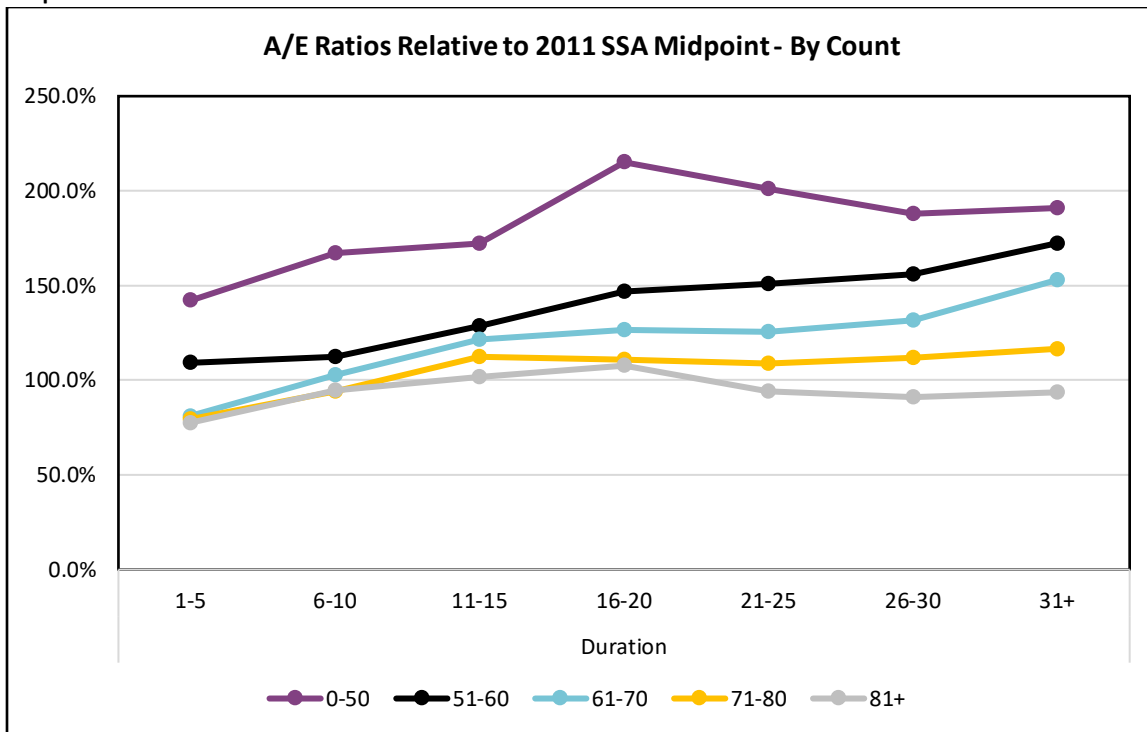


A/E Ratios Relative to 2012 IAM Period with G2 Scale - By Count

**Graph 4.2**



A/E Ratios Relative to 2011 SSA Midpoint - By Count

A/E ratios exceed 100% relative to the valuation table 2012 IAM Period with G2 scale for all attained age groups and all durations.

Relative to both tables, A/E ratios generally increase by duration up to durations 16-20, and then decrease up to durations 31+, for younger and older attained age groups (0-50 and 81+). For the other attained age groups, they tend to increase by duration.

Relative to both tables, A/E ratios generally decrease by attained age group at all durations.

## 4.13    A/E RATIOS BY BENEFIT CLASS

The benefit class definitions are in Section 3 of this report. By count, A/E ratios are lowest for single life only contracts. By amount, A/E ratios are lowest for single life only and single life with period certain contracts. The "by amount" data reflects only the total number of records with a reserve amount submitted. Both single life with cash refund and with installment refund contracts have relatively low exposures and, consequently, very few deaths, and as a result, their A/E ratios may not be credible. Although the current study has more comprehensive data than the previous ones, the number of deaths remains relatively low in comparison to the individual payout annuity study. Accordingly, considerable care must be taken in the interpretation of the results.

Table 13.1

| A/E RATIOS BY BENEFIT CLASS - BY COUNT | | | | | | |
|---|---|---|---|---|---|---|
| | **# of Deaths** | | | | | |
| | **5,377** | **10,000** | **209** | **50** | **915** | **1,263** | **17,814** |
| **Expected Bases** | **Single Life Only** | **Single Life with Period Certain** | **Single Life with Cash Refund** | **Single Life with Installment Refund** | **Temporary Single Life** | **Unknown** | **Grand Total** |
| 1983 IAM | 118.0% | 157.2% | 209.9% | 161.1% | 155.7% | 138.1% | 141.9% |
| 2000 Annuity | 139.9% | 191.2% | 251.5% | 196.8% | 195.0% | 169.8% | 171.4% |
| 2012 IAM Period with G2 Scale | 170.3% | 240.1% | 308.7% | 251.6% | 261.8% | 219.2% | 213.7% |
| 2011 SSA (midpoint) | 97.2% | 125.9% | 163.4% | 129.1% | 123.0% | 109.2% | 114.6% |

Table 13.2

| A/E RATIOS BY BENEFIT CLASS - BY AMOUNT | | | | | | |
|---|---|---|---|---|---|---|
| | **Death Amount ('000)** | | | | | |
| | **$207,695** | **$929,017** | **$13,409** | **$2,647** | **$16,598** | **$144,687** | **$1,314,053** |
| **Expected Bases** | **Single Life Only** | **Single Life with Period Certain** | **Single Life with Cash Refund** | **Single Life with Installment Refund** | **Temporary Single Life** | **Unknown** | **Grand Total** |
| 1983 IAM | 149.4% | 150.2% | 226.8% | 199.1% | 190.0% | 143.0% | 150.3% |
| 2000 Annuity | 180.1% | 184.2% | 271.1% | 240.1% | 236.7% | 175.5% | 183.8% |
| 2012 IAM Period with G2 Scale | 224.6% | 232.5% | 331.9% | 296.4% | 307.2% | 223.7% | 231.7% |
| 2011 SSA (midpoint) | 121.6% | 115.7% | 174.3% | 157.0% | 144.5% | 108.6% | 116.5% |

# Section 5: Substandard Lives

## 5.1 DEATHS

This study includes 13,475 deaths for substandard lives. Not all companies were able to provide the statutory reserves used for weighting the "by amount" computations. The total death amount provided represents $2,734,618,709. Although the current study has more comprehensive data than the previous ones, the number of deaths is much lower than in the most recent Individual Payout Annuity study which included 260,000 deaths. Therefore, some random fluctuation will be evident and credibility will be particularly impacted when results are subdivided into various categories. Accordingly, considerable care must be taken in the interpretation of the results.

**Table 14**

| DEATHS AND DEATH AMOUNT BY CALENDAR YEAR | | |
|---|---|---|
| **Year** | **Actual Deaths** | **Actual Death Amount ('000)** |
| **2005** | 461 | $81,562 |
| **2006** | 533 | $96,295 |
| **2007** | 572 | $100,807 |
| **2008** | 758 | $118,763 |
| **2009** | 875 | $198,377 |
| **2010** | 992 | $220,480 |
| **2011** | 1,176 | $285,936 |
| **2012** | 1,146 | $232,711 |
| **2013** | 1,279 | $278,690 |
| **2014** | 1,251 | $244,463 |
| **2015** | 1,360 | $255,806 |
| **2016** | 1,527 | $304,101 |
| **2017** | 1,545 | $316,628 |
| **TOTAL** | **13,475** | **$2,734,619** |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

## 5.2 EXPOSURE

The study includes 776,479 contract years of experience for substandard lives. Not all companies were able to provide the statutory reserves used for weighting the "by amount" computations. The total amount exposed represents $194,721,650,657. The current study includes much more exposure than the previous studies.

The average exposure per study year is just under 60,000 contracts, while the average amount exposed per study year is almost $15 billion. The following table provides the exposure by number of contracts exposed and by amount exposed for each calendar year of the study.

**Table 15**

| # OF CONTRACTS EXPOSED AND AMOUNT EXPOSED BY CALENDAR YEAR | | |
|---|---|---|
| Year | # of Contracts Exposed | Amount Exposed ('000) |
| 2005 | 29,821 | $6,497,511 |
| 2006 | 32,997 | $7,107,548 |
| 2007 | 36,528 | $7,753,803 |
| 2008 | 47,203 | $11,597,339 |
| 2009 | 55,814 | $15,432,652 |
| 2010 | 59,753 | $16,383,918 |
| 2011 | 63,445 | $15,782,588 |
| 2012 | 67,026 | $16,548,595 |
| 2013 | 70,200 | $17,731,007 |
| 2014 | 73,632 | $18,418,501 |
| 2015 | 76,836 | $19,321,547 |
| 2016 | 80,147 | $20,435,512 |
| 2017 | 83,077 | $21,711,130 |
| TOTAL | 776,479 | $194,721,651 |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

### 5.3 TRUE ISSUE AGE

The age distribution by true issue age for this business differs greatly from the retirement annuity business. As can be seen in the following table and graph, the peak issue age for substandard issues by policy years exposed is at ages 46-50 with 85,009 contracts exposed. The group shows a rapid decline in issues after age 65. By contrast, ages under 50 are usually sparsely represented in retirement annuity mortality studies. The group also shows large numbers at groups 0-5 and 6-10.

**Table 16**

| DATA BY TRUE ISSUE AGE GROUP | | | | |
|---|---|---|---|---|
| Issue Age Group | Actual Deaths | # of Contracts Exposed | Actual Death Amount ('000) | Amount Exposed ('000) |
| 0-5 | 674 | 55,187 | $314,090 | $29,851,497 |
| 6-10 | 423 | 58,784 | $216,150 | $29,974,215 |
| 11-15 | 180 | 35,016 | $103,431 | $14,746,967 |
| 16-20 | 301 | 41,106 | $111,057 | $14,989,514 |
| 21-25 | 461 | 48,420 | $186,173 | $17,492,845 |
| 26-30 | 523 | 44,905 | $157,317 | $14,212,382 |
| 31-35 | 636 | 49,449 | $211,403 | $13,676,351 |
| 36-40 | 901 | 60,865 | $208,006 | $13,550,781 |
| 41-45 | 1,321 | 75,345 | $273,902 | $13,112,050 |
| 46-50 | 1,612 | 85,009 | $265,493 | $11,858,522 |
| 51-55 | 1,919 | 80,742 | $253,175 | $9,471,591 |
| 56-60 | 1,721 | 68,106 | $206,340 | $6,469,989 |
| 61-65 | 1,453 | 45,489 | $127,897 | $3,486,094 |
| 66-70 | 789 | 21,027 | $57,236 | $1,322,525 |
| 71-75 | 357 | 5,381 | $26,041 | $368,736 |
| 76-80 | 163 | 1,300 | $12,757 | $104,282 |
| 81-85 | 34 | 302 | $3,856 | $30,394 |
| 86-90 | 7 | 46 | $295 | $2,916 |
| TOTAL | 13,475 | 776,479 | $2,734,619 | $194,721,651 |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

**Graph 5**

## # of Contracts Exposed by True Issue Age Group
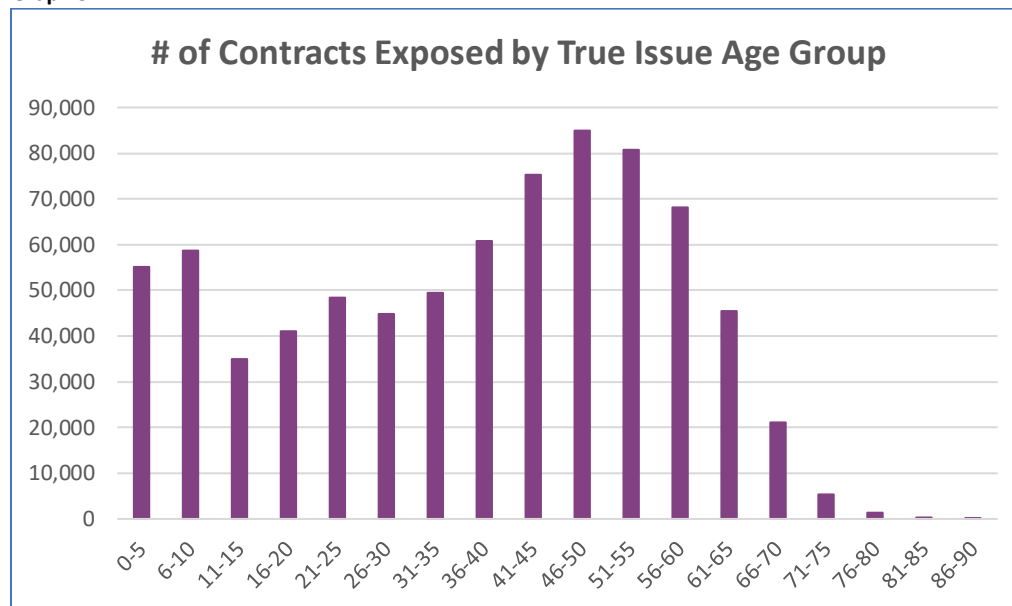


### 5.4 RATED AGE

Experience was studied on true age, rated age, and "true age plus constant extra deaths" (CED) bases.

All substandard contracts (also called "rated" contracts) are given a "rated age," which is higher than the true age. The rated age is deemed by the issuing company's underwriters and actuaries to produce an actuarial equivalency with respect to the cost of the guaranteed income stream.

The CED basis is specified as the statutory method for minimum substandard reserves in Actuarial Guideline IX-A of the NAIC's Financial Examiners Handbook. Substandard payout annuity reserves are allowed only for structured settlement contracts pursuant to tort actions and for contracts used to fund disabled lives and workers' compensation liabilities. Under the CED method, a constant "flat extra" increment to the valuation table rates is calculated to reproduce the life expectancy of the rated-up age.

Under the CED basis, the mortality is "front-loaded" because the extra deaths have a proportionally greater effect at the younger ages than at the advanced. Over time, the substandard mortality rates effectively approach standard rates as the underlying mortality rate increases and the increment becomes relatively less significant. Because of this grading towards standard mortality rates, reserves using the CED method approach standard reserves over time.

The incidence of extra mortality assumed under the two methods is not at all consistent. Both the rated-age method and the constant extra death method are a simplified approach to potentially more complex mortality patterns assumed by underwriters. While CED reserves are the statutory minimum, Actuarial Guideline IX-A also states that holding these reserves "shall in no way relieve the actuary from considering whether such reserves are adequate."

Since CED reserves are always based on the true age, they will go more years before reaching the end of the table and will grade toward the standard reserve. Therefore, the CED method should ultimately result in higher reserves for long-surviving structured settlement annuitants, as compared to reserves calculated using mortality rates based on rated age.

Although the current study has more comprehensive data than the previous ones, the number of deaths remains relatively low. Accordingly, considerable care must be taken in the interpretation of the results.

### 5.5 EXPECTED BASES

Substandard structured settlement annuity mortality is particularly challenging to quantify because age categories are not homogeneous. True age groupings consist of slightly impaired lives with small age rate-ups and heavily impaired lives with substantially higher rated ages. While rated-age groupings tend to be more informative and useful, a given rated-age grouping will comprise young true-age policies with large rate-ups and older true-age policies with small rate-ups. Slicing the results into more homogeneous categories will give too little exposure and deaths per cell.

Minimum statutory reserve rates must be computed based on true age, although the true-age plus constant extra deaths method is permitted to reflect impairments. An actuary may only base statutory reserves on a rated age if it can be demonstrated that such reserves are at least as high as the mandated true-age plus CED reserves at all durations. GAAP reserves, on the other hand, may be computed on a rated-age basis. Therefore, substandard results will be shown on both true-age and rated-age bases. In addition, results will be shown on a true-age plus 1983 IAM CED basis.

The table below shows the mortality bases available in the data.

**Table 17**

| EXPECTED BASES | | | | | |
|---|---|---|---|---|---|
| **Mortality Table** | **Valuation Margin** | **Projection** | **Base** | **Gender** | **Source** |
| 1983 IAM Table | Included | None | ANB | Gender distinct | SOA website |
| 2000 Annuity | Included | None | ANB | Gender distinct | SOA website |
| 2012 IAM Basic Table | None | None | ANB | Gender distinct | SOA website |
| 2012 IAM Basic G2 Table | None | G2 | ANB | Gender distinct | SOA website |
| 2012 IAM Period Table | Included | None | ANB | Gender distinct | SOA website |
| 2012 IAM Period G2 Table | Included | G2 | ANB | Gender distinct | SOA website |
| 2005-2017 SSA Table by Year | None | None | ANB | Gender distinct | SSA website |
| 2005-2017 SSA Table 2011 (midpoint) | None | None | ANB | Gender distinct | SSA website |
| 2005-2017 SSA Table Average | None | None | ANB | Gender distinct | SSA website |
| 1983 IAM Table + 1983 IAM CED | Included | None | ANB | Gender distinct | SOA website |

For simplicity, the expected bases used in the following pages of the report will be:

The 1983 IAM Table, the 2000 Annuity Table, the 2012 IAM Period with G2 Table, the 2011 SSA Table (2005-2017 midpoint), and the 1983 IAM Table plus 1983 IAM CED.

### 5.6 GENDER

As shown in Tables 18.1 and 18.2 below, the exposure by gender is 65% male by contract and 62% male by amount exposed. However, the number of deaths is 69% male and death amount is 67.5% male.

As stated before, structured settlements do not necessarily have annuity payments in all years. In addition, payments may vary substantially from year to year. Annual income, therefore, cannot be the measure of exposure. Instead, we used the statutory reserve for weighting the "by amount" computations and this may impact results. The "by amount" data reflects only the total number of records with a reserve amount submitted since not all companies were able to provide the statutory reserves used for weighting the "by amount" computations.

**Table 18.1**

| DATA BY GENDER - BY COUNT | | | | |
|---|---|---|---|---|
| Gender | Actual Deaths | % | # of Contracts Exposed | % |
| Male | 9,323 | 69.2% | 503,907 | 64.9% |
| Female | 4,152 | 30.8% | 272,572 | 35.1% |
| TOTAL | 13,475 | | 776,479 | |

**Table 18.2**

| DATA BY GENDER - BY AMOUNT | | | | |
|---|---|---|---|---|
| Gender | Actual Death Amount ('000) | % | Amount Exposed ('000) | % |
| Male | $1,844,752 | 67.5% | $120,431,063 | 61.8% |
| Female | $889,867 | 32.5% | $74,290,588 | 38.2% |
| TOTAL | $2,734,619 | | $194,721,651 | |

## 5.7 GLOBAL A/E RATIOS

The following table displays deaths and A/E ratios for the expected bases described earlier, on true-age and rated-age bases. These results are shown for both "by count" and "by amount." The "by amount" data reflects only the total number of records with a reserve amount submitted since not all companies were able to provide the statutory reserves used for weighting the "by amount" computations.

**Table 19**

| A/E RATIO BY EXPECTED BASIS | | | | | |
|---|---|---|---|---|---|
| **Expected Bases** | | **Actual Deaths** **13,475** **Expected Deaths** | **A/E Ratio** | **Actual Death Amount ('000)** **$2,734,619** **Expected Death Amount ('000)** | **A/E Ratio** |
| 1983 IAM | True Age | 4,382 | 307.5% | $610,785 | 447.7% |
| 2000 Annuity | True Age | 3,513 | 383.6% | $489,297 | 558.9% |
| 2012 IAM Period with G2 Scale | True Age | 2,697 | 499.5% | $378,878 | 721.8% |
| SSA 2011 (midpoint) | True Age | 5,549 | 242.8% | $805,158 | 339.6% |
| **Expected Bases** | | **Expected Deaths** | **A/E Ratio** | **Expected Death Amount ('000)** | **A/E Ratio** |
| 1983 IAM | Rated Age | 13,479 | 100.0% | $3,695,921 | 74.0% |
| 2000 Annuity | Rated Age | 11,117 | 121.2% | $2,762,692 | 99.0% |
| 2012 IAM Period with G2 Scale | Rated Age | 8,998 | 149.8% | $2,269,434 | 120.5% |
| SSA 2011 (midpoint) | Rated Age | 16,136 | 83.5% | $4,008,886 | 68.2% |
| **Expected Bases** | | **Expected Deaths** | **A/E Ratio** | **Expected Death Amount ('000)** | **A/E Ratio** |
| 1983 IAM plus 1983 IAM CED | | 17,334 | 77.7% | $4,170,641 | 65.6% |

The most recent valuation table has lower mortality rates and, thus, higher A/E ratios. A/E ratios are well over 100% when based on true age, as expected. None of these tables fit the experience very well; an implication of this is that structured settlement business should have its own mortality tables.

Measured by rated age, the A/E ratios relative to the 1983 IAM were a little over 100% by contract and lower than 100% by amount. The A/E ratios relative to the 2012 IAM are all higher than 100%.

Measured by true age and relative to the 1983 IAM plus CED expected basis, the A/E ratios remain below 100%.

Although the current study has more comprehensive data than the previous ones, the number of deaths remains relatively low. Accordingly, considerable care must be taken in the interpretation of the results.

## 5.8  A/E RATIOS BY GENDER

The A/E ratios by gender are shown in Table 20.1 below. Measured by true age, female ratios are higher than male ratios. Measured by rated age, female ratios are lower than male ratios. When the A/E ratios are calculated using the 1983 IAM Table plus 1983 IAM CED expected basis, the A/E ratios for females are also lower than those for males.

**Table 20.1**

| A/E RATIO BY GENDER | | | | | |
|---|---|---|---|---|---|
| | | Males | | Females | |
| **Expected Bases** | | **Actual Deaths** | **Actual Death Amount ('000)** | **Actual Deaths** | **Actual Death Amount ('000)** |
| | | **9,323** | **$1,844,752** | **4,152** | **$889,867** |
| | | **By Count** | **By Amount** | **By Count** | **By Amount** |
| 1983 IAM | True Age | 283.3% | 403.9% | 380.6% | 577.5% |
| 2000 Annuity | True Age | 362.7% | 517.8% | 440.3% | 669.0% |
| 2012 IAM Period with G2 Scale | True Age | 493.4% | 694.1% | 513.8% | 786.7% |
| SSA 2011 (midpoint) | True Age | 231.3% | 316.4% | 273.4% | 400.6% |
| **Expected Bases** | | **By Count** | **By Amount** | **By Count** | **By Amount** |
| 1983 IAM | Rated Age | 97.2% | 74.8% | 106.8% | 72.3% |
| 2000 Annuity | Rated Age | 121.1% | 103.4% | 121.4% | 90.9% |
| 2012 IAM Period with G2 Scale | Rated Age | 154.6% | 130.3% | 139.8% | 104.2% |
| SSA 2011 (midpoint) | Rated Age | 83.4% | 71.0% | 83.8% | 63.1% |
| **Expected Bases** | | **By Count** | **By Amount** | **By Count** | **By Amount** |
| 1983 IAM plus 1983 IAM CED | | 77.5% | 67.5% | 78.2% | 62.0% |

Table 20.2 below compares the A/E ratios by gender for standard and substandard lives.

**Table 20.2**

| A/E RATIOS BY GENDER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | # of Deaths | | | Death Amount ('000) | | | |
| Standard | | | 10,010 | 7,804 | 17,814 | $778,960 | $535,093 | $1,314,053 | |
| Substandard | | | 9,323 | 4,152 | 13,475 | $1,844,752 | $889,867 | $2,734,619 | |
| | | | By Count | | | By Amount | | | |
| Expected Bases | | | Male | Female | Total | Male | Female | Total | |
| 1983 IAM | Standard | True Age | 141.4% | 142.6% | 141.9% | 145.8% | 157.2% | 150.3% | |
| 1983 IAM | Substandard | True Age | 283.3% | 380.6% | 307.5% | 403.9% | 577.5% | 447.7% | |
| 1983 IAM | Substandard | Rated Age | 97.2% | 106.8% | 100.0% | 74.8% | 72.3% | 74.0% | |
| 2000 Annuity | Standard | True Age | 178.6% | 162.9% | 171.4% | 185.5% | 181.4% | 183.8% | |
| 2000 Annuity | Substandard | True Age | 362.7% | 440.3% | 383.6% | 517.8% | 669.0% | 558.9% | |
| 2000 Annuity | Substandard | Rated Age | 121.1% | 121.4% | 121.2% | 103.4% | 90.9% | 99.0% | |
| 2012 IAM Period with G2 Scale | Standard | True Age | 235.9% | 190.8% | 213.7% | 247.2% | 212.4% | 231.7% | |
| 2012 IAM Period with G2 Scale | Substandard | True Age | 493.4% | 513.8% | 499.5% | 694.1% | 786.7% | 721.8% | |
| 2012 IAM Period with G2 Scale | Substandard | Rated Age | 154.6% | 139.8% | 149.8% | 130.3% | 104.2% | 120.5% | |
| 2011 SSA (midpoint) | Standard | True Age | 118.5% | 110.0% | 114.6% | 118.5% | 113.7% | 116.5% | |
| 2011 SSA (midpoint) | Substandard | True Age | 231.3% | 273.4% | 242.8% | 316.4% | 400.6% | 339.6% | |
| 2011 SSA (midpoint) | Substandard | Rated Age | 83.4% | 83.8% | 83.5% | 71.0% | 63.1% | 68.2% | |

**NOTE:** Not all companies that provided data "by count" were able to provide the statutory reserves used for weighting the "by amount" computations.

Comparison of these A/E ratios provides a benchmark of how well or poorly substandard annuities have been underwritten. The A/E ratios for substandard annuities measured by rated age are significantly lower than the A/E ratios for standard annuities measured by true age under all four expected bases and for both genders. This might indicate that substandard annuities have been underwritten too aggressively.

### 5.9  A/E RATIOS BY DURATION

By count, the A/E ratios by duration are shown in Table 21.1 below. In general, ratios increase with duration up to durations 16-20, and decrease thereafter under the true-age basis.

Looking at the global A/E ratios shown in section 5.7 of the report, one might think that some multiple of rated age mortality is a good estimate, but the pattern of A/E ratios by duration shown in Table 21.1 below, suggests otherwise.

When the A/E ratios are calculated using the 1983 IAM Table plus 1983 IAM CED expected basis, the A/E ratios increase with duration. Even more interesting, the actual mortality is much lower than CED in durations 1-15, meaning that reserve mortality is aggressive in early durations before it seemingly becomes conservative in later durations. This could have an implication for some new policies and the adequacy of the initial reserves booked on these policies.

**Table 21.1**

| A/E RATIOS BY DURATION - BY COUNT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | # of Deaths | | | | | | | |
| | | 3,648 | 3,404 | 2,190 | 1,690 | 1,447 | 858 | 238 | 13,475 |
| **Expected Bases** | | 1-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31+ | **Grand Total** |
| 1983 IAM | True Age | 270.1% | 298.4% | 339.9% | 363.4% | 341.7% | 305.7% | 310.4% | 307.5% |
| 2000 Annuity | True Age | 340.8% | 372.4% | 421.1% | 449.2% | 422.0% | 377.2% | 383.1% | 383.6% |
| 2012 IAM Period with G2 Scale | True Age | 441.1% | 491.0% | 552.8% | 577.0% | 542.3% | 492.6% | 505.6% | 499.5% |
| SSA 2011 (midpoint) | True Age | 209.2% | 235.3% | 268.6% | 290.2% | 276.4% | 249.7% | 252.7% | 242.8% |
| **Expected Bases** | | 1-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31+ | **Grand Total** |
| 1983 IAM | Rated Age | 117.9% | 106.7% | 97.5% | 98.8% | 87.9% | 70.6% | 63.1% | 100.0% |
| 2000 Annuity | Rated Age | 145.6% | 130.2% | 117.8% | 119.0% | 105.4% | 83.9% | 74.3% | 121.2% |
| 2012 IAM Period with G2 Scale | Rated Age | 188.6% | 167.0% | 146.8% | 141.0% | 122.6% | 97.4% | 87.1% | 149.8% |
| SSA 2011 (midpoint) | Rated Age | 97.8% | 89.6% | 81.6% | 82.3% | 73.3% | 59.2% | 53.3% | 83.5% |
| **Expected Bases** | | 1-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31+ | **Grand Total** |
| 1983 IAM plus 1983 IAM CED | | 61.6% | 70.7% | 80.4% | 101.1% | 113.2% | 115.9% | 130.0% | 77.7% |

By amount, the A/E ratios by duration are shown in Table 21.2 below. Under the rated-age basis, ratios decrease by duration up to durations 31+. When the A/E ratios are calculated using the 1983 IAM Table plus 1983 IAM CED expected basis, the A/E ratios are lowest at durations 6-10 and tend to increase by duration.

**Table 21.2**

| A/E RATIOS BY DURATION - BY AMOUNT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Expected Bases** | | **Death Amount ('000)** | | | | | | | |
| | | $580,826 | $492,569 | $463,154 | $422,478 | $421,253 | $286,048 | $68,291 | $2,734,619 |
| | | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **Grand Total** |
| 1983 IAM | True Age | 480.0% | 422.2% | 452.3% | 433.6% | 443.6% | 456.6% | 435.4% | 447.7% |
| 2000 Annuity | True Age | 604.0% | 526.7% | 561.0% | 538.8% | 553.3% | 571.9% | 546.3% | 558.9% |
| 2012 IAM Period with G2 Scale | True Age | 779.3% | 683.9% | 722.4% | 683.6% | 711.4% | 756.0% | 729.7% | 721.8% |
| SSA 2011 (midpoint) | True Age | 365.5% | 323.3% | 341.8% | 323.4% | 335.6% | 349.9% | 333.6% | 339.6% |
| **Expected Bases** | | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **Grand Total** |
| 1983 IAM | Rated Age | 140.1% | 84.8% | 68.7% | 64.5% | 58.3% | 53.6% | 59.6% | 74.0% |
| 2000 Annuity | Rated Age | 192.4% | 114.9% | 92.2% | 86.3% | 77.2% | 70.2% | 78.2% | 99.0% |
| 2012 IAM Period with G2 Scale | Rated Age | 247.6% | 145.1% | 113.3% | 103.7% | 91.5% | 82.4% | 95.2% | 120.5% |
| SSA 2011 (midpoint) | Rated Age | 127.8% | 78.3% | 63.3% | 59.5% | 53.8% | 49.5% | 55.1% | 68.2% |
| **Expected Bases** | | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **Grand Total** |
| 1983 IAM plus 1983 IAM CED | | 64.4% | 51.8% | 57.0% | 66.4% | 80.6% | 98.4% | 123.6% | 65.6% |

## 5.10    A/E RATIOS OF ATTAINED AGE GROUPS BY DURATION

The following tables show the number of deaths and the A/E ratios of Attained Age Groups by Duration. Table 22.2 provides A/E ratios relative to the 2012 IAM Period with G2 scale, while Table 22.3 provides A/E ratios relative to the 2011 SSA (midpoint) under the true age basis.

**Table 22.1**

| NUMBER OF DEATHS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **True Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 1,113 | 859 | 597 | 484 | 412 | 207 | 41 | **3,713** |
| **51-60** | 1,138 | 940 | 481 | 365 | 269 | 164 | 74 | **3,431** |
| **61-70** | 1,036 | 961 | 623 | 387 | 333 | 184 | 57 | **3,581** |
| **71-80** | 327 | 537 | 392 | 340 | 286 | 177 | 36 | **2,095** |
| **81+** | 34 | 107 | 97 | 114 | 147 | 126 | 30 | **655** |
| **TOTAL** | **3,648** | **3,404** | **2,190** | **1,690** | **1,447** | **858** | **238** | **13,475** |

**Table 22.2**

| A/E RATIO RELATIVE TO 2012 IAM PERIOD WITH G2 SCALE (TRUE AGE BASIS) - BY COUNT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **True Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 1077.9% | 1194.6% | 1321.2% | 1390.1% | 1448.9% | 1431.7% | 1491.3% | **1234.3%** |
| **51-60** | 475.1% | 595.6% | 638.5% | 812.7% | 748.6% | 717.9% | 978.2% | **587.6%** |
| **61-70** | 293.0% | 359.6% | 470.7% | 491.5% | 539.7% | 513.6% | 528.7% | **380.9%** |
| **71-80** | 288.4% | 346.2% | 376.7% | 405.1% | 388.0% | 416.0% | 349.1% | **359.3%** |
| **81+** | 197.3% | 259.3% | 247.1% | 225.8% | 219.3% | 215.4% | 191.5% | **226.3%** |
| **TOTAL** | **441.1%** | **491.0%** | **552.8%** | **577.0%** | **542.3%** | **492.6%** | **505.6%** | **499.5%** |

**Table 22.3**

| A/E RATIO RELATIVE TO 2011 SSA (MIDPOINT) (TRUE AGE BASIS) - BY COUNT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **True Attained Age Group** | **Duration** | | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26-30** | **31+** | **TOTAL** |
| **0-50** | 447.2% | 497.0% | 553.4% | 579.6% | 602.1% | 577.1% | 582.3% | **512.5%** |
| **51-60** | 206.6% | 255.9% | 273.5% | 354.4% | 324.1% | 302.4% | 406.2% | **253.6%** |
| **61-70** | 149.8% | 181.7% | 238.1% | 253.6% | 275.7% | 254.9% | 258.4% | **193.6%** |
| **71-80** | 146.2% | 173.5% | 190.9% | 211.5% | 201.2% | 208.4% | 171.4% | **182.6%** |
| **81+** | 120.3% | 158.2% | 150.5% | 138.2% | 134.6% | 130.7% | 116.0% | **138.1%** |
| **TOTAL** | **209.2%** | **235.3%** | **268.6%** | **290.2%** | **276.4%** | **249.7%** | **252.7%** | **242.8%** |

**Graph 6.1**



A/E Ratios relative to 2012 IAM Period with G2 scale (True age basis) - By Count

**Graph 6.2**



A/E Ratios relative to 2011 SSA midpoint (True age basis) - By Count
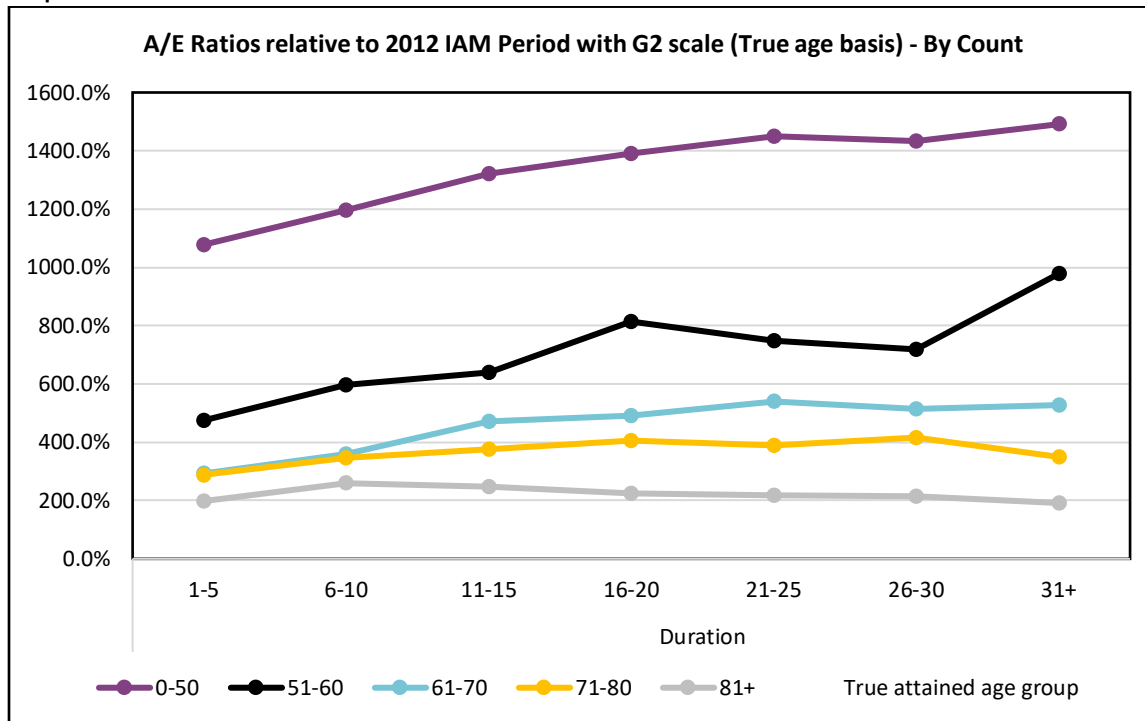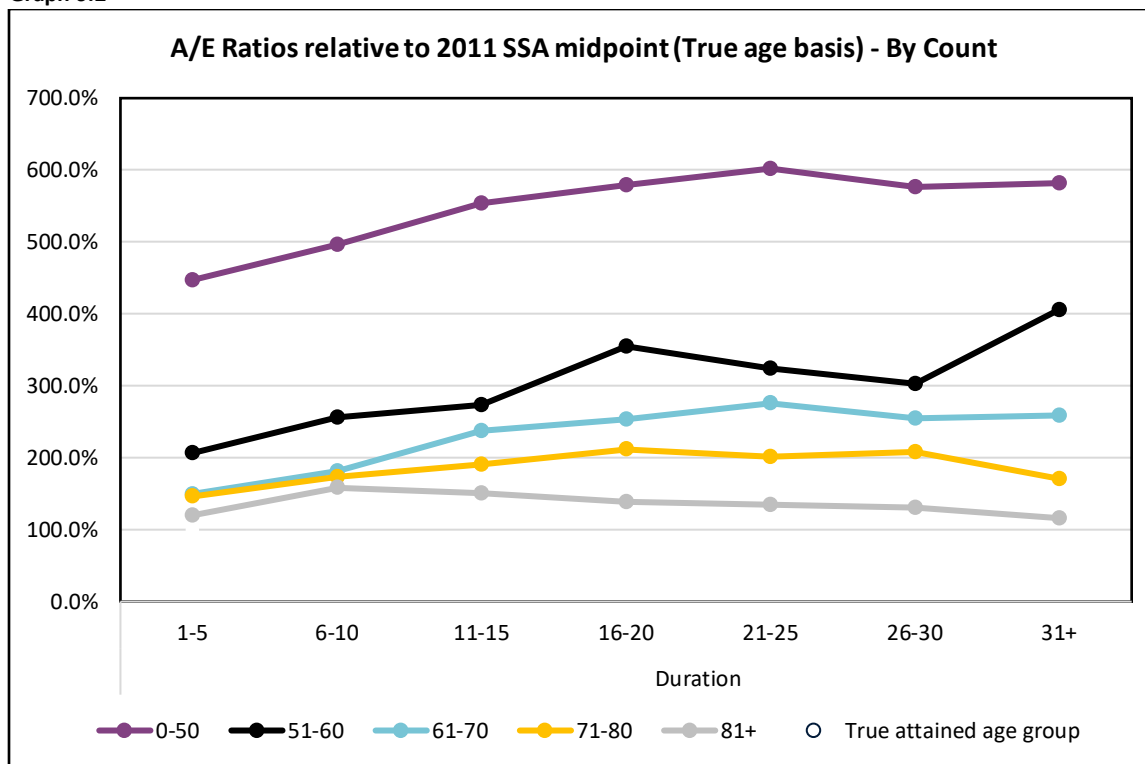
Under the true age basis, A/E ratios exceed 100% relative to the valuation table 2012 IAM Period with G2 scale for all attained age groups and durations. Relative to both tables, A/E ratios generally increase by duration. The curves

are generally steeper for younger attained age groups. Relative to both tables, A/E ratios generally decrease by attained age group at all durations.

Under the *rated-age basis*, the following tables show the number of deaths and A/E ratios of Attained Age Groups by Duration. Table 23.2 provides A/E ratios relative to the 2012 IAM Period with G2 scale, while Table 23.3 provides A/E ratios relative to the 2011 SSA (midpoint).

**Table 23.1**

| NUMBER OF DEATHS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rated Attained Age Group** | **Duration** | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26+** | **TOTAL** |
| **0-50** | 282 | 149 | 100 | 89 | 52 | 17 | **689** |
| **51-60** | 623 | 383 | 202 | 141 | 118 | 62 | **1,529** |
| **61-70** | 1,158 | 911 | 498 | 327 | 260 | 188 | **3,342** |
| **71-80** | 1,127 | 1,103 | 705 | 526 | 420 | 303 | **4,184** |
| **81+** | 458 | 858 | 685 | 607 | 597 | 526 | **3,731** |
| **TOTAL** | **3,648** | **3,404** | **2,190** | **1,690** | **1,447** | **1,096** | **13,475** |

**Table 23.2**

| A/E RATIO RELATIVE TO 2012 IAM PERIOD WITH G2 SCALE (RATED AGE BASIS) - BY COUNT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rated Attained Age Group** | **Duration** | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26+** | **TOTAL** |
| **0-50** | 420.2% | 313.0% | 326.9% | 437.8% | 437.2% | 333.6% | **377.3%** |
| **51-60** | 282.7% | 281.8% | 280.7% | 269.1% | 289.4% | 265.7% | **280.7%** |
| **61-70** | 194.4% | 216.9% | 235.2% | 227.0% | 223.2% | 230.5% | **212.9%** |
| **71-80** | 164.1% | 160.8% | 171.3% | 195.7% | 188.7% | 172.3% | **170.7%** |
| **81+** | 125.6% | 114.5% | 89.4% | 85.2% | 75.7% | 60.5% | **87.8%** |
| **TOTAL** | **188.6%** | **167.0%** | **146.8%** | **141.0%** | **122.6%** | **94.9%** | **149.8%** |

**Table 23.3**

| A/E RATIO RELATIVE TO 2011 SSA (MIDPOINT) (RATED AGE BASIS) - BY COUNT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rated Attained Age Group** | **Duration** | | | | | | |
| | **1-5** | **6-10** | **11-15** | **16-20** | **21-25** | **26+** | **TOTAL** |
| **0-50** | 171.7% | 127.3% | 132.6% | 176.5% | 171.6% | 126.0% | **152.8%** |
| **51-60** | 124.9% | 122.9% | 122.4% | 118.7% | 126.7% | 113.7% | **123.1%** |
| **61-70** | 99.9% | 110.0% | 119.0% | 117.3% | 114.0% | 114.3% | **108.6%** |
| **71-80** | 85.3% | 82.7% | 87.8% | 103.0% | 98.6% | 87.1% | **88.2%** |
| **81+** | 78.1% | 71.0% | 56.1% | 55.5% | 49.9% | 40.0% | **56.3%** |
| **TOTAL** | **97.8%** | **89.6%** | **81.6%** | **82.3%** | **73.3%** | **57.8%** | **83.5%** |

Under the rated age basis, A/E ratios cease to exceed 100% relative to the valuation table 2012 IAM Period with G2 scale only for attained age group 81+ at durations 11+. Relative to both tables, A/E ratios generally decrease by duration in total. Relative to both tables, A/E ratios also decrease by attained age group in total.

**Graph 7.1**

**A/E Ratios relative to 2012 IAM Period with G2 scale (Rated age basis) - By Count**



**Graph 7.2**

**A/E Ratios relative to 2011 SSA midpoint (Rated age basis) - By Count**
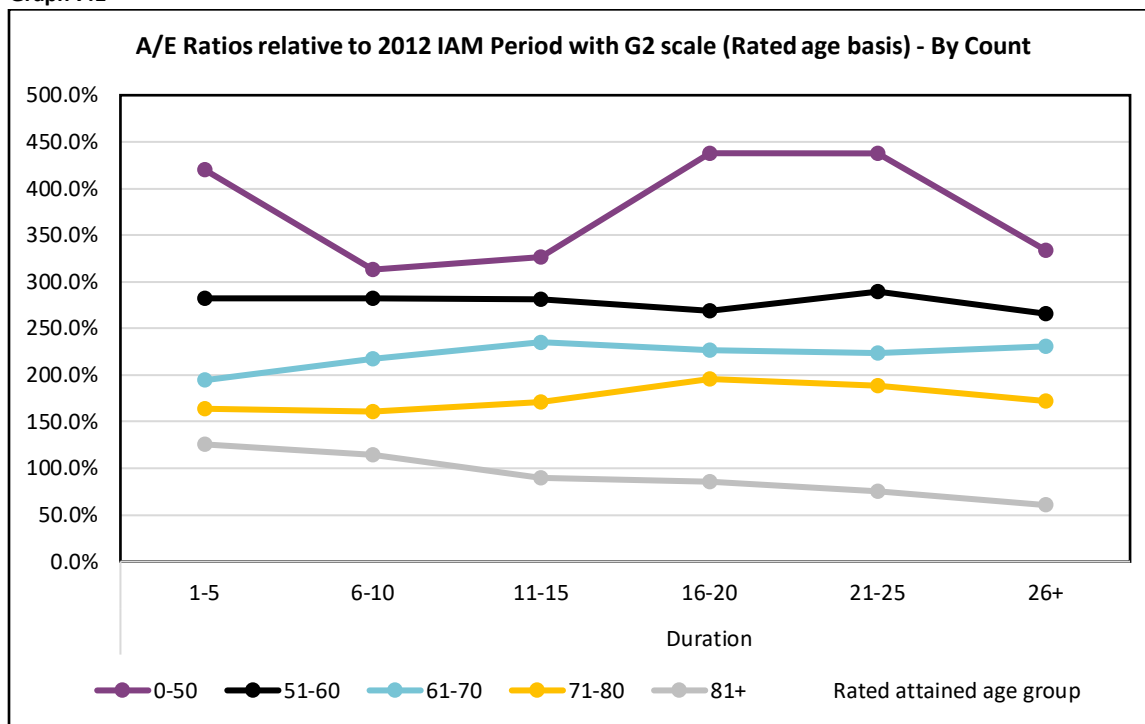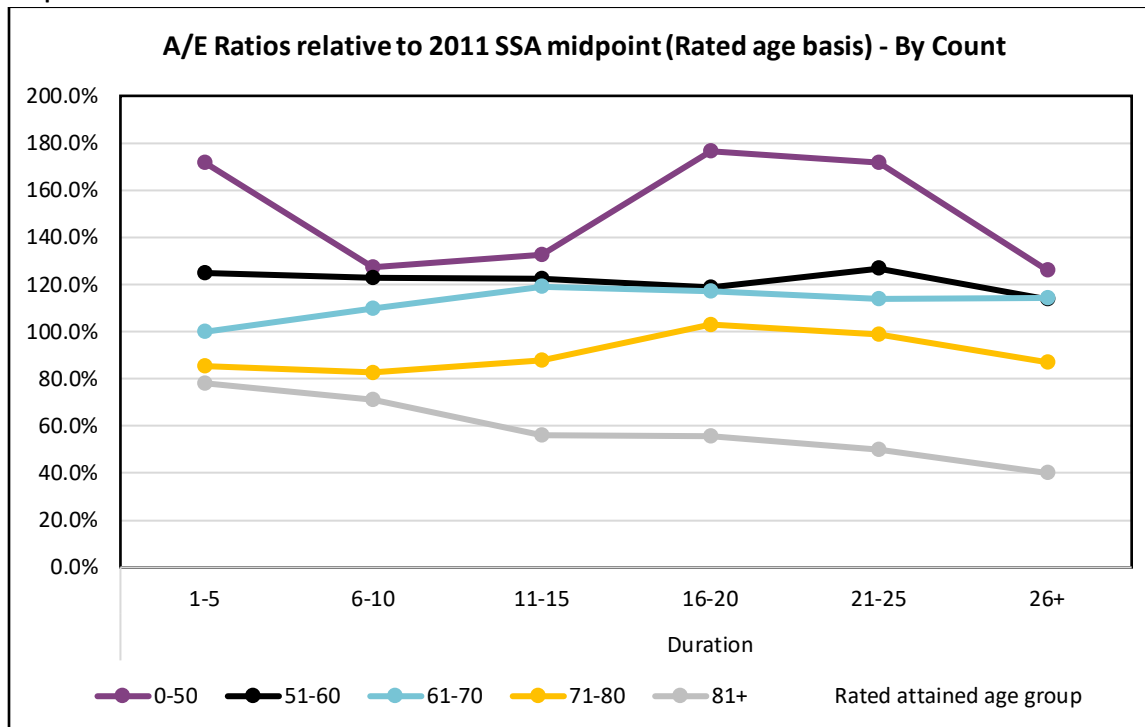
### 5.11 A/E RATIOS BY RATED ISSUE AGE GROUP

By count, the A/E ratios by rated issue age group are shown in Table 24.1 below. In general, ratios decrease with higher rated issue age group. A/E ratios tend to be lower under the rated-age basis. When the A/E ratios are calculated using the 1983 IAM Table plus 1983 IAM CED expected basis, the A/E ratios increase with rated issue age group up to age 60, then remain relatively level. Credibility is particularly impacted when results are subdivided into various categories. Accordingly, considerable care must be taken in the interpretation of the results.

**Table 24.1**

| A/E RATIOS BY RATED ISSUE AGE GROUP - BY COUNT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Expected Bases** | | **# of Deaths** | | | | | | | | | |
| | | **950** | **619** | **979** | **1,361** | **1,920** | **2,009** | **2,096** | **1,624** | **1,165** | **752** | **13,475** |
| | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM | True Age | 453.4% | 446.9% | 386.7% | 352.2% | 330.5% | 276.2% | 260.6% | 251.9% | 297.8% | 306.3% | 307.5% |
| 2000 Annuity | True Age | 555.7% | 577.6% | 498.4% | 451.4% | 418.0% | 346.5% | 323.5% | 310.0% | 363.2% | 365.8% | 383.6% |
| 2012 IAM Period with G2 Scale | True Age | 681.3% | 738.2% | 660.0% | 604.5% | 549.7% | 447.6% | 417.3% | 411.2% | 485.8% | 454.3% | 499.5% |
| SSA 2011 (midpoint) | True Age | 299.4% | 315.0% | 284.4% | 265.1% | 254.2% | 218.4% | 211.8% | 211.2% | 254.9% | 262.7% | 242.8% |
| **Expected Bases** | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM | Rated Age | 191.1% | 158.1% | 140.9% | 130.9% | 123.0% | 98.7% | 87.1% | 76.2% | 76.0% | 63.2% | 100.0% |
| 2000 Annuity | Rated Age | 244.0% | 201.2% | 177.1% | 162.9% | 151.6% | 120.7% | 105.1% | 91.3% | 90.1% | 72.7% | 121.2% |
| 2012 IAM Period with G2 Scale | Rated Age | 309.3% | 266.3% | 237.5% | 214.7% | 194.0% | 154.2% | 134.2% | 112.2% | 104.0% | 75.9% | 149.8% |
| SSA 2011 (midpoint) | Rated Age | 135.7% | 122.9% | 113.1% | 106.9% | 102.3% | 83.6% | 74.7% | 65.7% | 65.1% | 52.0% | 83.5% |
| **Expected Bases** | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM plus 1983 IAM CED | | 63.8% | 79.3% | 83.8% | 85.5% | 88.6% | 77.5% | 75.2% | 71.2% | 78.3% | 76.1% | 77.7% |

By amount, the A/E ratios by rated issue age group are shown in Table 24.2 below. In general, ratios follow the same pattern as by count.

**Table 24.2**

| A/E RATIOS BY RATED ISSUE AGE GROUP - BY AMOUNT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Expected Bases** | | **Death Amount ('000)** | | | | | | | | | | |
| | | $296,598 | $191,475 | $236,967 | $310,690 | $371,002 | $397,648 | $388,966 | $256,217 | $171,724 | $113,332 | $2,734,619 |
| | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM | True Age | 426.0% | 496.3% | 443.4% | 444.6% | 448.4% | 441.1% | 468.4% | 433.6% | 436.1% | 455.8% | 447.7% |
| 2000 Annuity | True Age | 519.1% | 635.1% | 564.1% | 566.2% | 565.9% | 552.8% | 582.3% | 535.5% | 532.0% | 546.9% | 558.9% |
| 2012 IAM Period with G2 Scale | True Age | 638.6% | 816.6% | 727.9% | 745.5% | 742.4% | 715.3% | 750.9% | 702.7% | 706.5% | 681.8% | 721.8% |
| SSA 2011 (midpoint) | True Age | 280.2% | 348.5% | 321.2% | 333.1% | 341.4% | 342.6% | 372.9% | 356.1% | 367.5% | 383.2% | 339.6% |
| **Expected Bases** | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM | Rated Age | 131.6% | 116.5% | 97.2% | 91.2% | 79.2% | 69.7% | 64.6% | 58.1% | 50.3% | 38.0% | 74.0% |
| 2000 Annuity | Rated Age | 186.9% | 163.9% | 134.6% | 125.0% | 107.3% | 93.8% | 85.3% | 76.6% | 64.9% | 47.7% | 99.0% |
| 2012 IAM Period with G2 Scale | Rated Age | 239.9% | 215.1% | 179.6% | 167.3% | 139.4% | 119.2% | 103.6% | 89.5% | 69.5% | 49.2% | 120.5% |
| SSA 2011 (midpoint) | Rated Age | 105.4% | 101.7% | 88.0% | 84.9% | 74.8% | 66.5% | 60.9% | 54.5% | 46.2% | 34.5% | 68.2% |
| **Expected Bases** | | **0-40** | **41-45** | **46-50** | **51-55** | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **81+** | **Grand Total** |
| 1983 IAM plus 1983 IAM CED | | 50.1% | 64.5% | 65.0% | 69.1% | 68.5% | 68.3% | 73.0% | 67.1% | 70.4% | 61.3% | 65.6% |

Although the current study has more comprehensive data than the previous ones, the number of deaths remains relatively low. Accordingly, considerable care must be taken in the interpretation of the results.

## 5.12    A/E RATIOS BY SIZE OF RATE-UP

By count, the A/E ratios by size of rate-up in years are shown in Table 25.1 below. In general, ratios increase with the size of the rate-up, based on true ages, as would be expected. Based on rated ages, ratios decrease with the size of the rate-up.

When the A/E ratios are calculated using the 1983 IAM Table plus 1983 IAM CED expected basis, the A/E ratios generally decrease with the size of the rate-up.

**Table 25.1**

| A/E RATIOS BY SIZE OF RATE-UP IN YEARS - BY COUNT | | | | | | |
|---|---|---|---|---|---|---|
| **Expected Bases** | | **# of Deaths** | | | | |
| | | **5,874** | **4,707** | **1,339** | **1,555** | **13,475** |
| | | **1-10** | **11-20** | **21-30** | **31+** | **Grand Total** |
| 1983 IAM | True Age | 199.5% | 381.0% | 886.2% | 3083.5% | 307.5% |
| 2000 Annuity | True Age | 248.2% | 478.8% | 1111.4% | 3627.3% | 383.6% |
| 2012 IAM Period with G2 Scale | True Age | 324.3% | 621.5% | 1413.6% | 4583.8% | 499.5% |
| SSA 2011 (midpoint) | True Age | 158.9% | 298.5% | 657.0% | 2178.1% | 242.8% |
| **Expected Bases** | | **1-10** | **11-20** | **21-30** | **31+** | **Grand Total** |
| 1983 IAM | Rated Age | 112.3% | 103.2% | 96.5% | 67.7% | 100.0% |
| 2000 Annuity | Rated Age | 137.6% | 125.7% | 115.9% | 79.8% | 121.2% |
| 2012 IAM Period with G2 Scale | Rated Age | 177.8% | 156.2% | 135.6% | 91.9% | 149.8% |
| SSA 2011 (midpoint) | Rated Age | 93.0% | 87.1% | 80.4% | 56.5% | 83.5% |
| **Expected Bases** | | **1-10** | **11-20** | **21-30** | **31+** | **Grand Total** |
| 1983 IAM plus 1983 IAM CED | | 83.2% | 77.6% | 80.8% | 60.9% | 77.7% |

## Section 6: Acknowledgements

The researchers' deepest gratitude goes to those without whose efforts this project could not have come to fruition: the subcommittee and others for their diligent work overseeing data request development, analyzing and discussing company submissions, and reviewing and editing this report for accuracy and relevance.

**Subcommittee Group Members:**

- Joel Sklar, ASA, MAAA (Chair)
- Cindy Chen, FSA, MAAA
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- Mike Straus, FSA, MAAA
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*Structured settlement professional

The SOA contracted with MIB's Actuarial and Statistical Research Group to collect, validate, and compile the data for this report. The SOA also contracted with an independent consultant, Michel Desmarais, FSA, FCIA, to complete the required analyses and draft the report.

**At the Society of Actuaries:**

Cynthia MacDonald, FSA, MAAA, CFA, Senior Experience Studies Actuary

Korrel Crawford, Senior Research Administrator


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## Section 7: List of Participating Companies

The Society of Actuaries would like to thank the following 19 companies who contributed data to this study:

- Allstate

- Allstate of New York

- American General Life

- AXA Equitable

- Genworth

- Hartford

- Integrity Life

- Liberty Mutual

- Lincoln National

- MetLife

- National Integrity Life

- New York Life

- Pacific Life

- Prudential

- Symetra

- Transamerica

- Union Fidelity Life

- United States Life of New York

- USAA Life

# Appendix A: Exposure Calculations – Mortality

## 1. Overview

For the statistical agent data, the data is submitted by calendar year split into two policy durations. For mortality, the Balducci approach is used. Therefore, the exposure assigned to a death will differ depending upon whether mortality is the decrement under study. The duration that a termination is assigned to is based on the Actual Termination Date. See the diagram below.

Each submitted record is split into two portions that correspond to the two policy durations:

- **B:** The policy duration before the anniversary date in the calendar year (Before Analytical Anniversary Portion = 'B'), and
- **A:** The policy duration after the anniversary date in the calendar year (After Analytical Anniversary Portion = 'A').

For example, a record submitted with the annuitant having a duration of 10 at the beginning of the observation year would have a Before Analytical Anniversary Portion of 'B' with a duration of 10, and the Analytical Anniversary Portion of 'A' would have a duration of 11.

Based on the two Analytical Anniversary Portions, we calculate Exposure Length for mortality. Then, we calculate the Policies Exposed, Annuity or Reserve Amount, and the Amount Exposed.

## 2. Mortality Exposure Length

The Exposure Length differs between the After Analytical Anniversary Portion 'A' and the Before Analytical Anniversary Portion 'B' for in force, death terminations, and non-death terminations. The Exposure Length is used to determine the Policies Exposed and the Annuity or Reserve Amount Exposed.

### 2.1 For In Force Policies

The Exposure Length of the Before Analytical Anniversary Portion 'B' is the fraction of the year from the beginning of the calendar year to the Anniversary Date of the policy in the Observation Year. For After Analytical Anniversary Portion 'A,' the Exposure Length is the fraction of the year from the anniversary date of the policy during the calendar year to the end of the calendar year.

### 2.2 For Death Terminated Policies

The calculation of Exposure Length depends upon whether the death occurred before the anniversary date or after the anniversary date:

- If the death occurs before the anniversary date, due to the Balducci hypothesis, the exposure length for 'B' is the fraction of the year from the beginning of the calendar year to the anniversary date in the Observation Year. The exposure length for the After Analytical Anniversary Portion 'A' would be zero.
- If the death occurs after the anniversary date, the exposure length for 'B' is the fraction of the year from the beginning of the calendar year to the anniversary date in the Observation Year. Due to the Balducci hypothesis, the exposure length for the After Analytical Anniversary Portion 'A' would be 1.

### 2.3 For Non-Death Terminated Policies

The calculation of Exposure Length depends upon whether the non-death termination occurred before or after the anniversary date:

- If the non-death termination occurs before the anniversary date, the exposure length for the Before Analytical Anniversary Portion 'B' is the fraction of the year from the beginning of the calendar year to the Actual Termination Date. The exposure length for the After Analytical Anniversary Portion 'A' would be zero.
- If the non-death termination occurs after the anniversary date, the exposure length for the Before Analytical Anniversary Portion 'B' is the fraction of the year from the beginning of the calendar year to the anniversary date in the Observation Year. The exposure length for the After Analytical Anniversary Portion 'A' would be the fraction of the year from the anniversary date to the Actual Termination Date.

## 3. Policies Exposed

Policies Exposed is calculated as the product of the Policy Exposure Indicator (PEI) and Exposure Length. For single life policies, the PEI is set to 1 for the base policy (Segment Number = 1) and set to 0 for the non-base policy (Segment Number >1).

## 4. Annuity or Reserve Amount

Annuity or Reserve Amount is based upon the Amount at the Beginning of the Year or the Amount at the End of the Year.

For the Analytical Anniversary Portion 'B,' the Annuity or Reserve Amount is based upon the Amount at the Beginning of the Year. For the Analytical Anniversary Portion 'A,' the Annuity or Reserve Amount is based upon the Amount at the End of the Year.

## 5. Amount Exposed

The Amount Exposed is calculated as the product of the Exposure Length and Annuity or Reserve Amount.

## 6. Cases Included in a Separate Excel File

### 6.1 Case issued before the study period (before 01/01/2005) and remained in force throughout the study (IBRI).

### 6.2 Case issued before the study period (before 01/01/2005) and died (IBTD).

### 6.3 Case issued before the study period (before 01/01/2005) and terminated other than by death (IBTO).

### 6.4 Case issued during the study (after 01/01/2005) and remained in force until the end of the study (IDRI).

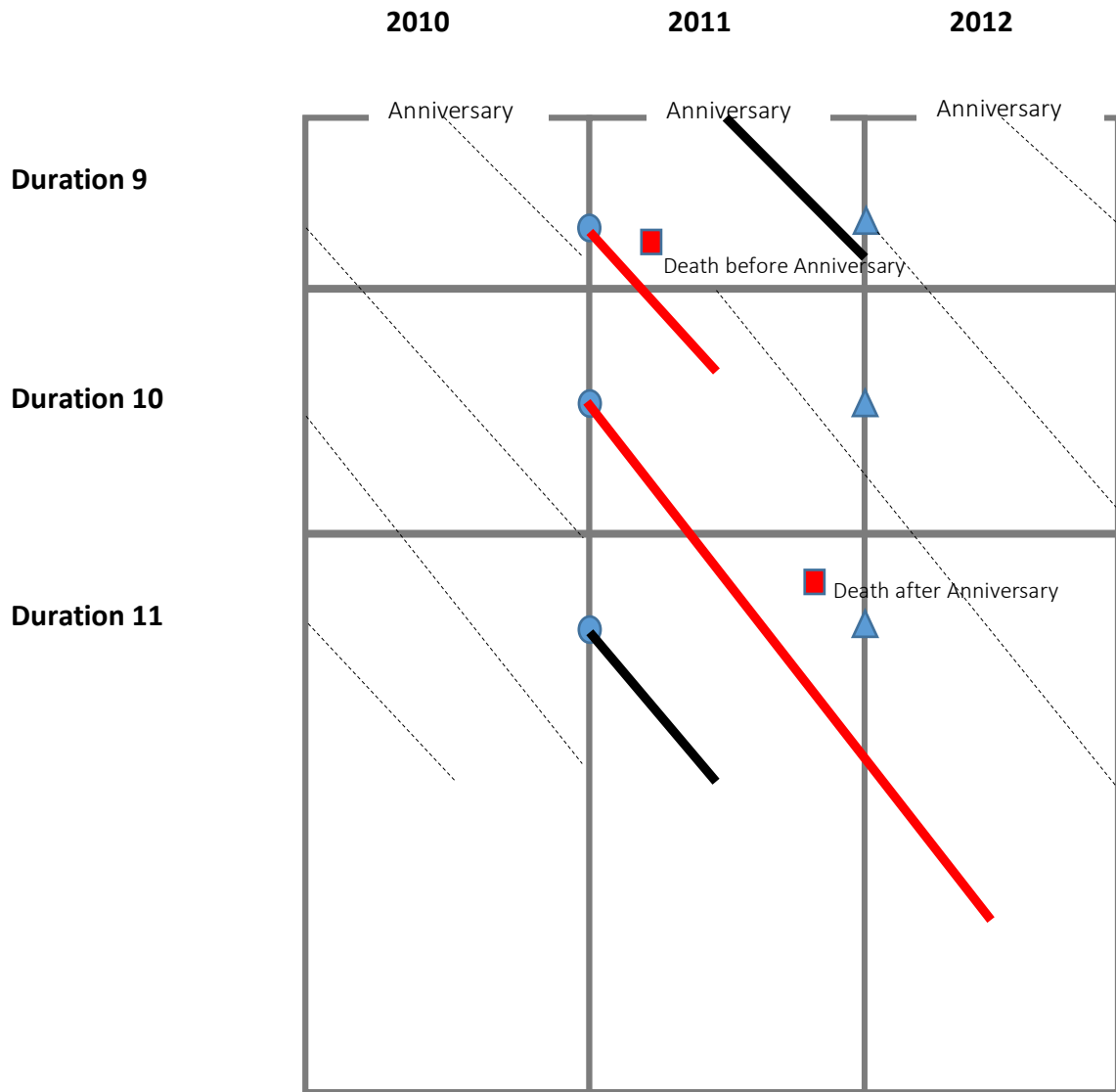*6.5 Case issued during the study (after 01/01/2005) and died (IDTD).*

*6.6 Case issued during the study (after 01/01/2005) and terminated other than by death (IDTO).*

**Diagrams
Exposure for Policy Duration
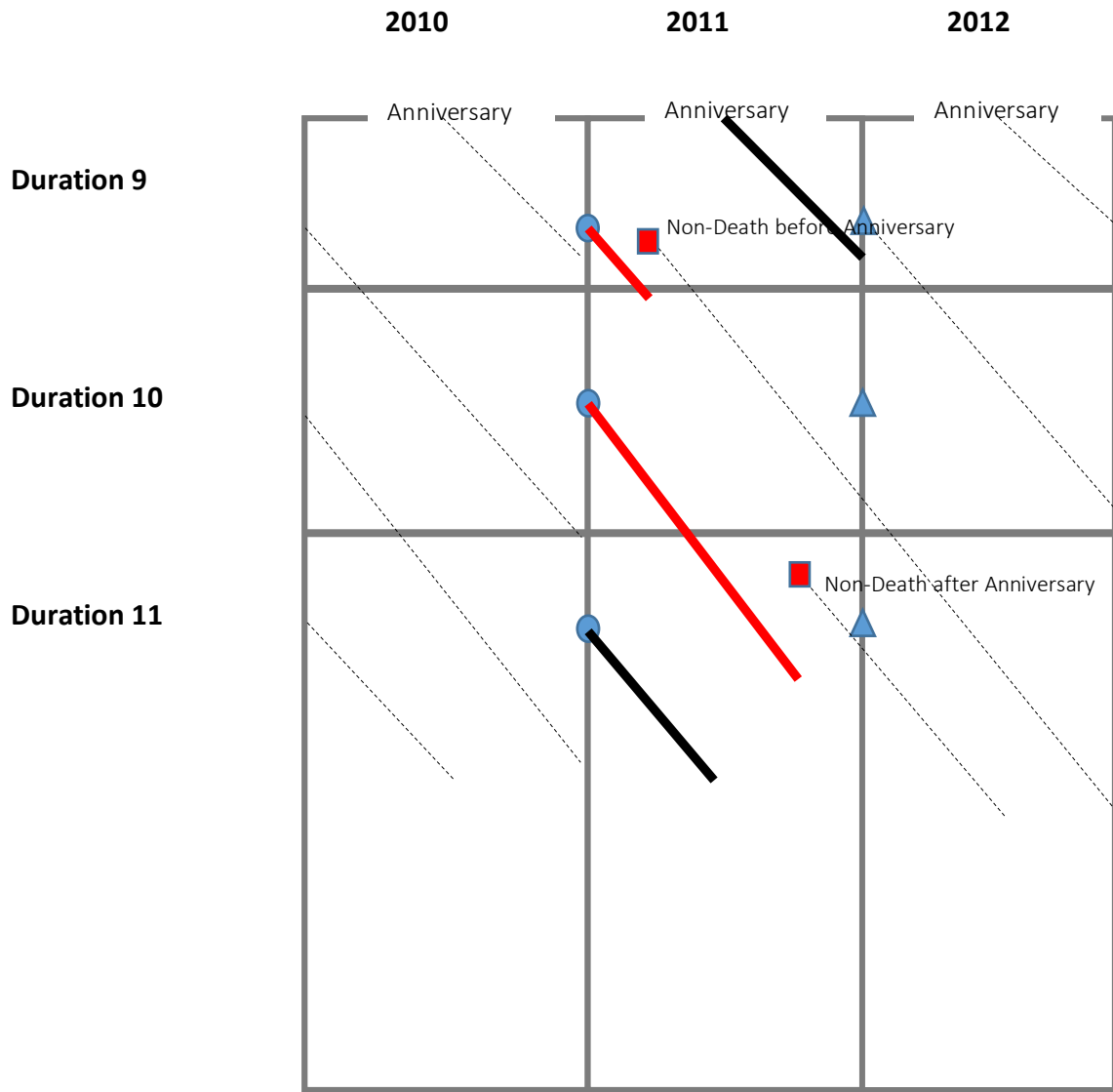in Calendar Year 2011**

*For In Force Policies*
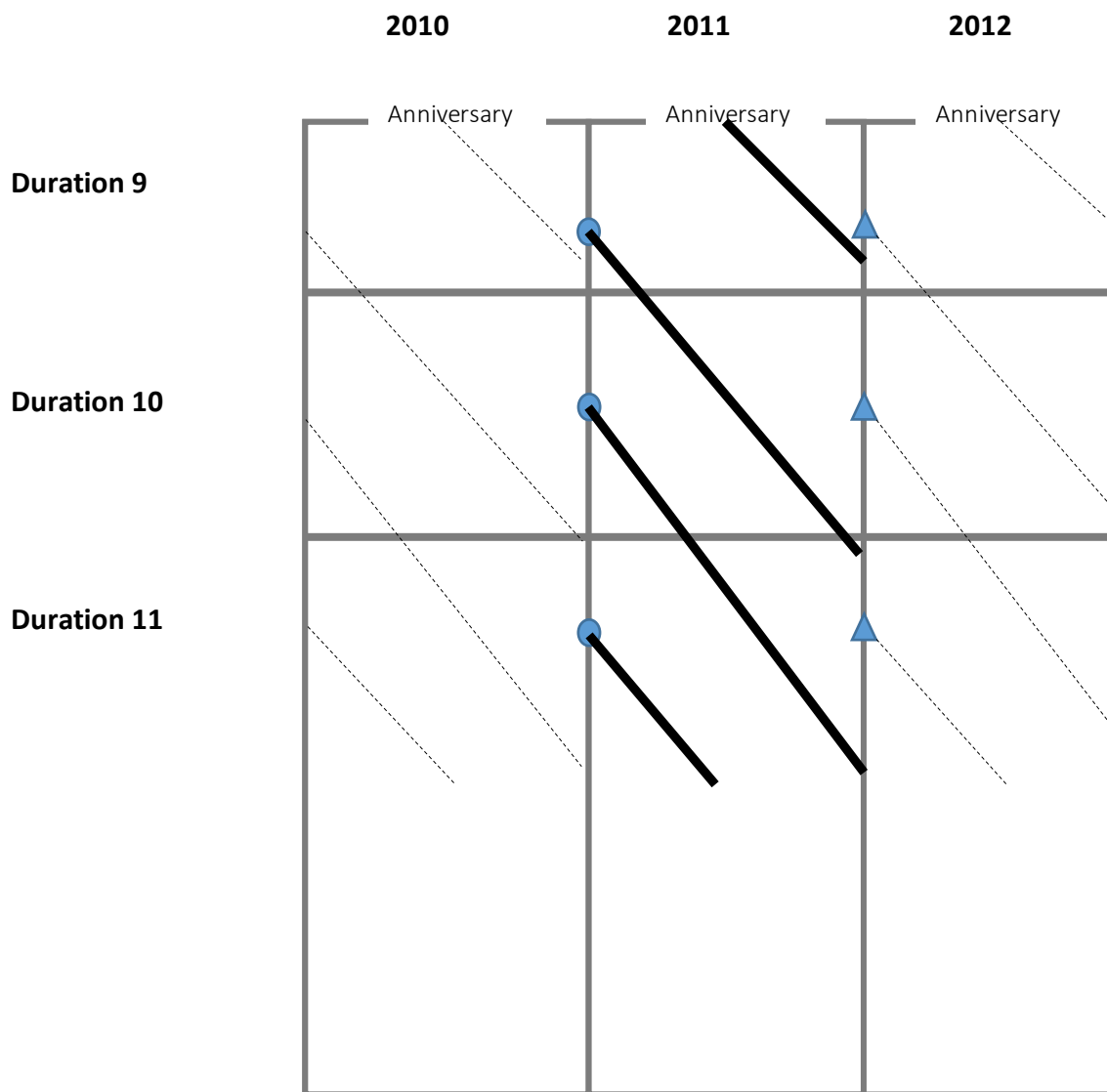
*For Death Terminated Policies*

**For Non-Death Terminated Policies**

## Appendix B: Death Rates by Attained Age Group – Males

| DEATH RATES BY ATTAINED AGE GROUP (1,000 QX) - MALES - BY COUNT | | | | | |
|---|---|---|---|---|---|
| Attained Age Group | Actual Death Rate | Expected Death Rates | | | |
| | | 1983 IAM | 2000 Annuity | 2012 IAM Period with G2 | 2011 SSA (midpoint) |
| 0-5 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6-10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 11-15 | 0.464 | 0.417 | 0.403 | 0.188 | 0.258 |
| 16-20 | 1.523 | 0.476 | 0.468 | 0.366 | 0.829 |
| 21-25 | 2.283 | 0.574 | 0.569 | 0.526 | 1.325 |
| 26-30 | 2.249 | 0.705 | 0.671 | 0.710 | 1.383 |
| 31-35 | 3.246 | 0.848 | 0.701 | 0.757 | 1.536 |
| 36-40 | 3.820 | 1.138 | 0.819 | 0.791 | 1.874 |
| 41-45 | 5.371 | 1.938 | 1.403 | 1.086 | 2.732 |
| 46-50 | 7.263 | 3.381 | 2.489 | 1.677 | 4.361 |
| 51-55 | 9.896 | 5.217 | 3.905 | 2.791 | 6.710 |
| 56-60 | 11.987 | 7.321 | 5.614 | 4.251 | 9.664 |
| 61-65 | 15.473 | 10.691 | 8.257 | 6.732 | 13.410 |
| 66-70 | 22.734 | 17.325 | 13.599 | 9.644 | 20.186 |
| 71-75 | 33.881 | 28.521 | 22.932 | 14.966 | 30.987 |
| 76-80 | 53.630 | 46.394 | 37.486 | 26.042 | 49.276 |
| 81-85 | 83.370 | 74.290 | 59.829 | 46.244 | 81.084 |
| 86-90 | 120.050 | 112.955 | 92.328 | 82.627 | 133.260 |
| 91-95 | 180.676 | 159.699 | 134.665 | 142.103 | 212.763 |
| 96-100 | 335.570 | 219.834 | 185.232 | 214.291 | 305.342 |
| 101+ | 250.000 | 314.068 | 263.182 | 307.289 | 387.513 |
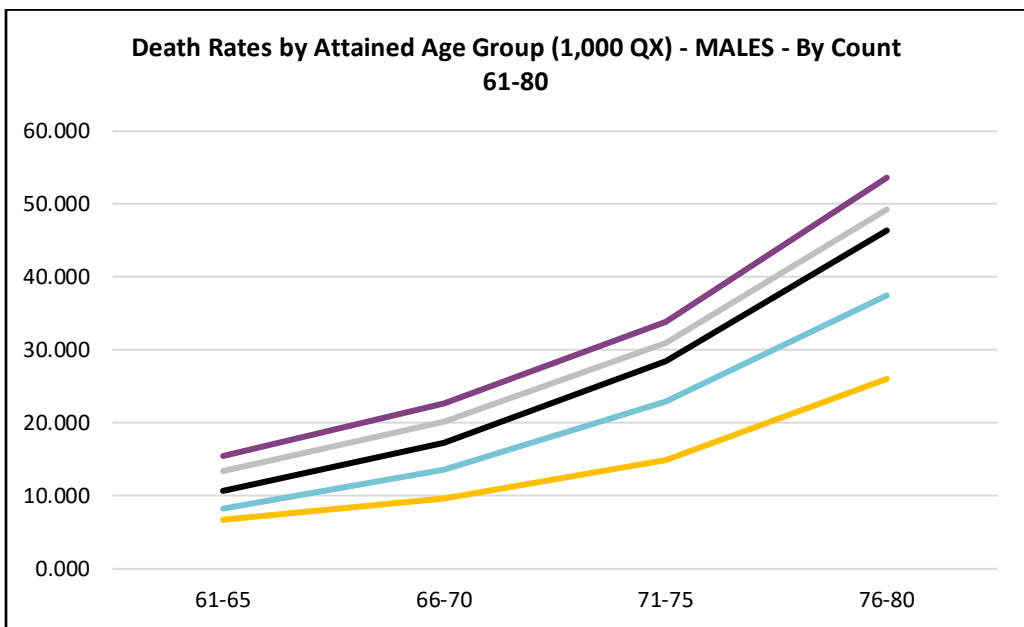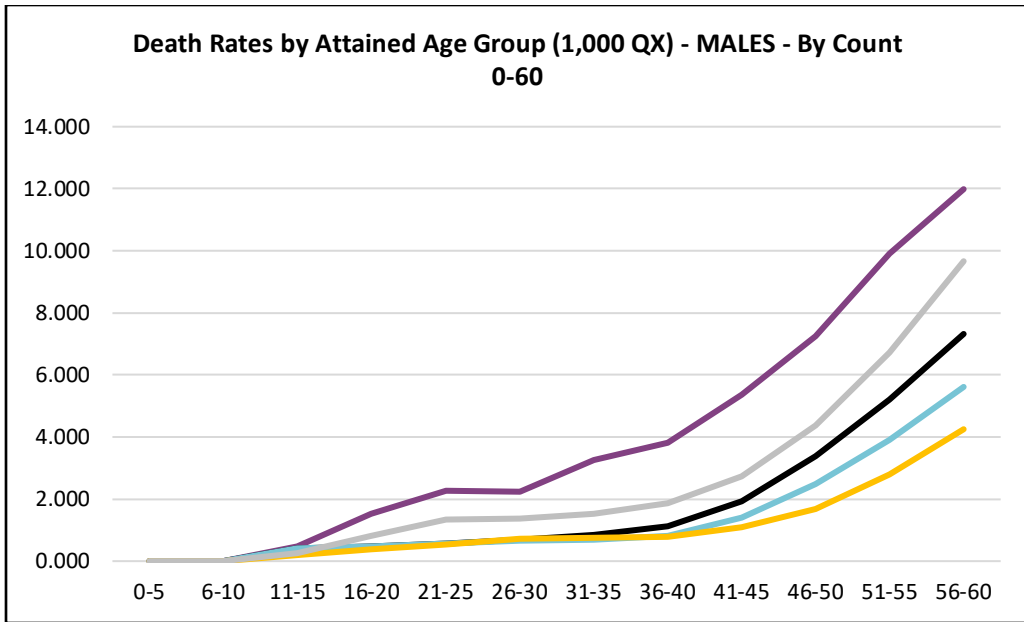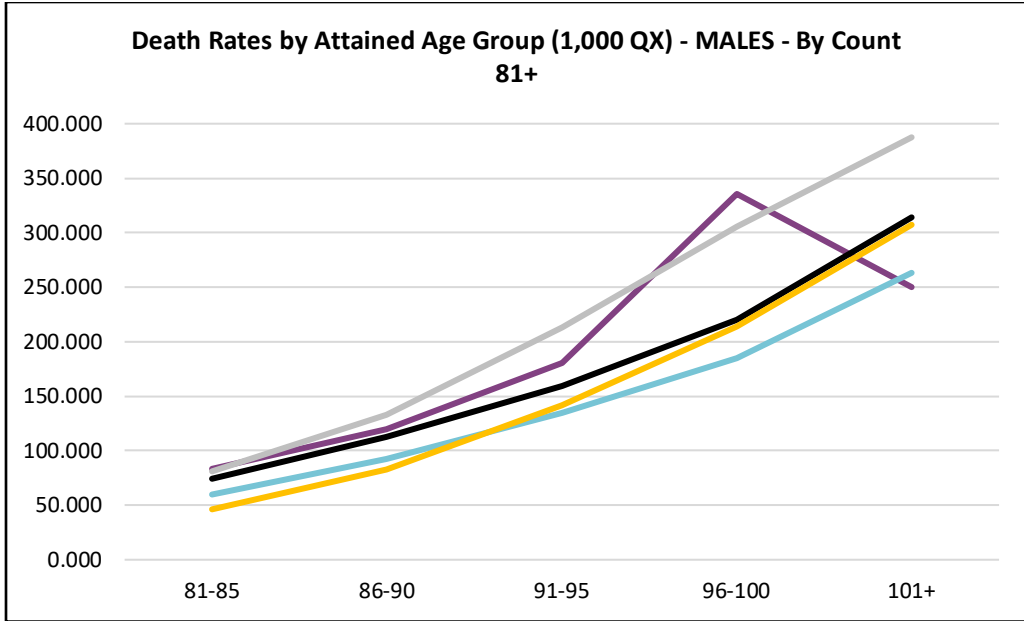
**Death Rates by Attained Age Group (1,000 QX) - MALES - By Count
0-60**

**Death Rates by Attained Age Group (1,000 QX) - MALES - By Count
61-80**

**Death Rates by Attained Age Group (1,000 QX) - MALES - By Count 81+**

| | |
|---|---|
| **Actual Death Rate** | |
| **Expected Death Rate - 1983 IAM** | |
| **Expected Death Rate - 2000 Annuity** | |
| **Expected Death Rate - 2012 IAM Period with G2** | |
| **Expected Death Rate - 2011 SSA (midpoint)** | |

## Appendix B: Death Rates by Attained Age Group – Females

| | | Expected Death Rates | | | |
|---|---|---|---|---|---|
| **DEATH RATES BY ATTAINED AGE GROUP (1,000 QX) - FEMALES - BY COUNT** | | | | | |
| **Attained Age Group** | **Actual Death Rate** | **1983 IAM** | **2000 Annuity** | **2012 IAM Period with G2** | **2011 SSA (midpoint)** |
| **0-5** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **6-10** | 0.536 | 0.196 | 0.173 | 0.137 | 0.135 |
| **11-15** | 0.384 | 0.168 | 0.156 | 0.121 | 0.144 |
| **16-20** | 0.715 | 0.232 | 0.222 | 0.212 | 0.321 |
| **21-25** | 1.427 | 0.313 | 0.299 | 0.246 | 0.466 |
| **26-30** | 1.214 | 0.405 | 0.375 | 0.276 | 0.592 |
| **31-35** | 1.527 | 0.501 | 0.437 | 0.352 | 0.805 |
| **36-40** | 2.256 | 0.653 | 0.539 | 0.474 | 1.109 |
| **41-45** | 2.848 | 0.959 | 0.796 | 0.703 | 1.738 |
| **46-50** | 4.214 | 1.525 | 1.283 | 0.990 | 2.747 |
| **51-55** | 5.486 | 2.445 | 2.066 | 1.629 | 4.049 |
| **56-60** | 7.366 | 3.768 | 3.242 | 2.747 | 5.648 |
| **61-65** | 10.363 | 6.010 | 5.157 | 4.930 | 8.379 |
| **66-70** | 15.584 | 9.699 | 8.273 | 7.603 | 13.475 |
| **71-75** | 22.859 | 16.005 | 13.889 | 11.786 | 21.431 |
| **76-80** | 37.214 | 28.791 | 25.222 | 19.765 | 35.759 |
| **81-85** | 59.801 | 51.656 | 45.504 | 37.237 | 60.814 |
| **86-90** | 100.576 | 89.429 | 79.651 | 68.521 | 104.578 |
| **91-95** | 155.104 | 142.711 | 128.306 | 112.753 | 174.420 |
| **96-100** | 243.451 | 201.164 | 180.841 | 182.382 | 261.367 |
| **101+** | 307.692 | 283.806 | 257.424 | 278.830 | 355.660 |
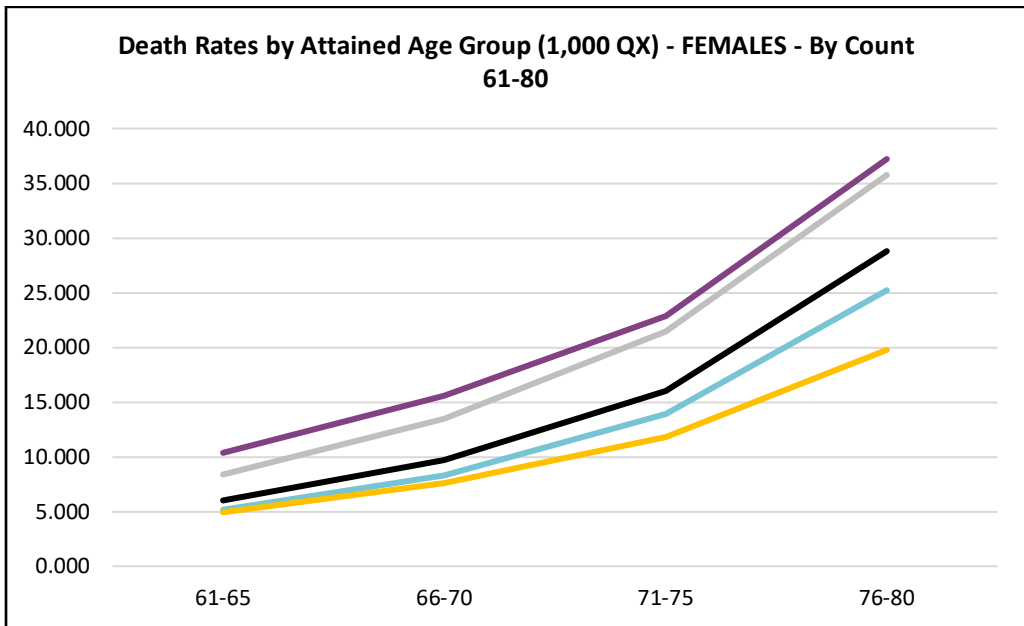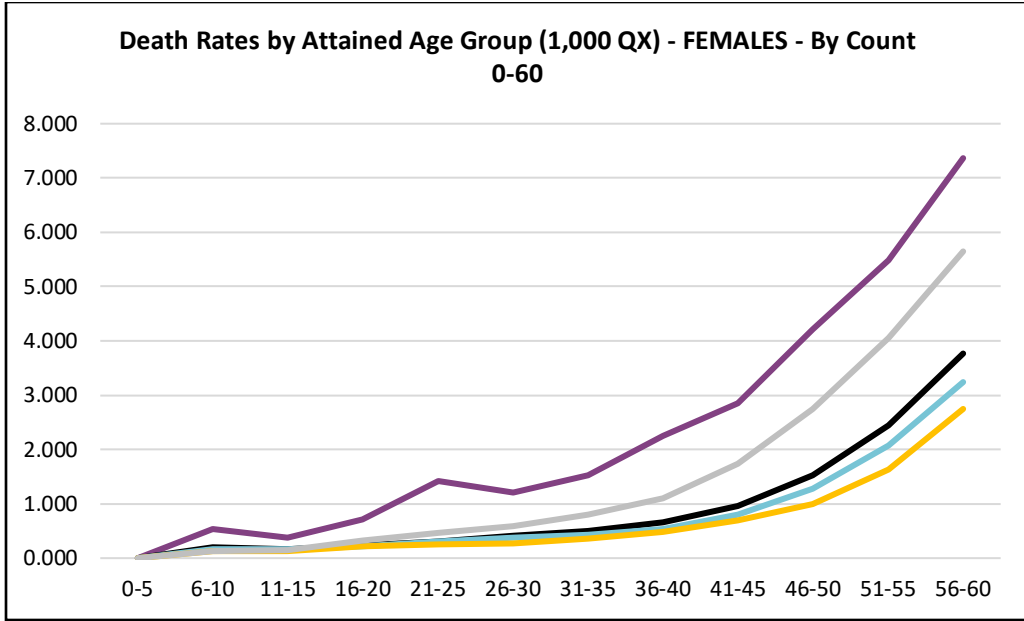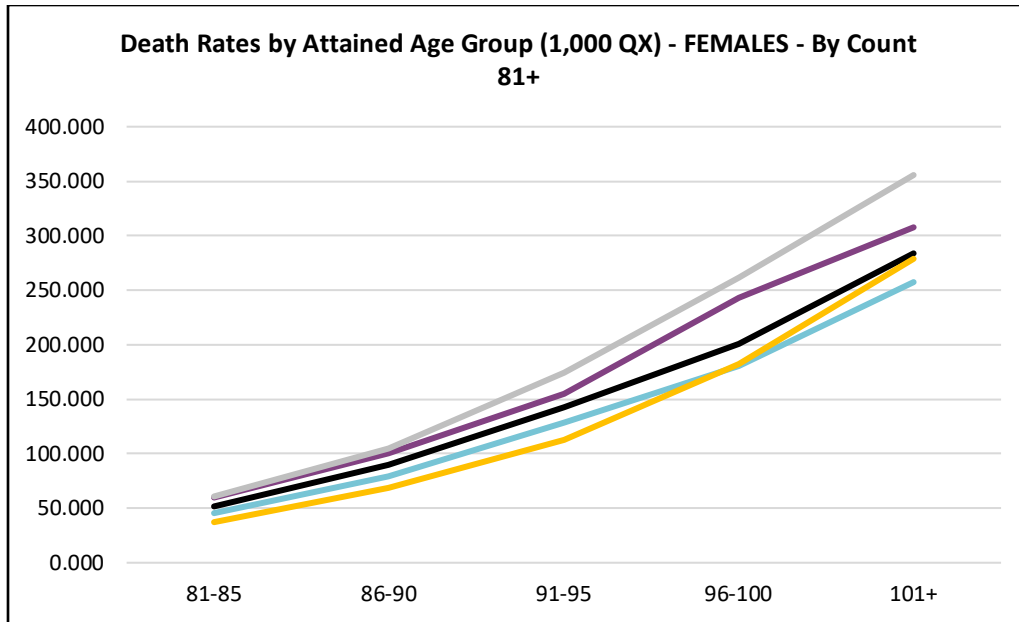
**Death Rates by Attained Age Group (1,000 QX) - FEMALES - By Count 0-60**



**Death Rates by Attained Age Group (1,000 QX) - FEMALES - By Count 61-80**

**Death Rates by Attained Age Group (1,000 QX) - FEMALES - By Count 81+**



| Actual Death Rate |
|---|
| Expected Death Rate - 1983 IAM |
| Expected Death Rate - 2000 Annuity |
| Expected Death Rate - 2012 IAM Period with G2 |
| Expected Death Rate - 2011 SSA (midpoint) |

## About The Society of Actuaries

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