



Mortality  
and Longevity

# 2011-2015 Deferred Annuity Mortality Study

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# 2011-2015 Deferred Annuity Mortality Study

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# 2011-2015 Deferred Annuity Mortality Study

## Section 1: Purpose of Study

The primary purposes of the study are to:

1. Compare emerging deferred annuity mortality experience with established valuation bases.
2. Compare deferred annuity mortality experience with the 2012 IAM Basic table, both with and without the G2 improvement scale.
3. Analyze recent annuitant mortality experience with respect to fixed and variable deferred annuities.
4. Compare the experience between various benefit types available with those deferred annuity products and analyze the impact of customer selection on mortality as it differs by product and benefit type.

No assessment has been made concerning the applicability of this experience to other purposes. In developing this report, the SOA Research Institute 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.

General background information on mortality experience credibility is available in a report published by the Society of Actuaries Research Institute: "[Credibility Educational Resource for Pension Actuaries: Application of Credibility Theory to Mortality Assumption](#)," Pension Section Council, Society of Actuaries, August 2017. This report also has a supporting Excel file that demonstrates the calculations in detail. Directly below is a link which accesses this report and the supporting Excel file.

<https://www.soa.org/sections/retirement/pension-resources/>

## Section 2: Overview

### 2.1 BACKGROUND

The Individual Annuity Experience Committee (IAEC) of the Society of Actuaries Research Institute has conducted an experience study of individual deferred annuities, covering calendar years 2011 through 2015. For purposes of this study, deferred annuities refer to annuity products which provide an account value and, thus, exclude deferred income annuities.

This is a new area of analysis for the SOA Research Institute's IAEC. Previous industry annuitant mortality studies have focused on payout annuities, as well as the specialized structured settlement annuity market. Traditionally, mortality had not been viewed as a critical assumption for deferred annuities. As the products have evolved over time, especially with the popularity of enhanced death benefits for variable annuities and guaranteed living benefits for both variable and fixed deferred annuities, mortality has taken on increased importance.

Twenty-four companies contributed data to this study. The study encompasses 41.7 million contract years exposed, more than \$3.4 trillion in account value years, and over 680,000 deaths over the five-year period.

Variable annuities with and without Guaranteed Living Benefits (GLBs) were analyzed separately. Variable annuities without GLBs were analyzed based on death benefit categorization. "Enhanced" death benefits reference those which include a roll-up benefit. "Basic" death benefits consist of return of premium and annual ratchet death benefits. Some variable annuities don't provide any minimum guaranteed death benefit. Note that greater data granularity than these broad categories of GLBs and death benefits were collected in the study, but we couldn't report out on them due to either concentration or credibility issues.

Fixed annuity experience includes data on Fixed Indexed Annuities (FIAs) but, due to concentration issues, FIAs could not be reported out separately. Data was collected on fixed annuities with GLBs, but concentration issues forced us to exclude those results.

In addition to the various benefit riders discussed above, the study analyzed many different cuts of the deferred annuity mortality data. For example, results were analyzed by tax qualification status, size band, region, distribution channel, and issue year cohort. All results are available on both a contract count and amount (account value) basis.

Experience data was collected on Joint and Survivor contracts, but the Committee was not comfortable with the results, so the J&S experience was excluded from the study.

A data challenge encountered in the study involved spousal continuation. Spousal continuation (or annuitant exchange) occurs on an annuity contract when the spouse decides to keep the contract active following the death of the owner/annuitant. On variable annuities, the account value may reflect a step up in value due to a death benefit. Since these contracts aren't terminated due to the death of the owner/annuitant, some companies undercount deaths as a result. To overcome this, we instituted a spousal continuation fix for companies that undercounted those deaths. This fix consisted of identifying that a new owner/annuitant on a given contract at the end of an experience year was attributable to spousal continuation following the death of the original owner/annuitant.

The spousal continuation fix did not provide for an adjustment to deaths in the first experience year, 2011, since it was premised on the identification of a different annuitant than what was reported for the prior year (and 2011 was the first study year). For this reason, we did not include the 2011 experience data for companies that were subject to the spousal continuation fix and, therefore, there are lower deaths and exposures in 2011 than the other study years.

Actual-to-Expected (A/E) ratios were developed using the mortality bases shown in the table below. For convenience and simplicity, the expected mortality used for the A/E ratios shown in this report are based on the 2012 IAM Basic G2 table. Mortality improvement based on scale G2 is projected forward and backward for each of the study years relative to the 2012 baseline. An explanation of the exposure calculations is available in section 5 of this report, with section 5.3 containing more details on how the expected mortality bases were used in the development of the A/E ratios. The pivot table which accompanies this report allows the user to view results using each of the expected bases listed in the table below.

**Table 1**

**MORTALITY TABLE DETAILS**

Mortality Table	Valuation Margin	Projection
1994 MGDB Table	N/A	None
2012 IAM Basic Table	None	None
2012 IAM Period Table	Included	None
2012 IAM Basic G2 Table	None	G2
2011-2015 SSA Average	None	None

## Section 3: Analysis – Variable Annuities

### 3.1 EXPOSURES AND DEATHS

#### 3.1.1 BY STUDY YEAR

Table 3.1.1 presents the exposures and deaths by contract count, as well as by account value (Amount) for each study year from 2011 to 2015. Study year 2011 has materially less deaths (and exposure) than the other study years due to the spousal continuation issue discussed in the last paragraph of Section 2. The average account value for a study year can be obtained by dividing the amount exposure by the contract exposure, and the increasing pattern of the average account value shows a trend of the account value growth for each contract exposed in the study period. The actual mortality rate in each year is the actual death count divided by the contract exposure.

Tables 3.1.2 and 3.1.3 present exposures and deaths by contract count and account value, as well as the actual mortality rates, by sex and attained age group, respectively.

**Table 3.1.1**  
EXPOSURES, DEATHS, AND MORTALITY RATES BY STUDY YEAR

Study Year	Contract Exposure	Amount Exposure	Actual Death Count	Actual Death Amount	Average Account Value	Actual Mortality Rate by Contract
2011	4,922,088	375,809,765,312	61,466	5,483,667,748	76,352	1.25%
2012	6,169,939	505,609,539,458	74,639	6,837,507,299	81,947	1.21%
2013	6,129,409	557,752,734,902	76,316	7,556,403,850	90,996	1.25%
2014	6,017,977	598,450,118,387	75,916	8,167,579,824	99,444	1.26%
2015	5,904,345	594,517,677,354	77,318	8,526,009,810	100,692	1.31%
<b>Total</b>	<b>29,143,757</b>	<b>2,632,139,835,413</b>	<b>365,655</b>	<b>36,571,168,531</b>	<b>90,316</b>	<b>1.25%</b>

#### 3.1.2 BY SEX

**Table 3.1.2**  
EXPOSURES, DEATHS, AND MORTALITY RATES BY SEX

Sex	Contract Exposure	Amount Exposure	Actual Death Count	Actual Death Amount	Average Account Value	Actual Mortality Rate by Contract
Male	13,648,418	1,368,084,762,828	185,690	19,366,923,554	100,238	1.36%
Female	15,495,338	1,264,055,072,585	179,965	17,204,244,977	81,576	1.16%
<b>Total</b>	<b>29,143,757</b>	<b>2,632,139,835,413</b>	<b>365,655</b>	<b>36,571,168,531</b>	<b>90,316</b>	<b>1.25%</b>

## 3.1.3 BY ATTAINED AGE GROUP

Table 3.1.3

## EXPOSURES, DEATHS, AND MORTALITY RATES BY ATTAINED AGE GROUP

Attained Age	Contract Exposure	Amount Exposure	Actual Death Count	Actual Death Amount	Average Account Value	Actual Mortality Rate by Contract
< 45	2,226,765	75,343,486,496	2,106	105,652,823	33,835	0.09%
45-49	1,726,238	93,987,147,846	2,265	145,414,683	54,446	0.13%
50-54	2,854,609	199,923,716,120	5,942	458,902,398	70,035	0.21%
55-59	4,046,171	346,226,013,081	13,065	1,207,922,968	85,569	0.32%
60-64	4,960,599	510,228,625,221	24,392	2,578,676,277	102,856	0.49%
65-69	4,698,357	524,289,297,508	37,364	4,085,242,216	111,590	0.80%
70-74	3,449,275	375,801,441,281	47,535	5,045,620,189	108,951	1.38%
75-79	2,401,464	241,872,251,080	57,536	5,682,959,852	100,719	2.40%
80-84	1,638,551	155,954,511,306	71,541	6,833,113,305	95,178	4.37%
85-89	889,491	82,194,951,912	68,389	6,579,178,212	92,407	7.69%
90-94	222,105	22,923,561,335	29,062	3,091,301,810	103,210	13.08%
95 +	30,130	3,394,832,226	6,458	757,183,798	112,673	21.43%
<b>Total</b>	<b>29,143,757</b>	<b>2,632,139,835,413</b>	<b>365,655</b>	<b>36,571,168,531</b>	<b>90,316</b>	<b>1.25%</b>

### 3.2 OVERALL A/E RATIOS BY SEX AND ATTAINED AGE GROUP

The table below shows the mortality A/E for the overall VA business by sex and attained age group, with the expected mortality as the 2012 IAM with G2 improvement. The actual death count and amount (AV) are shown along with the A/E ratio for readers to get a sense of the credibility. Due to the light experience in the younger ages (below 50) and older ages (95 and over), those ages have been grouped into “< 50” and “95 +” groups, respectively.

Although the overall A/Es for male and female hover around 100%, the results clearly demonstrate that the underlying slope of the 2012 IAM table does not match the actual experience at some age groups, especially for males between ages 50 to 69.

**Table 3.2**

#### A/E RATIOS BY SEX AND ATTAINED AGE GROUP FOR OVERALL VA BUSINESS

By Contract	Male		Female		By Amount (AV)	Male		Female	
	Attained Age	Actual Deaths	A/E by Contract	Actual Deaths		A/E by Contract	Attained Age	Claim Amount	A/E by Amount
< 50	2,260	98.6%	2,111	130.3%	< 50	128,346,579	108.6%	122,720,927	178.3%
50-54	3,094	81.7%	2,848	114.6%	50-54	248,359,104	84.8%	210,543,294	131.4%
55-59	6,993	85.3%	6,072	104.0%	55-59	672,050,217	86.4%	535,872,751	117.4%
60-64	13,357	82.7%	11,035	86.9%	60-64	1,522,104,453	81.5%	1,056,571,824	90.4%
65-69	20,581	90.7%	16,783	89.5%	65-69	2,428,890,970	85.3%	1,656,351,246	89.9%
70-74	26,212	105.1%	21,323	101.5%	70-74	2,970,098,231	98.7%	2,075,521,958	101.9%
75-79	31,231	107.5%	26,305	107.9%	75-79	3,223,979,028	102.3%	2,458,980,824	108.6%
80-84	36,664	111.2%	34,877	106.6%	80-84	3,610,003,024	109.9%	3,223,110,281	108.2%
85-89	31,801	111.9%	36,588	100.3%	85-89	3,094,588,422	115.1%	3,484,589,790	105.4%
90-94	11,527	108.0%	17,535	106.2%	90-94	1,233,829,390	108.5%	1,857,472,420	110.3%
95 +	1,970	103.9%	4,488	108.0%	95 +	234,674,136	107.6%	522,509,662	112.5%
<b>Total</b>	<b>185,690</b>	<b>102.6%</b>	<b>179,965</b>	<b>101.9%</b>	<b>Total</b>	<b>19,366,923,554</b>	<b>99.9%</b>	<b>17,204,244,977</b>	<b>104.7%</b>

### 3.3 A/E RATIOS BY GUARANTEED LIVING BENEFIT RIDER

#### 3.3.1 INTRODUCTION

Guaranteed Living Benefit (GLB) riders are offered in a variety of forms on the vast majority of Variable Annuities (VA) sold today. Here is a brief summary of the most popular GLB riders.

With the purchase of a Guaranteed Lifetime Withdrawal Benefit (GLWB), annuity owners can take lifetime withdrawals, guaranteed up to a maximum percent of the benefit base every year, regardless of the investment performance of the funds in their annuity. Typically, GLWB owners have flexibility in deciding when to start their withdrawals, can retain control over their assets, and are not obligated to annuitize their contracts to receive guaranteed lifetime income payments. For this reason, contracts with GLWBs generally remain in deferred annuity status until the annuity matures, typically at a relatively old age.

Guaranteed Minimum Withdrawal Benefits (GMWBs) permit annual withdrawals of a certain percentage of the benefit base balance until the guaranteed payments are exhausted, even if the contract value itself falls to zero. The benefit base may include step-ups or bonuses prior to withdrawals commencing, or optional step-ups to reflect investment growth after withdrawals have commenced. However, GMWBs do not provide income for life.

With the purchase of a Guaranteed Minimum Income Benefit (GMIB), annuity owners can receive guaranteed income at the end of a waiting period by annuitizing the benefit base. However, most GMIB riders give the owner flexibility to take withdrawals during the waiting period without disturbing the benefit base, blurring the distinction between GLWBs and GMIBs.

Guaranteed Minimum Accumulation Benefit (GMAB) riders in variable annuities guarantee that the contract owner will receive a minimum amount of the principal after a set period of time or waiting period. In essence, the rider guarantees protection of the investment's value from a market down turn. GMABs typically provide a one-time adjustment to the contract value on the benefit maturity date if the contract value is less than the guaranteed minimum accumulation value as stipulated in the contract.

Finally, some companies offer GLB riders that are a combination of the previous benefits.

The study only reports out on contracts with *any* GLB rider and contracts *without any* GLB rider. Due to concentration issues, we are not able to report on the distinct GLB riders individually.

Finally, throughout this section, the expected basis used is the 2012 Individual Annuitant Mortality (IAM) Basic Table projected using the G2 mortality improvement scale. The mortality rates are projected forward and backward for each of the study years relative to the 2012 baseline.

### 3.3.2 GLOBAL A/E RATIOS

**Table 3.3.2a**

#### GLOBAL A/E RATIOS - BY CONTRACT

VARIABLE ANNUITIES - DATA BY TYPE OF GLB RIDER - BY CONTRACT	Contracts Exposed	Actual Deaths	Expected Deaths	A/E Ratio with 2012 IAM with G2
With GLB Rider	13,215,480	128,184	135,607	94.5%
Without GLB Rider	15,928,277	237,471	222,124	106.9%
<b>Total</b>	<b>29,143,757</b>	<b>365,655</b>	<b>357,731</b>	<b>102.2%</b>

The contracts without GLB riders show the highest A/E ratio. This illustrates the mortality selection associated with the decision to purchase GLB riders. In total, the A/E ratio is close to 100%.

**Table 3.3.2b**  
GLOBAL A/E RATIOS - BY AMOUNT

VARIABLE ANNUITIES - DATA BY TYPE OF GLB RIDER - BY AMOUNT (AV) ('000)	Amount Exposed	Claim Amounts	Expected Claim Amounts	A/E Ratio with 2012 IAM with G2
With GLB Rider	1,608,354,106	16,234,709	17,162,534	94.6%
Without GLB Rider	1,023,785,730	20,336,460	18,663,081	109.0%
<b>Total</b>	<b>2,632,139,835</b>	<b>36,571,169</b>	<b>35,825,616</b>	<b>102.1%</b>

Again, the contracts without GLB riders show the highest A/E ratio. In total, the A/E ratio is over 100%.

### 3.3.3 A/E RATIOS BY DEATH BENEFIT RIDER WITH AND WITHOUT GLBS

Due to concentration issues, the underlying data (exposures and deaths) by Death Benefit (DB) rider are not made available. Only the A/E ratios resulting from the underlying data are available.

**Table 3.3.3a**  
A/E RATIOS BY DB RIDER - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY DB RIDER - BY CONTRACT	Roll-Up and Combo Death Benefits	Return of Premium, Ratchet and Other Death Benefits	Subtotal - All Death Benefits	No Death Benefit	TOTAL
With GLB Rider	96.1%	96.6%	<b>96.5%</b>	83.1%	<b>94.5%</b>
Without GLB Rider	119.4%	106.3%	<b>108.1%</b>	101.3%	<b>106.9%</b>
<b>Total</b>	<b>110.6%</b>	<b>102.5%</b>	<b>103.6%</b>	<b>95.1%</b>	<b>102.2%</b>

The A/E ratios are much lower for contracts without a DB rider. The lowest A/E ratio is for contracts with no DB rider and with a GLB rider. For contracts without a GLB rider, the distinction in A/E ratios is much greater based on the enhancement of the death benefit. This is not surprising because, when contracts have both GLBs and minimum death benefits, the generally more expensive GLB is thought to have the predominant effect on mortality selection.

**Table 3.3.3b**  
A/E RATIOS BY DB RIDER - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY DB RIDER - BY AMOUNT (AV)	Roll-Up and Combo Death Benefits	Return of Premium, Ratchet and Other Death Benefits	Subtotal - All Death Benefits	No Death Benefit	TOTAL
With GLB Rider	97.1%	96.1%	<b>96.3%</b>	85.0%	<b>94.6%</b>
Without GLB Rider	128.8%	108.0%	<b>111.2%</b>	100.2%	<b>109.0%</b>
<b>Total</b>	<b>113.8%</b>	<b>102.1%</b>	<b>103.8%</b>	<b>94.1%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.3.4 A/E RATIOS BY STUDY YEAR

Table 3.3.4a

#### A/E RATIOS BY STUDY YEAR - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY STUDY YEAR - BY CONTRACT	2011	2012	2013	2014	2015	TOTAL
With GLB Rider	98.8%	94.6%	94.5%	92.5%	94.0%	<b>94.5%</b>
Without GLB Rider	105.8%	104.7%	106.9%	107.5%	109.8%	<b>106.9%</b>
<b>Total</b>	<b>103.6%</b>	<b>101.1%</b>	<b>102.1%</b>	<b>101.4%</b>	<b>103.1%</b>	<b>102.2%</b>

A/E Ratios for contracts with a GLB rider decrease slowly by study year except for a small bump in 2015. A/E Ratios for contracts without a GLB rider dip slightly in 2012 and then increase regularly by study year.

Table 3.3.4b

#### A/E RATIOS BY STUDY YEAR - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY STUDY YEAR - BY AMOUNT (AV)	2011	2012	2013	2014	2015	TOTAL
With GLB Rider	100.6%	94.9%	93.7%	91.6%	95.0%	<b>94.6%</b>
Without GLB Rider	109.3%	106.2%	107.8%	109.0%	112.2%	<b>109.0%</b>
<b>Total</b>	<b>105.8%</b>	<b>101.0%</b>	<b>101.0%</b>	<b>100.3%</b>	<b>103.4%</b>	<b>102.1%</b>

Similar conclusions can be drawn from the analysis by amount.

### 3.3.5 A/E RATIOS BY DURATION

Table 3.3.5a

#### A/E RATIOS BY DURATION - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY DURATION - BY CONTRACT	1	2	3	4	5	6 - 10	11 +	TOTAL
With GLB Rider	72.5%	89.0%	90.0%	92.6%	94.1%	99.9%	101.2%	<b>94.5%</b>
Without GLB Rider	89.0%	114.7%	115.8%	119.7%	118.0%	110.9%	104.4%	<b>106.9%</b>
<b>Total</b>	<b>77.6%</b>	<b>96.0%</b>	<b>96.5%</b>	<b>99.9%</b>	<b>101.7%</b>	<b>105.1%</b>	<b>104.2%</b>	<b>102.2%</b>

For contracts with a GLB rider, A/E ratios generally increase by duration. These results show that anti-selection is very much present for these contracts. For contracts without a GLB rider, A/E ratios increase up to duration 4 and then decrease at the higher durations. In total, A/E ratios generally increase by duration.

**Table 3.3.5b**  
A/E RATIOS BY DURATION - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY DURATION - BY AMOUNT (AV)	1	2	3	4	5	6 - 10	11 +	TOTAL
With GLB Rider	75.6%	93.6%	89.6%	92.8%	95.7%	98.8%	101.9%	<b>94.6%</b>
Without GLB Rider	103.6%	125.8%	125.7%	130.0%	126.5%	113.3%	101.7%	<b>109.0%</b>
<b>Total</b>	<b>84.3%</b>	<b>102.3%</b>	<b>98.4%</b>	<b>102.2%</b>	<b>104.6%</b>	<b>105.2%</b>	<b>101.7%</b>	<b>102.1%</b>

For contracts with a GLB rider, A/E ratios generally increase by duration except in duration 3. These results show that anti-selection is very much present for these contracts. For contracts without a GLB rider, A/E ratios generally increase up to duration 4 and then decrease at the higher durations.

### 3.3.6 A/E RATIOS BY SEX

**Table 3.3.6a**  
A/E RATIOS BY SEX - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY SEX - BY CONTRACT	Male	Female	TOTAL
With GLB Rider	98.2%	90.6%	<b>94.5%</b>
Without GLB Rider	105.3%	108.5%	<b>106.9%</b>
<b>Total</b>	<b>102.6%</b>	<b>101.9%</b>	<b>102.2%</b>

For contracts with a GLB rider, A/E ratios are lower for females. For contracts without a GLB rider, A/E ratios are higher for females. The A/E ratio differentials between with and without GLB are more than twice as large for female lives as they are for males.

**Table 3.3.6b**  
A/E RATIOS BY SEX - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY SEX - BY AMOUNT (AV)	Male	Female	TOTAL
With GLB Rider	95.6%	93.3%	<b>94.6%</b>
Without GLB Rider	104.1%	114.3%	<b>109.0%</b>
<b>Total</b>	<b>99.9%</b>	<b>104.7%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.3.7 A/E RATIOS BY ACCOUNT VALUE BAND

Table 3.3.7a

#### A/E RATIOS BY ACCOUNT VALUE BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ACCOUNT VALUE BAND - BY CONTRACT	<100,000	100,000 to 249,999	250,000 to 499,999	500,000 +	TOTAL
With GLB Rider	95.7%	93.1%	92.2%	93.7%	<b>94.5%</b>
Without GLB Rider	106.0%	109.9%	109.7%	107.0%	<b>106.9%</b>
<b>Total</b>	<b>102.8%</b>	<b>101.2%</b>	<b>100.4%</b>	<b>100.4%</b>	<b>102.2%</b>

For contracts with a GLB rider, the A/E ratios decrease by Account Value Band, except for an increase for the highest band. However, for contracts without a GLB rider, A/E ratios are lowest for smaller and higher Account Value bands and highest for middle Account Value bands. In total, A/E ratios generally decrease by Account Value band.

Table 3.3.7b

#### A/E RATIOS BY ACCOUNT VALUE BAND - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY ACCOUNT VALUE BAND - BY AMOUNT (AV)	< 100,000	100,000 To 249,999	250,000 To 499,999	500,000 +	TOTAL
With GLB Rider	97.6%	93.8%	92.6%	95.1%	<b>94.6%</b>
Without GLB Rider	108.3%	111.0%	109.9%	105.3%	<b>109.0%</b>
<b>Total</b>	<b>104.1%</b>	<b>102.1%</b>	<b>100.7%</b>	<b>100.5%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.3.8 A/E RATIOS BY ATTAINED AGE BAND

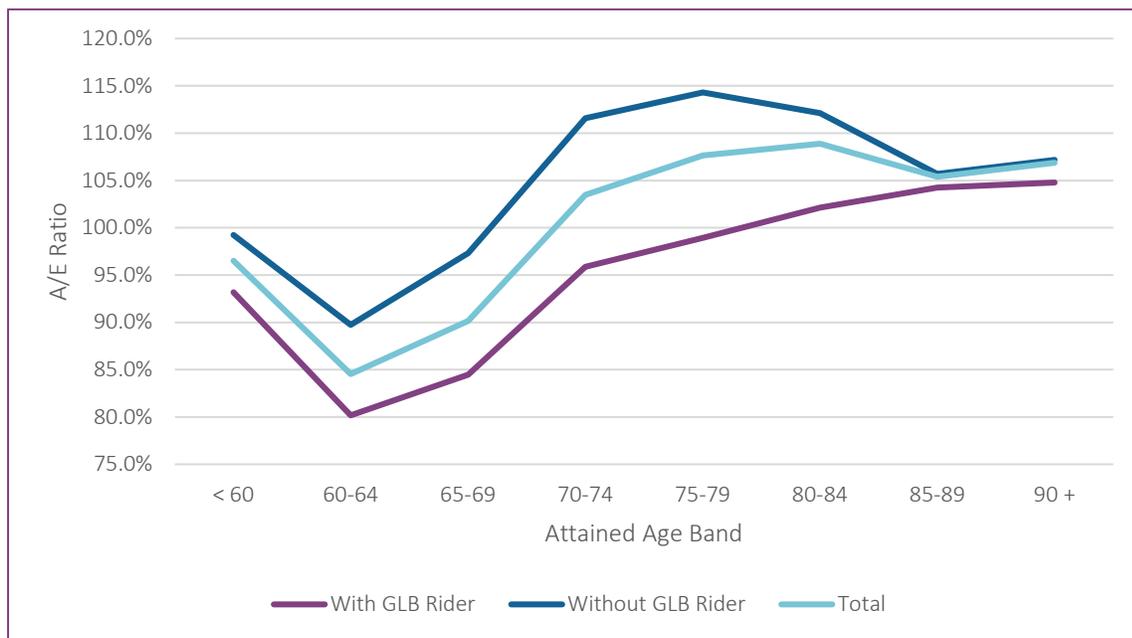
Table 3.3.8a

#### A/E RATIOS BY ATTAINED AGE BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ATTAINED AGE BAND - BY CONTRACT	< 60	60-64	65-69	70-74	75-79	80-84	85-89	90 +	TOTAL
With GLB Rider	93.2%	80.2%	84.5%	95.9%	98.9%	102.1%	104.2%	104.8%	<b>94.5%</b>
Without GLB Rider	99.2%	89.7%	97.3%	111.6%	114.3%	112.1%	105.7%	107.2%	<b>106.9%</b>
<b>Total</b>	<b>96.5%</b>	<b>84.5%</b>	<b>90.2%</b>	<b>103.5%</b>	<b>107.7%</b>	<b>108.9%</b>	<b>105.4%</b>	<b>106.9%</b>	<b>102.2%</b>

Data for the attained age band under 60 may not be statistically credible. For attained age bands 60-64 and over, contracts with a GLB rider show A/E ratios that increase by attained age band. Note that this attained age pattern may be partly explained by the durational impact of anti-selection seen in Table 3.3.5a. For contracts without a GLB rider, the A/E ratios first increase up to age band 75-79 and then generally decrease by attained age band with an increase at attained age band 90 +.

**Figure 1**  
**A/E RATIO BY ATTAINED AGE BAND – BY CONTRACT**

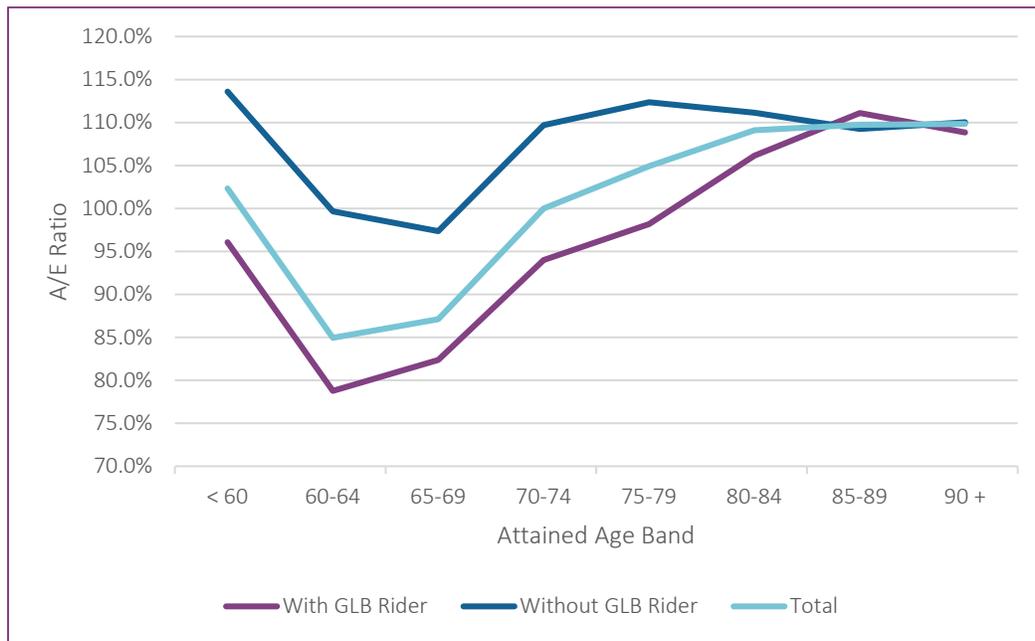


**Table 3.3.8b**  
**A/E RATIOS BY ATTAINED AGE BAND - BY AMOUNT (AV)**

VARIABLE ANNUITIES - A/E RATIO BY ATTAINED AGE BAND - BY AMOUNT (AV)	< 60	60-64	65-69	70-74	75-79	80-84	85-89	90 +	TOTAL
With GLB Rider	96.1%	78.8%	82.4%	94.0%	98.2%	106.1%	111.1%	108.8%	<b>94.6%</b>
Without GLB Rider	113.6%	99.6%	97.4%	109.7%	112.4%	111.1%	109.2%	110.0%	<b>109.0%</b>
<b>Total</b>	<b>102.3%</b>	<b>84.9%</b>	<b>87.1%</b>	<b>100.0%</b>	<b>104.9%</b>	<b>109.1%</b>	<b>109.7%</b>	<b>109.8%</b>	<b>102.1%</b>

Data for the attained age band under 60 may not be statistically credible. For attained age bands 60-64 and over, contracts with a GLB rider show A/E ratios that increase by attained age band with a small decrease at attained age band 90+. For contracts without a GLB rider, the A/E ratios do not follow as distinct a pattern and do not vary significantly following the age 70-74 cohort.

**Figure 2**  
**A/E RATIO BY ATTAINED AGE BAND – BY AMOUNT (AV)**



**3.3.9 A/E RATIOS BY DISTRIBUTION CHANNEL**

**Table 3.3.9a**  
**A/E RATIOS BY DISTRIBUTION CHANNEL - BY CONTRACT**

VARIABLE ANNUITIES - A/E RATIO BY DISTRIBUTION CHANNEL - BY CONTRACT	Career Agent	Other Distribution Channels	TOTAL
With GLB Rider	87.6%	96.3%	<b>94.5%</b>
Without GLB Rider	98.2%	114.0%	<b>106.9%</b>
<b>Total</b>	<b>95.8%</b>	<b>105.8%</b>	<b>102.2%</b>

The A/E ratios are lowest for contracts distributed by career agents.

**Table 3.3.9b**  
**A/E RATIOS BY DISTRIBUTION CHANNEL - BY AMOUNT**

VARIABLE ANNUITIES - A/E RATIO BY DISTRIBUTION CHANNEL - BY AMOUNT (AV)	Career Agent	Other Distribution Channels	TOTAL
With GLB Rider	84.0%	97.0%	<b>94.6%</b>
Without GLB Rider	95.0%	118.5%	<b>109.0%</b>
<b>Total</b>	<b>91.7%</b>	<b>106.5%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.3.10 A/E RATIOS BY ISSUE YEAR BAND

Table 3.3.10a

#### A/E RATIOS BY ISSUE YEAR BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ISSUE YEAR BAND - BY CONTRACT	Before January 1, 2007	January 1, 2007 and after	TOTAL
With GLB Rider	102.8%	90.5%	<b>94.5%</b>
Without GLB Rider	105.3%	114.4%	<b>106.9%</b>
<b>Total</b>	<b>104.8%</b>	<b>97.7%</b>	<b>102.2%</b>

For contracts with a GLB rider, the A/E ratios are higher for contracts issued prior to January 1, 2007. This is attributable in part to the durational differences we see for variable annuities with GLB riders, where results show the lowest A/E ratios in the earliest contract years. Contracts issued before January 1, 2007 would be already past those early contract durations during the experience period for this study. However, for contracts without a GLB rider, the A/E ratios are higher for contracts issued after January 1, 2007. This also likely reflects a durational component, as will be seen later in the report, where A/E ratios trend downward after contract year 4 for contracts featuring a death benefit.

Table 3.3.10b

#### A/E RATIOS BY ISSUE YEAR BAND - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY ISSUE YEAR BAND - BY AMOUNT (AV)	Before January 1, 2007	January 1, 2007 and after	TOTAL
With GLB Rider	103.2%	91.1%	<b>94.6%</b>
Without GLB Rider	104.5%	121.5%	<b>109.0%</b>
<b>Total</b>	<b>104.2%</b>	<b>99.8%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.3.11 A/E RATIOS BY REGION BAND

Table 3.3.11a

#### A/E RATIOS BY REGION BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY REGION BAND - BY CONTRACT	CT-ME-MA-NH-RI-VT	NJ-NY-PR-VI	DE-DC-MD-PA-VA-WV	AL-FL-GA-KY-MS-NC-SC-TN	IL-IN-MI-MN-OH-WI	AR-LA-NM-OK-TX	IA-KS-MO-NE	CO-MT-ND-SD-UT-WY	AZ-CA-HI-NV-AS-GU	AK-ID-OR-WA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
With GLB Rider	82.4%	89.3%	95.4%	100.5%	94.7%	100.7%	94.4%	89.5%	91.6%	90.0%	<b>94.5%</b>
Without GLB Rider	97.8%	102.1%	107.8%	115.2%	106.6%	115.4%	106.4%	101.8%	103.0%	101.3%	<b>106.9%</b>
<b>Total</b>	<b>91.9%</b>	<b>97.4%</b>	<b>103.0%</b>	<b>108.5%</b>	<b>102.7%</b>	<b>109.3%</b>	<b>102.9%</b>	<b>97.6%</b>	<b>98.3%</b>	<b>97.3%</b>	<b>102.2%</b>

In all region bands, the A/E ratios for contracts with a GLB rider are lower than those for contracts without a GLB rider. Overall, the A/E ratios are highest in regions (4) and (6) above.

Table 3.3.11b

## A/E RATIOS BY REGION BAND - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY REGION BAND - BY AMOUNT (AV)	CT-ME-MA-NH-RI-VT	NJ-NY-PR-VI	DE-DC-MD-PA-VA-WV	AL-FL-GA-KY-MS-NC-SC-TN	IL-IN-MI-MN-OH-WI	AR-LA-NM-OK-TX	IA-KS-MO-NE	CO-MT-ND-SD-UT-WY	AZ-CA-HI-NV-AS-GU	AK-ID-OR-WA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
With GLB Rider	82.2%	88.3%	93.8%	101.6%	93.5%	102.3%	93.7%	88.5%	94.0%	88.7%	<b>94.6%</b>
Without GLB Rider	99.8%	100.2%	106.2%	118.8%	108.7%	118.6%	105.0%	111.7%	106.9%	104.7%	<b>109.0%</b>
<b>Total</b>	<b>91.3%</b>	<b>94.5%</b>	<b>100.1%</b>	<b>109.4%</b>	<b>102.2%</b>	<b>110.4%</b>	<b>100.7%</b>	<b>101.4%</b>	<b>100.5%</b>	<b>97.8%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

## 3.3.12 A/E RATIOS BY TAX CLASSIFICATION

Table 3.3.12a

## A/E RATIOS BY TAX CLASSIFICATION - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY TAX CLASSIFICATION - BY CONTRACT	Qualified including IRA	Non-qualified	TOTAL
With GLB Rider	89.3%	101.4%	<b>94.5%</b>
Without GLB Rider	102.0%	110.8%	<b>106.9%</b>
<b>Total</b>	<b>96.4%</b>	<b>107.8%</b>	<b>102.2%</b>

The A/E ratios are consistently higher for non-qualified contracts.

Table 3.3.12b

## A/E RATIOS BY TAX CLASSIFICATION - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY TAX CLASSIFICATION - BY AMOUNT (AV)	Qualified including IRA	Non-qualified	TOTAL
With GLB Rider	86.4%	104.4%	<b>94.6%</b>
Without GLB Rider	101.3%	113.2%	<b>109.0%</b>
<b>Total</b>	<b>92.6%</b>	<b>109.7%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

## 3.4 A/E RATIOS BY DEATH BENEFIT RIDER

### 3.4.1 INTRODUCTION

Variable annuities often offer minimum guaranteed death benefits, either as part of the base contract or as a separate rider attached to the contract. Where these minimum death benefits exist, the death benefit paid to the beneficiaries will be the greater of the account value and the minimum death benefit.

The basic form of a variable annuity death benefit is the *Return of Premium Death Benefit*. In this case, the maximum of the current account value at time of death and the cumulative premiums net of withdrawals is paid as the death benefit to the beneficiaries.

In the case of the *Annual Ratchet Death Benefit*, the death benefit consists of the greater of the annual ratchet benefit base and the current account value. The annual ratchet benefit base is defined as the maximum value of the account on all past policy anniversary dates, adjusted for withdrawals as defined in the contract.

In the case of the *Roll-Up Death Benefit*, the death benefit consists of the maximum of the roll-up benefit base (often with an annual roll-up rate of 5% or 6%) and the current account value. The roll-up benefit base is defined as the theoretical value that results from accumulating the premiums paid at a constant interest rate of  $i\%$ , the roll-up rate.

In the case of the *Combo Death Benefit*, the guaranteed minimum death benefit consists of the maximum of the roll-up benefit base and the annual ratchet benefit base.

Finally, some companies offer their own specialized death benefit riders. These additional death benefit riders are classified as *Other Death Benefit*.

In this study, due to company concentration issues, the death benefit riders are classified in two categories:

1. Roll-Up Death Benefit and Combo Death Benefit (Enhanced DB).
2. Return of Premium Death Benefit, Ratchet Death Benefit and Other Death Benefit (Basic DB).

Finally, throughout this section, the expected basis used is the 2012 Individual Annuitant Mortality (IAM) Basic Table projected using the G2 mortality improvement scale. The mortality rates are projected forward and backward for each of the study years relative to the 2012 baseline.

### 3.4.2 A/E RATIOS BY GLB RIDER

Due to concentration issues, the underlying data (exposures and deaths) by GLB rider are not made available. Only the A/E ratios resulting from the underlying data are available.

**Table 3.4.2a**  
A/E RATIOS BY GLB RIDER - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY GLB RIDER - BY CONTRACT	With GLB Rider	Without GLB Rider	TOTAL
Roll-Up and Combo Death Benefits	96.1%	119.4%	<b>110.6%</b>
Return of Premium, Ratchet and Other Death Benefits	96.6%	106.3%	<b>102.5%</b>
Subtotal - All Death Benefits	96.5%	108.1%	<b>103.6%</b>
No Death Benefit	83.1%	101.3%	<b>95.1%</b>
<b>Total</b>	<b>94.5%</b>	<b>106.9%</b>	<b>102.2%</b>

This data was shown previously in Table 3.3.3, with more of an emphasis on the DB benefit differentials. The A/E ratios are much lower for contracts with a GLB rider. The lowest A/E ratio is for contracts with no DB rider and with a GLB rider. For contracts without a GLB rider, the A/E ratio is highest for contracts with Roll-up and Combo Death Benefits and lowest for contracts with no DB rider. This is all consistent with intuition involving customer anti-selection.

**Table 3.4.2b**  
A/E RATIOS BY GLB RIDER - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY GLB RIDER - BY AMOUNT (AV)	With GLB Rider	Without GLB Rider	TOTAL
Roll-Up and Combo Death Benefits	97.1%	128.8%	<b>113.8%</b>
Return of Premium, Ratchet and Other Death Benefits	96.1%	108.0%	<b>102.1%</b>
Subtotal - All Death Benefits	96.3%	111.2%	<b>103.8%</b>
No Death Benefit	85.0%	100.2%	<b>94.1%</b>
<b>Total</b>	<b>94.6%</b>	<b>109.0%</b>	<b>102.1%</b>

The same conclusions can be drawn from the analysis by amount.

After thoroughly analyzing the results by GLB rider, the committee concluded that it was more meaningful to analyze the experience by Death Benefit rider only for contracts with **no GLB riders**. As stated earlier in the report, when contracts offer together minimum DBs and GLBs, the generally more expensive GLB is thought to have the predominant effect on mortality selection. Thus, the following subsections only consider contracts with **no GLB riders**.

### 3.4.3 GLOBAL A/E RATIOS (NO GLB RIDER CONTRACTS)

Table 3.4.3a

#### GLOBAL A/E RATIOS - BY CONTRACT

VARIABLE ANNUITIES - DATA BY TYPE OF DEATH BENEFIT RIDER - BY CONTRACT	Contracts Exposed	Actual Deaths	Expected Deaths	A/E Ratio with 2012 IAM with G2
Roll-Up and Combo Death Benefits	1,204,224	29,777	24,929	119.4%
Return of Premium, Ratchet and Other Death Benefits	10,968,871	168,681	158,672	106.3%
Subtotal - All Death Benefits	12,173,095	198,458	183,601	108.1%
No Death Benefit	3,755,181	39,013	38,522	101.3%
<b>Total</b>	<b>15,928,277</b>	<b>237,471</b>	<b>222,124</b>	<b>106.9%</b>

The contracts with enhanced DB riders show the highest A/E ratio, while the contracts with no DBs have an A/E ratio closer to 100%.

Table 3.4.3b

#### GLOBAL A/E RATIOS - BY AMOUNT

VARIABLE ANNUITIES - DATA BY TYPE OF DEATH BENEFIT RIDER - BY AMOUNT (AV) ('000)	Amount Exposed	Claim Amounts	Expected Claim Amounts	A/E Ratio with 2012 IAM with G2
Roll-Up and Combo Death Benefits	99,856,215	2,920,552	2,267,476	128.8%
Return of Premium, Ratchet and Other Death Benefits	673,051,948	13,602,328	12,591,015	108.0%
Subtotal - All Death Benefits	772,908,162	16,522,880	14,858,491	111.2%
No Death Benefit	250,877,568	3,813,580	3,804,590	100.2%
<b>Total</b>	<b>1,023,785,730</b>	<b>20,336,460</b>	<b>18,663,081</b>	<b>109.0%</b>

Again, the contracts with enhanced DB riders show the highest A/E ratio and the contracts with no DBs have an A/E ratio close to 100%.

### 3.4.4 A/E RATIOS BY DURATION (NO GLB RIDER CONTRACTS)

Table 3.4.4a

#### A/E RATIOS BY DURATION - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY DURATION - BY CONTRACT	1	2	3	4	5	6 - 10	11 +	TOTAL
Roll-Up and Combo Death Benefits	188.5%	178.1%	181.8%	177.0%	159.5%	127.0%	110.3%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	92.3%	113.5%	108.4%	111.5%	111.9%	109.2%	105.0%	<b>106.3%</b>
Subtotal - All Death Benefits	102.9%	123.6%	121.3%	121.9%	117.4%	110.6%	105.8%	<b>108.1%</b>
No Death Benefit	56.6%	94.6%	103.5%	114.1%	119.4%	112.2%	95.2%	<b>101.3%</b>
<b>Total</b>	<b>89.0%</b>	<b>114.7%</b>	<b>115.8%</b>	<b>119.7%</b>	<b>118.0%</b>	<b>110.9%</b>	<b>104.4%</b>	<b>106.9%</b>

For contracts with enhanced DB riders, A/E ratios generally decrease by duration. These results show that anti-selection is very much present for these contracts. For contracts with more basic DBs, A/E ratios increase in duration

2, stay relatively level through duration 5, and then decrease. For contracts with no DBs, A/E ratios increase by duration up to duration 5 and then decrease.

**Table 3.4.4b**  
A/E RATIOS BY DURATION - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY DURATION - BY AMOUNT (AV)	1	2	3	4	5	6 - 10	11 +	TOTAL
Roll-Up and Combo Death Benefits	216.2%	198.2%	195.1%	198.0%	166.9%	130.4%	109.2%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	104.9%	124.9%	120.6%	120.6%	124.7%	112.1%	102.4%	<b>108.0%</b>
Subtotal - All Death Benefits	118.5%	138.5%	137.5%	137.5%	131.6%	113.8%	103.6%	<b>111.2%</b>
No Death Benefit	67.1%	95.9%	99.6%	111.9%	113.0%	111.7%	91.0%	<b>100.2%</b>
<b>Total</b>	<b>103.6%</b>	<b>125.8%</b>	<b>125.7%</b>	<b>130.0%</b>	<b>126.5%</b>	<b>113.3%</b>	<b>101.7%</b>	<b>109.0%</b>

The same conclusions can be drawn from the analysis by amount.

### 3.4.5 A/E RATIOS BY SEX (NO GLB RIDER CONTRACTS)

**Table 3.4.5a**  
A/E RATIOS BY SEX - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY SEX - BY CONTRACT	Male	Female	TOTAL
Roll-Up and Combo Death Benefits	124.5%	113.9%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	103.9%	108.7%	<b>106.3%</b>
Subtotal - All Death Benefits	106.8%	109.3%	<b>108.1%</b>
No Death Benefit	98.1%	104.5%	<b>101.3%</b>
<b>Total</b>	<b>105.3%</b>	<b>108.5%</b>	<b>106.9%</b>

For contracts with enhanced DB riders, A/E ratios are lower for females. For contracts with more basic DBs and globally, A/E ratios are higher for females.

**Table 3.4.5b**  
A/E RATIOS BY SEX - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY SEX - BY AMOUNT (AV)	Male	Female	TOTAL
Roll-Up and Combo Death Benefits	130.8%	126.4%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	101.8%	114.5%	<b>108.0%</b>
Subtotal - All Death Benefits	106.5%	116.2%	<b>111.2%</b>
No Death Benefit	95.3%	106.3%	<b>100.2%</b>
<b>Total</b>	<b>104.1%</b>	<b>114.3%</b>	<b>109.0%</b>

For contracts with enhanced DB riders, A/E ratios are similar by sex. For contracts with more basic DBs and globally, A/E ratios are higher for females.

## 3.4.6 A/E RATIOS BY ACCOUNT VALUE BAND (NO GLB RIDER CONTRACTS)

Table 3.4.6a

## A/E RATIOS BY ACCOUNT VALUE BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ACCOUNT VALUE BAND - BY CONTRACT	< 100,000	100,000 to 249,999	250,000 to 499,999	500,000 +	TOTAL
Roll-Up and Combo Death Benefits	117.5%	122.9%	129.2%	133.3%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	106.0%	107.3%	106.1%	110.2%	<b>106.3%</b>
Subtotal - All Death Benefits	107.5%	109.6%	109.8%	114.4%	<b>108.1%</b>
No Death Benefit	98.7%	111.0%	109.6%	89.9%	<b>101.3%</b>
<b>Total</b>	<b>106.0%</b>	<b>109.9%</b>	<b>109.7%</b>	<b>107.0%</b>	<b>106.9%</b>

For contracts with enhanced DB riders, the A/E ratios increase by Account Value Band. There are likely several drivers here. It is reasonable to expect higher levels of anti-selection among the larger annuity contracts. In addition, the distribution of the post-2006 cohort is skewed towards the higher AV bands. Due to the anti-selection wear-off by increasing duration, we see for contracts with enhanced DB riders in Table 3.4.5a above, the lower durations associated with the more newly issued business would be expected to have much higher A/E ratios.

For contracts with basic DB riders, A/E ratios are relatively stable across the Account Value Bands. For contracts with no DBs, A/E ratios fluctuate by Account Value Band.

Table 3.4.6b

## A/E RATIOS BY ACCOUNT VALUE BAND - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY ACCOUNT VALUE BAND - BY AMOUNT (AV)	< 100,000	100,000 to 249,999	250,000 to 499,999	500,000 +	TOTAL
Roll-Up and Combo Death Benefits	124.3%	127.0%	131.9%	136.1%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	106.5%	108.9%	107.2%	110.8%	<b>108.0%</b>
Subtotal - All Death Benefits	109.0%	111.6%	111.1%	115.5%	<b>111.2%</b>
No Death Benefit	104.9%	108.3%	105.2%	83.8%	<b>100.2%</b>
<b>Total</b>	<b>108.3%</b>	<b>111.0%</b>	<b>109.9%</b>	<b>105.3%</b>	<b>109.0%</b>

The same conclusions can be drawn from the analysis by amount.

3.4.7 A/E RATIOS BY ATTAINED AGE BAND (NO GLB RIDER CONTRACTS)

Table 3.4.7a

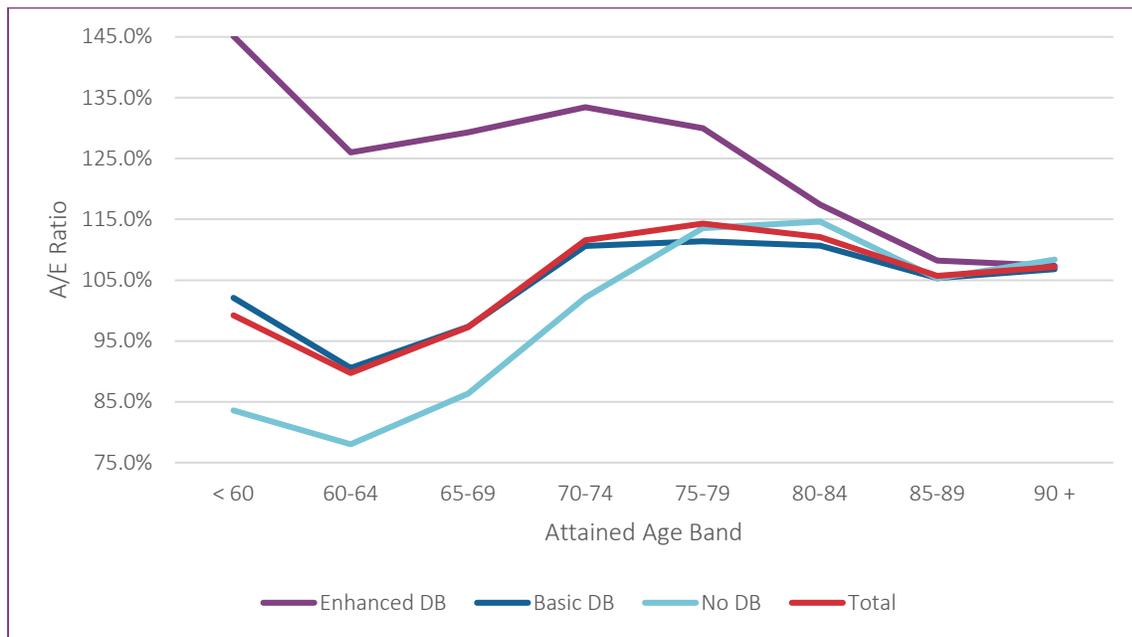
A/E RATIOS BY ATTAINED AGE BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ATTAINED AGE BAND - BY CONTRACT	< 60	60-64	65-69	70-74	75-79	80-84	85-89	90 +	TOTAL
Roll-Up and Combo Death Benefits	145.1%	126.0%	129.3%	133.4%	130.0%	117.5%	108.2%	107.4%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	102.1%	90.6%	97.4%	110.6%	111.4%	110.7%	105.3%	106.8%	<b>106.3%</b>
Subtotal - All Death Benefits	104.9%	93.5%	100.8%	113.9%	114.4%	111.7%	105.8%	106.9%	<b>108.1%</b>
No Death Benefit	83.6%	78.0%	86.4%	102.2%	113.6%	114.6%	105.3%	108.4%	<b>101.3%</b>
<b>Total</b>	<b>99.2%</b>	<b>89.7%</b>	<b>97.3%</b>	<b>111.6%</b>	<b>114.3%</b>	<b>112.1%</b>	<b>105.7%</b>	<b>107.2%</b>	<b>106.9%</b>

For contracts with enhanced DB riders, the A/E ratios increase between age bands 60-64 and 70-74 and then decline by attained age band. For contracts with more basic DBs, the A/E ratios generally increase up through the 70-74 age band (excluding the low credibility < 60 age band), remain relatively flat for the age 70-74 through 80-84 bands, and then are at lower levels at the older attained age bands. For contracts with no death benefit, the A/E ratios generally increase up through attained age band 80-84 and then are at lower levels at the older ages.

Figure 3

A/E RATIO BY ATTAINED AGE BAND – BY CONTRACT

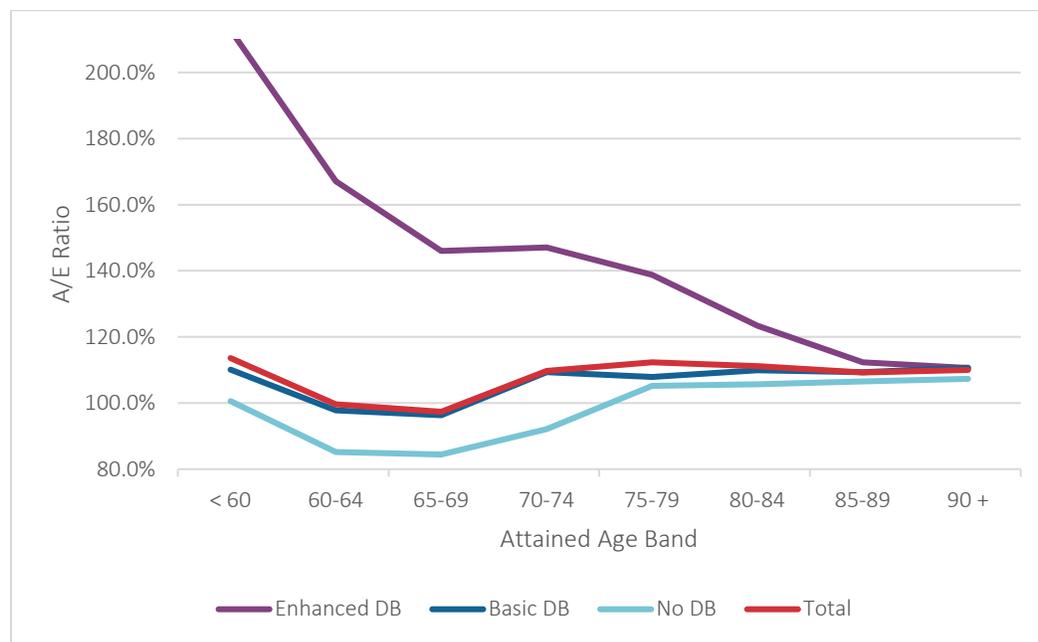


**Table 3.4.7b**  
**A/E RATIOS BY ATTAINED AGE BAND - BY AMOUNT (AV)**

VARIABLE ANNUITIES - A/E RATIO BY ATTAINED AGE BAND - BY AMOUNT (AV)	< 60	60-64	65-69	70-74	75-79	80-84	85-89	90 +	TOTAL
Roll-Up and Combo Death Benefits	212.9%	167.1%	146.1%	147.1%	138.8%	123.4%	112.3%	110.6%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	110.1%	97.8%	96.3%	109.3%	107.9%	109.9%	109.3%	110.7%	<b>108.0%</b>
Subtotal - All Death Benefits	117.9%	104.8%	102.8%	116.1%	114.2%	112.2%	109.8%	110.7%	<b>111.2%</b>
No Death Benefit	100.6%	85.1%	84.4%	92.1%	105.2%	105.6%	106.6%	107.3%	<b>100.2%</b>
<b>Total</b>	<b>113.6%</b>	<b>99.6%</b>	<b>97.4%</b>	<b>109.7%</b>	<b>112.4%</b>	<b>111.1%</b>	<b>109.2%</b>	<b>110.0%</b>	<b>109.0%</b>

The A/E ratios for contracts with enhanced DB riders generally decline steeply by attained age band. For contracts with more basic DB riders, the A/E ratios first decline up to age band 65-69, increase for age band 70-74, and then remain relatively stable.

**Figure 4**  
**A/E RATIO BY ATTAINED AGE BAND – BY AMOUNT (AV)**



### 3.4.8 A/E RATIOS BY DISTRIBUTION CHANNEL (NO GLB RIDER CONTRACTS)

Table 3.4.8a

#### A/E RATIOS BY DISTRIBUTION CHANNEL - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY DISTRIBUTION CHANNEL - BY CONTRACT	Career Agent	Other Distribution Channels	TOTAL
Roll-Up and Combo Death Benefits	123.7%	117.3%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	102.3%	108.9%	<b>106.3%</b>
Subtotal - All Death Benefits	104.8%	110.1%	<b>108.1%</b>
No Death Benefit	82.1%	161.4%	<b>101.3%</b>
<b>Total</b>	<b>98.2%</b>	<b>114.0%</b>	<b>106.9%</b>

Globally, the A/E ratios are lowest for contracts distributed by career agents. However, contracts distributed by career agents show a higher A/E ratio for contracts with enhanced DB riders and also exhibit the highest levels of anti-selection based on the differences between DB categories.

Table 3.4.8b

#### A/E RATIOS BY DISTRIBUTION CHANNEL - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY DISTRIBUTION CHANNEL - BY AMOUNT (AV)	Career Agent	Other Distribution Channels	TOTAL
Roll-Up and Combo Death Benefits	127.6%	129.2%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	102.9%	110.5%	<b>108.0%</b>
Subtotal - All Death Benefits	105.7%	113.7%	<b>111.2%</b>
No Death Benefit	77.7%	171.7%	<b>100.2%</b>
<b>Total</b>	<b>95.0%</b>	<b>118.5%</b>	<b>109.0%</b>

For the amount basis, A/E ratios are lowest for contracts distributed by career agents across the board and once again show evidence of having the highest level of anti-selection.

### 3.4.9 A/E RATIOS BY ISSUE YEAR BAND (NO GLB RIDER CONTRACTS)

Table 3.4.9a

#### A/E RATIOS BY ISSUE YEAR BAND - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY ISSUE YEAR BAND - BY CONTRACT	Before January 1, 2007	January 1, 2007 and after	TOTAL
Roll-Up and Combo Death Benefits	111.8%	168.8%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	105.7%	109.5%	<b>106.3%</b>
Subtotal - All Death Benefits	106.6%	116.6%	<b>108.1%</b>
No Death Benefit	98.1%	109.0%	<b>101.3%</b>
<b>Total</b>	<b>105.3%</b>	<b>114.4%</b>	<b>106.9%</b>

The A/E ratios are lower for contracts issued before January 1, 2007. The A/E ratios for contracts with enhanced DB riders show a significant increase from one issue year band to the other. This may be partially attributable to the introduction of contracts with GLB riders in recent years, which likely increased the anti-selection associated with

customers selecting enhanced DBs. Duration effects, such as seen in Table 3.4.4a above, likely have a large impact here as well.

**Table 3.4.9b**

**A/E RATIOS BY ISSUE YEAR BAND - BY AMOUNT**

VARIABLE ANNUITIES - A/E RATIO BY ISSUE YEAR BAND - BY AMOUNT (AV)	Before January 1, 2007	January 1, 2007 and after	TOTAL
Roll-Up and Combo Death Benefits	111.3%	184.1%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	105.4%	116.9%	<b>108.0%</b>
Subtotal - All Death Benefits	106.3%	127.5%	<b>111.2%</b>
No Death Benefit	96.2%	107.0%	<b>100.2%</b>
<b>Total</b>	<b>104.5%</b>	<b>121.5%</b>	<b>109.0%</b>

The same conclusions can be drawn from the analysis by amount.

**3.4.10 A/E RATIOS BY REGION BAND (NO GLB RIDER CONTRACTS)**

**Table 3.4.10a**

**A/E RATIOS BY REGION BAND - BY CONTRACT**

VARIABLE ANNUITIES - A/E RATIO BY REGION BAND - BY CONTRACT	CT-ME-MA-NH-RI-VT	NJ-NY-PR-VI	DE-DC-MD-PA-VA-WV	AL-FL-GA-KY-MS-NC-SC-TN	IL-IN-MI-MN-OH-WI	AR-LA-NM-OK-TX	IA-KS-MO-NE	CO-MT-ND-SD-UT-WY	AZ-CA-HI-NV-AS-GU	AK-ID-OR-WA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Roll-Up and Combo Death Benefits	118.9%	112.2%	123.5%	125.6%	119.4%	125.0%	115.7%	114.3%	114.7%	112.3%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	98.6%	103.7%	107.7%	113.2%	104.6%	114.9%	105.9%	103.0%	102.6%	102.4%	<b>106.3%</b>
Subtotal - All Death Benefits	101.0%	104.8%	110.2%	115.0%	106.7%	116.2%	107.1%	104.6%	104.2%	103.5%	<b>108.1%</b>
No Death Benefit	86.6%	89.0%	97.3%	116.7%	105.9%	112.1%	103.3%	90.3%	98.0%	93.8%	<b>101.3%</b>
<b>Total</b>	<b>97.8%</b>	<b>102.1%</b>	<b>107.8%</b>	<b>115.2%</b>	<b>106.6%</b>	<b>115.4%</b>	<b>106.4%</b>	<b>101.8%</b>	<b>103.0%</b>	<b>101.3%</b>	<b>106.9%</b>

In the regions represented by columns 4 and 5, we can see the A/E ratios for contracts with no DBs are higher than those for contracts with basic DB riders. The highest A/E ratios overall are concentrated in Regions (4) and (6).

**Table 3.4.10b**  
A/E RATIOS BY REGION BAND - BY AMOUNT

VARIABLE ANNUITIES - A/E RATIO BY REGION BAND - BY AMOUNT (AV)	CT-ME-MA-NH-RI-VT	NJ-NY-PR-VI	DE-DC-MD-PA-VA-WV	AL-FL-GA-KY-MS-NC-SC-TN	IL-IN-MI-MN-OH-WI	AR-LA-NM-OK-TX	IA-KS-MO-NE	CO-MT-ND-SD-UT-WY	AZ-CA-HI-NV-AS-GU	AK-ID-OR-WA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Roll-Up and Combo Death Benefits	130.8%	114.0%	126.4%	139.3%	128.8%	129.1%	126.2%	125.1%	132.6%	105.5%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	99.4%	102.1%	106.7%	114.9%	106.3%	119.5%	104.3%	114.0%	104.5%	109.3%	<b>108.0%</b>
Subtotal - All Death Benefits	104.1%	103.6%	110.2%	119.0%	109.7%	121.0%	107.0%	115.8%	108.9%	108.8%	<b>111.2%</b>
No Death Benefit	87.8%	88.2%	92.7%	117.7%	104.1%	109.4%	97.1%	97.5%	99.6%	93.6%	<b>100.2%</b>
<b>Total</b>	<b>99.8%</b>	<b>100.2%</b>	<b>106.2%</b>	<b>118.8%</b>	<b>108.7%</b>	<b>118.6%</b>	<b>105.0%</b>	<b>111.7%</b>	<b>106.9%</b>	<b>104.7%</b>	<b>109.0%</b>

On an amount basis, column 4 shows a higher A/E ratio for contracts with no DBs than for contracts with basic DB riders. As was the case with the count basis, the highest A/E ratios overall are concentrated in Regions (4) and (6).

### 3.4.11 A/E RATIOS BY TAX CLASSIFICATION (NO GLB RIDER CONTRACTS)

**Table 3.4.11a**  
A/E RATIOS BY TAX CLASSIFICATION - BY CONTRACT

VARIABLE ANNUITIES - A/E RATIO BY TAX CLASSIFICATION - BY CONTRACT	Qualified including IRA	Non-qualified	TOTAL
Roll-Up and Combo Death Benefits	125.1%	115.9%	<b>119.4%</b>
Return of Premium, Ratchet and Other Death Benefits	102.9%	108.7%	<b>106.3%</b>
Subtotal - All Death Benefits	105.7%	109.7%	<b>108.1%</b>
No Death Benefit	89.5%	118.0%	<b>101.3%</b>
<b>Total</b>	<b>102.0%</b>	<b>110.8%</b>	<b>106.9%</b>

Globally, A/E ratios are higher for non-qualified contracts, although for contracts with enhanced DB riders they are higher for qualified contracts. For contracts with no DBs, the A/E differential for non-qualified versus qualified contracts is almost 30%. The above results suggest a much higher degree of DB anti-selection is present in qualified contracts.

**Table 3.4.11b**  
**A/E RATIOS BY TAX CLASSIFICATION - BY AMOUNT**

<b>VARIABLE ANNUITIES - A/E RATIO BY TAX CLASSIFICATION - BY AMOUNT (AV)</b>	<b>Qualified including IRA</b>	<b>Non-qualified</b>	<b>TOTAL</b>
Roll-Up and Combo Death Benefits	143.6%	122.8%	<b>128.8%</b>
Return of Premium, Ratchet and Other Death Benefits	103.9%	109.8%	<b>108.0%</b>
Subtotal - All Death Benefits	109.8%	111.8%	<b>111.2%</b>
No Death Benefit	84.0%	122.0%	<b>100.2%</b>
<b>Total</b>	<b>101.3%</b>	<b>113.2%</b>	<b>109.0%</b>

Similar conclusions can be drawn from the analysis by amount.

## Section 4: Analysis – Fixed Annuities

### 4.1 INTRODUCTION

With a fixed annuity, the rate of return (the crediting rate) is guaranteed by the issuing company for a certain period of time. In addition, the contract will have a guaranteed minimum crediting rate, which provides a floor on future rate declarations. Although the word "fixed" might suggest otherwise, the interest rate on a fixed annuity can change over time. The contract will explain whether, how and when this can happen. Often, the interest rate is fixed for a few years and then changes periodically based on current rates.

Indexed annuities have characteristics of both fixed and variable annuities. Indexed annuities offer a minimum guaranteed interest rate combined with an interest rate linked to a market index, hence the name.

Due to concentration issues, this report will provide analysis of both fixed and fixed indexed annuities together. In addition, only single life contracts are considered.

Because there was a minimal amount of fixed annuity experience with GLB riders, concentration and credibility issues arose and the committee concluded that it was more meaningful to analyze the experience only for contracts with **no GLB riders**. Thus, the following subsections only consider contracts with **no GLB riders**.

### 4.2 GLOBAL DATA FOR FIXED ANNUITIES

Table 4.2

#### GLOBAL DATA FOR FIXED ANNUITIES

FIXED ANNUITIES - GLOBAL DATA BY CONTRACT	Contracts Exposed	Actual Deaths	Expected Deaths	A/E Ratio with 2012 IAM with G2
Contracts with no GLB Riders	12,535,817	314,422	297,391	105.7%

FIXED ANNUITIES - GLOBAL DATA BY AMOUNT (AV)	Amount Exposed ('000)	Claim Amounts ('000)	Expected Claim Amounts ('000)	A/E Ratio with 2012 IAM with G2
Contracts with no GLB Riders	773,155,800	21,099,737	20,262,569	104.1%

Globally, the A/E ratios for fixed annuities are higher by contract than by amount and are both above 100%, when compared with the expected basis of the 2012 Individual Annuitant Mortality (IAM) Basic Table projected using the G2 mortality improvement scale. The mortality rates are projected forward and backward for each of the study years relative to the 2012 baseline.

### 4.3 A/E RATIOS BY STUDY YEAR

Table 4.3

#### A/E RATIOS BY STUDY YEAR

FIXED ANNUITIES - A/E RATIO BY STUDY YEAR	2011	2012	2013	2014	2015	TOTAL
A/E Ratio by Contract	107.2%	105.0%	107.2%	103.2%	106.4%	<b>105.7%</b>
A/E Ratio by Amount (AV)	106.8%	103.8%	104.6%	102.1%	104.2%	<b>104.1%</b>

There is not much variation of A/E ratios by study year.

### 4.4 A/E RATIOS BY DURATION

Table 4.4

#### A/E RATIOS BY DURATION

FIXED ANNUITIES - A/E RATIO BY DURATION	1	2	3	4	5	6 - 10	11 +	TOTAL
A/E Ratio by Contract	68.8%	97.2%	100.4%	103.0%	103.3%	109.3%	108.5%	<b>105.7%</b>
A/E Ratio by Amount (AV)	75.2%	103.4%	103.8%	105.5%	103.7%	106.4%	105.8%	<b>104.1%</b>

A/E ratios increase by duration and tend to level off after duration 5.

### 4.5 A/E RATIOS BY SEX

Table 4.5

#### A/E RATIOS BY SEX

FIXED ANNUITIES - A/E RATIO BY SEX	Male	Female	TOTAL
A/E Ratio by Contract	103.3%	107.5%	<b>105.7%</b>
A/E Ratio by Amount (AV)	98.3%	109.0%	<b>104.1%</b>

A/E ratios are lower for males by contract and by amount. For males, the A/E ratio by amount is lower than by contract. However, the reverse is true for females.

#### 4.6 A/E RATIOS BY ACCOUNT VALUE BAND

Table 4.6

##### A/E RATIOS BY ACCOUNT VALUE BAND

FIXED ANNUITIES - A/E RATIO BY ACCOUNT VALUE BAND	< 100,000	100,000 to 249,999	250,000 to 499,999	500,000 +	TOTAL
A/E Ratio by Contract	106.0%	104.2%	106.4%	109.9%	<b>105.7%</b>
A/E Ratio by Amount (AV)	103.9%	103.3%	105.5%	107.0%	<b>104.1%</b>

After the lowest band (<\$100,000), A/E ratios tend to increase by account value band. This is an interesting result, which differs from what is usually seen with other annuity products (i.e., there typically is a wealth effect, which results in decreasing A/E ratios as size increases).

#### 4.7 A/E RATIOS BY ATTAINED AGE BAND

Table 4.7

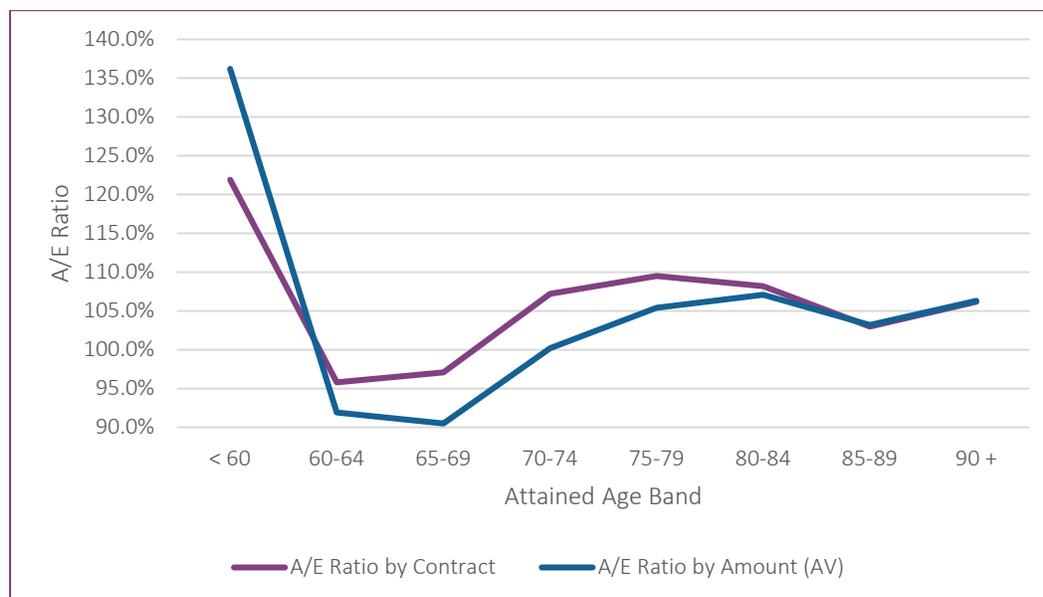
##### A/E RATIOS BY ATTAINED AGE BAND

FIXED ANNUITIES - A/E RATIO BY ATTAINED AGE BAND	< 60	60-64	65-69	70-74	75-79	80-84	85-89	90 +	TOTAL
A/E Ratio by Contract	121.9%	95.8%	97.1%	107.2%	109.5%	108.2%	103.0%	106.2%	<b>105.7%</b>
A/E Ratio by Amount (AV)	136.2%	91.9%	90.5%	100.2%	105.4%	107.1%	103.2%	106.3%	<b>104.1%</b>

A/E ratios are very high under attained age 60; however, there is limited data at those ages. A/E ratios generally tend to increase from the 60-64 band to the 80-84 band.

Figure 5

##### A/E RATIOS BY ATTAINED AGE BAND



#### 4.8 A/E RATIOS BY DISTRIBUTION CHANNEL

Table 4.8

##### A/E RATIOS BY DISTRIBUTION CHANNEL

FIXED ANNUITIES - A/E RATIO BY DISTRIBUTION CHANNEL	Career Agent	Other Distribution Channels	TOTAL
A/E Ratio by Contract	102.0%	107.8%	<b>105.7%</b>
A/E Ratio by Amount (AV)	101.4%	105.4%	<b>104.1%</b>

A/E ratios by distribution channel are very similar by contract and by amount and are lower for the career agent channel.

#### 4.9 A/E RATIOS BY REGION BAND

Table 4.9

##### A/E RATIOS BY REGION BAND

FIXED ANNUITIES - A/E RATIO BY REGION BAND	CT-ME-MA-NH-RI-VT	NJ-NY-PR-VI	DE-DC-MD-PA-VA-WV	AL-FL-GA-KY-MS-NC-SC-TN	IL-IN-MI-MN-OH-WI	AR-LA-NM-OK-TX	IA-KS-MO-NE	CO-MT-ND-SD-UT-WY	AZ-CA-HI-NV-AS-GU	AK-ID-OR-WA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
A/E Ratio by Contract	91.6%	93.8%	107.8%	113.0%	107.6%	109.2%	105.9%	103.2%	103.5%	101.3%	<b>105.7%</b>
A/E Ratio by Amount (AV)	87.7%	91.2%	106.6%	110.2%	105.7%	107.4%	105.0%	104.7%	106.4%	98.9%	<b>104.1%</b>

A/E Ratios are the lowest in the regions shown in columns 1 and 2.

#### 4.10 A/E RATIOS BY TAX CLASSIFICATION

Table 4.10

##### A/E RATIOS BY TAX CLASSIFICATION

FIXED ANNUITIES - A/E RATIO BY TAX CLASSIFICATION	Qualified including IRA	Non-qualified	TOTAL
A/E Ratio by Contract	99.0%	110.2%	<b>105.7%</b>
A/E Ratio by Amount (AV)	96.4%	108.8%	<b>104.1%</b>

A/E ratios are much lower for qualified contracts.

## Section 5: Methodology

This section lays out definitions of terms used in this report, as well as methodology used to conduct the experience study.

### 5.1 AGE BASIS

The study was performed on an age nearest birthday basis. Issue age on an age nearest birthday or date of birth was requested in the data request as indicated in Appendix A. In cases where date of birth was provided, the issue age nearest birthday was calculated using the date of birth and the issue date.

### 5.2 EXPOSURE CALCULATIONS

#### 5.2.1 OVERVIEW

Exposure was determined using the Balducci approach. The contract year that a death is assigned to is based on the Actual Date of Death.

The data were submitted by calendar year split into two portions that correspond to the two contract years in that calendar year:

B: The contract year before the anniversary date in the calendar year (Before Analytical Anniversary Portion = 'B'), and

A: The contract year after the anniversary date in the calendar year (After Analytical Anniversary Portion = 'A').

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

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

#### 5.2.2 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 Amount Exposed.

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.

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.

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 terminations occur 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.

### 5.2.3 POLICIES EXPOSED

Policies Exposed is calculated as the product of the Policy Exposure Indicator (PEI) and Exposure Length. For single life policies, which were the only type reported on in this study, the PEI is set to 1.

### 5.2.4 AMOUNT EXPOSED

The Amount Exposed is calculated as the product of the Exposure Length, the PEI, and the Amount of Annual Income.

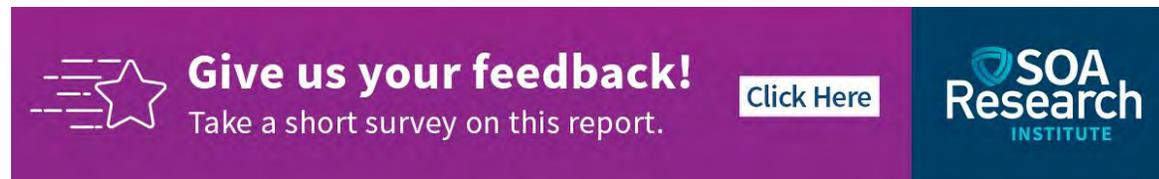
## 5.3 ACTUAL-TO-EXPECTED RATIOS

Expected deaths were determined by taking the attained age mortality rate in the expected basis table times the exposure in that contract year. Several different expected mortality bases were used in the study. The 1994 MGDB table has been included due to its application in statutory valuation for VA contracts with guaranteed minimum death benefits. The mortality rates from the 2011-2015 Social Security Administration (SSA) Table represent population mortality over that period, while the 1994 MGDB and 2012 IAM tables represent individual annuity mortality. For the 2012 IAM Basic G2 Table A/Es, the 2012 IAM expected mortality rates were improved (or disimproved, as appropriate) from July 1, 2012 to July 1 of the applicable calendar year, and those (improved/disimproved) rates were used to determine the expected deaths for the contract years in that calendar year. No improvement was applied to either the 1994 MGDB or 2011-2015 SSA expected bases. The 1994 MGDB and 2012 IAM Basic and Period Tables were developed on an age nearest birthday basis using amount-weighted experience. Actual study experience was determined on an age-nearest birthday basis.

## Section 6: Reliance and Limitations

No assessment has been made concerning the applicability of this experience to other purposes. In developing this report, the SOA Research Institute 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.

The results in this report are technical in nature and are dependent on certain assumptions and methods. No party should rely upon these results without a thorough understanding of those assumptions and methods. Such an understanding may require consultation with qualified professionals. This report should be distributed and reviewed only in its entirety.



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## Section 7: Acknowledgments

The Society of Actuaries Research Institute would like to especially thank the Individual Annuity Experience Committee for their diligent work overseeing the data request development, reviewing and analyzing the results of the study, and preparing, reviewing and editing this report for accuracy and relevance.

Society of Actuaries Research Institute Individual Annuity Experience Committee members:

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## Section 8: List of Participating Companies

The SOA Research Institute thanks the following companies for their participation in this study.

Athene Annuity & Life Assurance Company  
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Hartford Life  
Integrity Life  
Lincoln Financial Group  
MetLife  
Nationwide Life  
New York Life  
Ohio National Life Insurance Company  
Pacific Life  
Penn Insurance & Annuity  
Penn Mutual  
Principal Financial Group  
Protective Life  
Prudential Financial  
RiverSource Life Insurance (Ameriprise)  
Sammons Financial  
State Farm Life  
Symetra Financial  
The Standard  
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TIAA/CREF  
Western Southern Group

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