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Update on Mortality Tables and Application

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New Mortality Tables—A Change from Historical Approaches

Over the past year, the Joint American Academy of Actuaries and Society of Actuaries Project Oversight Group on Mortality (the Joint Committee) has been busy with developing mortality tables for life and annuity products. In particular, the Joint Committee has developed the 2012 Individual Annuity Reserve (IAR) Table and is currently developing the 2014 Valuation Basic Table (VBT), 2014 Commissioners' Standard Ordinary (CSO) Table and new tables for guaranteed issue (GI), simplified issue (SI) and preneed insurance products. The 2012 IAR Table structure is a departure from current tables in that it is dynamic and requires the use of projection factors. The 2014 VBT and CSO are being developed with the consideration for use within principle-based reserves and specifically VM-20. The GI/SI/Preneed tables are in their earlier stages of development but will be used for valuation of these types of underwritten products. At least for GI and SI, these will be the first valuation tables specifically for this level of underwriting. The various tables will become effective in January 2014 for the annuity table, with VM-20 and PBR (likely 2016 or later) for

the VBT/CSO, and a future, undetermined date for the GI/SI/Preneed. For the 2012 IAR Table in particular, the impact to reserves for annuities (both those in payout status and for deferred annuities) can be significant, and implementation of the new tables can have system implications. Companies, if they haven't already, should be paying close attention to the developments and, at least for the case of the annuity table, closely reviewing their systems and annuity pricing to make sure the new tables are incorporated.

Application and Clarification of 2012 IAR Table

The current individual annuity mortality tables are based on underlying mortality experience from the 1980s and 1990s and, for the Annuity 2000 (a2000) Table, the mortality rates were projected with mortality improvement to the year 2000 but not beyond. Since the development of the a2000 Table, the industry has experienced significant mortality improvement, especially at the older ages. This had caused concern amongst the regulators that annuities in payout status are under-reserved. The 2012 IAR Table and accompanying projection Scale G2 were developed to take into consideration the more recent industry

experience as well as future improvement at each valuation date. This makes the table more dynamic with the intention to keep the table from becoming dated too quickly. As such, the 2012 IAR Table is a generational mortality table. This means that the mortality table contains a set of mortality rates that decrease for a given age from one projection year to the next.

The National Association of Insurance Commissioners (NAIC) adopted the NAIC Model Regulation for Recognizing New Annuity Mortality Tables (the Model Reg) at its December 2012 meeting. The model regulation recognizes the 2012 IAR Table for reserving purposes with a proposed effective date for issues on or after January 2014. The Model Reg is now in the process of going through the state legislative process. There is potential that the new table could go into effect for tax reserve purposes prior to it becoming effective in any given state. This could add further complexity to the implementation of the new table.

The new table applies to annuities in payout status, including deferred and certain and life annuities for life policies. In most states, the new table applies to the following reserving applications: AG IX-A, AG IX-B, AG IX-C, AG33, AG35 and AG43. In addition, the new table likely will apply to settlement options in life insurance contracts so companies may wish to review the guaranteed values within their life contracts in addition to their pricing and reserving for their annuities. While implementation of new valuation tables is not new, the generational nature of the 2012 IAR Table may create implementation challenges for companies due to tables with rates which vary from one year to the next. In addition, the new tables create an increase in reserves at most ages. Unlike when a new life mortality table goes into effect, there is no phase-in period for the mandatory effective date of the tables. That means that all scoped-in contracts issued in or after January 2014 are impacted.

The current model regulation defines several tables—the 2012 Annuity Mortality Period Table and the 2012 IAR Table as well as projection Scale G2. The model regulation defines the 2012 IAR Table as a table of mortality rates determined by applying a combination of a Period table and Projection Scale where the Period table is based on the Individual Annuity Mortality Basic Table, the underlying experience table with improvement factors to 2012 (i.e., the 2012 IAM Basic Table) and a margin. The margin is similar to that for the a2000 tables and is 10 percent for all attained ages up to 100, grading down 1 percent per year at ages beyond 100 until ultimate mortality cap of 0.400 is invoked.

The generational mortality table rate for a person age x in year (2012 + n) is determined as follows:

$$q_x^{2012+n} = q_x^{2012} * (1 - G2_x)^n$$

where,

- $G2_x$ is the annual rate of mortality improvement for age x. For each age, the mortality improvement rate is projected for all years in the projection period, with no limit to the number of years the projection applies. The improvement rate varies by gender and attained age. The improvement factors start at 1.0 percent for ages 50 and under, grade up to 1.5 percent and 1.3 percent for ages 60 through 80 for males and females, respectively, then grade to 0 percent at ages 104 and above;

- q_x is the mortality rate from 2012 Individual Annuity Mortality Period Table; and

- **n** is the projection year beyond 2012.

Scale G₂

Age	Male	Female
0-50	1.0%	1.0%
51	1.1%	1.0%
52	1.1%	1.1%
53	1.2%	1.1%
54	1.2%	1.1%
55	1.3%	1.2%
56	1.3%	1.2%
57	1.4%	1.2%
58	1.4%	1.2%
59	1.5%	1.3%
60-80	1.5%	1.3%
81	1.4%	1.2%
82	1.3%	1.2%
83	1.3%	1.1%
84	1.2%	1.0%
85	1.1%	1.0%
86	1.0%	0.9%
87	0.9%	0.8%
88	0.9%	0.7%
89	0.8%	0.7%
90	0.7%	0.6%
91	0.7%	0.6%
92	0.6%	0.5%
93	0.5%	0.5%
94	0.5%	0.4%
95	0.4%	0.4%
96	0.4%	0.4%
97	0.3%	0.3%
98	0.3%	0.3%
99	0.2%	0.2%
100	0.2%	0.2%
101	0.2%	0.2%
102	0.1%	0.1%
103	0.1%	0.1%
104+	0.0%	0.0%

For example, if the table were in effect for valuation year 2013, the period table would start with the 2013 table (i.e., the 2012 table projected forward one year). For the valuation, the second projection year (2014) would use the 2013 table improved one year; the third projection year (2015) would use the 2013 table improved two years and so on. The model regulation also specifies rounding rules which state that the *ending* mortality rates are rounded to three

decimal places per 1,000. It clarified that it would be incorrect to use the already rounded qx 2012+n to calculate qx 2012+(n+1).

The following illustrates the development of the 2012 IAR Mortality Table.

Age	2012	2013	2014	2015	2016	2017	2018	...	2070
65	q_{65}^{2012}	q_{65}^{2013}	q_{65}^{2014}	q_{65}^{2015}	q_{65}^{2016}	q_{65}^{2017}	q_{65}^{2018}	...	q_{65}^{2070}
66	q_{66}^{2012}	q_{66}^{2013}	q_{66}^{2014}	q_{66}^{2015}	q_{66}^{2016}	q_{66}^{2017}	q_{66}^{2018}	...	q_{66}^{2070}
67	q_{67}^{2012}	q_{67}^{2013}	q_{67}^{2014}	q_{67}^{2015}	q_{67}^{2016}	q_{67}^{2017}	q_{67}^{2018}	...	q_{67}^{2070}
68	q_{68}^{2012}	q_{68}^{2013}	q_{68}^{2014}	q_{68}^{2015}	q_{68}^{2016}	q_{68}^{2017}	q_{68}^{2018}	...	q_{68}^{2070}
69	q_{69}^{2012}	q_{69}^{2013}	q_{69}^{2014}	q_{69}^{2015}	q_{69}^{2016}	q_{69}^{2017}	q_{69}^{2018}	...	q_{69}^{2070}
...	...	...	...	...	...	...	...	...	...
120	q_{120}^{2012}	q_{120}^{2013}	q_{120}^{2014}	q_{120}^{2015}	q_{120}^{2016}	q_{120}^{2017}	q_{120}^{2018}	...	q_{120}^{2070}

An example of the mortality table for years 2013 through 2018 based on the 2012 IAM Period Table for males, using Scale G2 is shown below for attained ages 65 through 69.

Attained Age	$1000q_x^{2012}$	$G2_x$	Values of 1000q_x					
			2013	2014	2015	2016	2017	2018
65	8.106	0.015	7.984	7.865	7.747	7.630	7.516	7.403
66	8.548	0.015	8.420	8.293	8.169	8.047	7.926	7.807
67	9.076	0.015	8.940	8.806	8.674	8.544	8.415	8.289
68	9.708	0.015	9.562	9.419	9.278	9.138	9.001	8.866
69	10.463	0.015	10.306	10.151	9.999	9.849	9.701	9.556
	2013 valuation year IAR Table							
	2014 valuation year IAR Table							

For example, for valuation year 2014, the projected mortality rate for a male attained age 65 at the valuation date (based on age nearest birthday), is determined as follows:

$1000*q_{65}2012 = 8.106$; $G2_{65} = 1.5\%$.

$1000*q_{65} 2014 = 8.106 * (1 - 0.015)^2 = 7.8646439$ which is rounded to 7.865.

$1000*q_{66} 2015 = 8.548 * (1 - 0.015)^3 = 8.1690811$, which is rounded to 8.169

For the above, the rounding rules state it would not be correct to take $8.293 * (1-.015) = 8.168$.

For joint life contracts or unisex policies, the rates are to be determined for each life or gender independently, then blended or frasierized. The rounding would then apply at the end after the blending has been performed.

An example of the mortality rates versus the a2000 Table is shown on page 6 for male and female risks, ages 65 through 90.

**Mortality Rate per 1,000 Comparison
2012 Table to a2000 Table
Male Risks, Ages 65-90**
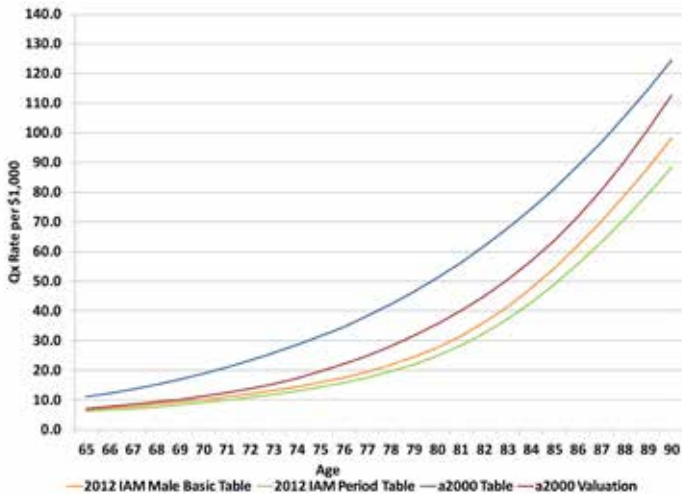
The new tables result in an increase in the statutory reserves for most attained ages. For some ages, the increase is significant from current reserve levels. For example, for a male age 75, the reserve per $1,000 of annual annuity payment increases between 8 and 11 percent over the first 10 valuation years since contract issuance.

Reserve per $1000 of Annuity Payout						
	At Issue @ 5% Interest			10 Years after Issue @ 5% Interest		
Life Annuity	A2000	2012 IAR	% Increase	A2000	2012 IAR	% Increase
Male, Age 65	11.60	12.76	9.9%	8.50	9.79	15.1%
Male, Age 75	8.50	9.45	11.2%	5.50	5.95	8.1%
Female, Age 65	12.62	13.32	5.5%	9.41	10.43	10.8%
Female, Age 75	9.41	10.16	8.0%	5.91	6.57	11.1%

**Mortality Rate per 1,000 Comparison
2012 Table to a2000 Table
Female Risks, Ages 65-90**
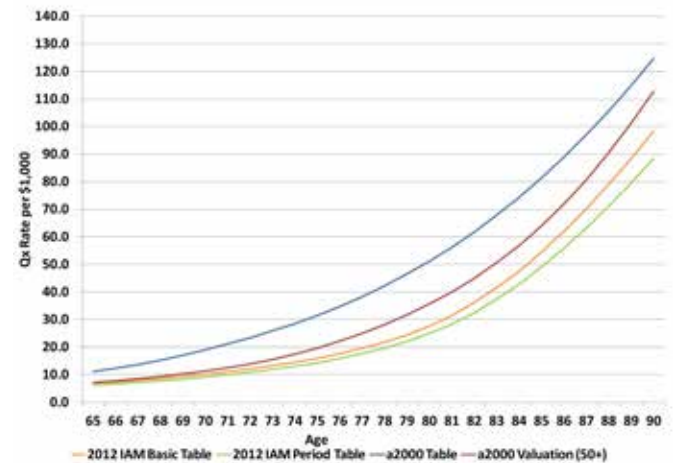
One area noted of the underlying experience was significant variation in the mortality experience by type of payout selected and level of annual annuity benefit. The underlying experience exhibited significantly lower mortality (and thus anti-selection) for life-only annuities (i.e., without a certain period) and for higher annual annuity benefits. The underlying experience, however, was more heavily weighted toward lower contract amounts and annuities with some form of deferral or certain period. For various reasons, the Joint Committee recommended and the NAIC agreed to not vary the 2012 IAR Table by payout option or amount. While not a requirement of the model regulation, companies may want to consider the additional improvement in mortality for these types and levels of payout in their pricing, asset adequacy testing and business planning.

As described above, the 2012 IAR Table is a departure from how companies have been able to implement new annuity valuation tables in the past. How to incorporate the tables on their systems, in their settlement option pricing and contractual guarantees, annuity pricing and valuation systems are all areas companies will need to consider. The Joint Committee is in the process of developing a Q&A document for common questions it has received regarding the implementation of the new table. This document is expected to be completed in early fall. In addition, the Joint Committee will make available a table and reserve calculator for companies to use to verify the application of the new tables and model regulation.

Development Considerations for 2014 VBT and CSO

The VBT and CSO tables are being developed for use in a principle-based reserve environment and VM-20. The 2014 VBT tables are based on a significantly greater amount of underlying business and exposures from either the 2001 or 2008 VBT tables. In addition, there is materially more experience for preferred risks, older issue ages and female risks. The underlying experience also shows significant variation by issue age, face amount and smoking status, as well as significant improvement over the 2008 VBT. As shown in the table, the underlying mortality experience used to develop the table (actual to expected or A/E where the expected basis is the 2008 VBT RR 100 Table) decreased by over 6 percent while the exposure increased by over $20 million in face amount and by nearly 2 million death claims.

Study Period	Male	Female	Aggregate	Exposure (Trillion)	# Death Claims
2002-2004	101.1%	100.5%	100.9%	$ 7.4	699,890
2002-2007	96.2%	97.0%	96.4%	21.1	1,800,912
2002-2009 - Preliminary	94.2%	94.7%	94.3%	30.7	2,549,490

In addition to gender, the underlying experience has also exhibited variation by many factors including face amount, smoking status and issue age, with the oldest issue ages showing the greatest improvement.

Face Amount Band ($)	A/E Ratio by Amount
50,000 – 99,999	105.6%
250,000 – 499,999	88.6%
1,000,000 – 2,499,999	81.9%
5,000,000 – 9,999,999	74.1%
Aggregate	92.7%

- The underlying experience shows significant variation by issue amount. For face amounts of $250,000 and above, the A/E is approximately 84 percent.
- Currently, the new table is not expected to vary by amount; however, the need to have a limited underwriting table is still under consideration.

Issue Age	A/E Ratio by Amount
40 – 49	100.1%
60 – 69	95.1%
80-89**	61.6%

- The underlying experience shows fairly good fit to the 2008 VBT at the mid issue ages but starts to deviate from the 2008 VBT at the older ages. This is a combination of having more experience at the older ages in the underlying study and the structure of the 2008 VBT grading pattern into population mortality.
- Less variation has been observed by attained age.
- This experience is being reflected in the 2014 VBT.
- There has been significant focus by the 2014 VBT development team on the older issue ages; both select and ultimate.

Smoking Status	A/E Ratio by Amount
Nonsmoker	92.3%
Smoker	97.5%
Unknown Status	99.8%
Aggregate	94.3%

- The A/E for the underlying experience is similar for smoker and nonsmoker classes.
- Like the 2008 VBT, much of the ultimate experience is still issued under an unknown status. Therefore, the team has worked on developing smoker/nonsmoker splits.

A key difference between the 2008 VBT and the 2014 VBT and CSO is that the new tables will be prospective tables and really take into consideration the expected experience for issues 2014 *and later* informed from underlying historical experience versus purely a historical or retrospective table. The table structure will be similar to the 2008 VBT, with both Primary and RR tables. The RR tables are expected to be same in number as with the 2008 VBT but will likely have different relativity amongst the classes. The need for a limited underwriting table is still under examination and is somewhat dependent on the final results and table structures from the guaranteed issue/simplified issue/preneed tables, which are also in development. For the VBT, there will be an omega rate per 1,000 (0.5000 at attained age 112) but no omega age; the CSO will have omega age of 121.

The proposed select factor and period vary by both gender and issue age. The select periods were determined based on analysis of the underlying data. The VBT team attempted to normalize the socioeconomic impact over time as well as to consider changes in smoker prevalence. The team looked to "events" or changes in underwriting which have impacted the select period in the underlying 2002 to 2009 data such as smoker prevalence and changes in underwriting. The proposed select period remains at 25 for males but is 20 for females. The select period grades down by age to two years for both males and females by age 92. The underlying select

period is independent of any additional preferred wear-off that will apply in the RR tables. A sample of the proposed select periods is shown below.

Issue Age	Male Risks	Female Risks
50	25	20
60	21	20
70	17	15
80	11	10
90	4	4
95	2	2

The VBT team plans to release the aggregate select and ultimate tables for comment/review in early fall 2013 while it continues to work on the RR tables and the 2014 CSO. Within the context of PBR and VM-20, the CSO tables will be the prescribed table with no adjustment for own company experience used within the net premium reserve, as well as for non-forfeiture and tax. Where the 2014 VBT will have a similar number of RR tables as the 2008 VBT, the 2014 CSO Table will have fewer classes, more similar to the preferred structure tables of the 2001 CSO in place today.

The following table compares the use of the new life tables (VBT and CSO) within the context of their application to statutory reserves compared to the current 2001 CSO Table.

Criteria/Table Structure	2001 CSO	2014 CSO	Prudent Estimate Mortality
Uses	•Net Premium Reserves •Tax Reserves •Non-forfeiture	•Net Premium Reserves •Tax Reserves •Non-forfeiture	•VM20 Deterministic •VM20 Stochastic Reserves
Underlying mortality table and experience	2001 VBT (1990-1995 data)	2014 VBT (2002-2009 data)	Blend of (a) and (b) (a) Own Company (max 10 yrs) (b) 2014 VBT (2002-2009 data)
Number of tables	•Gender distinct/Composite •Smoker distinct/Composite •3 NT/NS •2 TB/SM	Expect to be similar to 2001 CSO	Subject to # of company mortality segments
Risk class tables aggregate back to composite	Yes	Yes (proposed)	No
Own company experience	None	None	Yes, subject to sufficient data period and credibility
Prescribed table	Yes	Yes	No, subject to VM-20 requirements
Considers mortality improvement	No	No	Yes, to valuation date – prescribed and own company
Smoothness versus fit	Smoothness	Smoothness	Fit
Omega age	121	121	None
Margins	Embedded within table	Margin levels as well as approach to margins being revisited with development of new tables	

Work continues by the various committees on the VBT and CSO tables and is expected to continue throughout the remainder of 2013. Companies interested should be able to get an early look at the aggregate VBT tables (select and ultimate, male/female, smoker/nonsmoker) in early fall 2013 when the tables are released for industry and regulator feedback/comment. For the CSO, considerable consideration on the margin development is underway. The CSO team is seeking additional volunteers and would welcome those interested in helping to shape the analysis and direction.

The Joint Committee is also working on new guaranteed issue, simplified issue and preneed tables to be used in valuation. With principle-based reserves approaching, companies may wish to take a greater interest in the development of these tables and resulting impacts. In the case of the 2012 IAR Table, companies should be planning for implemen-tation or in the process of executing their implementation plan as the new tables, at least for some states, become effective for new contracts entered into starting January of next year, less than six months away.

Note: All figures and graphs are presented from work produced by the Society of Actuaries & American Academy of Actuaries Joint Project Oversight Group and American Academy of Actuaries Life Experience Sub-Committee. ●

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