Report on the Lapse and Mortality Experience of Post-Level Premium Period Term Plans (2014)

REVISED MAY 2014

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RGA Reinsurance Company

Background

The Society of Actuaries (SOA) engaged RGA Reinsurance Company (RGA) to undertake a research project on level premium term life insurance products with a particular focus on the magnitude and impact of the shock lapse at the end of the level premium period. This project is a follow-up to SOA-sponsored research completed by RGA in October 2009 (http://www.soa.org/research/research-projects/life-insurance/research-post-level.aspx) and July 2010 (http://www.soa.org/research/research-projects/life-insurance/research-shock-lapse-report.aspx).

As with the research project completed by RGA in 2010, this project was completed in two phases:

- Phase 1 included a survey of the mortality and lapse assumptions used by actuaries for pricing and modeling level premium term products at the end of 2012. This report summarizes the findings from the 41 Phase 1 survey responses received.
- Phase 2 included a study of the mortality and lapse experience of level premium term policies as they transition out of the level premium period. Participating companies were asked to supply policy level inforce and termination records so that experience results could be analyzed at a granular level including, but not limited to, age, gender, risk class, premium jump, and policy size. In addition, comparisons to the 2010 experience studies were added to the analysis.

This report will analyze the results of the Phase 2 study in the following sections:

1) Analysis of shock lapse rate experience;

2) Analysis of post-level period mortality deterioration experience;

3) Comparisons of results between Phase 1 assumption survey and Phase 2 experience study; and

4) A proposed generalized linear model of shock lapse rates.

The following major enhancements to the 2010 study include:

1) Increased lapse and mortality credibility;

2) Monthly lapse study to aid in the analysis of lapse skewness;

3) Monthly mortality study to illustrate the impact of the grace period after the shock lapse;

4) Predictive Model on the T10 duration 10 shock lapse; and

5) Analysis of issue age and face amount within a given premium jump.

Disclaimer of Liability

This report is intended for use by actuaries familiar with the level premium term product design, underwriting and marketing techniques used by U.S. life insurance companies. The actuary responsible for preparing this report is Derek Kueker, FSA, a qualified actuary. While good faith effort has been made to analyze the reasonableness of each company's data submission, the final report is ultimately reliant on the accuracy of the underlying data.

The results provided herein come from a variety of life insurance companies with unique product structures, target markets, underwriting philosophies and distribution methods. As such, these results should not be deemed directly applicable to any particular company or representative of the life insurance industry as a whole.

RGA, its directors, officers and employees, disclaim liability for any loss or damage arising or resulting from any error or omission in RGA's analysis and summary of the experience study results or any other information contained herein. The report is to be reviewed and understood as a complete document.

This report is published by the SOA and contains information based on input from companies engaged in the U.S. life insurance industry. The information published in this report was developed from actual historical information and does not include any projected information.

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the SOA or its members. The SOA makes no representations regarding the accuracy or completeness of the content of this study. It is for informational purposes only. The SOA does not recommend, encourage or endorse any particular use of the information provided in this study. The study should not be construed as professional or financial advice. The SOA makes no warranty, expressed or implied, guarantee or representation whatsoever and assumes no liability or responsibility in connection with the use or misuse of this study.

A revision of the study was published in May 2014 to reflect a change to the confidence interval calculation found on page 8 and presented in the charts in the "Mortality Deterioration" section of the document.

Executive Summary

Shock Lapses

The aggregate duration 10 shock lapse for all 10-year level term plans (T10) was 60.3% by count although there was a wide range of results by company, product structure, and policy attributes. The median of company-specific shock lapse results was 72.6%. The duration 10 shock lapse was 69.9% for T10 products structured with an annually increasing post-level premium scale with a median shock lapse of 76.4%. For 15-year level term plans (T15), the duration 15 shock lapse was 72.0% with a median shock lapse of 67.6%. For both products, the initial shock lapse at the end of the level period was followed by a smaller secondary shock lapse in the following duration. Lapse rates tend to grade down in later durations of the post-level period.

The policy attribute most highly correlated with shock lapse is the size of the jump in premium from the level period to the post-level period. This is especially significant since more recently issued products experience higher shock lapses due to larger premium jumps after the end of the level period. Shock lapses are higher for older issue ages, even within a given premium jump band. In addition, shock lapse rates are higher for annual premium modes than for monthly premium modes.

Lapses within the first year of the post-level period are more heavily skewed toward the beginning of the policy year, indicating a disproportionate amount of off-anniversary lapse activity compared to the level period.

Mortality Deterioration

The median of company-specific experience for T10 showed duration 11 mortality as 262% of 2008 VBT by count, although there was a wide range of results by company. Mortality deterioration grades down by duration after the initial shock lapse.

As with shock lapses, mortality deterioration seems to increase by issue age and by the size of the post-level period premium jump. These dimensions are important considerations when applying shock lapse and mortality deterioration assumptions for pricing new products.

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Introduction

The Phase 2 data request was sent along with the Phase 1 survey request. Companies that provided data may or may not have participated during the Phase 1 survey. A list of participants is included in Appendix A (p. 115).

Methods of Analysis

Participating companies were asked to provide a listing of each inforce and terminated level term policy, including exact issue dates and dates of termination. The collection of data in this manner allowed the researchers to ensure a consistent calculation of experience study exposures across multiple companies. This also enabled cells with relatively small exposure to be aggregated such that total credibility can be improved. This data was used to create a 2000-2012 anniversary year lapse study and a 2000-2012 calendar year mortality study. The anniversary year method was chosen for the lapse study to account for the skewness of lapses throughout the policy year. Since many lapses occurred on policy anniversaries, a calendar year study would potentially miss much of the anticipated lapse activity at the end of a policy's most recent policy year. Since deaths were generally evenly distributed throughout the policy year, a calendar year method was used for the mortality study to increase the amount of fully completed experience that could be included in the study. Both studies were primarily performed on a policy count basis to help minimize the impact of volatility related to policy size. Results by face amount band are provided to help identify differences in experience at different policy sizes.

A process of data validation and cleansing was undertaken with each company's submission. In addition, a summary of each individual company's results was provided back to the data provider. This process helped the researchers ensure that they had a good understanding of the data that had been submitted. In a few cases, this process led to companies providing additional or corrected data.

In addition to the information published in this document, additional analysis was completed to look at both experience on business with face amount decreases near the end of the level period as well as conversion experience. Unfortunately, due to data issues and limited credibility, this information was not sufficiently reliable to be included in the document.

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Grace Period Adjustments

The most significant adjustment that was made during the data validation process was to account for differences in how companies captured the effective date of lapses. For terminations due to lack of premium payment, some companies submitted a termination date equal to the anniversary date plus the grace period. To ensure consistency across companies, the researchers adjusted these dates to replicate the true effective date of the termination. This adjustment effectively moved shock lapses that were reported 30 to 100 days into the first duration of the post-level period back into the final duration of the level period. After this adjustment, the results from these companies were much more consistent with those who reported the effective date of the termination (often on the policy anniversary). While other approaches may also have been appropriate, it was felt that this was the best way to report results in a manner most likely to be consistent with premium calculations and new business pricing model mechanics. An illustration of the impact of the grace period adjustments can be found in Appendix B. All displays in the remainder of the document exclude the grace period when appropriate.

Post-Level Premium Structure Mapping

Contributors were asked to describe the structure of the premium rates after the end of the level premium period. Due to credibility concerns, analysis was only included for all business combined (labeled "All") and "Premium Jump to ART[1]." The following chart illustrates the mapping of the original premium structure provided by clients to what was used throughout the document.

Original: Post-Level Premium Structure	Document: Post-Level Premium Structure
Premium Jump to ART	Premium Jump to ART
Premium Grade to ART	Premium Jump to Other
Premium Jump to New Level Period	Premium Jump to Other

[1]ART stands for annually renewable term, but is used more generally to describe any product with an annually increasing premium structure. Level term products often have premiums in the post-level period that are set as a fixed percentage of the ultimate period rates from an industry mortality table such as 1980 CSO or 2001 CSO.

Lapse Study Specifications

The lapse study covered policy anniversaries beginning in 2000 to policy anniversaries ending in 2012. For the purposes of this study, any voluntary termination was considered a lapse. This includes terminations coded as "lapse," "surrender," "full conversion," "term upgrade," and some other miscellaneous values. Exposure was calculated for up to 11 policy years for each policy. Fractional exposure was calculated for policies in the year of death. A full policy year of exposure was credited to policies in the year of lapse. Results were shown by count unless otherwise stated.

Mortality Study Specifications

The mortality study covered calendar years 2000 through 2012. Fractional exposure was calculated for policies in the year of lapse. A full policy year of exposure was credited to policies in the year of death. Expected mortality was calculated using several industry standard tables: SOA 1975-80, 2001 VBT, and 2008 VBT. Actual/Tabular ratios were calculated as the ratio of the actual number of deaths to the tabular expected number of deaths. Results were shown by count unless otherwise stated.

Relative mortality ratios are also provided to compare the post-level period mortality to the level period mortality. These values are calculated as the ratio of 2008 VBT actual/tabular ratio for a given post-level period duration to the 2008 VBT actual/tabular ratio during the last five durations of the level period.

A 90% confidence interval is included in many illustrations for mortality by count. The formula used was:

$$\frac{\text{Actual Claim Count}}{\text{2008 VBT Tabular}} * \left(1 \pm 1.645 * \frac{1}{\sqrt{(\text{Actual Claim Count})}} \right)$$

Lapse Experience

Overview

This section will present lapse experience from participating companies with a primary focus on the shock lapse at the end of the level period. Multiple companies have submitted credible data for T10 products and these results will be shown for all analyzed dimensions. A smaller number of companies contributed T15 experience, so these results will only be shown when the dimensions being analyzed are credible and represent an appropriate cross-section of companies. Five-year level term and 20-year level term plan results will not be provided since there were not multiple companies contributing credible experience for these products.

Total Lapse Rates by Duration

T10 (All)

The following table and chart show the lapse experience for T10 by duration. The aggregate shock lapse at the end of the level period is 60.3% with a smaller secondary shock lapse in duration 11 of 30.5%. Note that the duration 11 lapse rate is artificially low compared to duration 10 due to differences in the average premium jump between durations 11 and 10 (as illustrated in the "Dur 11 / Dur 10" column of the chart on page 21). Lapse rates continue to drift down by duration until converging towards an ultimate lapse rate.

T10 Lapse Experience by Duration					
Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate [1]	Average Prem Jump Ratio [2]
6	1,302,502	89,906	6.9%	6.7%	7.1
7	1,241,787	78,689	6.3%	6.2%	7.1
8	1,168,874	73,142	6.3%	6.2%	6.9
9	1,048,781	73,146	7.0%	7.0%	6.5
10	884,751	533,416	60.3%	72.6%	5.8
11	317,313	96,661	30.5%	44.7%	3.1
12	199,819	23,131	11.6%	19.6%	2.6
13	157,463	13,488	8.6%	13.2%	2.5
14	123,243	8,685	7.0%	12.1%	2.4
15	90,519	5,324	5.9%	11.9%	2.3
16+	195,746	13,632	7.0%	11.6%	2.3
Grand Total	6,730,798	1,009,220		n/a	n/a

(1) Median lapse rate for companies with 100 or more lapses in given duration
(2) Weighted Average duration 11/10 premium jump ratio by exposure for policies with premium data available

T10 Lapse Rates by Duration

RGA Reinsurance Company
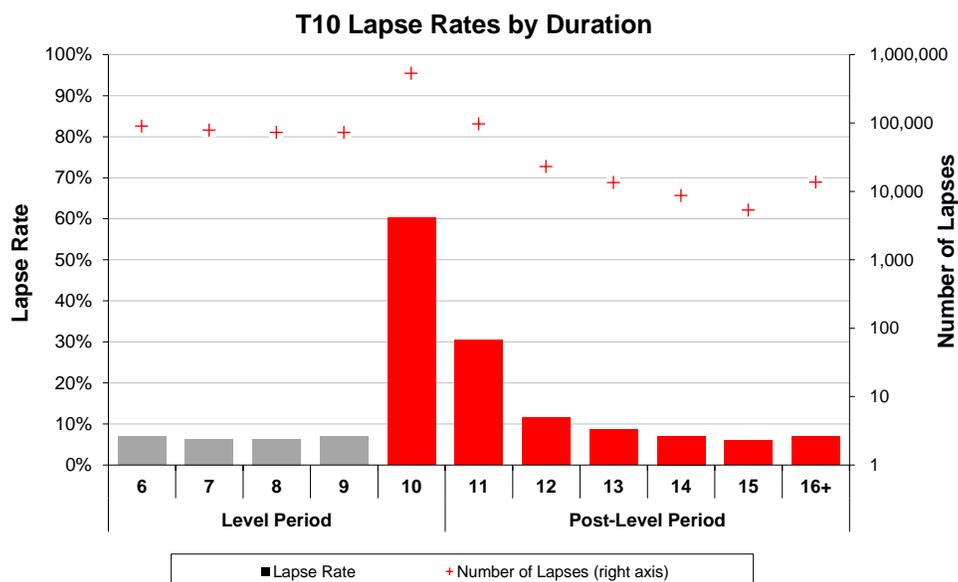
Total Lapse Rates by Duration (cont.)

T10 (Jump to ART)

A breakdown of T10 for only policies structured with a jump to an ART scale is included below. The aggregate shock lapse in duration 10 is 69.9% with a median shock lapse of 76.4%. Once again, the relationship between the duration 10 and duration 11 lapse rates is artificially low due to the dramatic decrease in average premium jump in business persisting from 10 to 11.

T10 Jump to ART Lapse Experience by Duration					
Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate [1]	Average Prem Jump Ratio [2]
6	1,064,291	78,181	7.3%	6.7%	8.6
7	1,015,570	67,609	6.7%	6.4%	8.7
8	953,357	62,526	6.6%	6.4%	8.5
9	845,701	62,055	7.3%	7.0%	8.1
10	693,591	484,987	69.9%	76.4%	7.4
11	178,032	71,486	40.2%	47.1%	4.3
12	91,330	15,733	17.2%	19.7%	3.5
13	62,616	8,371	13.4%	14.3%	3.3
14	40,029	4,866	12.2%	13.4%	3.2
15	21,186	2,290	10.8%	11.9%	3.3
16+	38,026	3,415	9.0%	11.6%	3.2
Grand Total	5,003,729	861,519		n/a	n/a

(1) Median lapse rate for companies with 100 or more lapses in given duration

(2) Weighted Average duration 11/10 premium jump ratio by exposure for policies with premium data available

T10 Jump to ART Lapse Rates by Duration

RGA Reinsurance Company
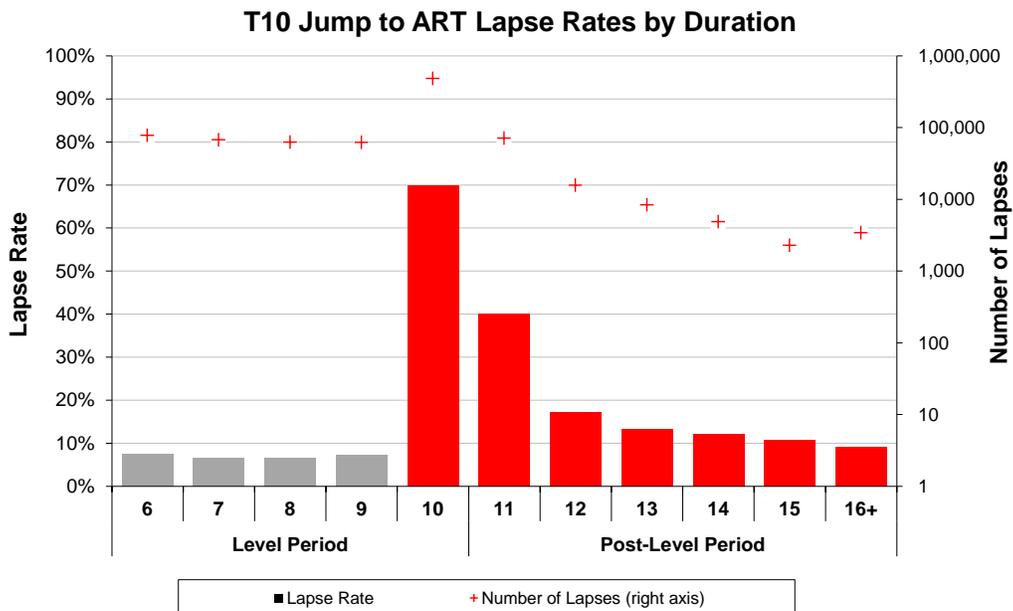
Total Lapse Rates by Duration (cont.)

T15 (All)

The T15 product also experiences a large shock lapse at the end of the level period (duration 15).

Consistent with T10, a secondary shock occurs in duration 16 followed by decreasing lapse rates until

settling at an ultimate lapse rate. The relationship of duration 16 lapse rates is artificially low compared to

duration 15, driven by the change in average premium jump for the two durations.

T15 Lapse Experience by Duration					
Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate [1]	Average Prem Jump Ratio [2]
11	207,657	7,779	3.7%	3.5%	10.6
12	157,063	6,128	3.9%	3.6%	10.1
13	119,801	4,726	3.9%	4.1%	9.8
14	67,789	3,207	4.7%	5.0%	9.4
15	44,341	31,920	72.0%	67.6%	8.8
16	11,712	3,794	32.4%	39.8%	5.5
17	8,354	865	10.4%	12.6%	4.1
18	7,599	545	7.2%	10.8%	3.7
19+	22,482	1,913	8.5%	10.4%	3.0
Grand Total	646,798	60,877		n/a	n/a

(1) Median lapse rate for companies with 100 or more lapses in given duration

(2) Weighted Average duration 16/15 premium jump ratio by exposure for policies with premium data available

T15 Lapse Rates by Duration

RGA Reinsurance Company
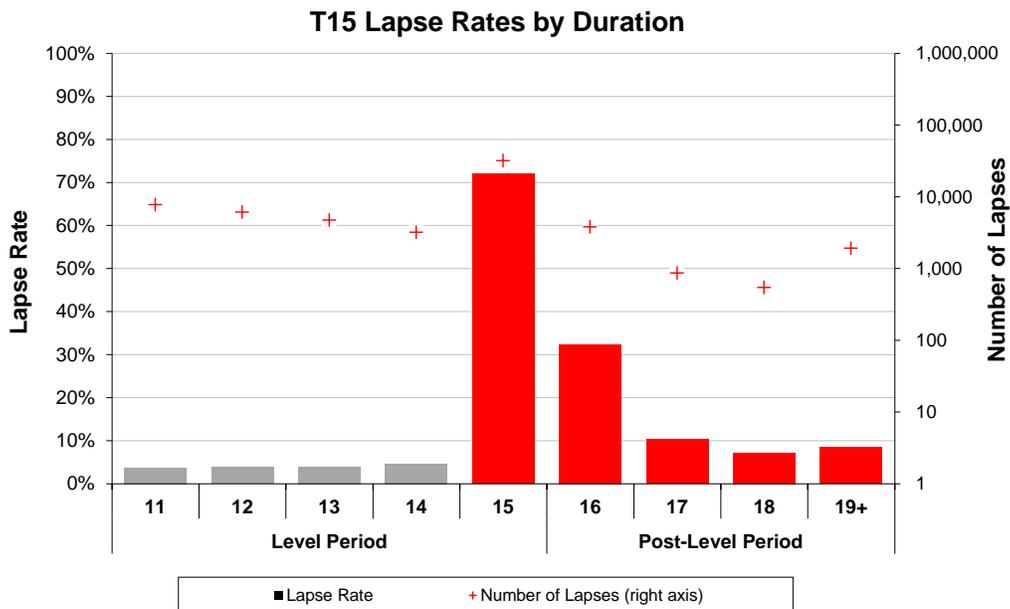
Distribution of Results

<u>T10 (All)</u>

Results varied widely by company. The following table and chart plot the company-specific T10 lapse

rates at different percentiles.

Lapse Rate Range	Duration					
	6-8	9	10	11	12	13+
# of Companies	34	30	34	31	20	21
20th percentile	5.1%	5.9%	47.9%	31.7%	14.8%	8.9%
Median	6.5%	7.0%	72.6%	44.7%	19.6%	13.3%
Aggregate	6.5%	7.0%	60.3%	30.5%	11.6%	7.3%
80th percentile	7.5%	7.9%	84.4%	56.7%	24.5%	15.1%

* Companies with 100 or more lapses in given duration

T10 Lapse Rates by Duration
Distribution by Company

RGA Reinsurance Company
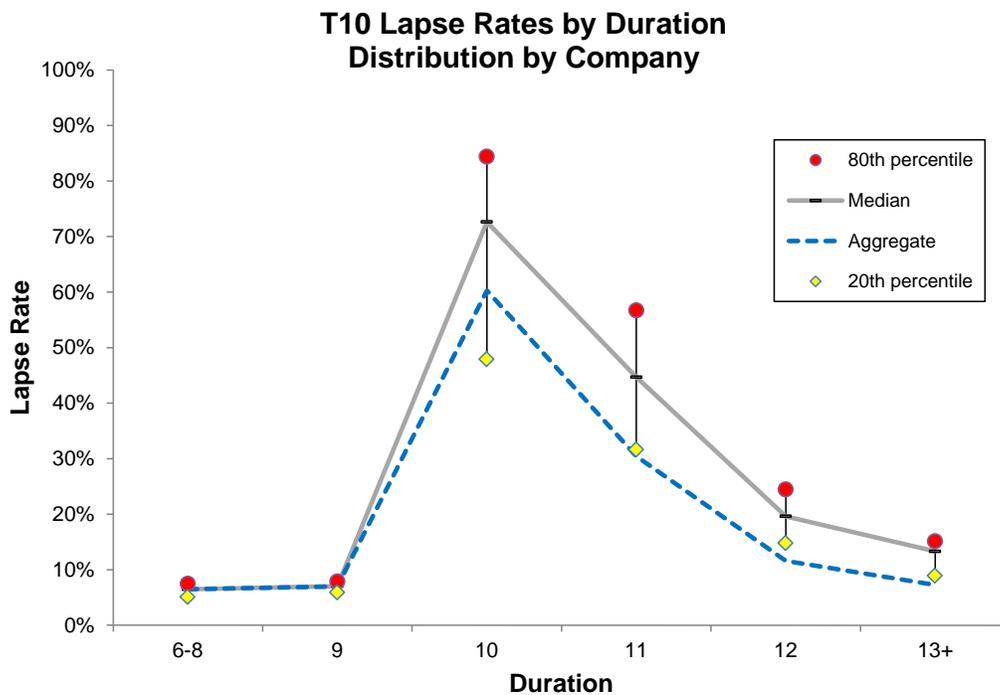
Distribution of Results (cont.)

T10 Jump to ART

When looking at T10 business with a jump to an ART scale only, the aggregate results show less

variation from the median.

Lapse Rate Range	Duration					
	6-8	9	10	11	12	13+
# of Companies	31	29	31	29	17	16
20th percentile	5.1%	6.2%	57.9%	38.0%	16.6%	11.6%
Median	6.7%	7.0%	76.4%	47.1%	19.7%	13.5%
Aggregate	6.9%	7.3%	69.9%	40.2%	17.2%	11.7%
80th percentile	7.6%	8.3%	86.3%	57.9%	23.8%	16.5%

Companies with 100 or more lapses in given duration

**T10 Jump to ART
Lapse Rates by Duration
Distribution by Company**

RGA Reinsurance Company
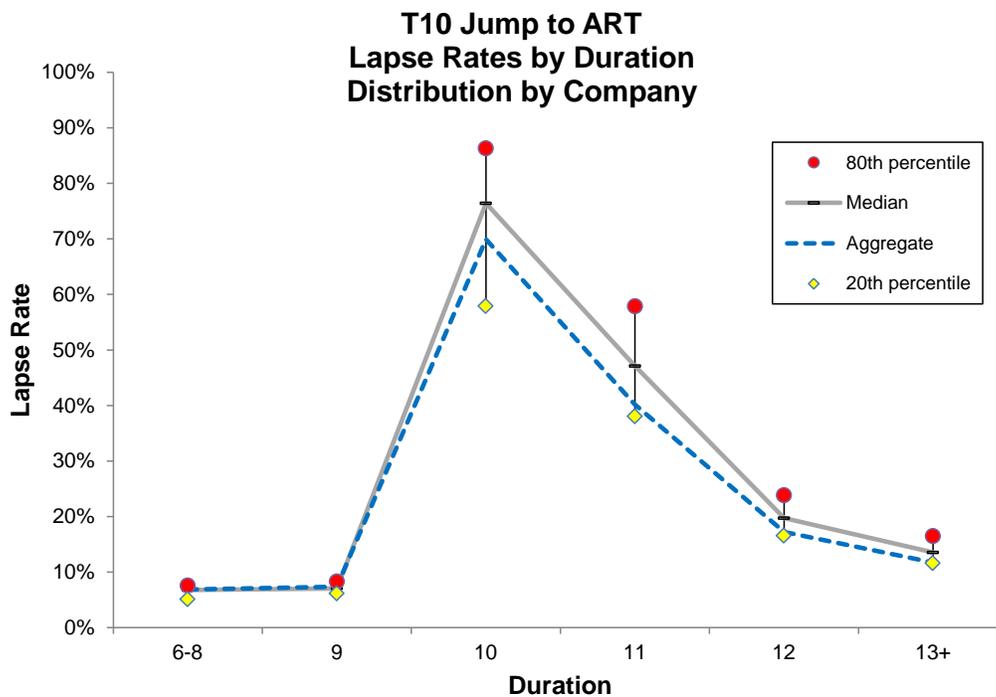
Distribution of Results (cont.)

T15 (All)

The number of companies contributing T15 business is much smaller than that of T10, leading to a much

smaller spread of results. In addition, there are very few companies who provided T15 business with a

"Jump to Other" post-level premium structure.

Lapse Rate Range	Duration			
	11-14	15	16	17+
# of Companies	17	9	4	3
20th percentile	3.4%	54.8%	**	**
Median	3.9%	67.6%	39.8%	16.1%
Aggregate	4.0%	72.0%	32.4%	8.6%
80th percentile	4.3%	76.2%	**	**

Companies with 100 or more lapses in given duration

** *Insufficient Data*

T15 Lapse Rates by Duration
Distribution by Company
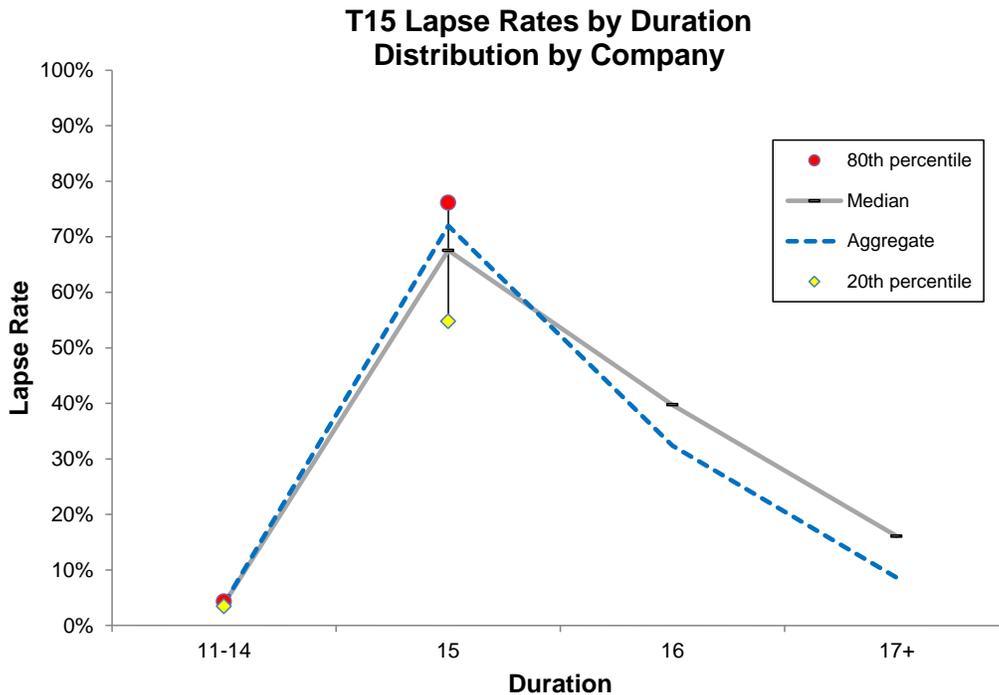
Post-Level Period Premium Structure

<u>T10 (All)</u>

The dominant post-level premium structure is "Premium Jump to ART", although there are multiple companies with credible lapse experience for "Jump to Other" beyond duration 16. Phase 1 Survey results indicate that the "Premium Jump to ART" design is overwhelmingly the predominant structure used for new products. In total, "Jump to Other" products experienced lower shock lapse rates than those jumping to a new ART scale.

Policy Duration	Policy-Years Exposed		Total Lapses		Lapse Rate	
	Jump to ART	Jump to Other	Jump to ART	Jump to Other	Jump to ART	Jump to Other
6-8	3,033,218	679,945	208,316	33,421	6.9%	4.9%
9	845,701	203,080	62,055	11,091	7.3%	5.5%
10	693,591	191,160	484,987	48,429	69.9%	25.3%
11	178,032	139,281	71,486	25,175	40.2%	18.1%
12	91,330	108,489	15,733	7,398	17.2%	6.8%
13	62,616	94,848	8,371	5,117	13.4%	5.4%
14	40,029	83,213	4,866	3,819	12.2%	4.6%
15	21,186	69,333	2,290	3,034	10.8%	4.4%
16+	38,026	157,720	3,415	10,217	9.0%	6.5%
Grand Total	5,003,729	1,727,069	861,519	147,701		

T10 Lapse Rates by Duration and Post-Level Period Premium Structure

RGA Reinsurance Company
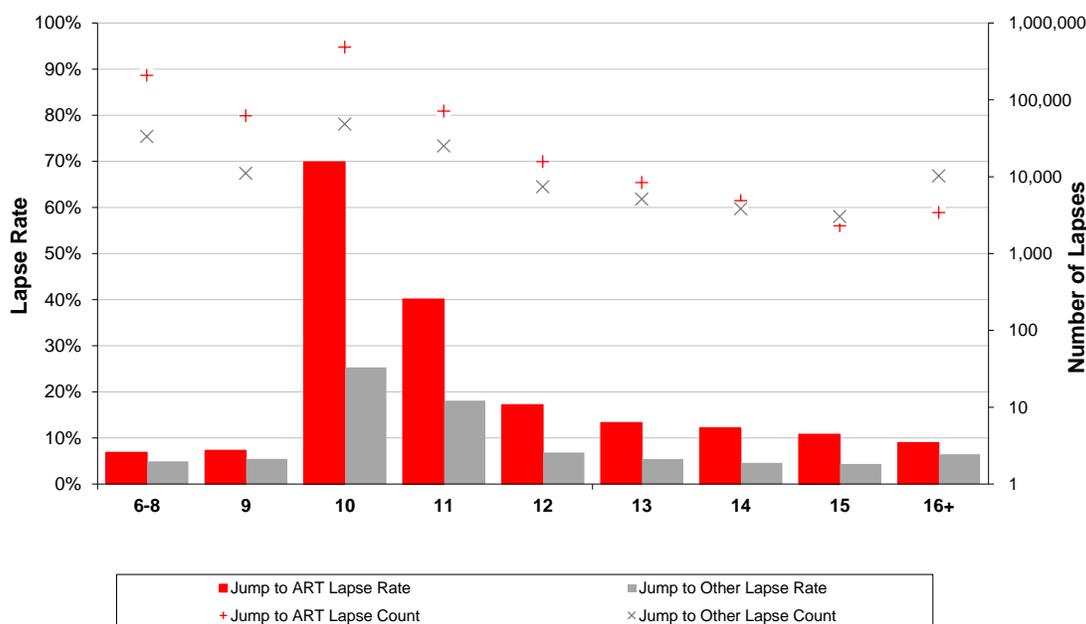
Premium Jump Ratio

T10

Since the shock lapse is primarily driven by the dramatic increase in premiums that a policyholder would have to pay to keep his or her policy in force, it stands to reason that policies with larger premium jumps also have larger shock lapses. To study this, the researchers asked participants to supply the level period and post-level period per-thousand premium rates for each policy record. Usable premium data was provided by 30 participating companies, representing approximately 63% of the T10 duration 10 exposure. For each policy, the researchers calculated a "Premium Jump Ratio" as the ratio of the duration 11 per thousand rate to the duration 10 per thousand rate. The lapse rate experience was then stratified into bands by premium jump ratio. For example, "1.01x – 2x" in the charts on the following pages represents policies with a duration 11 premium rate between one and two times the premium rate in duration 10.

It is clear that policies with lower premium jump ratios experienced significantly lower shock lapses than policies with larger premium jump ratios. This is particularly relevant when considering how to apply the results from this experience study to current pricing. As seen in the Phase 1 survey, a common current practice is to set post-level period premium rates at 200% of 2001 CSO or higher. This would generally lead to much higher premium jumps on average than those policies in this study that have already entered the post-level period. As a result, the researchers expect the shock lapse experience that eventually emerges on recently issued business could be much higher than the aggregated totals from this study suggest.

The results on the following pages provide a calculation of the "Average Prem Jump Ratio" and the "Average Issue Age". The average premium jump obviously ends up near the midpoint of each premium jump ratio band. As mentioned earlier, issue age is strongly correlated with premium jump ratio.

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Premium Jump Ratio (cont.)

T10 All

Lapse rates by premium jump are presented below by amount and count. Lapse rates increase steadily as the premium jump ratio increases. However, lapse rates do begin to level out just below 100% at the highest premium jump levels.

Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate Count	Duration 10 Lapse Rate Amount	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 2x	74,714	12,390	16.6%	21.0%	1.6	31.9
2.01x - 3x	157,487	48,129	30.6%	34.1%	2.5	39.6
3.01x - 4x	67,698	35,451	52.4%	57.4%	3.4	41.5
4.01x - 5x	43,675	28,427	65.1%	67.4%	4.5	42.7
5.01x - 6x	36,639	27,979	76.4%	77.5%	5.5	44.4
6.01x - 7x	34,346	28,156	82.0%	83.1%	6.5	46.6
7.01x - 8x	29,096	24,430	84.0%	86.0%	7.4	46.4
8.01x - 9x	21,638	18,437	85.2%	87.4%	8.5	45.8
9.01x - 10x	19,723	17,072	86.6%	88.9%	9.5	46.5
10.01x-12x	29,176	25,855	88.6%	90.6%	11.0	47.0
12.01x-14x	18,836	16,799	89.2%	90.8%	12.9	47.6
14.01x-16x	16,836	15,114	89.8%	89.1%	15.0	47.2
16.01x-18x	7,788	7,186	92.3%	92.5%	16.9	49.5
18.01x-20x	6,834	6,362	93.1%	92.9%	18.9	48.6
20.01x-22x	3,332	3,094	92.9%	92.7%	20.8	52.2
22.01x-24x	2,504	2,363	94.4%	94.0%	23.1	51.1
24.01x +	7,349	6,915	94.1%	93.0%	27.9	53.7
Subtotal Prem Data Available	577,672	324,159	56.1%	64.0%	5.8	42.0
No Prem Data Available	307,079	209,257	68.1%	75.4%	n/a	38.8
Grand Total	884,751	533,416	60.3%	67.4%	n/a	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available
(2) Weighted Average issue age by duration 10 exposure

T10 Duration 10 Lapse Rate
by Duration 11/10 Premium Jump Ratio
Count vs Amount

RGA Reinsurance Company
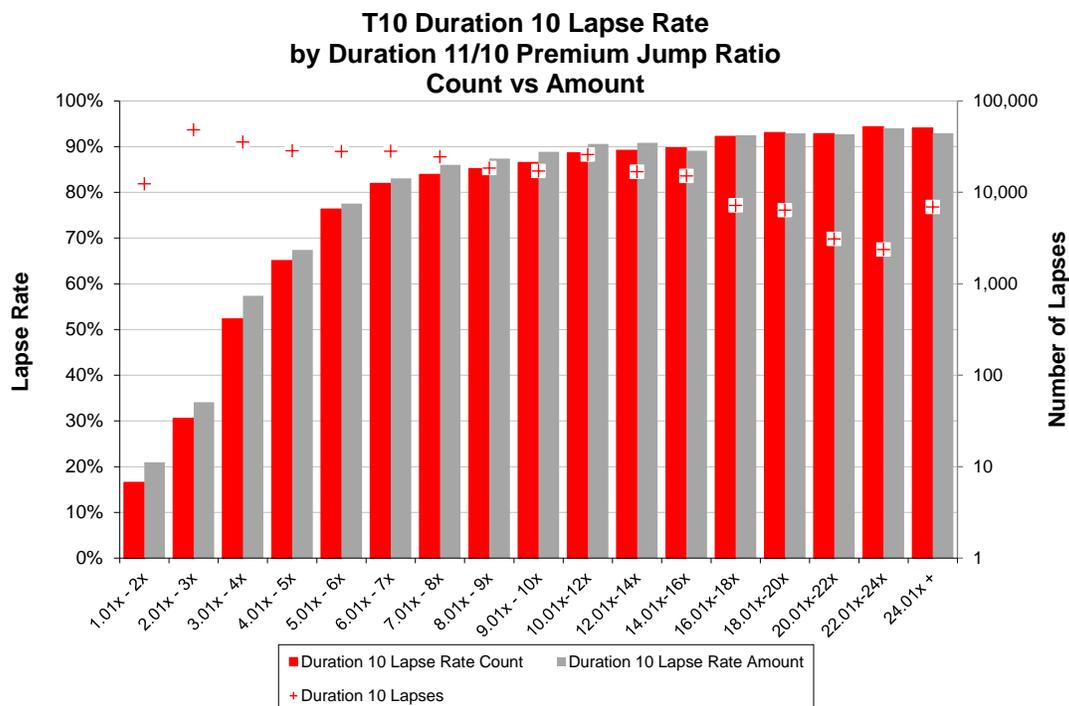
Premium Jump Ratio (cont.)

T10 Jump to ART

T10 products with a jump to ART experience the same trend as the overall T10 results.

Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate Count	Duration 10 Lapse Rate Amount	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 2x	21,761	5,896	27.1%	30.8%	1.7	33.2
2.01x - 3x	54,168	23,257	42.9%	43.2%	2.5	39.4
3.01x - 4x	42,180	22,272	52.8%	54.9%	3.5	38.1
4.01x - 5x	40,768	26,612	65.3%	67.4%	4.5	41.9
5.01x - 6x	36,023	27,518	76.4%	77.6%	5.5	44.2
6.01x - 7x	34,229	28,056	82.0%	83.1%	6.5	46.6
7.01x - 8x	29,006	24,350	83.9%	86.0%	7.4	46.4
8.01x - 9x	21,584	18,387	85.2%	87.4%	8.5	45.7
9.01x - 10x	19,671	17,024	86.5%	88.9%	9.5	46.4
10.01x-12x	29,076	25,759	88.6%	90.6%	11.0	46.9
12.01x-14x	18,796	16,761	89.2%	90.8%	12.9	47.6
14.01x-16x	16,823	15,101	89.8%	89.1%	15.0	47.2
16.01x-18x	7,784	7,183	92.3%	92.5%	16.9	49.4
18.01x-20x	6,834	6,362	93.1%	92.9%	18.9	48.6
20.01x-22x	3,332	3,094	92.9%	92.7%	20.8	52.2
22.01x-24x	2,504	2,363	94.4%	94.0%	23.1	51.1
24.01x +	7,349	6,915	94.1%	93.0%	27.9	53.7
Subtotal Prem Data Available	391,891	276,910	70.7%	75.3%	7.4	43.6
No Prem Data Available	301,700	208,077	69.0%	76.0%	n/a	38.9
Grand Total	693,591	484,987	69.9%	75.6%	n/a	41.5

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
Duration 10 Lapse Rate by Duration 11/10 Premium Jump Ratio
Count vs Amount

RGA Reinsurance Company
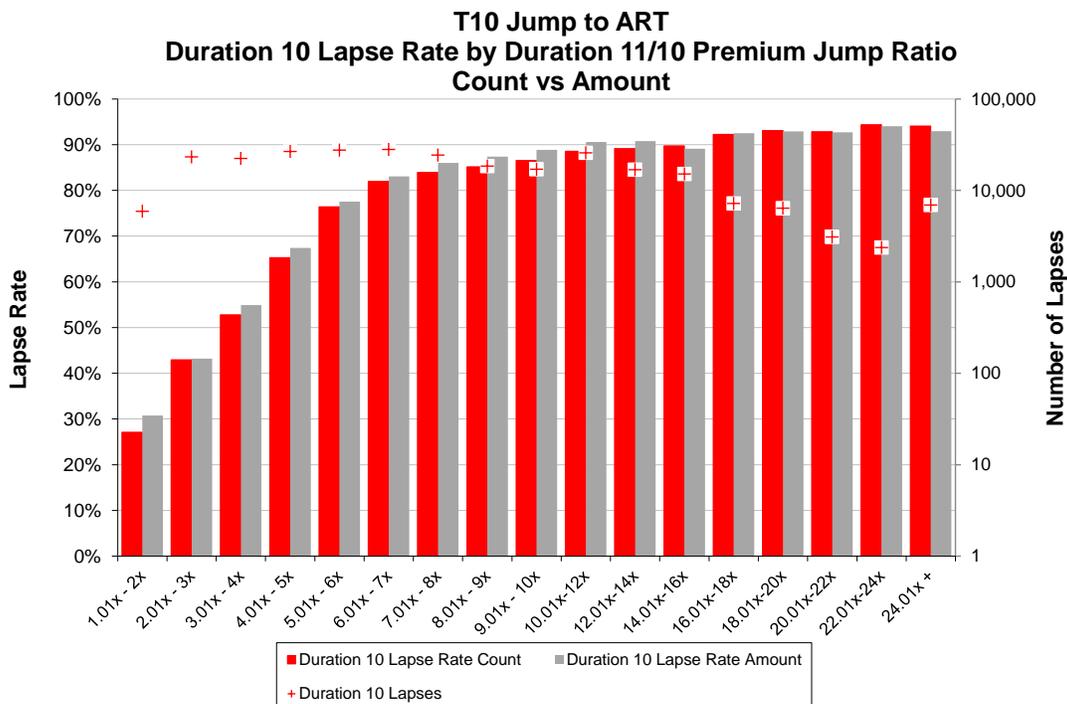
Premium Jump Ratio (cont.)

T15 (All)

The pattern of T15 experience is very similar to that of T10, although the shock lapse appears to be slightly lower at the higher premium jumps.

Duration 16/15 Premium Jump Ratio Band	Policy-Years Exposed	Duration 15 Lapses	Duration 15 Lapse Rate Count	Duration 15 Lapse Rate Amount	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 3x	2,688	709	26.4%	28.4%	2.3	33.2
3.01x - 4x	2,921	1,414	48.4%	50.7%	3.5	38.4
4.01x - 5x	3,515	2,176	61.9%	64.0%	4.5	41.5
5.01x - 6x	4,731	3,437	72.7%	74.4%	5.5	42.7
6.01x - 7x	5,428	4,215	77.7%	79.1%	6.5	45.8
7.01x - 8x	3,509	2,755	78.5%	80.7%	7.5	47.7
8.01x - 9x	2,817	2,246	79.7%	79.4%	8.5	46.8
9.01x - 10x	2,266	1,785	78.8%	78.9%	9.5	46.7
10.01x-12x	5,931	4,674	78.8%	78.9%	11.1	46.8
12.01x-14x	1,984	1,656	83.5%	83.2%	12.9	48.4
14.01x-16x	2,357	1,981	84.1%	82.3%	14.9	44.4
16.01x +	4,279	3,803	88.9%	90.1%	18.8	44.5
Subtotal Prem Data Available	42,425	30,851	72.7%	76.7%	8.8	44.1
No Prem Data Available	1,917	1,069	55.8%	63.7%	n/a	39.7
Grand Total	44,341	31,920	72.0%	76.3%	n/a	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Duration 16 Lapse Rate
by Duration 16/15 Premium Jump Ratio
Count vs Amount

RGA Reinsurance Company
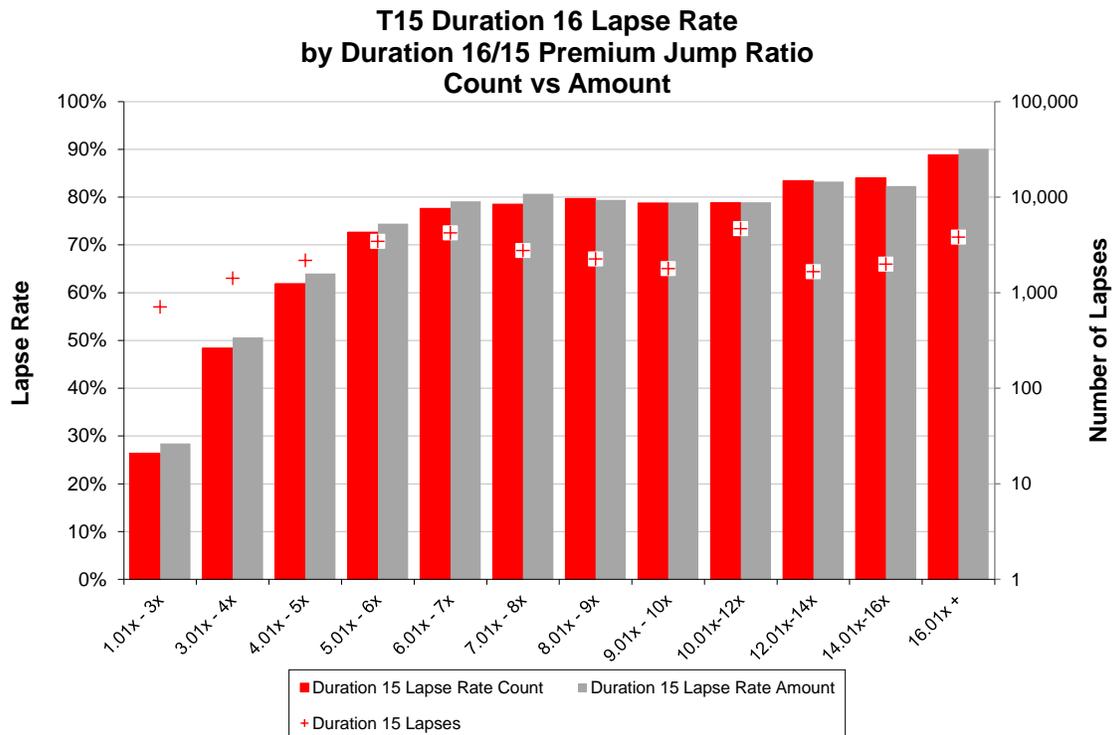
Premium Jump Ratio and Duration

T10 All

When comparing the initial premium jump to the lapse rates in durations 10, 11 and 12, there is an increasing trend in lapse rates as the premium jump increases for all three durations. In addition, the relationship of the lapse rate in duration 11 to duration 10 and lapse rate in duration 12 to duration 11 was also analyzed. The two lines illustrated in the chart below show the ratio of lapse rates is relatively level by premium jump. It is important to note the "Dur 11 / Dur 10" total of 50.5% is much smaller than the individual premium jump bands, which range from 70.5% to 87.1%, due to more exposure in duration 11 at lower premium jump levels.

Duration 11/10 Premium Jump Ratio Band	Duration 10 Lapses	Duration 11 Lapses	Duration 12 Lapses	Duration 10 Lapse Rate	Duration 11 Lapse Rate	Duration 12 Lapse Rate	Dur 11 / Dur 10	Dur 12 / Dur 11	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 2x	12,390	8,084	3,639	16.6%	13.4%	7.2%	80.6%	53.9%	1.6	31.9
2.01x - 3x	48,129	23,609	6,228	30.6%	22.9%	8.6%	74.8%	37.5%	2.5	39.6
3.01x - 4x	35,451	10,905	2,398	52.4%	37.3%	15.0%	71.2%	40.3%	3.4	41.5
4.01x - 5x	28,427	6,670	1,307	65.1%	47.2%	19.8%	72.6%	41.9%	4.5	42.7
5.01x - 6x	27,979	4,107	734	76.4%	53.9%	24.0%	70.5%	44.5%	5.5	44.4
6.01x - 7x	28,156	3,083	460	82.0%	60.0%	26.3%	73.2%	43.8%	6.5	46.6
7.01x - 8x	24,430	2,226	320	84.0%	61.1%	27.8%	72.8%	45.5%	7.4	46.4
8.01x - 9x	18,437	1,506	204	85.2%	63.3%	28.7%	74.3%	45.3%	8.5	45.8
9.01x - 10x	17,072	1,258	161	86.6%	67.9%	37.3%	78.4%	54.9%	9.5	46.5
10.01x-12x	25,855	1,584	167	88.6%	70.1%	34.7%	79.1%	49.5%	11.0	47.0
12.01x-14x	16,799	909	82	89.2%	71.0%	35.0%	79.7%	49.3%	12.9	47.6
14.01x-16x	15,114	839	93	89.8%	74.4%	42.3%	82.9%	56.8%	15.0	47.2
16.01x +	25,920	570	39	93.2%	81.2%	45.7%	87.1%	56.3%	21.4	50.8
Subtotal Prem Data Available	324,159	65,350	15,832	56.1%	28.0%	10.3%	50.0%	36.7%	5.8	42.0
No Prem Data Available	209,257	31,311	7,299	68.1%	37.2%	15.9%	54.6%	42.7%	n/a	38.8
Grand Total	533,416	96,661	23,131	60.3%	30.5%	11.6%	50.5%	38.0%	n/a	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

**T10 Lapse Rate
by Duration 11/10 Premium Jump Ratio**
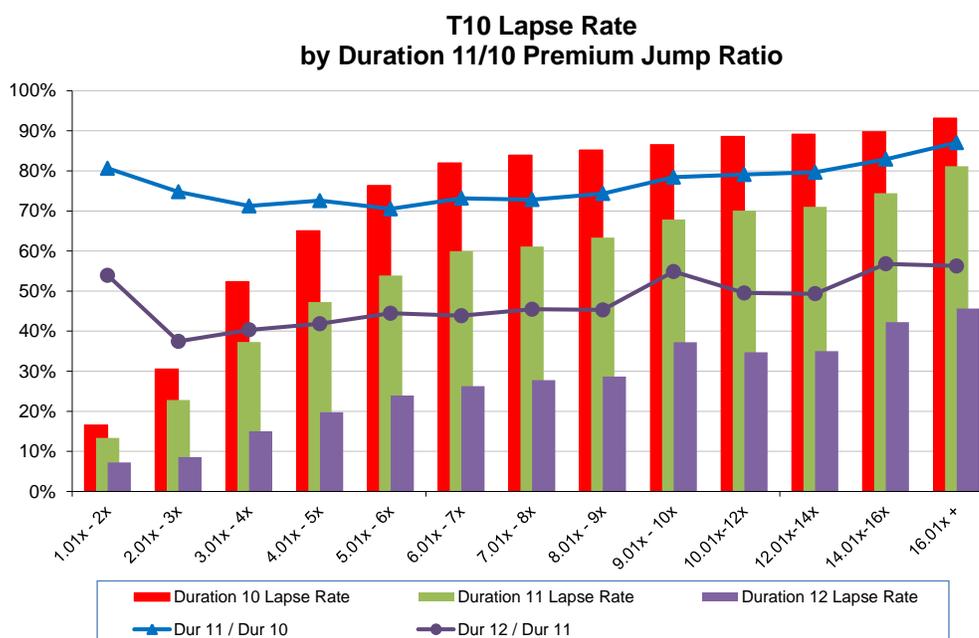
Premium Jump Ratio and Duration (cont.)

T10 Jump to ART

For T10 business with a jump to ART, the same trends can be seen when looking at both lapse rates by

duration and the ratio of lapse rates between durations.

Duration 11/10 Premium Jump Ratio Band	Duration 10 Lapses	Duration 11 Lapses	Duration 12 Lapses	Duration 10 Lapse Rate	Duration 11 Lapse Rate	Duration 12 Lapse Rate	Dur 11 / Dur 10	Dur 12 / Dur 11	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 2x	5,896	3,020	1,270	27.1%	21.5%	12.8%	79.5%	59.5%	1.7	33.2
2.01x - 3x	23,257	8,879	2,267	42.9%	33.1%	15.4%	77.0%	46.7%	2.5	39.4
3.01x - 4x	22,272	7,163	1,731	52.8%	38.7%	17.3%	73.2%	44.9%	3.5	38.1
4.01x - 5x	26,612	6,248	1,234	65.3%	47.7%	20.4%	73.1%	42.7%	4.5	41.9
5.01x - 6x	27,518	3,929	694	76.4%	53.9%	24.5%	70.5%	45.4%	5.5	44.2
6.01x - 7x	28,056	3,038	454	82.0%	60.2%	27.2%	73.5%	45.1%	6.5	46.6
7.01x - 8x	24,350	2,197	316	83.9%	61.5%	28.4%	73.2%	46.3%	7.4	46.4
8.01x - 9x	18,387	1,495	203	85.2%	63.5%	29.1%	74.5%	45.9%	8.5	45.7
9.01x - 10x	17,024	1,255	158	86.5%	68.1%	37.2%	78.7%	54.7%	9.5	46.4
10.01x-12x	25,759	1,579	167	88.6%	70.1%	34.8%	79.1%	49.7%	11.0	46.9
12.01x-14x	16,761	908	82	89.2%	71.1%	35.1%	79.7%	49.4%	12.9	47.6
14.01x-16x	15,101	839	93	89.8%	74.4%	42.3%	82.9%	56.8%	15.0	47.2
16.01x +	25,917	570	39	92.9%	79.9%	47.7%	86.0%	59.8%	19.0	49.8
Subtotal Prem Data Available	276,910	41,120	8,708	70.7%	42.0%	18.0%	59.4%	42.9%	7.4	43.6
No Prem Data Available	208,077	30,366	7,025	69.0%	37.9%	16.4%	55.0%	43.1%	n/a	38.9
Grand Total	484,987	71,486	15,733	69.9%	40.2%	17.2%	57.4%	42.9%	n/a	41.5

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
Lapse Rate
by Duration 11/10 Premium Jump Ratio
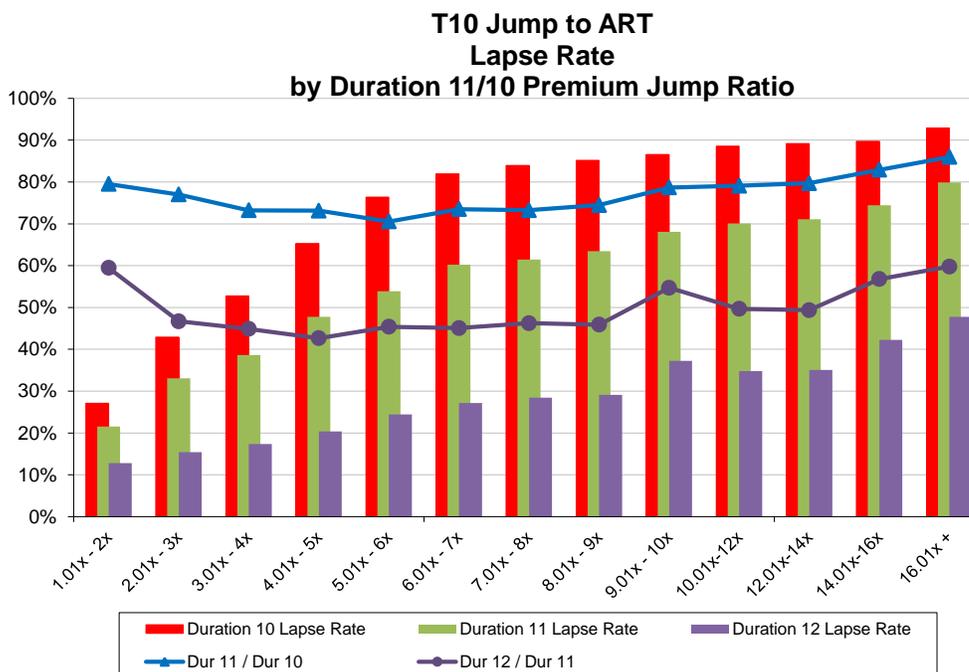
Premium Jump Ratio and Duration (cont.)

T15 (All)

Consistent with T10, T15 also experiences increasing lapse rates within each post-level duration when comparing to the premium jump at the end of duration 15. Additionally, the ratio of lapse rates in duration 16 to duration 15 as well as duration 17 to duration 16 also seems to hold a relatively steady pattern, although results are not as credible as T10.

Duration 16/15 Premium Jump Ratio Band	Duration 15 Lapses	Duration 16 Lapses	Duration 17 Lapses	Duration 15 Lapse Rate	Duration 16 Lapse Rate	Duration 17 Lapse Rate	Dur 16 / Dur 15	Dur 17 / Dur 16	Average Prem Jump Ratio [1]	Average Issue Age [2]
1.01x - 2x	120	92	57	15.4%	9.0%	4.8%	58.3%	52.9%	1.6	29.4
2.01x - 3x	589	324	165	30.8%	15.8%	7.2%	51.3%	45.7%	2.6	34.7
3.01x - 4x	1,414	445	107	48.4%	24.3%	6.8%	50.2%	27.9%	3.5	38.4
4.01x - 5x	2,176	480	101	61.9%	34.1%	11.2%	55.1%	32.8%	4.5	41.5
5.01x - 6x	3,437	433	90	72.7%	40.0%	17.8%	55.0%	44.5%	5.5	42.7
6.01x - 7x	4,215	424	80	77.7%	44.4%	20.1%	57.2%	45.2%	6.5	45.8
7.01x - 8x	2,755	230	37	78.5%	42.4%	14.8%	54.0%	35.0%	7.5	47.7
8.01x - 9x	2,246	200	40	79.7%	47.9%	21.1%	60.1%	43.9%	8.5	46.8
9.01x - 10x	1,785	203	31	78.8%	53.8%	20.9%	68.4%	38.8%	9.5	46.7
10.01x-12x	4,674	505	107	78.8%	51.2%	24.3%	65.0%	47.4%	11.1	46.8
12.01x-14x	1,656	107	4	83.5%	66.3%	*	79.4%	*	12.9	48.4
14.01x-16x	1,981	82	1	84.1%	62.1%	*	73.9%	*	14.9	44.4
16.01x +	3,803	107	0	88.9%	67.5%	*	75.9%	*	18.8	44.5
Subtotal Prem Data Available	30,851	3,632	820	72.7%	32.7%	10.4%	44.9%	31.7%	8.8	44.1
No Prem Data Available	1,069	162	45	55.8%	27.5%	10.3%	49.3%	37.7%	n/a	39.7
Grand Total	31,920	3,794	865	72.0%	32.4%	10.4%	45.0%	32.0%	n/a	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

  * Insufficient data

**T15 Lapse Rate
by Duration 16/15 Premium Jump Ratio**

RGA Reinsurance Company
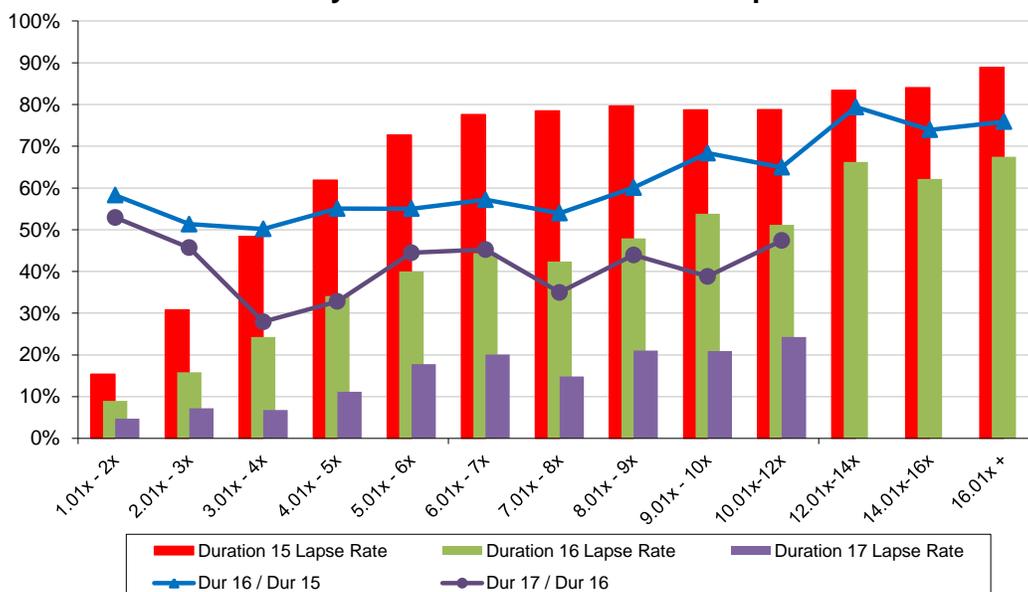
Premium Jump Ratio and Post-Level Period Premium Structure

<u>T10 (All)</u>

Both the "Jump to ART" and the "Jump to Other" product designs have shock lapses that generally increase with the size of the premium jump. The products with a "Jump to Other" experienced lower shock lapses than those that jumped to an ART scale below a 6x jump. Results are relatively thin above a 6x jump for "Jump to Other" business. It is interesting to note that the average issue age increases significantly as premium jump increases for "Jump to Other" business compared to business with a jump to ART. The quickly increasing average issue age for "Jump to Other" is driven primarily by business with a jump to a new level period. For this business, as issue age increases, the premium jump increases more dramatically in order to support the entire new level period.

Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed		Total Lapses		Lapse Rate		Average Prem Jump Ratio [1]		Average Issue Age [2]	
	Jump to ART	Jump to Other	Jump to ART	Jump to Other	Jump to ART	Jump to Other	Jump to ART	Jump to Other	Jump to ART	Jump to Other
1.01x - 2x	21,761	52,952	5,896	6,494	27.1%	12.3%	1.7	1.6	33.2	31.4
2.01x - 3x	54,168	103,318	23,257	24,872	42.9%	24.1%	2.5	2.5	39.4	39.7
3.01x - 4x	42,180	25,519	22,272	13,179	52.8%	51.6%	3.5	3.3	38.1	47.1
4.01x - 5x	40,768	2,907	26,612	1,815	65.3%	62.4%	4.5	4.4	41.9	53.8
5.01x - 6x	36,023	616	27,518	461	76.4%	74.8%	5.5	5.3	44.2	55.9
6.01x - 7x	34,229	117	28,056	100	82.0%	85.5%	6.5	6.5	46.6	54.6
7.01x - 8x	29,006	90	24,350	80	83.9%	88.9%	7.4	7.5	46.4	56.5
8.01x - 9x	21,584	54	18,387	50	85.2%	93.2%	8.5	8.5	45.7	58.6
9.01x - 10x	19,671	52	17,024	48	86.5%	92.3%	9.5	9.4	46.4	60.0
10.01x-11x	13,411	37	11,867	34	88.5%	91.9%	10.5	10.5	46.7	65.8
11.01x - 12x	15,666	63	13,892	62	88.7%	98.4%	11.5	11.4	47.2	67.3
12.01x+	63,423	57	57,779	54	91.1%	95.3%	17.1	13.5	48.9	69.8
Subtotal Data Available	391,891	185,781	276,910	47,249	70.7%	25.4%	7.4	2.4	43.6	38.7
No Prem Data Available	301,700	5,379	208,077	1,180	69.0%	21.9%	n/a	n/a	38.9	36.5
Grand Total	693,591	191,160	484,987	48,429	69.9%	25.3%	n/a	n/a	41.5	38.6

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available
(2) Weighted Average issue age by duration 10 exposure

T10 Duration 10 Lapse Rates by Duration 11/10 Premium Jump Ratio and Post-Level Premium Structure

RGA Reinsurance Company
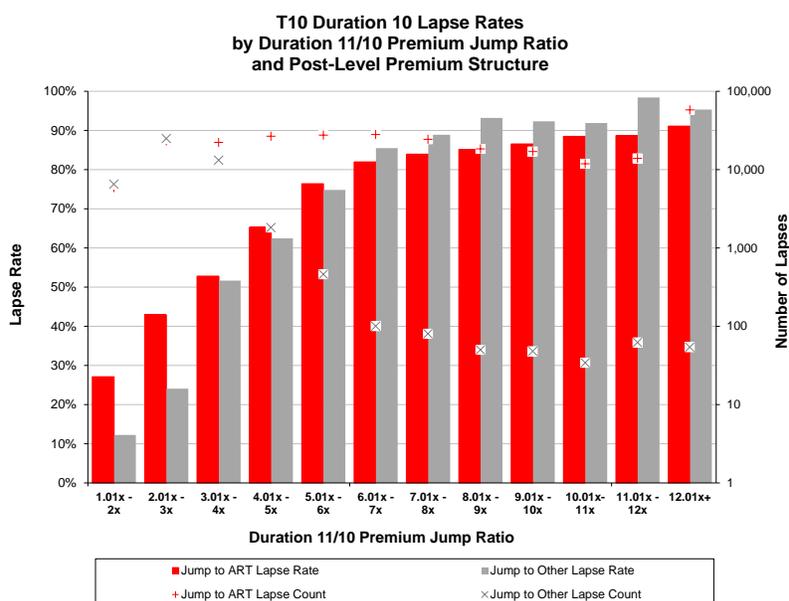
Average Premium Jump by Company

T10 (All)

A wide spread of shock lapse results is seen from company to company. This is attributable to a number of company-specific factors including product design, target market, age distribution, and policyholder retention programs. The following chart shows the company-specific duration 10 shock lapse as a function of the average premium jump ratio between durations 10 and 11 for each company that provided premium information. The data below matches well with the previous charts showing lapse rate by premium jump. In general, companies with higher average premium jumps experienced higher shock lapses with some leveling toward the highest jumps. A logarithmic trend line has been added to the graph below only to aid the visual display.

**T10 Duration 10 Lapse Rates
by Average Premium Jump Ratio**
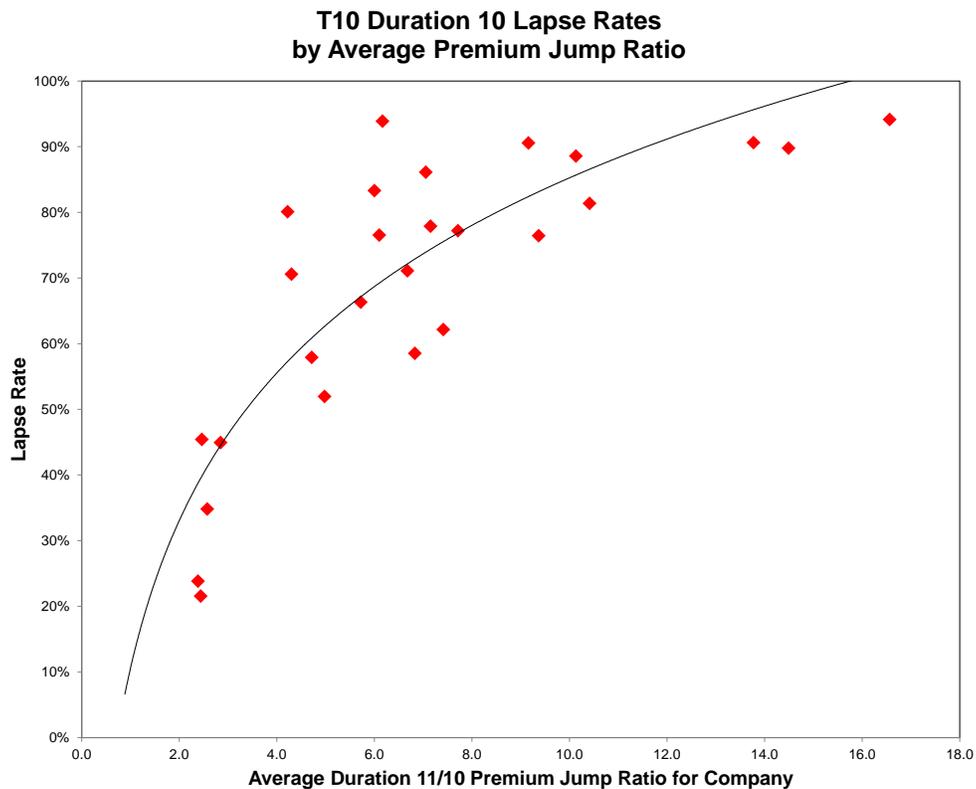
Premium Jump Ratio by Company

<u>T10</u>

One possible concern might be that companies are represented disproportionately along different parts of the premium jump ratio spectrum. This is a valid concern given the wide spread of company-specific experience results and the differences between various companies' gross premium rates and product structures. To determine whether company mix was creating the trends displayed in the prior pages, each company's specific results were plotted by premium jump ratio.

The two graphs on the following page plot company-specific lapse rates at each premium jump level. The first graph requires a minimum of 100 lapses at any given point and the second requires 1,000 lapses at any given point. While there can be significant differences by individual company, the general trend of both graphs is consistent with what has been demonstrated in previous pages. Lapse rates increase very quickly at the lowest premium jumps, begin to level off as jumps begin to increase, and then level off at the highest premium jump levels.

RGA Reinsurance Company

T10 (All)

**T10 Duration 10 Shock Lapse by
Premium Ratio and Company (minimum of 100 lapses)**

**T10 Duration 10 Shock Lapse by
Premium Ratio and Company (minimum of 1,000 lapses)**

RGA Reinsurance Company

Lapse Skewness

Similar to the 2010 Post-Level Term study, analysis was completed in order to help quantify how lapses were skewed by month before and after the shock lapse. Results from the Phase 1 Survey for the year of the shock were primarily consistent, with most companies assuming lapses occur at or near the end of the policy year. Results during the post-level period in the survey varied.

The below charts, taken from the Phase 1 survey, illustrate these results.

Monthly Lapse Skewness During Level Premium Period	
Response	Respondents
Lapses are uniformly distributed	18
Lapses occur on premium payment modes	10
Lapses occur at the end of the year	7
Other	4
No response	5

Monthly Lapse Skewness During Year of Shock Lapse	
Response	Respondents
Lapses are uniformly distributed	5
Lapses occur on premium payment modes	3
Lapses occur at the end of the year	17
Lapses graded toward end of the year with shock in month 12	12
No response	7

Monthly Lapse Skewness During Post-Level Period	
Response	Respondents
Lapses are uniformly distributed	6
Lapses occur on premium payment modes	7
Lapses occur at the end of the year	9
Lapses skewed to the beginning of L+1, Uniform thereafter	8
No response	14

<u>Lapse Skewness (cont.)</u>

The tables and charts on the following pages show the proportion of T10 lapses within each policy month of lapse. Since the grace period adjustments to lapse dates that were made for some companies, as discussed earlier, could potentially affect this analysis, the results for companies that had grace period adjustments are displayed separately from those without grace period adjustments. The results for these two groups are quite similar, providing additional confirmation of the validity of the adjustments.

In total, it is clear that lapses in duration 10 are skewed heavily toward the end of the policy year. The most significant finding, consistent with the 2010 study, is that duration 11 lapses are skewed heavily toward the beginning of the policy year. This is especially important when considering the portion of duration 11 premium that will be collected. To the extent that the distribution of off-anniversary lapses during the post-level period is different from the level period, this should be an important consideration in developing new business pricing assumptions.

RGA Reinsurance Company

Lapse Skewness (cont.)

T10 (All)

Over 50% of duration 11 lapses occurred in the first three policy months following the policy's 10th anniversary, compared to less than 25% during the first three months of durations 6-9. The monthly distribution of lapses for durations 12+ is similar to the distribution during durations 6-9. Twice as many lapses occur in month 11 of duration 10 compared to month 11 of durations 6-9 in anticipation of the end of the level period.

Grace Period Adjustment?	Lapse Month within Pol Yr	Number of Lapses				Proportion of Lapses			
		Dur 6-9	Dur 10	Dur 11	Dur 12+	Dur 6-9	Dur 10	Dur 11	Dur 12+
Companies	1	16,598	3,647	21,605	4,591	6%	1%	26%	8%
WITHOUT	2	15,131	3,278	11,741	3,932	6%	1%	14%	7%
Termination	3	23,112	5,128	11,856	5,614	9%	1%	14%	10%
Date	4	13,431	3,188	5,406	3,019	5%	1%	6%	5%
Adjustments	5	12,923	3,406	4,138	2,937	5%	1%	5%	5%
	6	25,273	7,158	6,137	5,583	10%	2%	7%	10%
	7	12,483	4,305	2,810	2,644	5%	1%	3%	5%
	8	12,642	6,315	2,425	2,569	5%	1%	3%	5%
	9	20,200	15,226	2,899	3,792	8%	4%	3%	7%
	10	13,503	31,043	2,158	2,711	5%	7%	3%	5%
	11	17,034	65,254	2,514	3,572	7%	15%	3%	6%
	12	73,629	275,935	10,958	15,912	29%	65%	13%	28%
	Total	255,959	423,883	84,647	56,876	100%	100%	100%	100%
Companies	1	3,494	684	3,776	645	6%	1%	31%	9%
WITH	2	3,321	738	1,708	567	6%	1%	14%	8%
Termination	3	5,256	1,098	1,550	668	9%	1%	13%	9%
Date	4	3,141	716	666	441	5%	1%	6%	6%
Adjusted	5	3,182	771	546	384	5%	1%	5%	5%
	6	5,683	1,509	738	645	10%	1%	6%	9%
	7	3,058	927	367	325	5%	1%	3%	4%
	8	3,029	1,654	253	383	5%	2%	2%	5%
	9	5,196	7,636	489	501	9%	7%	4%	7%
	10	3,323	8,049	325	471	6%	7%	3%	6%
	11	4,431	23,302	359	629	8%	21%	3%	9%
	12	15,810	62,449	1,237	1,725	27%	57%	10%	23%
	Total	58,924	109,533	12,014	7,384	100%	100%	100%	100%
Grand Total		314,883	533,416	96,661	64,260				

T10: Lapse Skewness by Month
Companies without Grace Period Adjustments

RGA Reinsurance Company
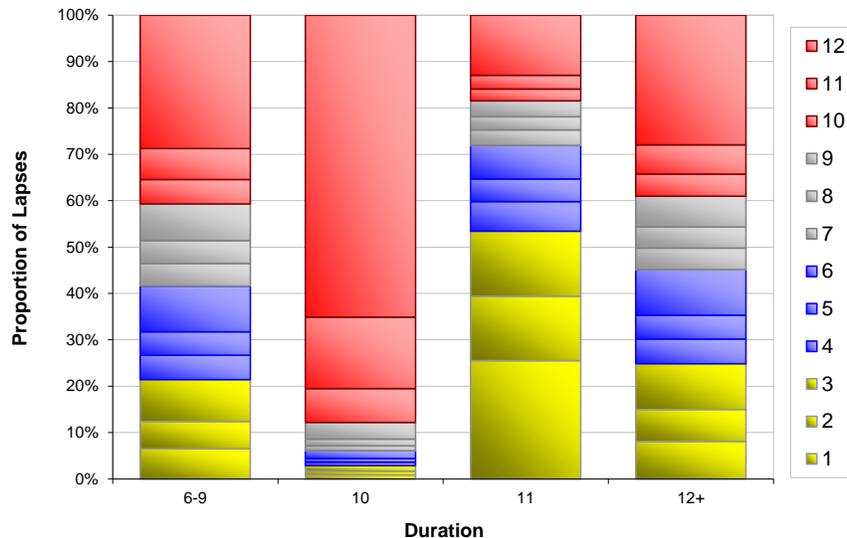
Lapse Skewness (cont.)

T10 (All – Annual Premium Payment Mode)

Premium payment mode is also a fundamental driver of lapse skewness. The following displays cover business that was reported as having an annual premium payment mode. As expected, lapses during the level period are more heavily skewed toward the end of each policy year than for other modes, but a significant portion of duration 11 lapses still occur toward the beginning of the policy year.

T10: Lapse Skewness by Month
Companies without Grace Period Adjustments
Annual Premium Payment Mode
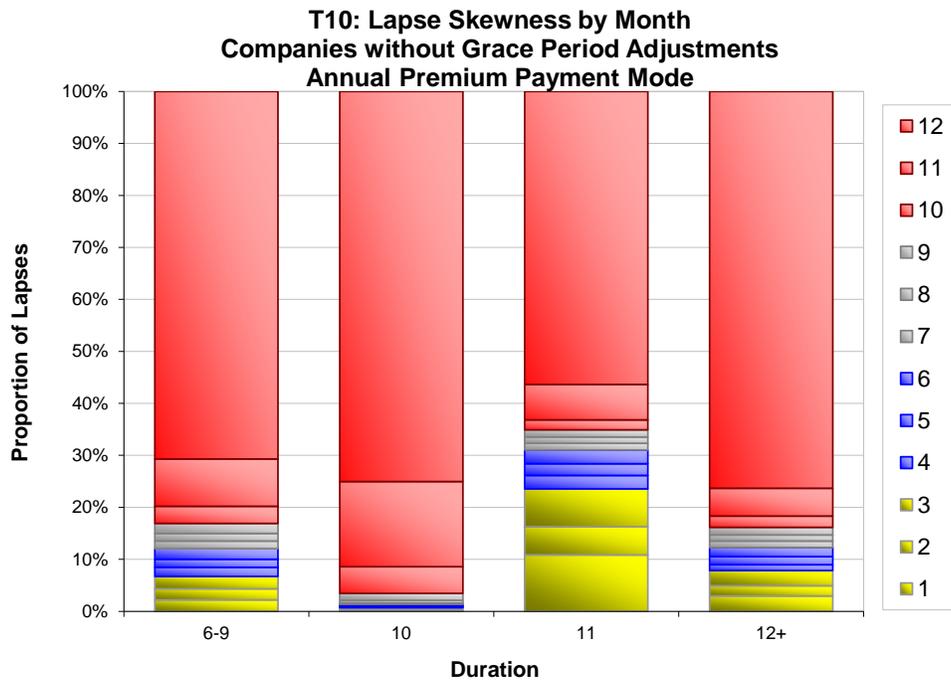
Lapse Skewness (cont.)

T10 (All – Quarterly Premium Payment Mode)

The following displays cover business that was reported as having a quarterly premium payment mode. A spike in lapses is evident after each quarterly premium payment with a large shock lapse at the end of duration 10. Consistent with the other displays, duration 11 lapses are skewed toward the beginning of the policy year.
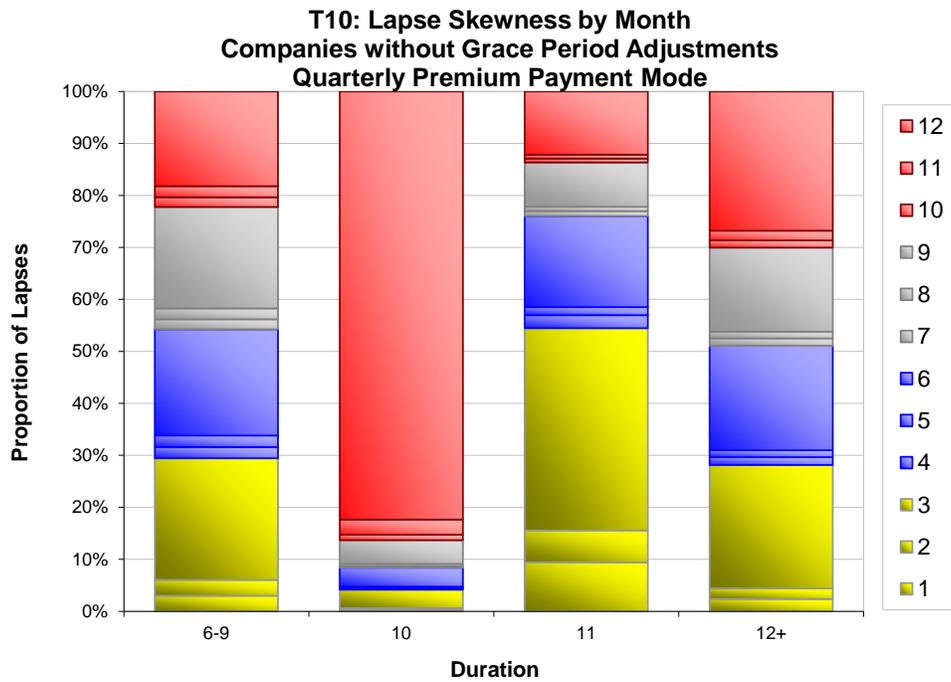
T10: Lapse Skewness by Month
Companies without Grace Period Adjustments
Quarterly Premium Payment Mode

RGA Reinsurance Company

Lapse Skewness (cont.)

T10 (All – Monthly Premium Payment Mode)

The following displays cover business that was reported as having a monthly premium payment mode.

Lapses during the level period are very evenly distributed throughout the policy year. In duration 10,

lapses are skewed toward the end of the policy year with an increase beginning in month 10. In duration

11, lapses are skewed toward the beginning of the policy year.

T10: Lapse Skewness by Month
Companies without Grace Period Adjustments
Monthly Premium Payment Mode
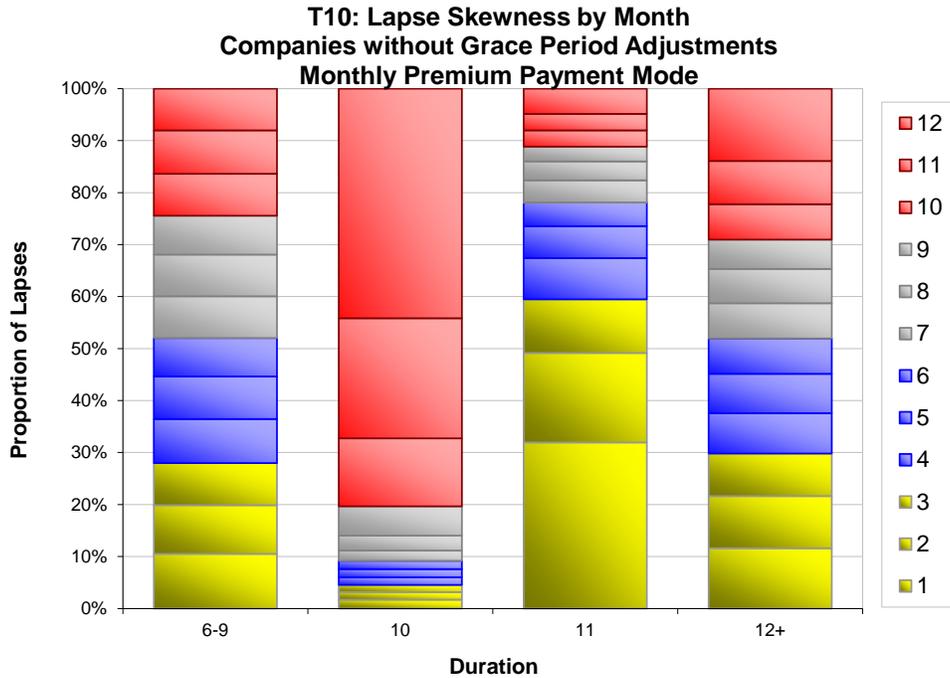
Lapse Skewness (cont.)

While the distribution of the number of lapses paints a directionally correct picture of the skewness of lapses by policy month, it is slightly overstated due to the rapidly decreasing exposure associated with extremely high lapse rates. In order to more accurately quantify lapse skewness adjusted for monthly changes in exposure, a monthly lapse study was also completed. This study was a Monthly Anniversary Study, using monthly anniversaries as the exposure period. The following charts compare the lapse skewness by number of lapses to the relative distribution of the monthly lapse rates calculated using this study approach. In the chart below, duration 11 month one had 820 lapses compared to 197 lapses in duration 11 month four, thus the month one segment is 4.2 times larger than the month four segment. Similarly, the duration 11 month one monthly lapse rate was 2.3% compared to 0.6% for duration 11 month four, thus the month one segment is 3.9 times larger than the month four segment. These charts demonstrate that although the decreasing exposure throughout the policy year does influence the skewness, the effect is relatively minor.

T10 (All – Annual Premium Payment Mode)

The difference as a percentage of the total comparing skewness by lapse count and monthly lapse rates is minimal.

T10: Lapse Skewness Comparison
Companies without Grace Period Adjustments
Annual Premium Payment Mode
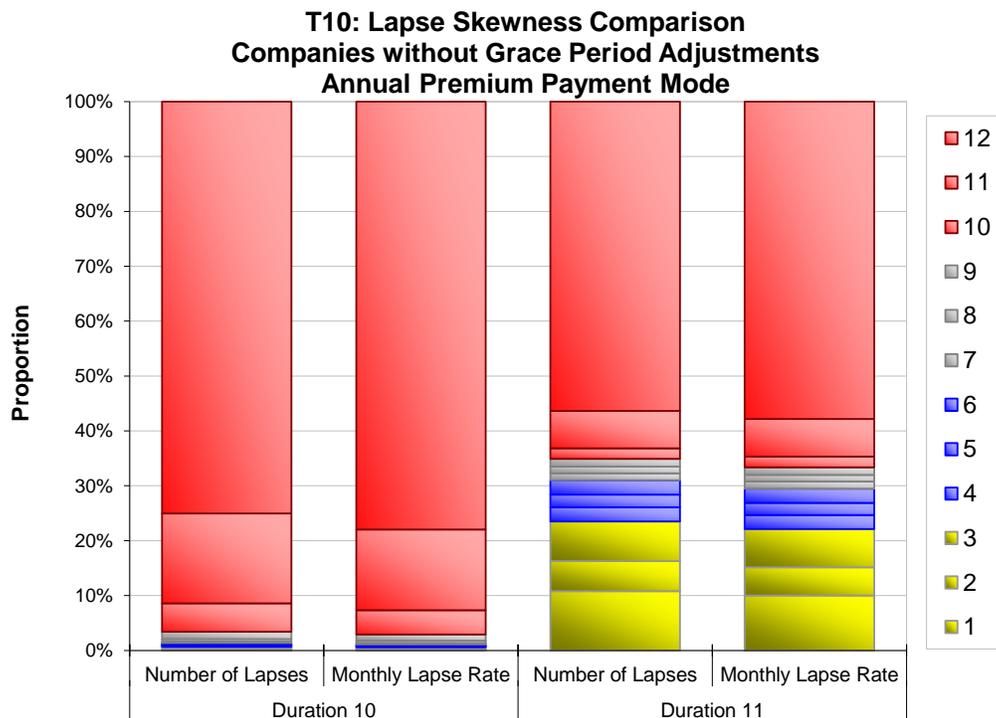
Lapse Skewness (cont.)

<u>T10 (All – Monthly Premium Payment Mode)</u>

Once again, looking at monthly premium mode business, the differences are minimal. Any differences

between the two are due to exposure quickly decreasing in the study due to the very high lapse rates.

RGA Reinsurance Company
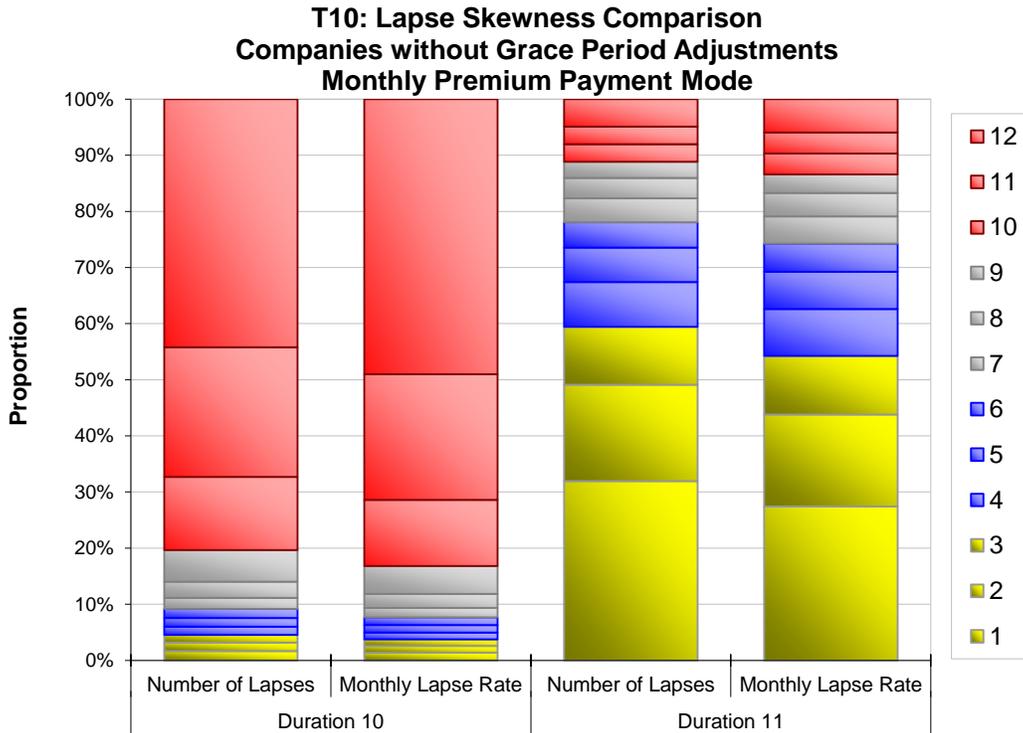
Lapse Skewness (cont.)

As the previous charts have shown, it appears that some of the policyholders that do not lapse at the end of duration 10 may have some form of buyer's remorse, choosing to lapse the policy early in duration 11. Using the lapse rates from monthly lapse study (described on page 34) in place of lapse count, the duration 11 skewness was analyzed to determine whether certain policy attributes might have an effect on the level of lapses early in Duration 11.

T10 (All – Annual Premium Payment Mode)

When skewness is analyzed by premium jump, there does appear to be an increasing trend in early duration 11 lapses.

T10 Duration 11: Lapse Skewness by Premium Jump
Companies without Grace Period Adjustments
Annual Premium Payment Mode

RGA Reinsurance Company
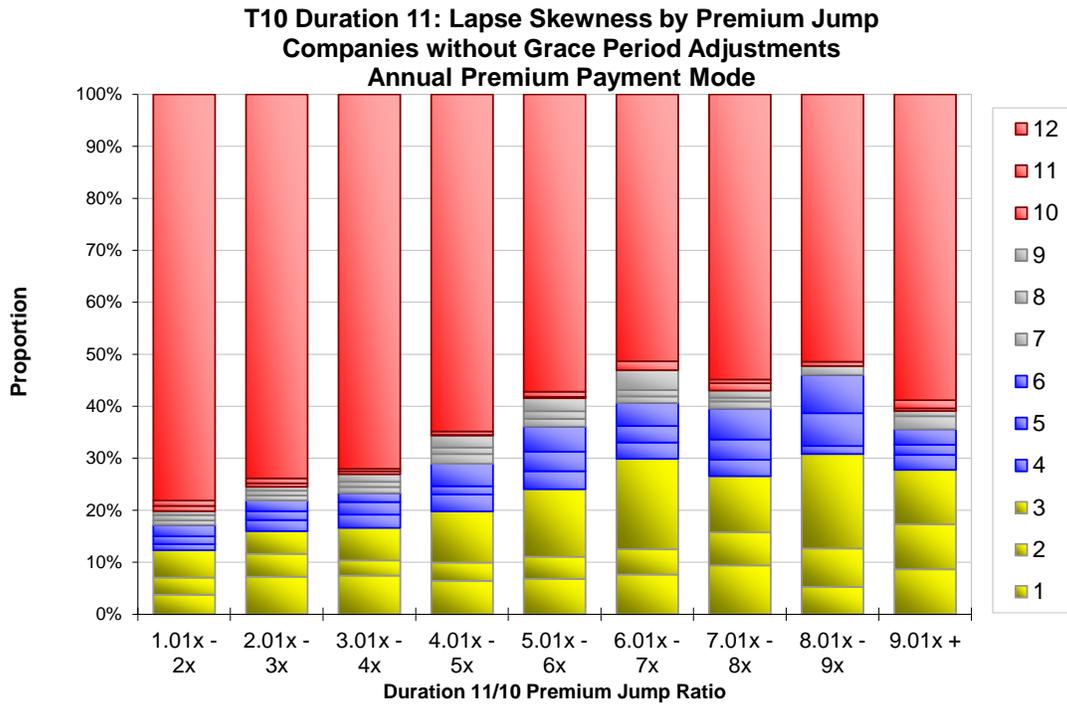
Lapse Skewness (cont.)

T10 (All – Annual Premium Payment Mode)

The same increasing trend can be seen as face amount increases, implying that higher premium jumps in terms of dollar amount may cause policyholders to lapse earlier in duration 11.

T10 Duration 11: Lapse Skewness by Face Amount
Companies without Grace Period Adjustments
Annual Premium Payment Mode
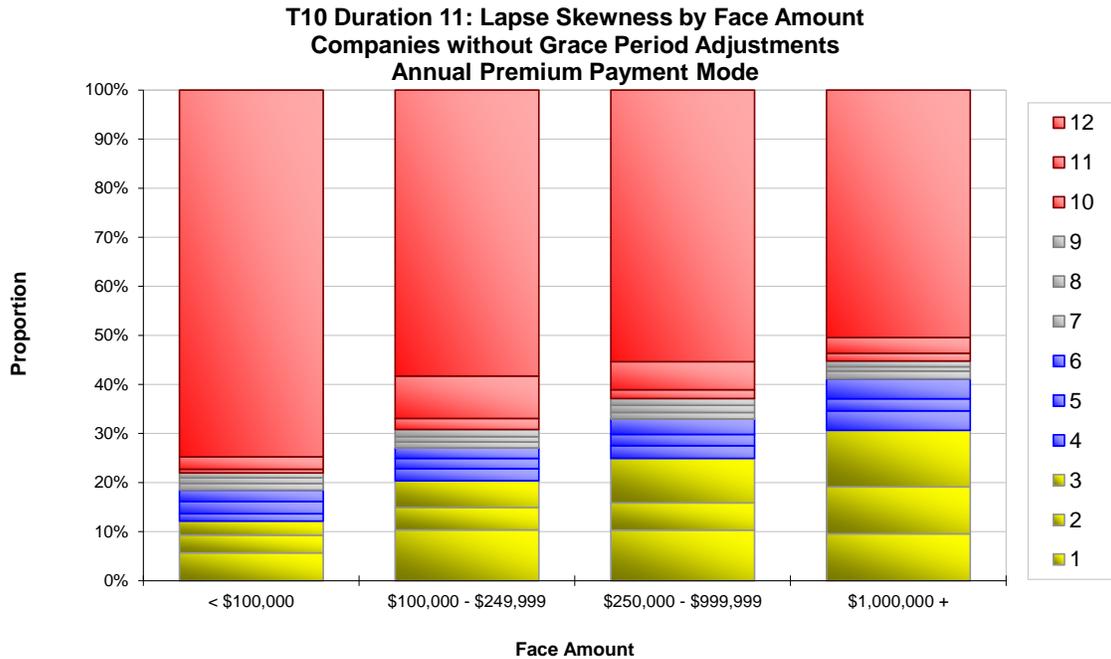
<u>Lapse Skewness (cont.)</u>

<u>T10 (All – Annual Premium Payment Mode)</u>

An increasing trend in early duration 11 lapses is also apparent as issue age increases. As mentioned

earlier, issue age is highly correlated with premium jump.

T10 Duration 11: Lapse Skewness by Issue Age
Companies without Grace Period Adjustments
Annual Premium Payment Mode
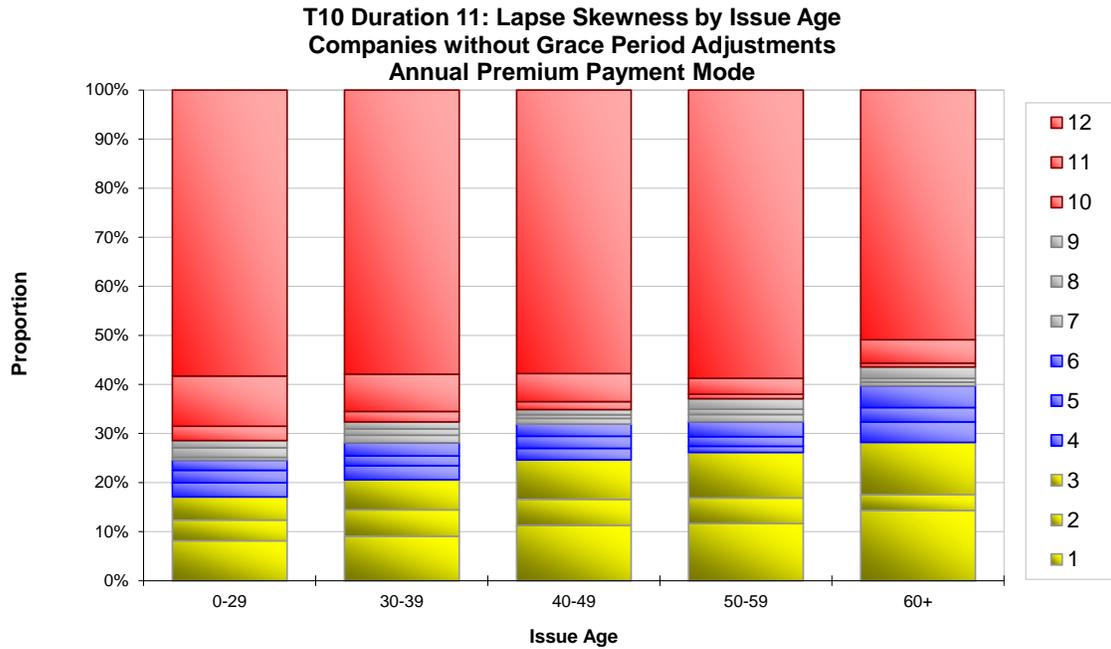
Issue Age

T10 (All)

Shock lapse rates in duration 10 and the secondary shock in duration 11 tend to increase dramatically by increasing issue age, although issue age is also correlated with increasing premium jump ratios. The columns on the right in the following table show the average premium jump ratios (calculated when available) and average issue age for duration 10 exposures.

Issue Age	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
0-19	26,008	2,333	9.0%	7,942	1,114	14.0%	7,368	670	9.1%	41,232	2,557	6.2%	2.9	9.5
20-29	553,033	51,276	9.3%	108,143	40,880	37.8%	61,703	13,476	21.8%	176,935	12,687	7.2%	2.9	26.3
30-39	1,527,641	104,362	6.8%	312,416	162,204	51.9%	139,197	41,421	29.8%	353,707	29,550	8.4%	4.8	34.7
40-49	1,472,212	86,678	5.9%	270,209	177,886	65.8%	81,803	28,957	35.4%	158,156	15,373	9.7%	5.9	44.2
50-59	895,860	53,338	6.0%	142,170	113,228	79.6%	23,716	10,243	43.2%	33,708	3,624	10.8%	7.7	53.7
60-69	254,505	15,175	6.0%	38,321	33,224	86.7%	3,198	1,709	53.4%	2,862	442	15.4%	10.3	63.3
70+	32,684	1,721	5.3%	5,550	4,880	87.9%	328	185	56.4%	189	27	14.2%	16.8	72.3
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Issue Age
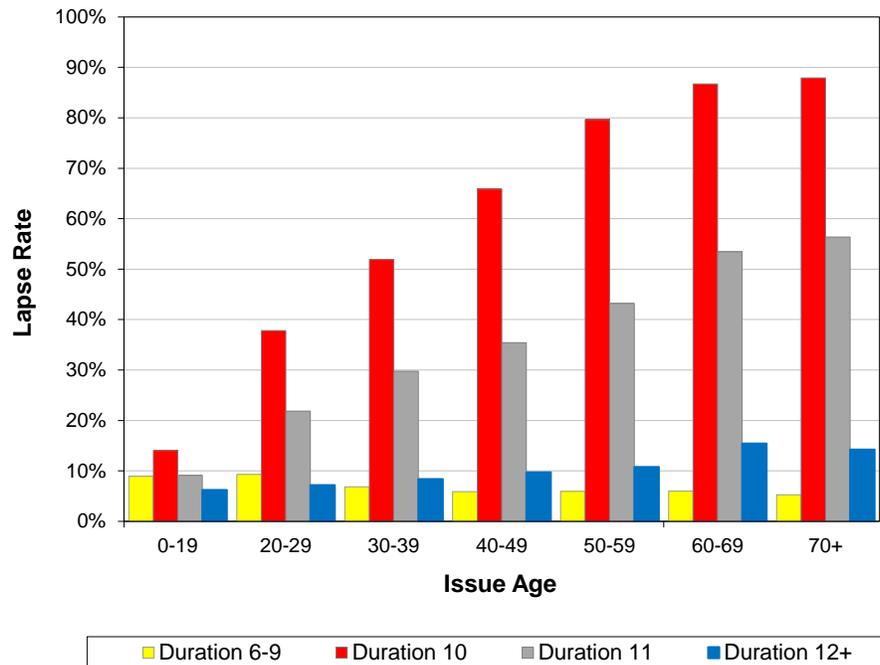
Issue Age (cont.)

T10 (All)

The same general trends of increasing duration 10 shock lapses by issue age hold true when comparing

individual company experience.

Lapse Rate Range	Issue Age					
	20-29	30-39	40-49	50-59	60-69	70+
# of Companies	24	32	33	31	24	8
20th percentile	28.7%	45.0%	53.7%	68.5%	78.7%	83.8%
Median	50.3%	67.0%	76.6%	85.4%	86.7%	86.7%
Aggregate	37.8%	51.9%	65.8%	79.6%	86.7%	87.9%
80th percentile	65.7%	78.6%	84.4%	92.6%	94.3%	95.1%

Companies with 100 or more lapses in given age group

T10 Lapse Rates by Issue Age
Distribution by Company

RGA Reinsurance Company
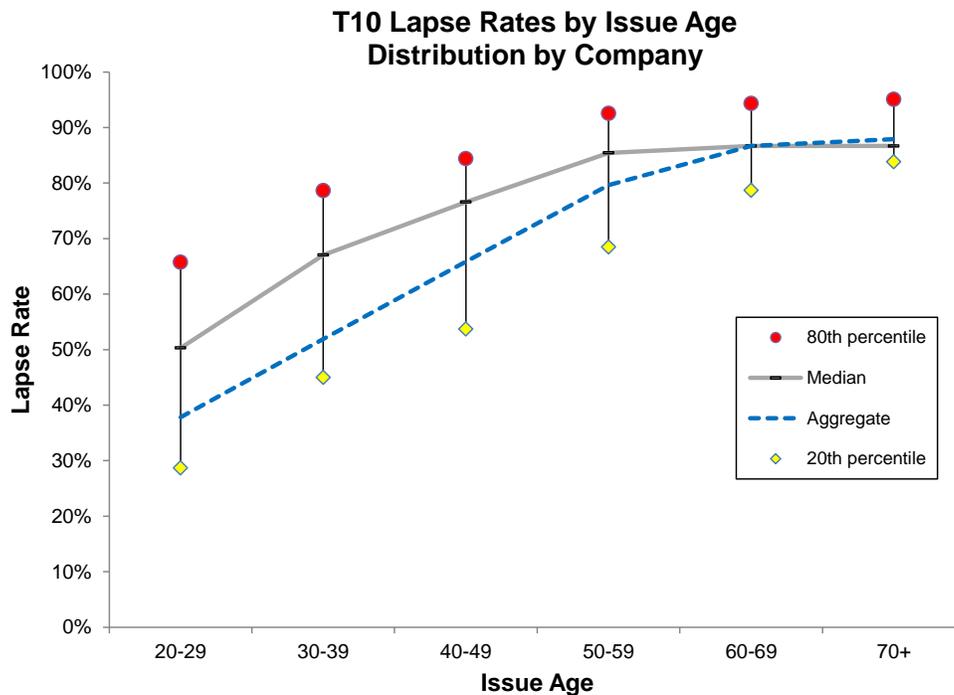
Issue Age (cont.)

T15 (All)

Similar trends are seen in the T15 experience compared to the T10 with lapses increasing by issue age.

Issue Age	Duration 11-14			Duration 15			Duration 16			Duration 17+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
0-19	577	33	5.7%	78	10	12.8%	76	4	5.3%	463	19	4.1%	3.1	16.5
20-29	20,145	1,180	5.9%	1,721	728	42.3%	1,061	164	15.5%	5,689	310	5.4%	3.8	26.8
30-39	137,045	5,595	4.1%	13,300	8,008	60.2%	5,291	1,429	27.0%	20,030	1,623	8.1%	7.8	35.3
40-49	208,857	8,160	3.9%	17,985	13,735	76.4%	3,847	1,579	41.0%	9,277	1,042	11.2%	9.4	44.4
50-59	131,009	5,149	3.9%	8,252	6,854	83.1%	1,154	497	43.1%	2,395	261	10.9%	9.4	53.4
60+	54,676	1,723	3.2%	3,006	2,585	86.0%	283	121	42.7%	581	68	11.7%	10.1	63.6
Grand Total	552,310	21,840	4.0%	44,341	31,920	72.0%	11,712	3,794	32.4%	38,435	3,323	8.6%	8.8	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Lapse Rates by Issue Age

RGA Reinsurance Company
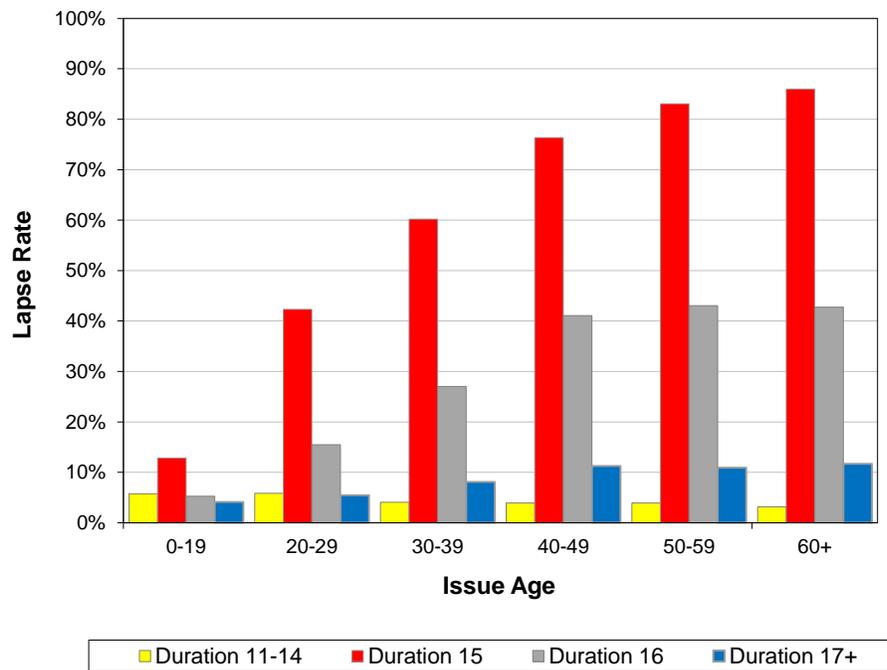
T15 (All)

Median and aggregate lapse rates are consistent by age, increasing as age increases.

Lapse Rate Range	Issue Age			
	20-39	40-49	50-59	60+
# of Companies	6	7	5	5
20th percentile	51.3%	64.8%	82.4%	83.6%
Median	58.4%	75.0%	85.1%	88.2%
Aggregate	58.2%	76.4%	83.1%	86.0%
80th percentile	60.7%	78.2%	87.9%	91.8%

Companies with 100 or more lapses in given age group

T15 Lapse Rates by Issue Age
Distribution by Company
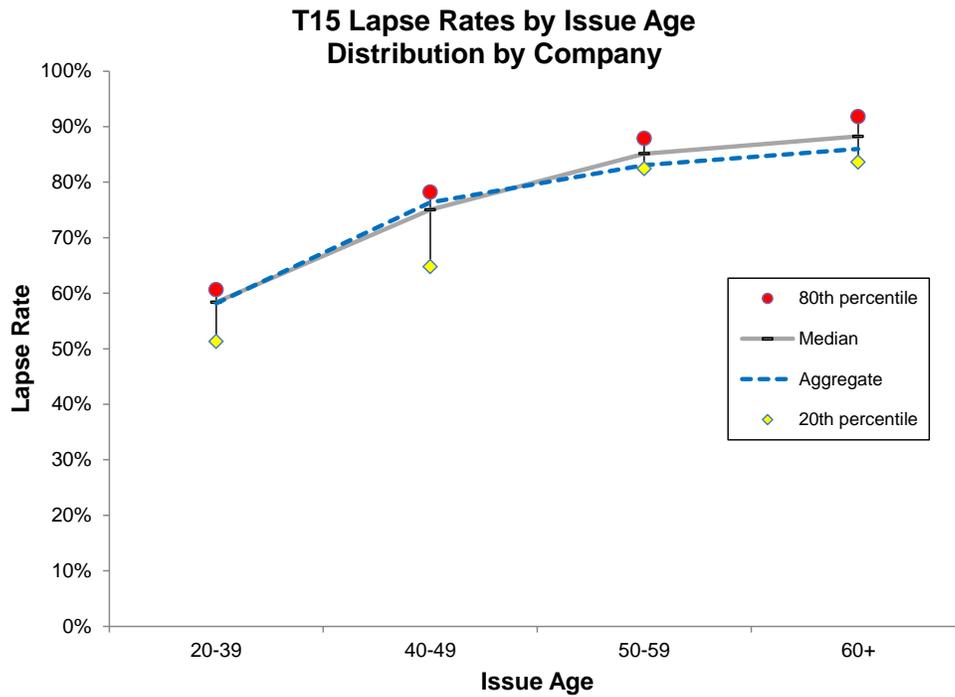
Issue Age and Premium Jump

T10 (All)

When looking at the shock lapse by premium jump and issue age, the lapse rate continues to increase by age even within a premium jump band. The largest variances by age within a band are seen at the lowest premium jump band "1.01 – 3x", partially due to increasing average premium jumps at increasing age bands. When looking at the percentage of those who persist, the largest deviation between the "<40" age group and "60+" age group exists at a "9.01x +" jump, with "<40" seeing nearly three times the percentage of those who persist than "60+" (16.1% vs. 5.4%).

Duration 11/10 Premium Jump Ratio Band	Issue Age	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate	Average Prem Jump Ratio [1]
1.01x - 3x	<40	147,002	30,362	20.7%	2.1
	40-49	66,676	20,661	31.0%	2.4
	50-59	16,406	8,013	48.8%	2.6
	60+	2,115	1,483	70.1%	2.7
3.01x - 5x	<40	48,717	24,965	51.2%	3.8
	40-49	36,007	21,552	59.9%	3.8
	50-59	22,376	14,164	63.3%	3.8
	60+	4,273	3,197	74.8%	4.2
5.01x - 7x	<40	20,991	15,267	72.7%	5.9
	40-49	24,836	19,683	79.3%	5.9
	50-59	19,173	16,107	84.0%	6.1
	60+	5,985	5,078	84.8%	6.1
7.01x - 9x	<40	15,069	11,955	79.3%	7.9
	40-49	16,291	13,674	83.9%	7.9
	50-59	13,813	12,266	88.8%	7.9
	60+	5,561	4,972	89.4%	7.8
9.01x +	<40	27,409	23,009	83.9%	13.9
	40-49	36,153	32,087	88.8%	13.5
	50-59	32,025	29,777	93.0%	13.8
	60+	16,792	15,887	94.6%	17.0
Subtotal Prem Data Available		577,672	324,159	56.1%	5.8
No Prem Data Available		307,079	209,257	68.1%	n/a
Grand Total		884,751	533,416	60.3%	n/a

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

**T10 Duration 10 Lapse Rate
by Issue Age and
Duration 11/10 Premium Jump Ratio**

T10 (Jump to ART)

The largest variances by issue age within a premium jump band are in the "1.01 – 3x" jump band. As the jumps start to increase, the differences by issue age begin to decrease. However, it is once again important to look at the percentage of those who persist. Focusing on the "9.01x +" jump again, there are nearly three times the number of persisters in the "<40" age band (16.1%) compared to "60+" (5.4%).

Duration 11/10 Premium Jump Ratio Band	Issue Age	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate	Average Prem Jump Ratio [1]
1.01x - 3x	<40	45,430	14,544	32.0%	2.2
	40-49	22,493	9,873	43.9%	2.3
	50-59	7,015	4,041	57.6%	2.4
	60+	992	695	70.0%	2.7
3.01x - 5x	<40	44,197	23,258	52.6%	3.9
	40-49	25,187	15,873	63.0%	4.0
	50-59	9,918	7,046	71.0%	4.1
	60+	3,646	2,707	74.3%	4.3
5.01x - 7x	<40	20,976	15,257	72.7%	5.9
	40-49	24,761	19,623	79.3%	5.9
	50-59	18,558	15,643	84.3%	6.1
	60+	5,957	5,051	84.8%	6.1
7.01x - 9x	<40	15,069	11,955	79.3%	7.9
	40-49	16,273	13,657	83.9%	7.9
	50-59	13,751	12,212	88.8%	7.9
	60+	5,498	4,913	89.4%	7.8
9.01x +	<40	27,409	23,009	83.9%	13.9
	40-49	36,150	32,085	88.8%	13.5
	50-59	32,001	29,753	93.0%	13.8
	60+	16,610	15,715	94.6%	17.1
Subtotal Prem Data Available		391,891	276,910	70.7%	7.4
No Prem Data Available		301,700	208,077	69.0%	n/a
Grand Total		693,591	484,987	69.9%	n/a

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

T10 Jump to ART Duration 10 Lapse Rate by Issue Age and Duration 11/10 Premium Jump Ratio
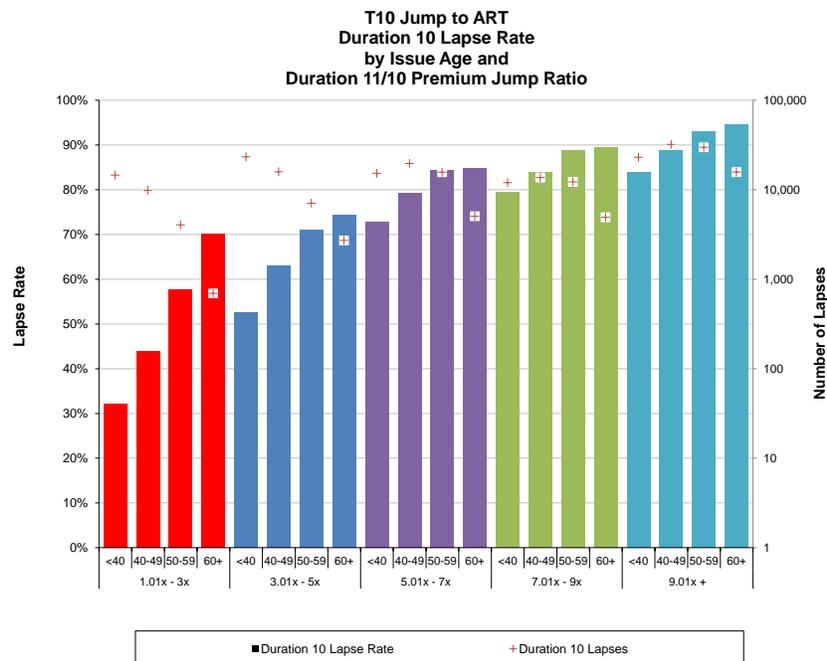
Issue Age and Premium Jump (cont.)

T15 (All)

T15 also shows increasing lapse rates within a given premium jump range. Because the results are thin, there does appear to be more variability compared to T10.

Duration 16/15 Premium Jump Ratio Band	Issue Age	Policy-Years Exposed	Duration 15 Lapses	Duration 15 Lapse Rate	Average Prem Jump Ratio [1]
1.01x - 3x	<40	2,462	642	26.1%	2.2
	40-49	226	67	29.6%	2.7
	50-59	0	0	n/a	n/a
	60+	0	0	n/a	n/a
3.01x - 5x	<40	3,168	1,676	52.9%	4.0
	40-49	2,442	1,409	57.7%	4.1
	50-59	685	423	61.8%	4.3
	60+	141	82	58.1%	4.7
5.01x - 7x	<40	3,066	1,934	63.1%	5.9
	40-49	4,542	3,545	78.0%	6.1
	50-59	2,013	1,720	85.4%	6.2
	60+	537	453	84.3%	6.2
7.01x - 9x	<40	1,623	1,053	64.9%	8.0
	40-49	2,118	1,708	80.7%	7.9
	50-59	1,757	1,517	86.3%	7.8
	60+	828	723	87.4%	8.0
9.01x +	<40	3,842	3,031	78.9%	14.4
	40-49	7,958	6,559	82.4%	13.5
	50-59	3,574	3,029	84.7%	13.0
	60+	1,442	1,280	88.8%	13.2
Subtotal Prem Data Available		42,425	30,851	72.7%	8.8
No Prem Data Available		1,917	1,069	55.8%	n/a
Grand Total		44,341	31,920	72.0%	n/a

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

**T15 Duration 15 Lapse Rate
by Issue Age and
Duration 16/15 Premium Jump Ratio**
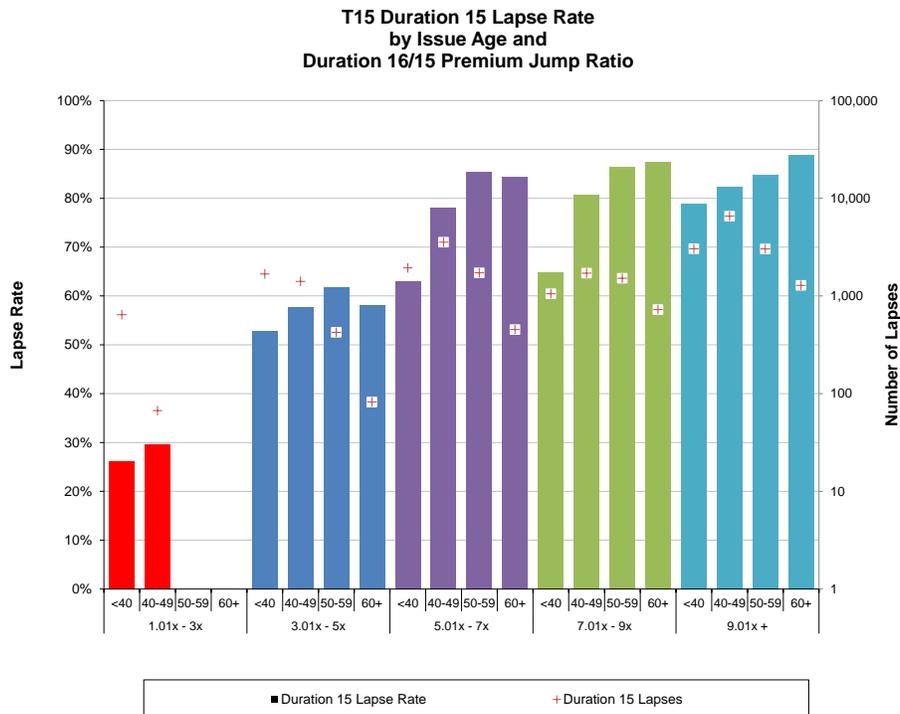
Gender

T10 (All)

Shock lapses are higher for males than females, although males also have higher average issue ages and premium jump ratios.

	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
Issue Age	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Male	3,079,738	204,821	6.7%	560,548	355,466	63.4%	184,475	59,011	32.0%	427,661	37,848	8.8%	6.2	42.3
Female	1,682,206	110,062	6.5%	324,203	177,950	54.9%	132,838	37,650	28.3%	339,129	26,412	7.8%	5.1	38.5
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Gender

RGA Reinsurance Company
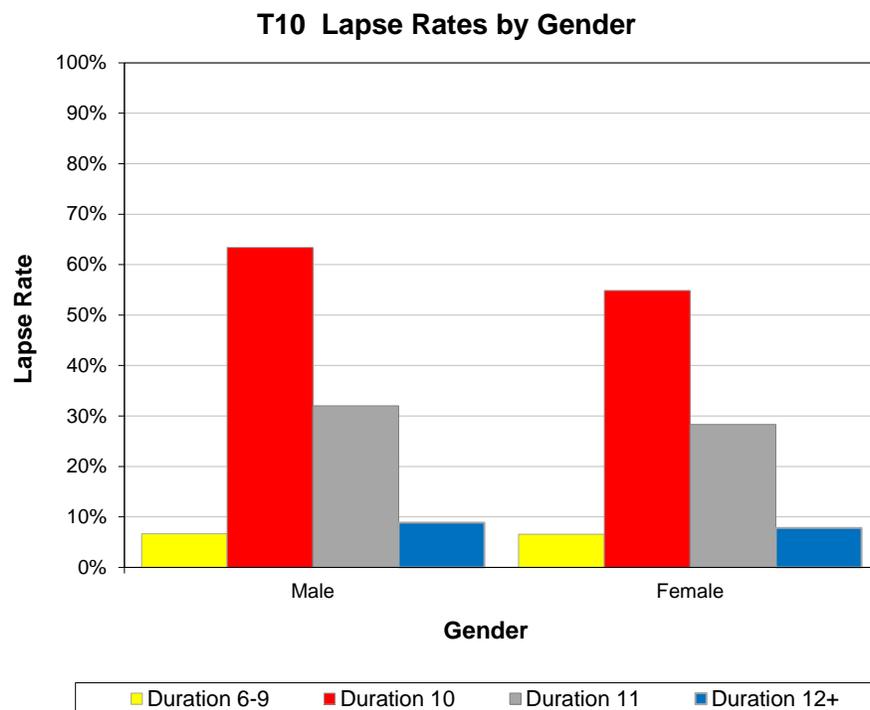
Gender (cont.)

T15 (All)

The differential between male and female shock lapses is more pronounced on T15 than T10. Once

again, males have a higher average premium jump and average issue age.

Issue Age	Duration 11-14			Duration 15			Duration 16			Duration 17+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Male	366,525	14,590	4.0%	29,889	22,564	75.5%	6,802	2,393	35.2%	20,656	2,042	9.9%	9.1	45.0
Female	185,785	7,250	3.9%	14,452	9,356	64.7%	4,910	1,401	28.5%	17,779	1,281	7.2%	8.0	41.7
Grand Total	552,310	21,840	4.0%	44,341	31,920	72.0%	11,712	3,794	32.4%	38,435	3,323	8.6%	8.8	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Lapse Rates by Gender

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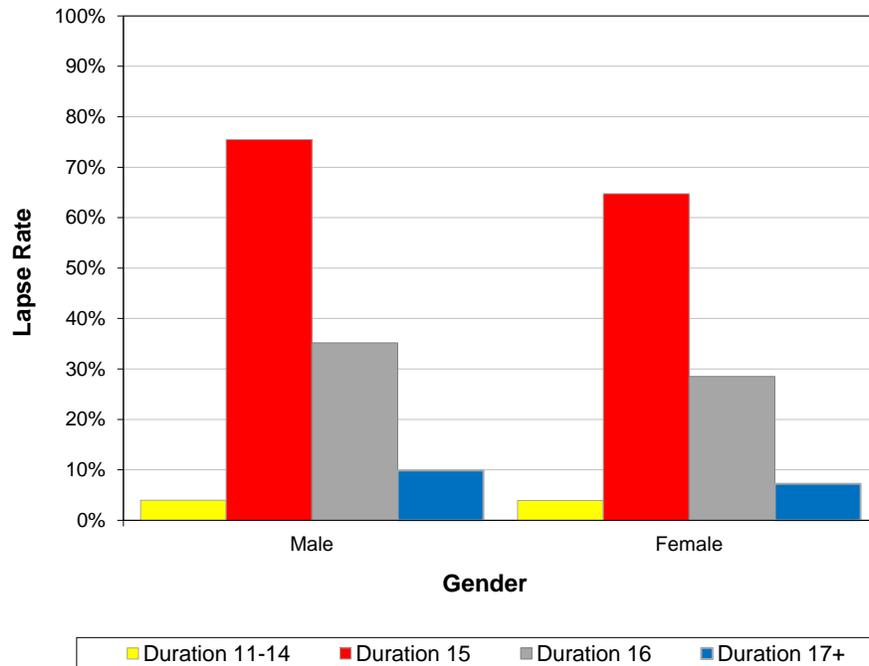
Risk Class

Respondents were asked to provide the underwriting risk class of each policy record. Due to differences in risk class structures and underwriting criteria, it is difficult to aggregate results across companies by risk class. In addition, these data fields presented some challenges from a data quality perspective. The researchers often combined the data "as submitted" with their independent knowledge of each company's product structures and internal risk class definitions to cleanse and adjust the necessary fields to ensure consistency across companies.

Policies were mapped into the following risk classes based on the number of preferred classes and the rank of each risk class within the overall preferred class structure. The mapping used is as follows:

Risk Class	Description
Super-Preferred NS	Best class in a three or more NS class structure
Preferred NS	Best class in a two NS class structure or second class in a three NS class structure or second or third class in a four or more NS class structure
Non-Preferred NS	Worst class in a three or four NS class structure or fourth or worse in a five or more NS class structure
Undifferentiated NS	Only one NS class
Preferred SM	Best class in a two SM class structure or best two classes in a three SM class structure
Non-Preferred SM	Worst class in a two or three SM class structure
Undifferentiated SM	Only one SM class

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Risk Class (cont.)

T10 (All)

Super-preferred classes experience the highest shock lapses. This is correlated with premium jump since the post-level premium rates often do not vary by risk class except non-smoker/smoker. This can be seen in the table below as super-preferred has twice the average premium jump of any other group. Some of the differences across risk classes may also be driven by differences in company-specific experience that are not entirely explained by risk class or premium jump.

	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
Risk Class	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Super-Pref NS	649,299	38,168	5.9%	93,894	72,803	77.5%	16,703	7,543	45.2%	17,242	2,105	12.2%	10.9	43.5
Preferred NS	1,875,515	118,159	6.3%	342,453	212,204	62.0%	112,938	35,604	31.5%	189,445	18,384	9.7%	5.6	40.9
Non-Pref NS	1,185,810	76,661	6.5%	213,876	141,921	66.4%	60,187	20,853	34.6%	90,585	10,212	11.3%	5.8	42.9
Undiff/Unknown NS	500,979	36,629	7.3%	129,919	47,618	36.7%	84,848	19,438	22.9%	350,678	23,035	6.6%	3.7	38.5
Preferred SM	154,660	12,035	7.8%	23,200	16,938	73.0%	5,135	2,544	49.5%	5,542	1,070	19.3%	6.3	41.3
Non-Pref SM	105,347	9,301	8.8%	15,799	8,154	51.6%	5,944	1,489	25.0%	5,985	749	12.5%	4.8	32.3
Undiff/Unknown SM	286,729	23,516	8.2%	64,085	32,939	51.4%	30,892	8,975	29.1%	104,282	8,345	8.0%	3.4	37.0
Unknown/Aggregate	3,605	414	11.5%	1,524	839	55.1%	666	215	32.3%	3,031	360	11.9%	4.2	47.3
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Risk Class

RGA Reinsurance Company
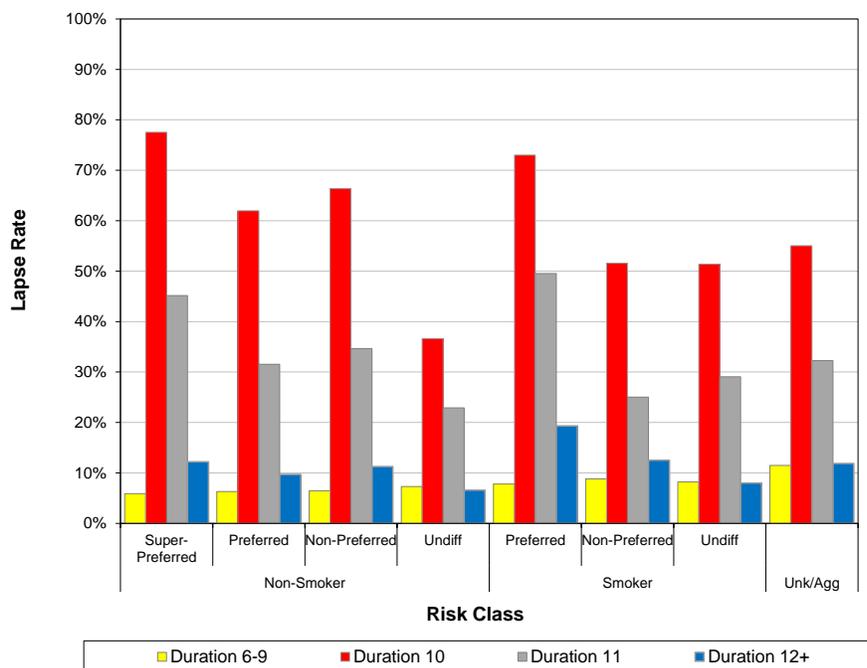
Risk Class (cont.)

T15 (All)

Consistent with T10, super-preferred classes see the highest shock lapses of any group. Once again, this is highly correlated with the premium jump.

Risk Class	Duration 11-14			Duration 15			Duration 16			Duration 17+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Super-Pref NS	167,224	5,755	3.4%	9,522	7,876	82.7%	837	413	49.4%	283	41	14.5%	13.3	43.3
Preferred NS	167,624	6,564	3.9%	16,910	12,433	73.5%	3,696	1,541	41.7%	4,013	609	15.2%	8.7	43.6
Non-Pref NS	113,161	4,720	4.2%	9,080	6,283	69.2%	2,056	790	38.4%	1,531	228	14.9%	7.1	45.4
Undiff/Unknown NS	58,488	2,478	4.2%	4,857	2,564	52.8%	4,180	742	17.8%	30,310	2,234	7.4%	4.4	44.5
Preferred SM	23,697	1,139	4.8%	2,124	1,612	75.9%	265	129	48.7%	156	29	18.6%	8.2	42.4
Non-Pref SM	6,732	386	5.7%	425	301	70.8%	77	30	38.9%	65	13	20.0%	6.5	41.1
Undiff/Unknown SM	13,942	738	5.3%	1,109	688	62.1%	455	97	21.3%	1,679	119	7.1%	4.5	43.0
Unknown/Aggregate	1,441	60	4.2%	314	163	51.9%	146	52	35.7%	399	50	12.5%	n/a	42.8
Grand Total	552,310	21,840	4.0%	44,341	31,920	72.0%	11,712	3,794	32.4%	38,435	3,323	8.6%	8.8	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Lapse Rates by Risk Class

RGA Reinsurance Company
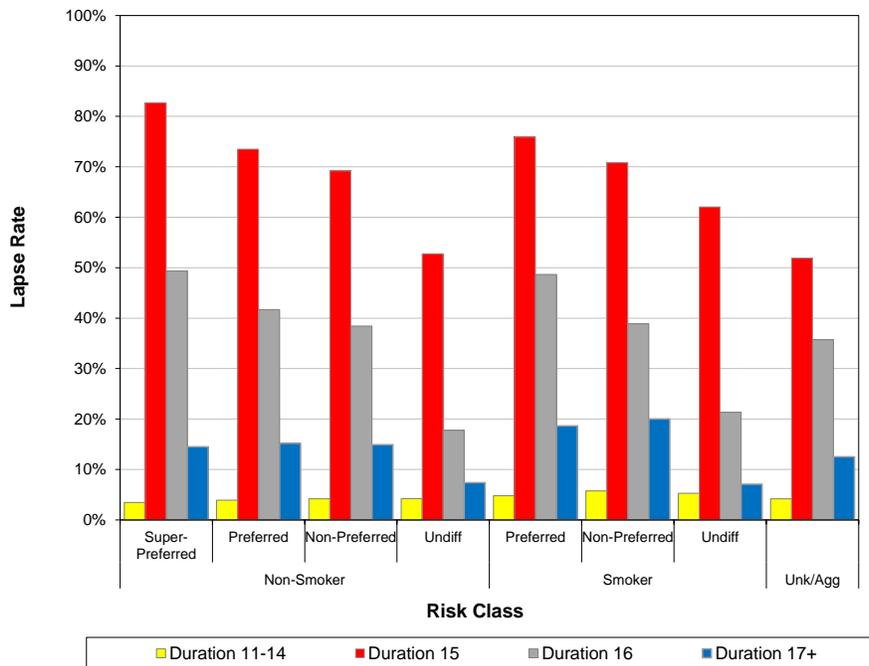
Face Amount

T10 (All)

Post-level period lapse rates increase with policy size in all durations. This is correlated with premium jump ratio because companies generally have lower per $1000 level period premium rates at higher face amounts with a post-level period scale that doesn't vary by size band. Additionally, larger face amount policies are generally sold at older issue ages. At the lower face amounts, the policy fee, which is currently excluded from the average premium jump ratio calculation, becomes a larger component of the total premium. Excluding this fee drives up the average premium jump for the lowest face amount bands.

Policy Face Amount	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
< $50k	29,705	2,749	9.3%	8,565	1,458	17.0%	7,007	675	9.6%	40,818	2,572	6.3%	5.0	19.4
$50k - $99k	240,149	16,766	7.0%	62,580	23,228	37.1%	39,713	7,983	20.1%	162,623	10,196	6.3%	3.8	41.6
$100k - $249k	2,248,876	150,618	6.7%	449,715	262,069	58.3%	170,727	51,186	30.0%	406,868	34,466	8.5%	5.3	40.6
$250k - $999k	1,867,481	117,440	6.3%	313,240	209,583	66.9%	89,145	32,700	36.7%	142,523	15,517	10.9%	6.6	41.3
$1 M - $4.9 M	363,094	25,949	7.1%	49,200	35,884	72.9%	10,530	4,031	38.3%	13,775	1,484	10.8%	8.0	43.8
$5 M +	12,638	1,361	10.8%	1,451	1,194	82.3%	191	86	45.0%	183	25	13.7%	9.4	46.8
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Face Amount Band

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RGA Reinsurance Company
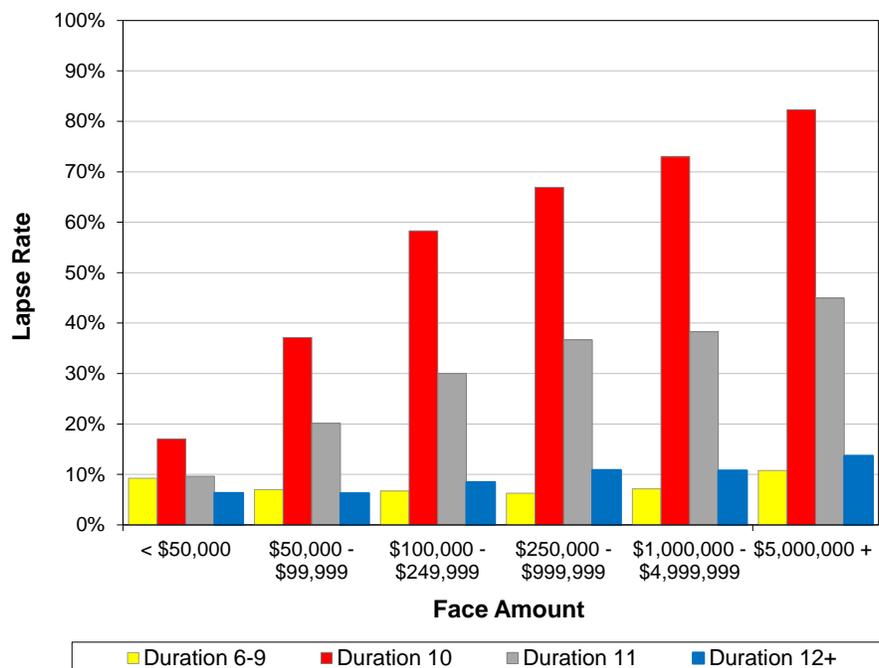
Face Amount (cont.)

T15 (All)

The correlation between face amount and shock lapse is not as pronounced on T15 compared to T10, although there is still higher shock lapse rates for larger policies. This is due to the higher premium jumps on average for each band.

Policy Face Amount	Duration 11-14			Duration 15			Duration 16			Duration 17+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
< $50k	3,399	145	4.3%	962	513	53.3%	527	96	18.2%	2,790	178	6.4%	6.0	54.9
$50k - $99k	24,685	884	3.6%	1,936	1,119	57.8%	950	197	20.7%	4,620	306	6.6%	5.8	48.7
$100k - $249k	263,341	9,985	3.8%	22,767	15,800	69.4%	6,879	2,097	30.5%	24,990	2,068	8.3%	8.1	44.2
$250k - $999k	226,554	9,098	4.0%	16,603	12,836	77.3%	3,064	1,239	40.4%	5,798	728	12.6%	9.9	42.4
$1 M - $4.9 M	33,578	1,681	5.0%	2,042	1,626	79.6%	290	165	56.8%	237	43	18.2%	11.0	43.8
$5 M +	753	47	6.2%	31	26	83.9%	2	0	0.0%	1	0	0.0%	12.1	47.9
Grand Total	552,310	21,840	4.0%	44,341	31,920	72.0%	11,712	3,794	32.4%	38,435	3,323	8.6%	8.8	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Lapse Rates by Face Amount Band

RGA Reinsurance Company
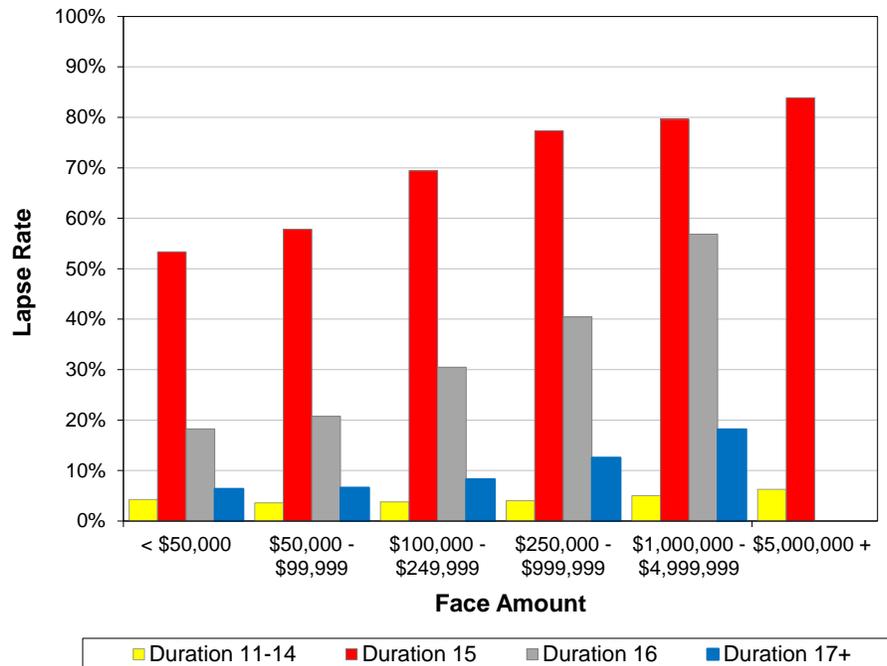
Face Amount and Premium Jump

<u>T10 (All)</u>

The shock lapse not only increases with face amount, it also increases with face amounts within a given premium jump band.

Duration 11/10 Premium Jump Ratio Band	Policy Face Amount	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate	Average Prem Jump Ratio [1]
1.01x - 3x	<100k	36,642	7,235	19.7%	2.3
	100k-249k	109,167	26,698	24.5%	2.2
	250k-999k	74,484	22,530	30.2%	2.2
	1M+	11,906	4,056	34.1%	2.2
3.01x - 5x	<100k	15,801	7,929	50.2%	3.6
	100k-249k	52,441	28,950	55.2%	3.9
	250k-999k	38,621	24,008	62.2%	3.9
	1M+	4,511	2,991	66.3%	4.0
5.01x - 7x	<100k	3,959	3,038	76.7%	5.9
	100k-249k	36,306	28,604	78.8%	5.9
	250k-999k	26,790	21,288	79.5%	6.0
	1M+	3,930	3,205	81.6%	6.0
7.01x - 9x	<100k	1,733	1,384	79.9%	8.0
	100k-249k	20,569	17,017	82.7%	7.9
	250k-999k	22,964	19,627	85.5%	7.9
	1M+	5,469	4,839	88.5%	8.0
9.01x +	<100k	3,922	3,640	92.8%	15.9
	100k-249k	39,969	35,531	88.9%	13.7
	250k-999k	54,435	48,703	89.5%	14.3
	1M+	14,052	12,886	91.7%	14.8
Subtotal Prem Data Available		577,672	324,159	56.1%	5.8
No Prem Data Available		307,079	209,257	68.1%	n/a
Grand Total		884,751	533,416	60.3%	n/a

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

**T10 Duration 10 Lapse Rate
by Face Amount and
Duration 11/10 Premium Jump Ratio**

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Face Amount and Premium Jump (cont.)

T10 (ART)

The increase in shock lapse by face amount within a given premium jump range is less pronounced for business moving to an ART scale.

Duration 11/10 Premium Jump Ratio Band	Policy Face Amount	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate	Average Prem Jump Ratio [1]
1.01x - 3x	<100k	7,425	3,075	41.4%	2.6
	100k-249k	30,811	12,261	39.8%	2.3
	250k-999k	32,003	11,439	35.7%	2.1
	1M+	5,691	2,378	41.8%	2.2
3.01x - 5x	<100k	10,086	5,833	57.8%	3.7
	100k-249k	44,140	25,228	57.2%	3.9
	250k-999k	26,034	15,983	61.4%	4.1
	1M+	2,688	1,840	68.4%	4.3
5.01x - 7x	<100k	3,659	2,819	77.0%	5.9
	100k-249k	35,998	28,362	78.8%	5.9
	250k-999k	26,680	21,199	79.5%	6.0
	1M+	3,915	3,194	81.6%	6.0
7.01x - 9x	<100k	1,725	1,377	79.8%	8.0
	100k-249k	20,488	16,943	82.7%	7.9
	250k-999k	22,915	19,583	85.5%	7.9
	1M+	5,463	4,834	88.5%	8.0
9.01x +	<100k	3,907	3,626	92.8%	15.9
	100k-249k	39,825	35,396	88.9%	13.7
	250k-999k	54,390	48,659	89.5%	14.3
	1M+	14,047	12,881	91.7%	14.8
Subtotal Prem Data Available		391,891	276,910	70.7%	7.4
No Prem Data Available		301,700	208,077	69.0%	n/a
Grand Total		693,591	484,987	69.9%	n/a

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

T10 Jump to ART
Duration 10 Lapse Rate
by Face Amount and
Duration 11/10 Premium Jump Ratio

RGA Reinsurance Company

Premium Mode

<u>T10 (All)</u>

The initial duration 10 shock lapse seems to decrease with increasing premium payment frequency. This is likely a function of the larger dollar amount increase in premium for the less frequent premium payment options. In addition, both annual and quarterly premium modes have higher average premium jumps, driving lapse rates up. As discussed earlier, the distribution of lapses within the year varies significantly for different premium payment modes.

Premium Payment Mode	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Annual	1,019,062	65,346	6.4%	193,465	150,860	78.0%	38,673	8,928	23.1%	111,324	9,713	8.7%	7.6	42.0
Semi-Annual	224,958	15,577	6.9%	41,310	25,995	62.9%	13,920	3,247	23.3%	35,204	3,179	9.0%	5.0	42.1
Quarterly	874,226	65,546	7.5%	164,688	108,324	65.8%	52,088	18,065	34.7%	126,965	12,685	10.0%	6.9	41.9
Monthly	2,131,545	140,528	6.6%	411,943	191,160	46.4%	200,973	60,859	30.3%	483,296	36,662	7.6%	4.4	38.9
Other/Unkown	512,154	27,886	5.4%	73,345	57,077	77.8%	11,660	5,562	47.7%	10,001	2,021	20.2%	5.4	46.5
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available
(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Premium Payment Mode
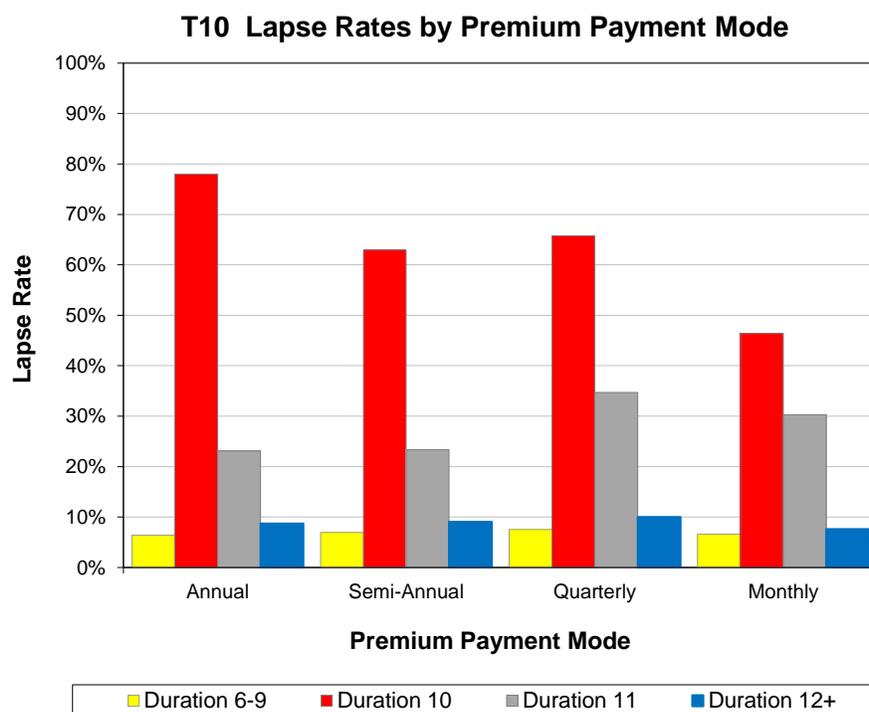
Premium Mode (cont.)

<u>T15 (All)</u>

Results for T15 also illustrate a decreasing shock lapse by increasing premium frequency. Monthly mode has a significantly smaller average premium jump than the others which helps drive the duration 15 lapse rate down.

Premium Payment Mode	Duration 11-14			Duration 15			Duration 16			Duration 17+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Annual	151,882	6,371	4.2%	15,388	12,153	79.0%	2,873	821	28.6%	7,821	844	10.8%	9.0	43.6
Semi-Annual	33,609	1,459	4.3%	3,130	2,402	76.7%	581	247	42.5%	655	102	15.6%	10.1	44.2
Quarterly	116,238	6,091	5.2%	13,694	10,545	77.0%	2,522	1,088	43.1%	7,795	893	11.5%	10.3	44.1
Monthly	176,278	5,313	3.0%	10,391	5,678	54.6%	5,164	1,484	28.7%	19,702	1,263	6.4%	6.3	44.2
Other/Unkown	74,302	2,606	3.5%	1,739	1,142	65.7%	571	154	27.0%	2,462	221	9.0%	4.9	42.9
Grand Total	552,310	21,840	4.0%	44,341	31,920	72.0%	11,712	3,794	32.4%	38,435	3,323	8.6%	8.8	43.9

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Lapse Rates by Premium Payment Mode
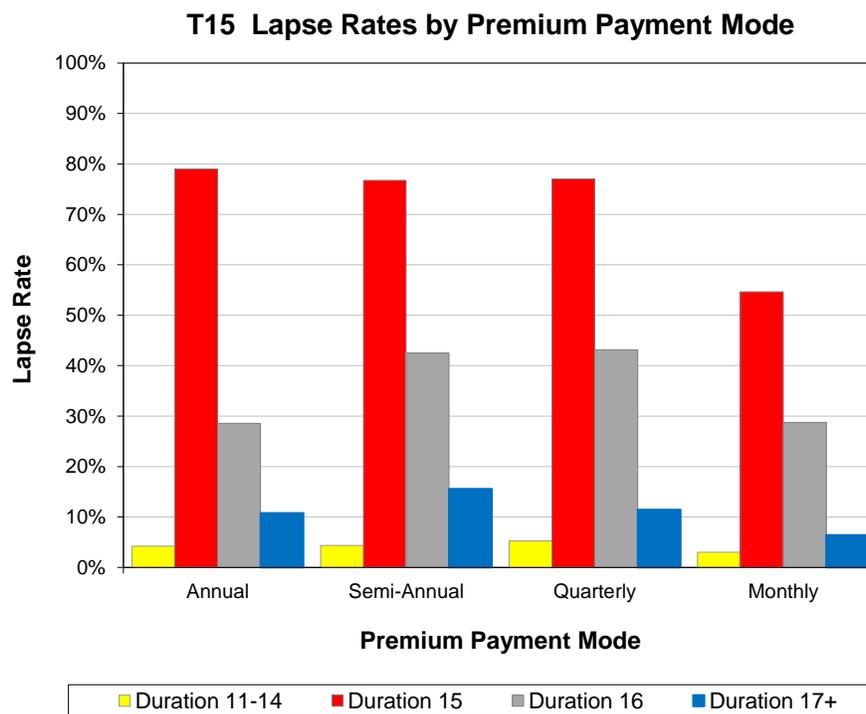
Distribution System

T10 (All)

Shock lapse rates in duration 10 and the secondary shock in duration 11 vary widely by distribution system. However, this is driven somewhat by higher average issue ages and premium jump ratios.

Distribution System	Duration 6-9			Duration 10			Duration 11			Duration 12+			Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate	Policy-Years Exposed	Total Lapses	Lapse Rate		
Career Agent	1,127,185	78,412	7.0%	189,492	83,702	44.2%	93,414	25,631	27.4%	162,907	13,760	8.4%	3.4	41.5
Multiline Exclusive Agent	1,909,165	133,068	7.0%	414,933	235,865	56.8%	168,164	48,060	28.6%	479,807	35,774	7.5%	4.7	37.4
Personal Producing General Agent	171,864	11,350	6.6%	30,304	17,593	58.1%	11,914	3,974	33.4%	32,790	3,705	11.3%	5.8	44.8
Independent Life Broker	715,989	43,900	6.1%	112,809	91,780	81.4%	18,474	9,671	52.4%	27,391	5,133	18.7%	10.1	48.6
Stockbroker/Wirehouse Agent	28,127	1,607	5.7%	3,992	3,441	86.2%	540	246	45.6%	1,279	136	10.6%	12.2	45.9
Direct Responce Marketing	34,850	2,074	6.0%	7,766	7,086	91.2%	497	274	55.1%	223	30	13.4%	12.7	48.9
Bank or Other Financial Institution	10,960	507	4.6%	1,931	1,494	77.4%	405	171	42.2%	505	90	17.8%	8.0	45.7
Other	47,457	2,196	4.6%	6,901	4,812	69.7%	1,093	432	39.5%	609	101	16.6%	7.0	43.7
Unknown	716,346	41,769	5.8%	116,623	87,643	75.2%	22,813	8,202	36.0%	61,278	5,531	9.0%	6.4	42.9
Grand Total	4,761,944	314,883	6.6%	884,751	533,416	60.3%	317,313	96,661	30.5%	766,790	64,260	8.4%	5.8	40.9

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Lapse Rates by Distribution System

RGA Reinsurance Company
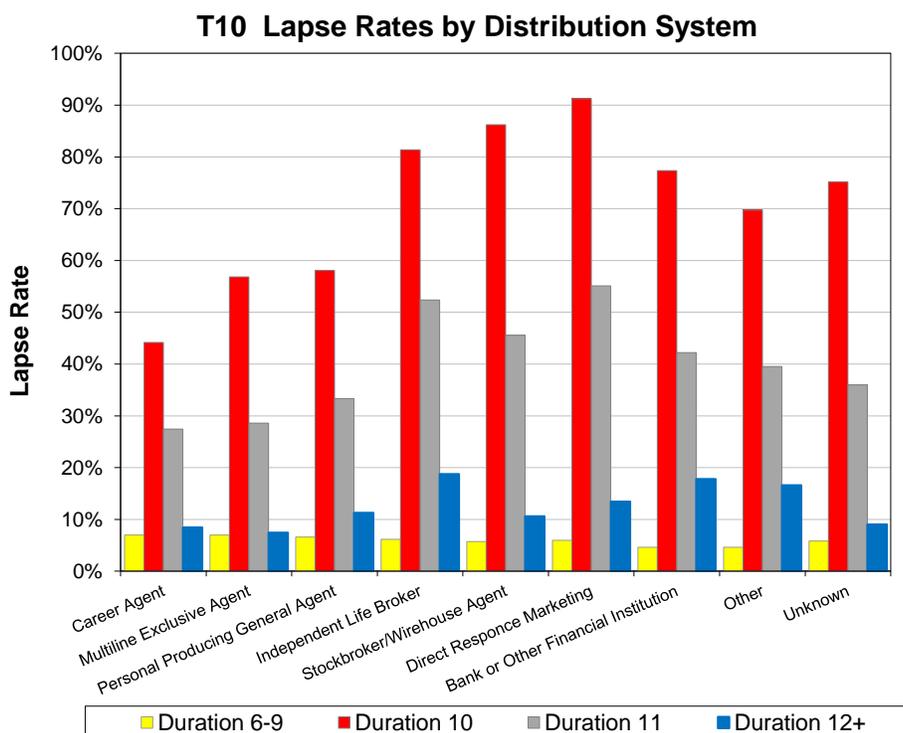
Comparison to 2010 Study

Overview

Credibility increased significantly in this study compared to the 2010 study. This study now has nearly 700,000 post-level lapses for T10, of which nearly 450,000 contain the premium jump information. T15 also increased significantly over the 2010 study, contributing nearly 40,000 post-level lapses, almost all of which contained premium information.

		2014 Study	2010 Study	Change
10-Year Term	Number of Companies w/ Post Level Experience	36	25	144%
	Post-Level Lapses with Premiums	436,307	87,544	498%
	Post-Level Lapses without Premiums	258,030	170,171	152%
15-Year Term	Number of Companies w/ Post Level Experience	15	7	214%
	Post-Level Lapses with Premiums	37,673	12,191	309%
	Post-Level Lapses without Premiums	1,364	1,359	100%

Comparison to 2010 Study (cont.)

Premium Jump Ratio – T10

The shock lapse in this study is very similar to the prior study. The primary differences include lower lapse rates at premium jumps below 3x as well as lower lapse rates at jumps over 16x. The study is now much more credible at the highest jumps which suggests lapse rates do not hit 100% at these points.

T10 Shock Lapse Rate
by Duration 11/10 Premium Jump Ratio

T10 Jump to ART Shock Lapse Rate
by Duration 11/10 Premium Jump Ratio

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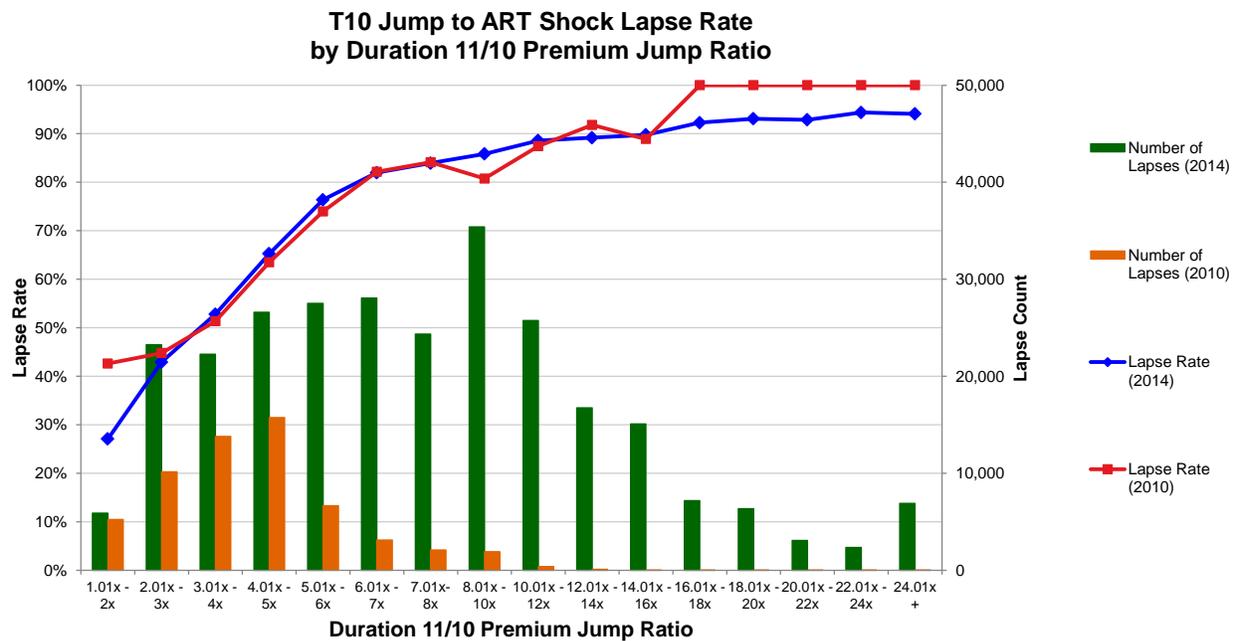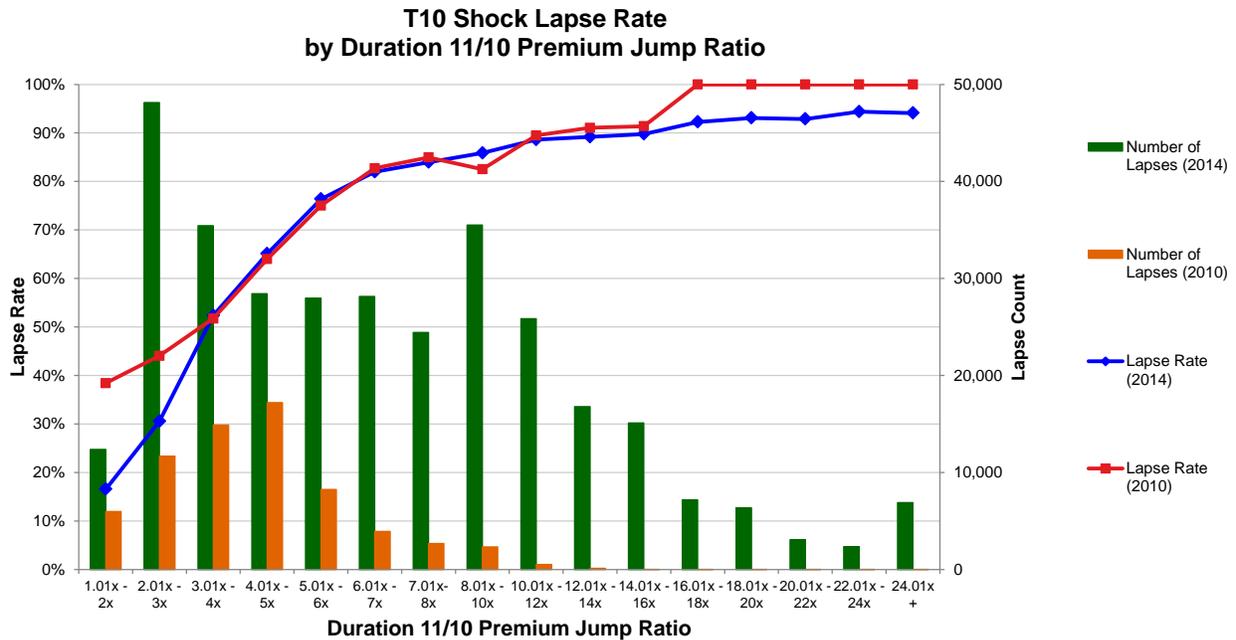
Premium Jump Ratio – T15 (All)

In general, the current study is similar to the prior study for T15; however, credibility has significantly

increased. Where the prior study had credible information, results are nearly identical.

**T15 Shock Lapse Rate
by Duration 16/15 Premium Jump Ratio**
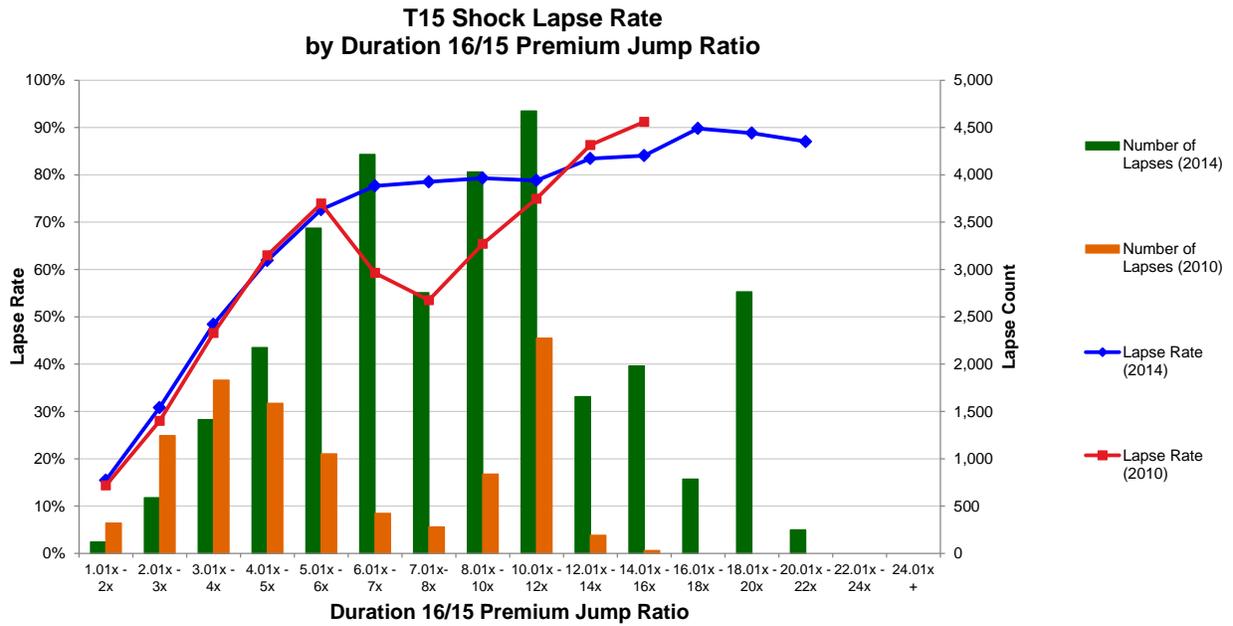
Total Lapse Rates by Duration – T10

By duration, the current study and prior study are very similar. Only minor differences in later durations arise, which is primarily caused by business mix. Also, note the shock at duration 20 in the "10-Yr (All)" graph due to the end of the second level term for business that jumped to a new level period.

T10 Lapse Rates by Duration
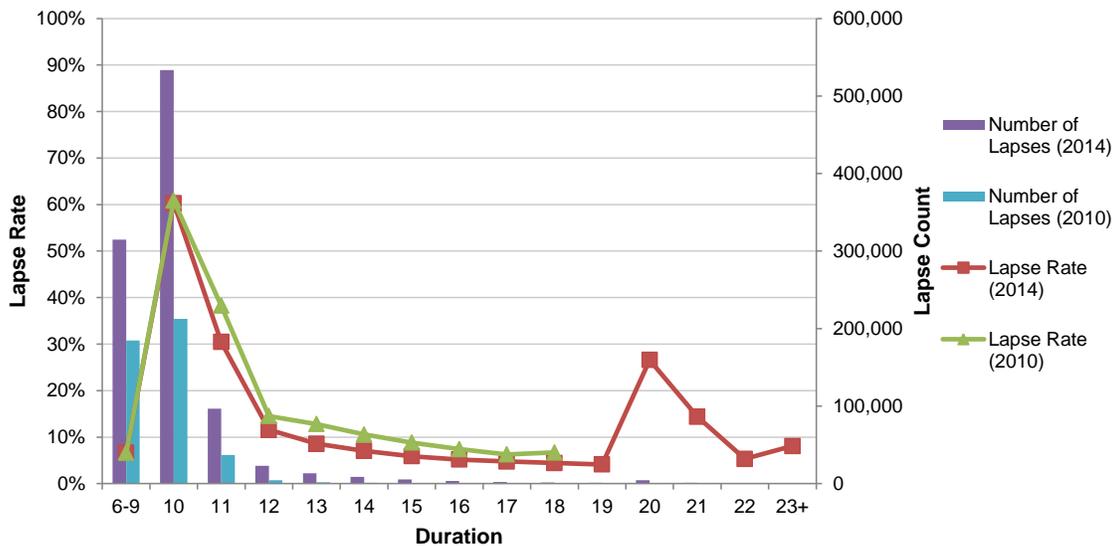
T10 Jump to ART
Lapse Rates by Duration

RGA Reinsurance Company
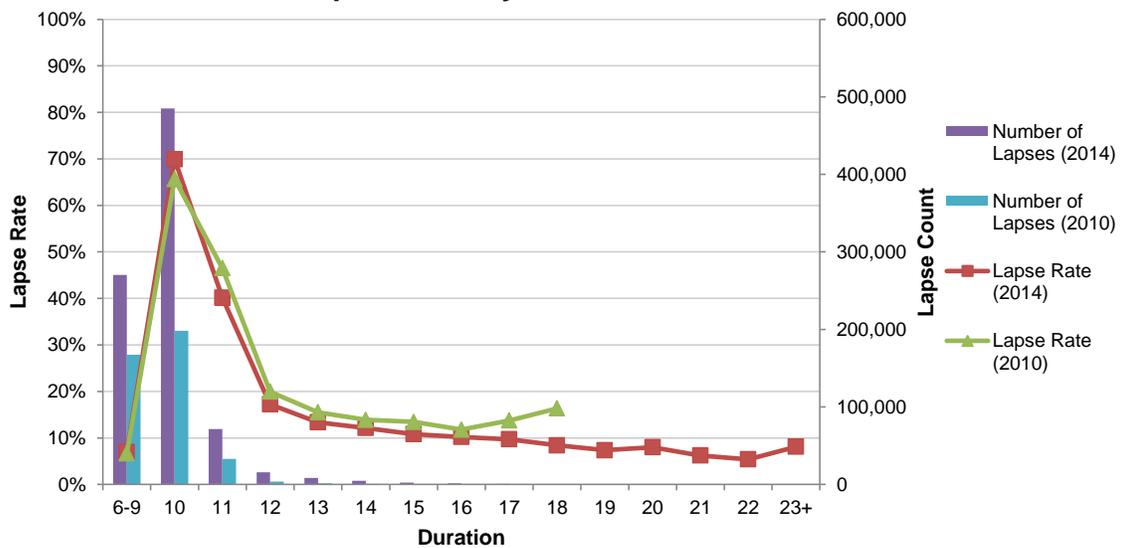
Total Lapse Rates by Duration – T15

Consistent with T10, T15 is relatively consistent between the two studies. The most significant change is to the duration 15 shock lapse, with a much higher shock lapse than the previous study. The levels of the new shock are very consistent with that of T10.

T15 Lapse Rates by Duration

RGA Reinsurance Company
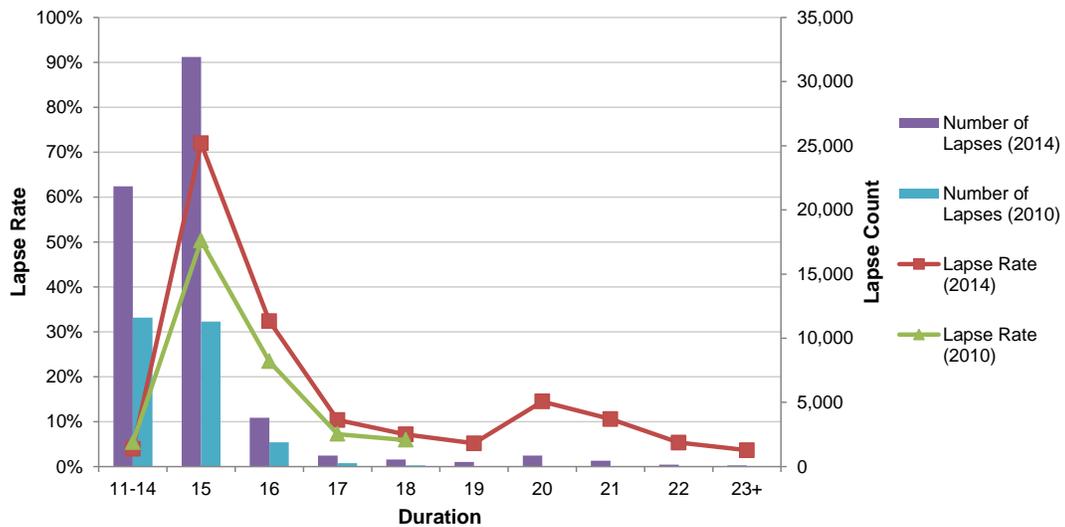
Mortality Deterioration

Overview

This section will analyze the mortality experience from participating companies with a particular focus on the increase in mortality between the level period and the post-level period. The mortality increase can be primarily attributed to adverse selection of unhealthy policyholders choosing to persist after a large increase in their premium. A secondary component of mortality deterioration, which becomes increasingly significant for higher shock lapse rates, is attributable to normal mortality from policyholders who intended to lapse but died during the grace period.

For T10, 36 companies provided experience that included at least one post-level period death claim, 15 companies provided at least 50 death claims, and eight companies provided at least 100 death claims. For T15, six companies provided experience that included at least one post-level period death claim and three provided at least 50. Because T15 is generally thin, only certain views will be presented.

The displays in this section include mortality ratios on three different industry-standard tabular bases: 2008 VBT, 2001 VBT, and SOA 75-80. In addition to this, a relative ratio is provided, which normalizes the 2008 VBT mortality ratio in the post-level period as a percentage of the ratio for the last five durations of the level period. In this way, the post-level period mortality deterioration can be isolated as a multiple of the mortality during the latter part of the level period. These relative mortality ratios are alternatively referred to as "vs LP", "Mortality Relative to Durations 6-10", or "Mortality Relative to Durations 11-15" on the displays.

There was significantly less anti-selective mortality seen in products with a "Jump to Other" post-level premium structure. As seen earlier, these products experienced lower shock lapses in total than products jumping up to an ART scale. In order to provide analysis that is most likely to be relevant to the readers of this report, separate displays will be provided for products with a jump to an ART scale.

Note, confidence intervals will be shown throughout the mortality deterioration section as error bars in the graphs. These confidence intervals are consistent with the definition in the Introduction on page 8.

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Mortality by Duration

T10 All

In total, the post-level period mortality is roughly 159% of the level period (duration 6-10) mortality on an 08VBT basis. For duration 11 alone, the mortality is 232% of the level period. As will be discussed later, there is significant exposure from a small number of companies with a "Jump to Other" post-level premium product structure and/or with lower than average shock lapses and premium jump ratios. As a result, these aggregated results, while technically accurate, might understate the expected mortality deterioration for most companies—especially for more recently issued products.

Policy Duration	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					Median 08 VBT [1]	Average Prem Jump Ratio [2]
			08 VBT	01 VBT	7580	vs LP			
6	1,380,348	2,506	91%	66%	45%	100%	90%	7.3
7	1,306,769	2,669	90%	65%	45%	100%	90%	7.2
8	1,212,026	2,861	92%	66%	48%	102%	93%	7.0
9	1,087,295	2,691	86%	61%	46%	96%	91%	6.7
10	903,613	2,615	92%	64%	50%	102%	92%	6.1
Subtotal 6-10	5,890,051	13,342	90%	64%	47%	100%	91%	n/a
11	274,633	1,090	209%	141%	105%	232%	262%	2.9
12	203,670	588	149%	99%	74%	165%	159%	2.6
13	164,438	437	128%	84%	63%	142%	195%	2.5
14	132,269	330	111%	73%	54%	123%	180%	2.4
15	102,238	278	114%	74%	55%	127%	184%	2.3
16+	229,776	657	117%	76%	55%	130%	150%	2.3
Subtotal 11+	1,107,024	3,380	143%	94%	70%	159%	225%	n/a
Grand Total	6,997,075	16,722	97%	69%	50%	108%	101%	n/a

T10 Mortality Experience by Duration

(1) Median mortality ratio for companies with 10 or more deaths in given duration

(2) Weighted Average duration 11/10 premium jump ratio by exposure for policies with premium data available

T10 Mortality by Duration

RGA Reinsurance Company
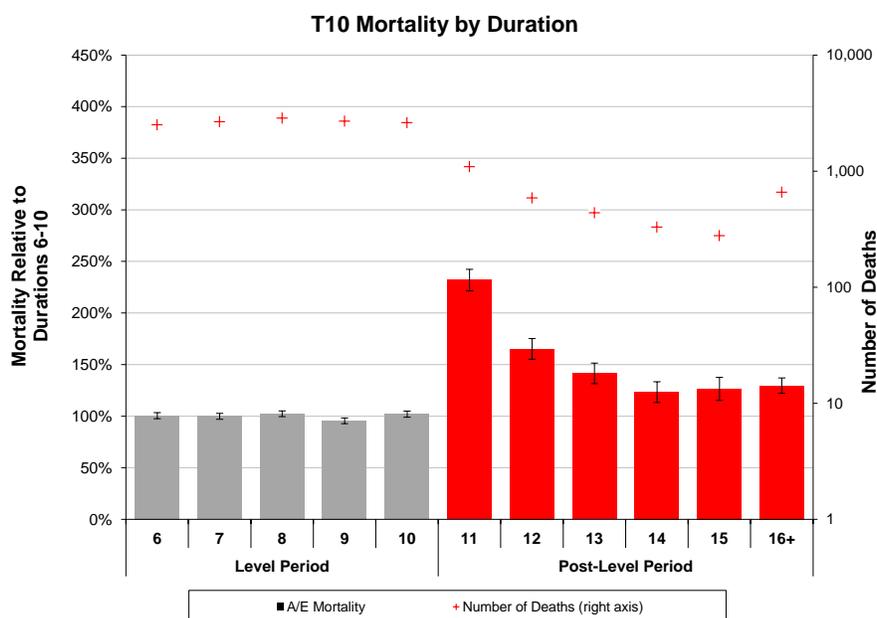
Mortality by Duration (cont.)

T10 (ART)

When isolating the experience for the companies with a Jump to ART product structure, the aggregated

mortality deterioration is 227% of the level period on an 08VBT Basis. Duration 11 experience alone is

304% of the level period.

Policy Duration	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					Average Prem Jump Ratio [2]
			08 VBT	01 VBT	7580	vs LP	Median 08 VBT [1]	
6	1,130,094	2,312	97%	71%	49%	102%	91%	8.9
7	1,068,167	2,449	95%	69%	49%	100%	92%	8.9
8	985,532	2,627	97%	70%	52%	103%	97%	8.7
9	873,090	2,434	90%	65%	49%	95%	92%	8.4
10	705,270	2,294	95%	67%	52%	100%	91%	7.8
Subtotal 6-10	4,762,152	12,116	95%	68%	50%	100%	91%	n/a
11	146,331	845	287%	198%	151%	304%	335%	4.0
12	94,460	392	208%	141%	108%	219%	218%	3.5
13	67,450	258	179%	120%	93%	189%	236%	3.3
14	46,472	177	168%	111%	86%	177%	211%	3.2
15	28,306	110	164%	108%	84%	173%	199%	3.2
16+	46,240	171	158%	105%	79%	167%	159%	3.2
Subtotal 11+	429,259	1,953	215%	145%	111%	227%	250%	n/a
Grand Total	5,191,411	14,069	103%	74%	54%	108%	101%	n/a

Table title: T10 Jump to ART Mortality Experience by Duration

(1) Median mortality ratio for companies with 10 or more deaths in given duration

(2) Weighted Average duration 11/10 premium jump ratio by exposure for policies with premium data available

T10 Jump to ART
Mortality by Duration
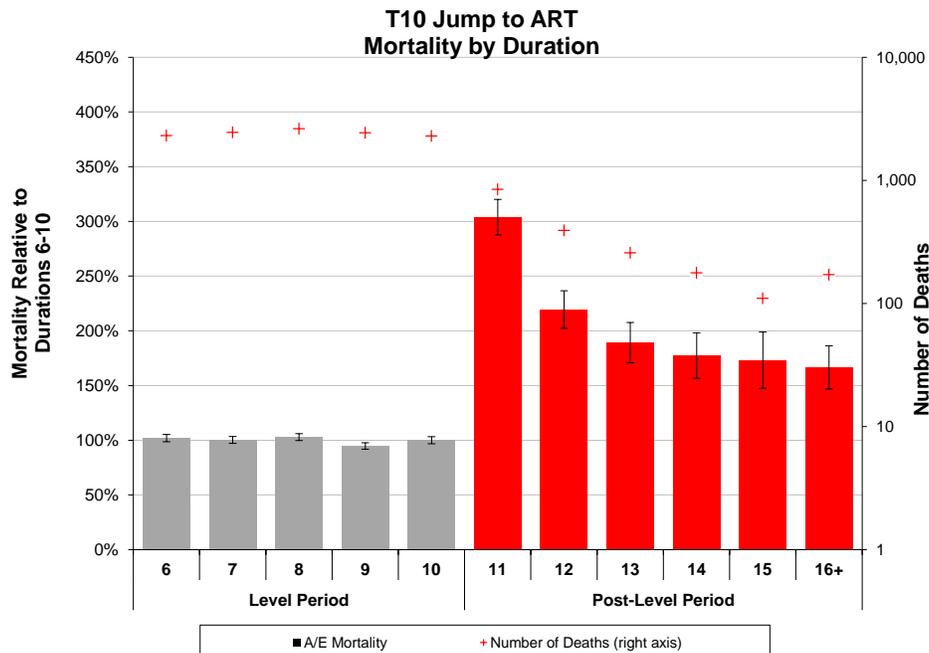
T15 (All)

In total, post-level mortality relative to durations 11-15 of the level period is 210% on an 08VBT basis. In addition, duration 16 experience is 344% of the level period.

T15 Mortality Experience by Duration								
Policy Duration	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					Average Prem Jump Ratio [2]
			08 VBT	01 VBT	7580	vs LP	Median 08 VBT [1]	
11	236,858	970	84%	57%	45%	101%	85%	11.0
12	180,028	805	82%	55%	44%	99%	84%	10.2
13	136,447	684	82%	54%	44%	99%	79%	9.8
14	88,490	469	82%	54%	44%	99%	85%	9.3
15	54,747	304	85%	55%	45%	103%	82%	8.7
Subtotal 11-15	696,570	3,232	83%	55%	44%	100%	84%	n/a
16	11,362	130	285%	183%	130%	344%	243%	5.1
17	9,598	75	200%	128%	92%	241%	208%	4.1
18	8,955	53	146%	94%	68%	176%	126%	3.6
19+	27,316	186	137%	91%	67%	165%	139%	3.0
Subtotal 16+	57,231	444	174%	114%	82%	210%	172%	n/a
Grand Total	753,801	3,676	89%	59%	47%	107%	85%	n/a

(1) Median mortality ratio for companies with 10 or more deaths in given duration

(2) Weighted Average duration 16/15 premium jump ratio by exposure for policies with premium data available

T15 Mortality by Duration

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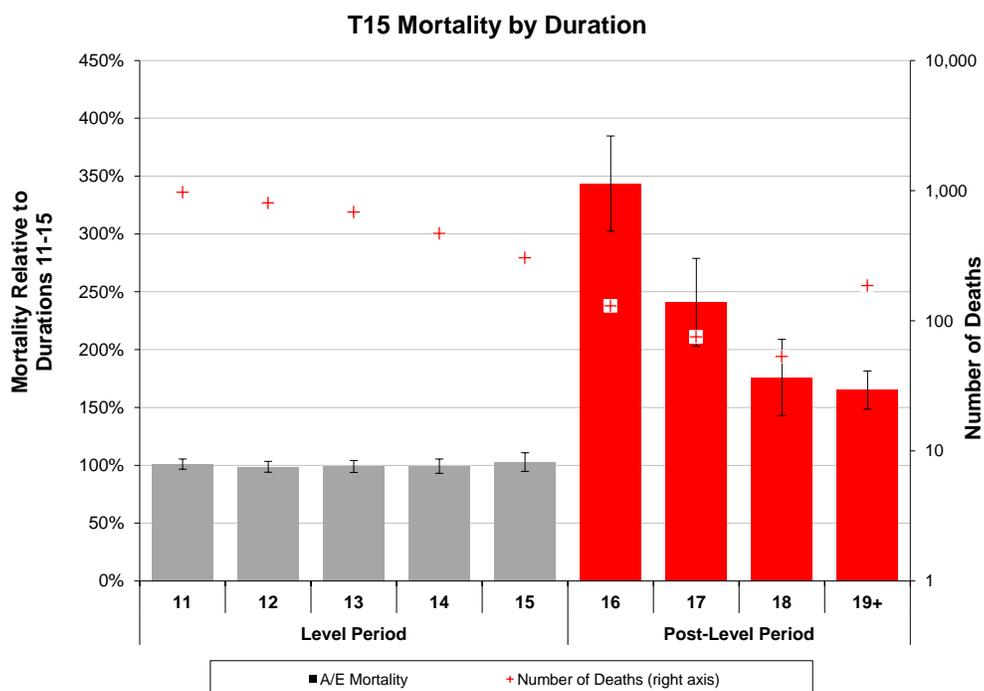
Distribution of Results

<u>T10 All</u>

As mentioned earlier and as the graph below shows, there is a wide spread of company-specific mortality experience. The following charts show this distribution of any company that provided at least 10 death claims in a given duration. The aggregated mortality increase is much lower than the median of the individual company results. The median levels might give a more realistic representation of the underlying experience.

2008 VBT Ratio Range	Duration				
	6-10	11	12	13+	11+
# of Companies	34	18	13	17	24
20th percentile	80%	148%	135%	116%	118%
Median	91%	262%	159%	140%	225%
Aggregate	90%	209%	149%	118%	143%
80th percentile	111%	604%	257%	179%	319%

Companies with 10 or more deaths in given duration

**T10 Mortality Ratios by Duration
Distribution by Company**

RGA Reinsurance Company
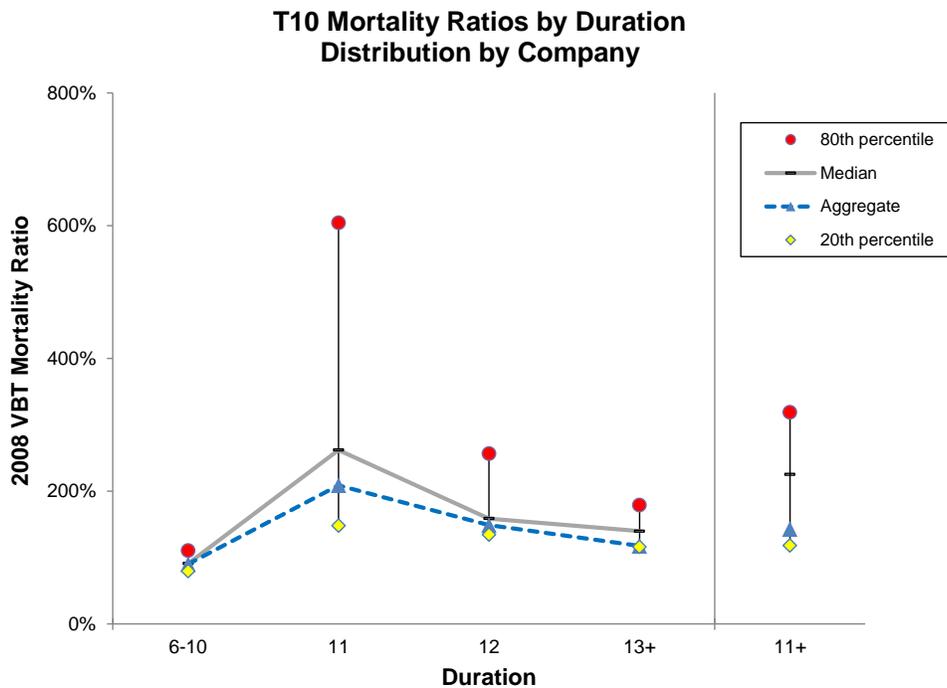
Distribution of Results (cont.)

T10 Jump to ART

The median results are higher in the post-level period when looking at only business with a jump to ART.

The range of results by company is still quite large, however.

2008 VBT Ratio Range	Duration				
	6-10	11	12	13+	11+
# of Companies	31	16	9	12	22
20th percentile	81%	195%	142%	121%	159%
Median	91%	335%	218%	148%	250%
Aggregate	95%	287%	208%	168%	215%
80th percentile	113%	787%	287%	196%	377%

Companies with 10 or more deaths in given duration

T10 Jump to ART
Mortality Ratios by Duration
Distribution by Company
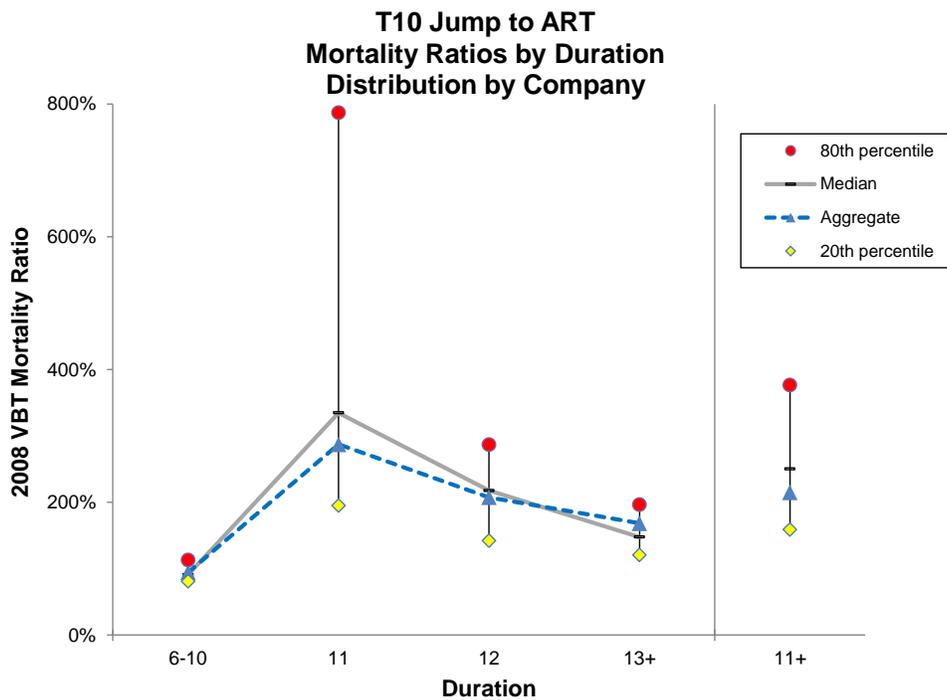
Premium Jump Ratio

T10 (All) – Durations 11+

The lapse rate experience shows a clear link between the size of the jump in premium after the end of the level period and the size of the shock lapse. The next logical question is whether or not this relationship extends to mortality deterioration. The experience results for mortality after the level period illustrate mortality increases significantly as the size of the premium jump increases. Note that for the "1.01x – 2x" band the mortality in the post-level period came in lower (79%) than during the level period. Given that the shock lapse rate for this band was 16.6% (p. 18), the authors view this result as an aberration that should not be considered indicative of expected future experience.

T10 Post-Level Mortality Experience by Premium Jump Ratio							Average Prem Jump Ratio [1]	Average Issue Age [2]
Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580	vs LP		
1.01x - 2x	299,179	298	79%	54%	38%	79%	1.6	31.9
2.01x - 3x	423,219	1,006	100%	64%	46%	129%	2.5	39.7
3.01x - 4x	78,339	443	151%	100%	84%	188%	3.4	41.8
4.01x - 5x	30,228	203	190%	125%	92%	182%	4.5	42.9
5.01x - 6x	14,323	173	245%	164%	130%	226%	5.5	44.5
6.01x - 7x	8,143	149	323%	220%	183%	334%	6.5	46.6
7.01x - 8x	5,406	111	365%	255%	216%	369%	7.4	46.5
8.01x - 9x	3,567	72	343%	231%	177%	331%	8.5	45.9
9.01x - 12x	4,627	86	471%	315%	238%	528%	10.4	46.9
12.01x-15x	1,880	42	660%	437%	324%	847%	13.4	47.4
15.01x-18x	792	29	869%	610%	463%	1088%	16.2	48.9
18.01x +	448	39	1091%	857%	713%	1459%	23.3	51.1
Subtotal Prem Data Available	870,149	2,651	133%	88%	65%	152%	6.1	42.3
No Prem Data Available	236,875	729	194%	131%	98%	200%	n/a	39.0
Grand Total	1,107,024	3,380	143%	94%	70%	159%	n/a	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Post-Level Mortality Relative to Level Period by Duration 11/10 Premium Jump Ratio

RGA Reinsurance Company
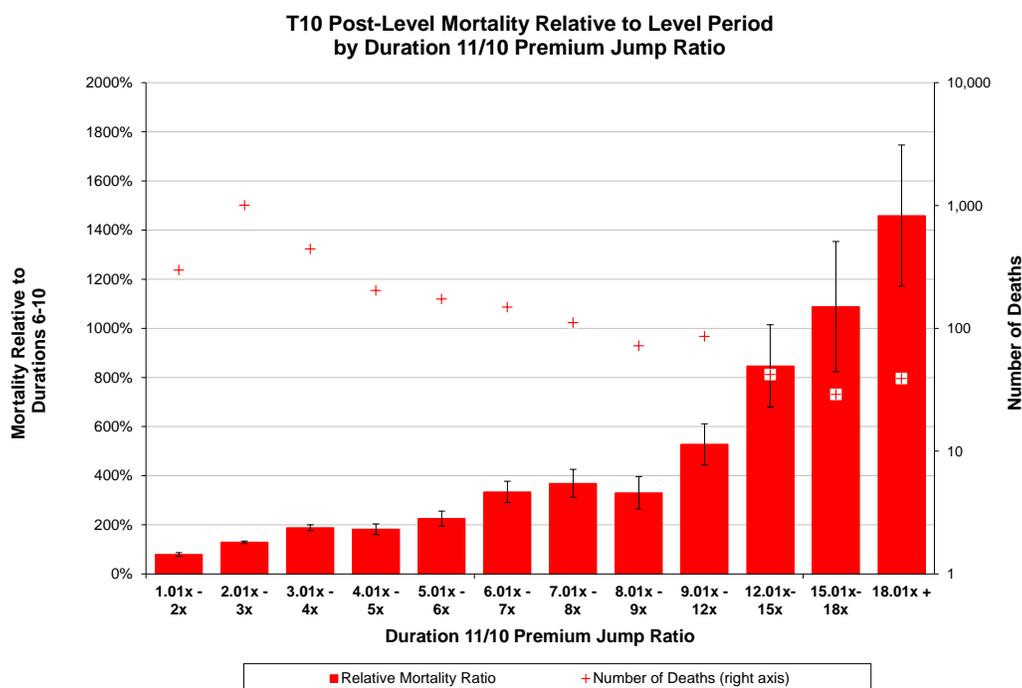
Premium Jump Ratio (cont.)

T10 (All) – Duration 11 Only

Mortality for duration 11 only is illustrated below. As expected, mortality is slightly elevated by premium jump compared to durations 11+. As previously noted, the lower than expected duration 11 mortality for the "1.01x – 2x" premium band is considered an aberration.

T10 Duration 11 Mortality Experience by Premium Jump Ratio							Average Prem Jump Ratio [1]	Average Issue Age [2]
Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580	vs LP		
1.01x - 2x	57,713	42	73%	50%	36%	73%	1.6	31.9
2.01x - 3x	93,010	224	122%	81%	58%	158%	2.5	39.7
3.01x - 4x	24,165	117	173%	116%	93%	216%	3.4	41.8
4.01x - 5x	10,877	70	210%	142%	105%	202%	4.5	42.9
5.01x - 6x	5,604	71	307%	213%	170%	282%	5.5	44.5
6.01x - 7x	3,610	74	435%	305%	252%	449%	6.5	46.6
7.01x - 8x	2,518	57	471%	337%	280%	475%	7.4	46.5
8.01x - 9x	1,667	34	482%	332%	257%	464%	8.5	45.9
9.01x - 12x	2,763	55	574%	388%	290%	644%	10.4	46.9
12.01x-15x	1,188	34	883%	595%	438%	1133%	13.4	47.4
15.01x-18x	536	22	1031%	716%	539%	1292%	16.2	48.9
18.01x +	383	39	1169%	931%	781%	1564%	23.3	51.1
Subtotal Prem Data Available	204,035	839	199%	135%	101%	227%	6.1	42.3
No Prem Data Available	70,598	251	249%	169%	124%	257%	n/a	39.0
Grand Total	274,633	1,090	209%	141%	105%	232%	n/a	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Duration 11 Mortality Relative to Level Period
by Duration 11/10 Premium Jump Ratio

RGA Reinsurance Company
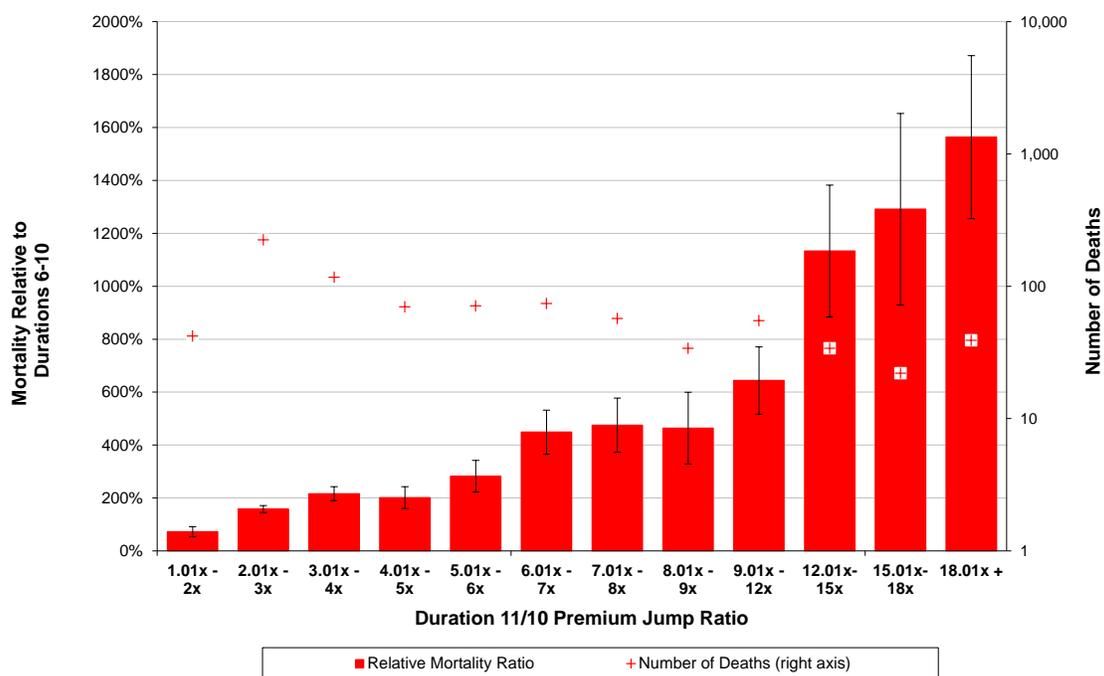
Premium Jump Ratio (cont.)

T10 (Jump to ART) – Durations 11+

Mortality also increases by premium jump ratio when looking only at the jump to ART products for

durations 11+.

T10 Jump to ART Post-Level Mortality Experience by Premium Jump Ratio							Average Prem Jump Ratio [1]	Average Issue Age [2]
Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580	vs LP		
1.01x - 2x	49,888	67	93%	62%	47%	75%	1.7	33.0
2.01x - 3x	64,474	236	139%	94%	74%	139%	2.5	39.6
3.01x - 4x	42,312	175	189%	126%	98%	158%	3.5	38.2
4.01x - 5x	27,148	160	188%	126%	94%	174%	4.5	42.1
5.01x - 6x	13,189	153	257%	174%	138%	236%	5.5	44.2
6.01x - 7x	7,804	145	351%	239%	198%	365%	6.5	46.5
7.01x - 8x	5,231	101	366%	254%	214%	368%	7.4	46.4
8.01x - 9x	3,505	69	340%	229%	174%	328%	8.5	45.8
9.01x - 12x	4,589	83	469%	313%	236%	525%	10.4	46.8
12.01x-15x	1,878	41	650%	430%	318%	837%	13.4	47.3
15.01x-18x	791	28	846%	593%	449%	1061%	16.2	48.8
18.01x +	448	39	1091%	857%	713%	1459%	23.3	51.1
Subtotal Prem Data Available	221,257	1,297	216%	146%	114%	231%	7.8	43.8
No Prem Data Available	208,002	656	212%	144%	107%	218%	n/a	38.9
Grand Total	429,259	1,953	215%	145%	111%	227%	n/a	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
Post-Level Mortality Relative to Level Period
by Duration 11/10 Premium Jump Ratio

RGA Reinsurance Company
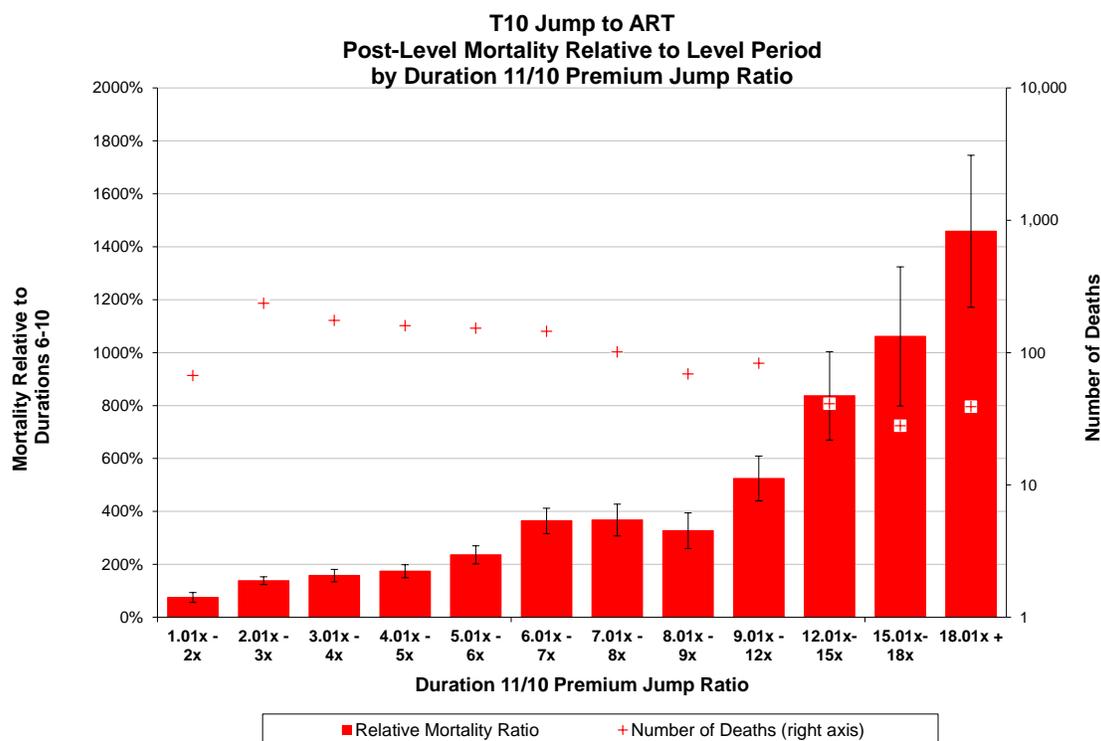
Premium Jump Ratio (cont.)

T10 (Jump to ART) – Duration 11

Mortality increases even quicker by premium jump for duration 11 than 11+. In total, duration 11 is 304% of the level period on an 08VBT basis compared to 227% for durations 11+.

T10 Jump to ART Duration 11 Mortality Experience by Premium Jump Ratio							Average Prem Jump Ratio [1]	Average Issue Age [2]
Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580	vs LP		
1.01x - 2x	13,481	14	96%	66%	50%	77%	1.7	33.0
2.01x - 3x	23,558	101	187%	128%	101%	187%	2.5	39.6
3.01x - 4x	14,900	59	201%	139%	108%	168%	3.5	38.2
4.01x - 5x	9,928	59	206%	142%	106%	192%	4.5	42.1
5.01x - 6x	5,335	65	303%	211%	169%	278%	5.5	44.2
6.01x - 7x	3,518	74	459%	322%	267%	477%	6.5	46.5
7.01x - 8x	2,461	50	444%	316%	262%	446%	7.4	46.4
8.01x - 9x	1,647	34	502%	345%	266%	483%	8.5	45.8
9.01x - 12x	2,747	52	560%	378%	281%	627%	10.4	46.8
12.01x-15x	1,187	34	892%	600%	441%	1148%	13.4	47.3
15.01x-18x	536	21	998%	691%	520%	1252%	16.2	48.8
18.01x +	383	39	1169%	931%	781%	1564%	23.3	51.1
Subtotal Prem Data Available	79,679	602	300%	208%	162%	321%	7.8	43.8
No Prem Data Available	66,652	243	260%	177%	129%	267%	n/a	38.9
Grand Total	146,331	845	287%	198%	151%	304%	n/a	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
Duration 11 Mortality Relative to Level Period
by Duration 11/10 Premium Jump Ratio
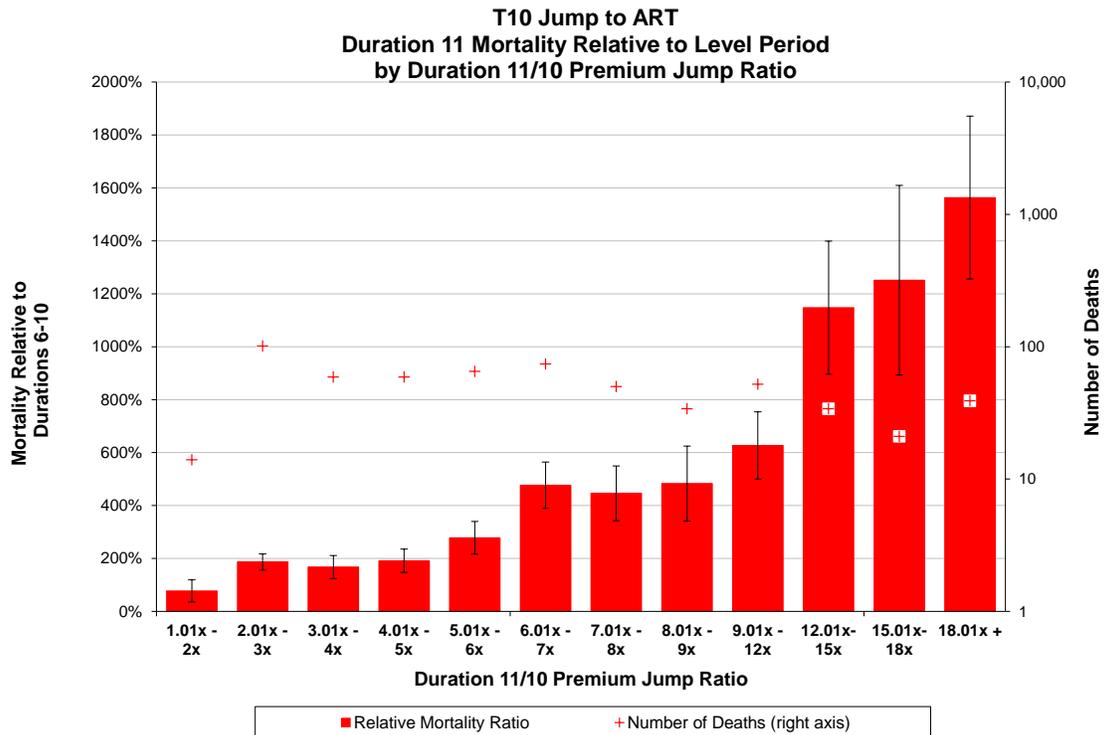
Premium Jump Ratio (cont.)

T15 (ALL)

T15 also exhibits increasing mortality experience by premium jump on an 08VBT basis. Results are still relatively thin above 12x jumps compared to T10 so it is difficult to conclude whether mortality is as high as T10 at those levels.

T15 Post-Level Mortality Experience by Premium Jump Ratio							Average Prem Jump Ratio [1]	Average Issue Age [2]
Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580	vs LP		
1.01x - 2x	10,246	17	107%	69%	51%	170%	1.6	29.5
2.01x - 3x	18,324	67	135%	84%	60%	432%	2.6	34.7
3.01x - 4x	10,392	73	133%	85%	65%	431%	3.5	38.7
4.01x - 5x	5,179	98	162%	110%	79%	184%	4.5	41.4
5.01x - 7x	4,329	69	199%	136%	96%	225%	6.0	44.1
7.01x - 9x	2,096	41	355%	233%	174%	361%	7.9	47.2
9.01x - 12x	2,694	46	273%	170%	116%	331%	10.6	47.7
12.01x +	526	21	491%	315%	221%	564%	16.3	45.7
Subtotal Prem Data Available	53,786	432	174%	113%	82%	209%	8.7	44.3
No Prem Data Available	3,445	12	178%	126%	89%	225%	n/a	42.0
Grand Total	57,231	444	174%	114%	82%	210%	n/a	44.1

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 Post-Level Mortality Relative to Level Period by Duration 16/15 Premium Jump Ratio

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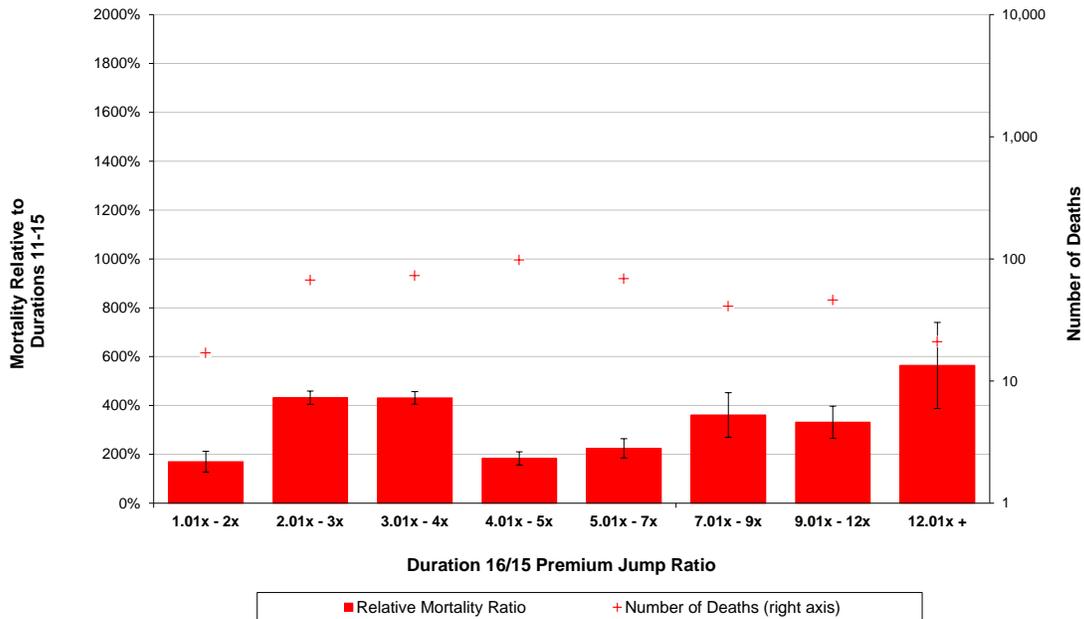
Issue Age

T10 (All)

Mortality during the post-level period increases by issue age. As expected, premium jump, which is correlated with issue age, also increases as age increases. A corresponding trend was also seen in the shock lapse experience results.

Issue Age	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
0-29	710,163	308	102%	68%	55%	303,127	245	107%	78%	61%	105%	3.0	25.0
30-39	1,891,955	1,478	102%	67%	44%	499,563	903	119%	81%	57%	117%	4.9	34.7
40-49	1,818,971	3,057	92%	61%	43%	241,342	1,072	135%	86%	63%	146%	6.2	44.2
50-59	1,106,871	4,091	86%	59%	43%	56,524	708	168%	103%	79%	196%	8.1	53.8
60+	362,091	4,408	89%	73%	56%	6,469	452	293%	216%	194%	330%	11.7	64.5
Grand Total	5,890,051	13,342	90%	64%	47%	1,107,024	3,380	143%	94%	70%	159%	6.1	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 2008 VBT Mortality Ratios
by Issue Age

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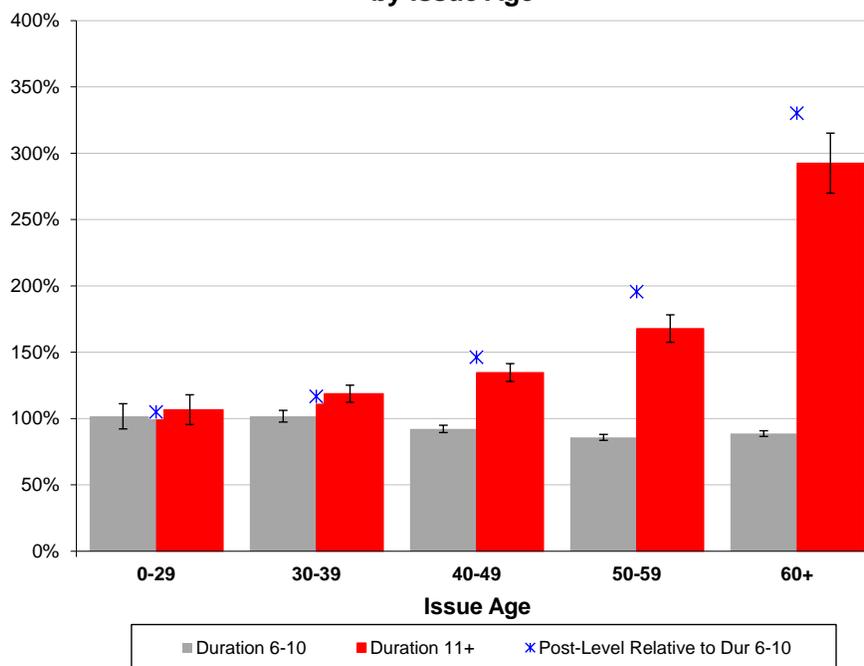
Issue Age (cont.)

T10 (Jump to ART)

Results by issue age for business with a jump to ART also demonstrate increasing mortality by increasing issue age.

Issue Age	Duration 6-10					Duration 11+						Average Prem Jump Ratio (1)	Average Issue Age (2)
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
0-29	556,775	240	101%	68%	55%	135,852	108	123%	91%	74%	121%	4.2	24.6
30-39	1,485,082	1,164	102%	67%	44%	174,690	371	153%	106%	73%	150%	6.6	34.8
40-49	1,456,538	2,644	98%	65%	46%	90,048	578	205%	132%	100%	208%	7.7	44.2
50-59	926,072	3,748	92%	64%	47%	23,475	480	283%	177%	141%	306%	9.4	53.8
60+	337,685	4,320	92%	76%	58%	5,194	416	330%	246%	223%	358%	12.2	64.5
Grand Total	4,762,152	12,116	95%	68%	50%	429,259	1,953	215%	145%	111%	227%	7.8	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

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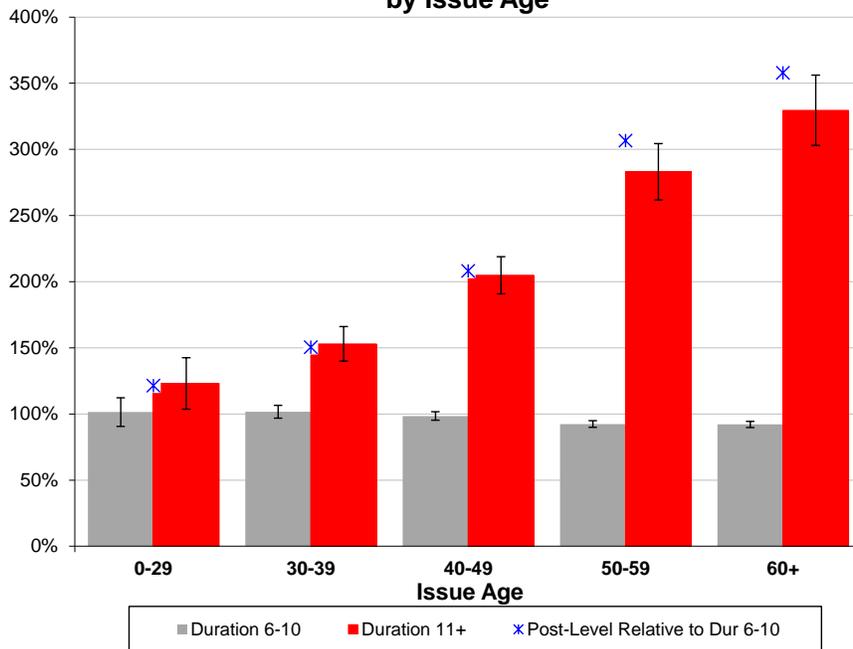
Issue Age (cont.)

T15 (All)

T15 post-level mortality generally increases by issue age as we saw with T10.

Issue Age	Duration 11-15					Duration 16+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
0-29	25,938	24	132%	95%	73%	8,697	13	119%	86%	62%	90%	3.9	26.4
30-39	172,684	184	73%	51%	35%	29,294	96	138%	88%	62%	189%	7.7	35.3
40-49	263,316	633	75%	48%	35%	14,361	118	158%	96%	69%	211%	9.2	44.4
50-59	166,186	992	81%	50%	39%	3,865	126	222%	147%	109%	274%	9.4	53.4
60+	68,446	1,399	90%	65%	58%	1,014	91	209%	157%	121%	233%	10.3	63.7
Grand Total	696,570	3,232	83%	55%	44%	57,231	444	174%	114%	82%	210%	8.7	44.1

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 2008 VBT Mortality Ratios by Issue Age
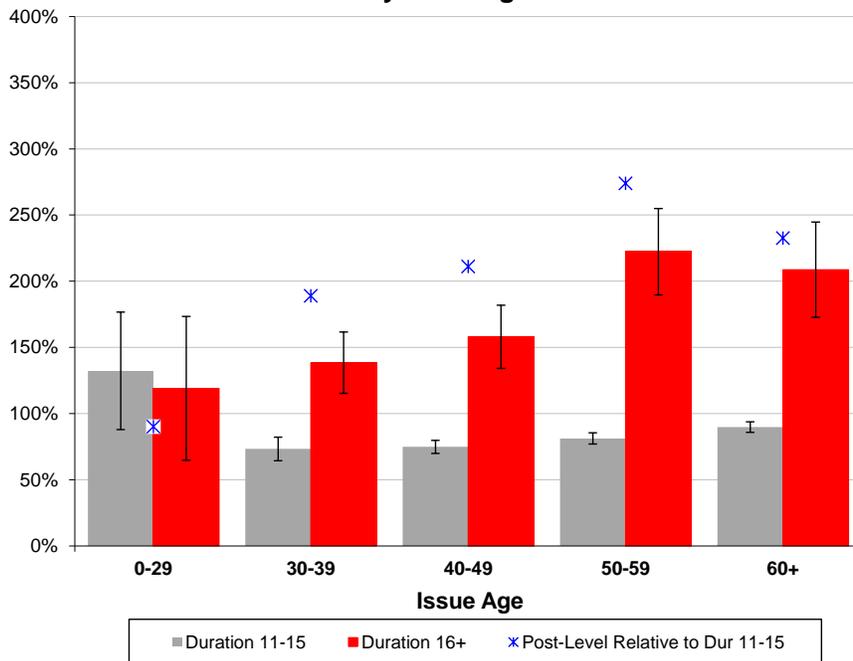
Gender

T10 (All)

Post-level period mortality deterioration for males is slightly higher than females, which is consistent with the shock lapse experience. On average, the premium jump and average issue age is higher for males which helps explain the slight deviation.

Gender	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
Male	3,809,688	10,316	90%	64%	46%	622,192	2,360	145%	97%	70%	162%	6.5	42.5
Female	2,080,364	3,026	92%	66%	51%	484,832	1,020	139%	88%	71%	151%	5.4	38.7
Grand Total	5,890,051	13,342	90%	64%	47%	1,107,024	3,380	143%	94%	70%	159%	6.1	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 2008 VBT Mortality Ratios by Gender
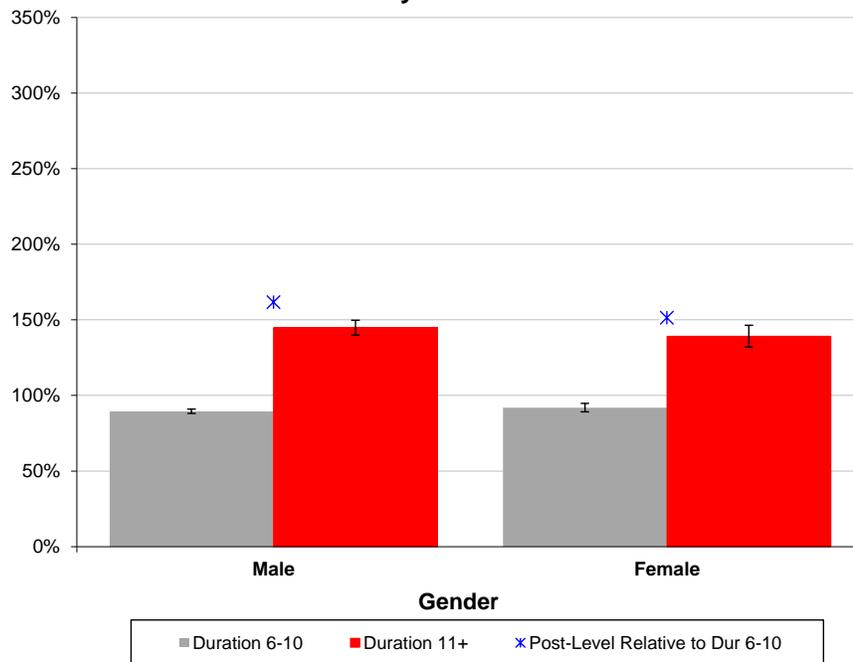
<u>T10 (Jump to ART)</u>

Results are similar when only looking at "Jump to ART" products. Slightly higher mortality deterioration for

males compared to females can be seen once again.

Gender	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
Male	3,092,154	9,395	94%	68%	49%	242,974	1,367	218%	150%	111%	231%	8.2	43.1
Female	1,669,998	2,721	96%	69%	55%	186,284	586	209%	135%	111%	218%	7.1	39.4
Grand Total	4,762,152	12,116	95%	68%	50%	429,259	1,953	215%	145%	111%	227%	7.8	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
2008 VBT Mortality Ratios
by Gender
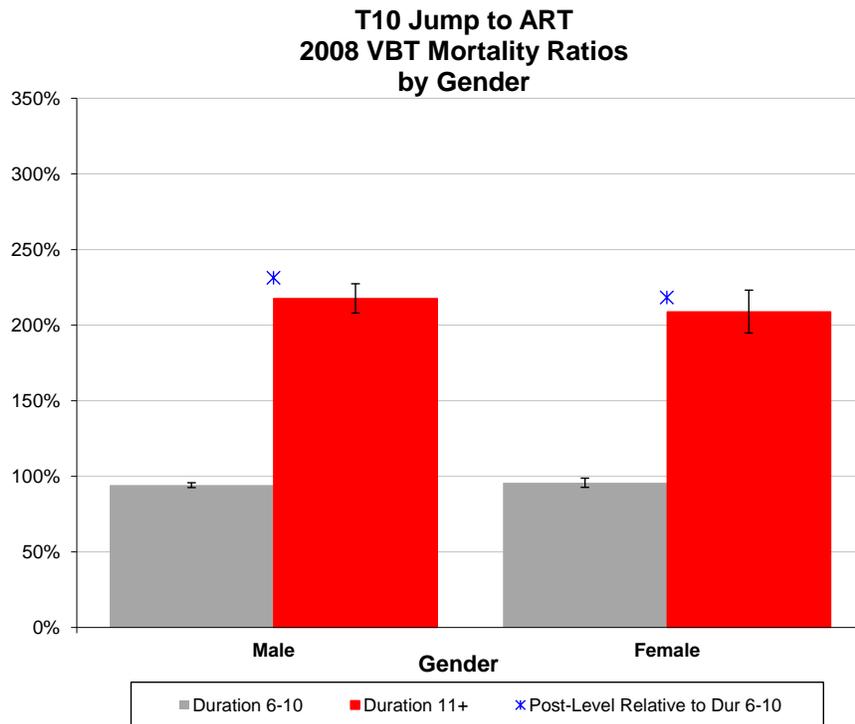
Gender (cont.)

T15 (All)

T15 illustrates significant mortality differences between males and females. Mortality is fairly consistent in the level period and the majority of the deviation is occurring in the post-level period. The majority of this difference is due to the mixture of post-level premium structures. A larger portion of males have a "Jump to ART" which inherently has a larger premium jump and shock lapse on average.

Gender	Duration 11-15					Duration 16+							Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality						
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP			
Male	462,003	2,524	82%	55%	43%	30,975	310	197%	132%	88%	239%	9.0	45.2
Female	234,567	708	85%	55%	51%	26,256	134	137%	86%	72%	161%	7.9	41.8
Grand Total	696,570	3,232	83%	55%	44%	57,231	444	174%	114%	82%	210%	8.7	44.1

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 2008 VBT Mortality Ratios
by Gender

RGA Reinsurance Company
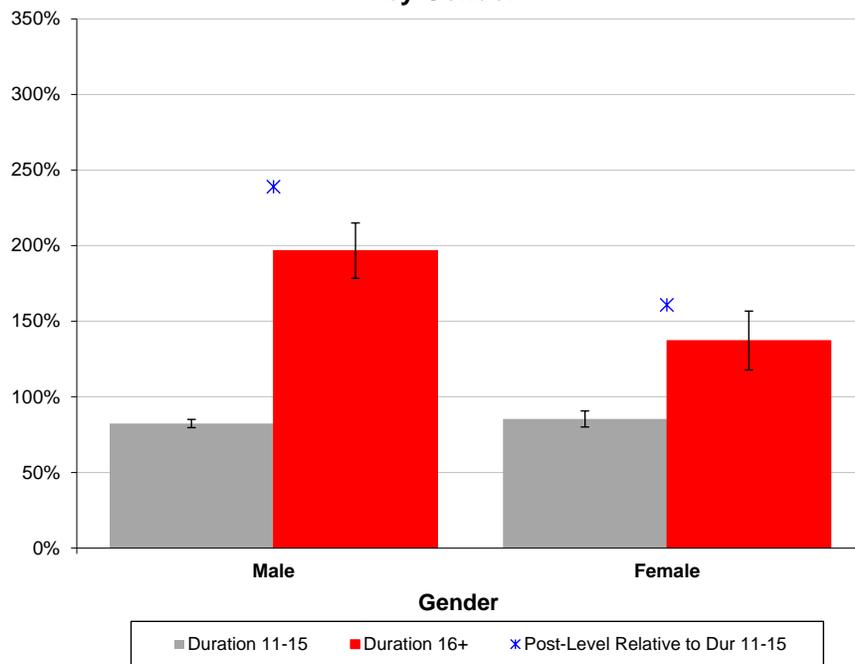
Risk Class

The following pages will display mortality results by underwriting risk class. For a description of the mapping process used, see page 48.

T10 (All)

During the level period, the results by risk class show the expected trend of lower mortality for preferred classes. The distribution of business by risk class is driven by the companies contributing to the study and isn't necessarily representative of the current risk class structures of the broader industry. Specifically, we expect that the products with only one or two NS classes are overrepresented in this study relative to currently issued products.

Super-preferred classes (best NS out of three or more NS) have the lowest level period mortality and the highest post-level mortality deterioration.

Risk Class	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
Super-Pref NS	798,673	1,232	69%	47%	32%	33,754	163	243%	161%	112%	352%	11.4	43.6
Preferred NS	2,294,698	3,575	80%	54%	36%	311,029	800	123%	78%	52%	154%	6.0	41.2
Non-Pref NS	1,469,025	4,170	103%	72%	48%	154,097	675	166%	106%	73%	160%	5.9	43.2
Undiff/Unknown NS	649,465	1,736	102%	74%	51%	441,007	990	134%	87%	58%	132%	3.8	38.8
Preferred SM	184,507	689	79%	67%	93%	9,776	85	168%	128%	180%	213%	6.4	41.4
Non-Pref SM	130,350	643	103%	89%	123%	13,332	83	253%	197%	261%	246%	4.9	33.1
Undiff/Unknown SM	357,413	1,260	99%	81%	111%	140,329	540	137%	102%	137%	139%	3.5	36.8
Unknown/Aggregate	5,920	37	127%	99%	77%	3,700	44	191%	133%	104%	150%	4.1	47.2
Grand Total	5,890,051	13,342	90%	64%	47%	1,107,024	3,380	143%	94%	70%	159%	6.1	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available
(2) Weighted Average issue age by duration 10 exposure

T10 2008 VBT Mortality Ratios by Risk Class
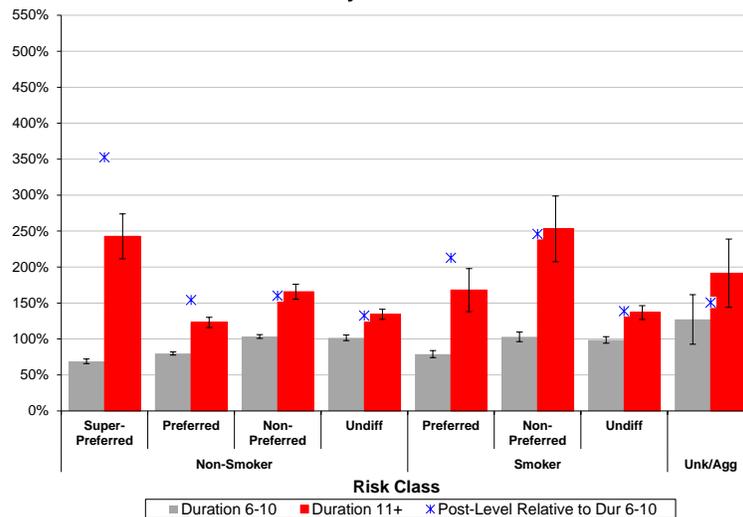
Risk Class (cont.)

T10 (Jump to ART)

Similar experience is seen when looking just at the jump to ART plans. The Super-preferred NS class has the best mortality in the level period and experiences significantly higher mortality deterioration in the post-level period.

Risk Class	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
Super-Pref NS	667,887	1,170	75%	52%	35%	15,767	132	334%	222%	161%	444%	13.2	43.9
Preferred NS	1,820,560	3,164	88%	60%	40%	156,993	576	208%	135%	91%	236%	8.0	40.9
Non-Pref NS	1,342,844	3,978	107%	74%	50%	107,470	542	218%	142%	99%	205%	6.5	43.3
Undiff/Unknown NS	362,715	1,454	101%	75%	53%	52,725	270	245%	160%	111%	243%	5.6	43.3
Preferred SM	182,276	683	79%	67%	93%	9,614	84	169%	129%	182%	214%	6.4	41.4
Non-Pref SM	128,482	640	104%	90%	124%	12,967	83	264%	206%	272%	255%	5.0	33.0
Undiff/Unknown SM	251,469	990	100%	84%	115%	70,109	223	172%	131%	166%	172%	4.4	37.1
Unknown/Aggregate	5,920	37	127%	99%	77%	3,614	43	191%	133%	103%	150%	4.1	47.2
Grand Total	4,762,152	12,116	95%	68%	50%	429,259	1,953	215%	145%	111%	227%	7.8	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
2008 VBT Mortality Ratios
by Risk Class
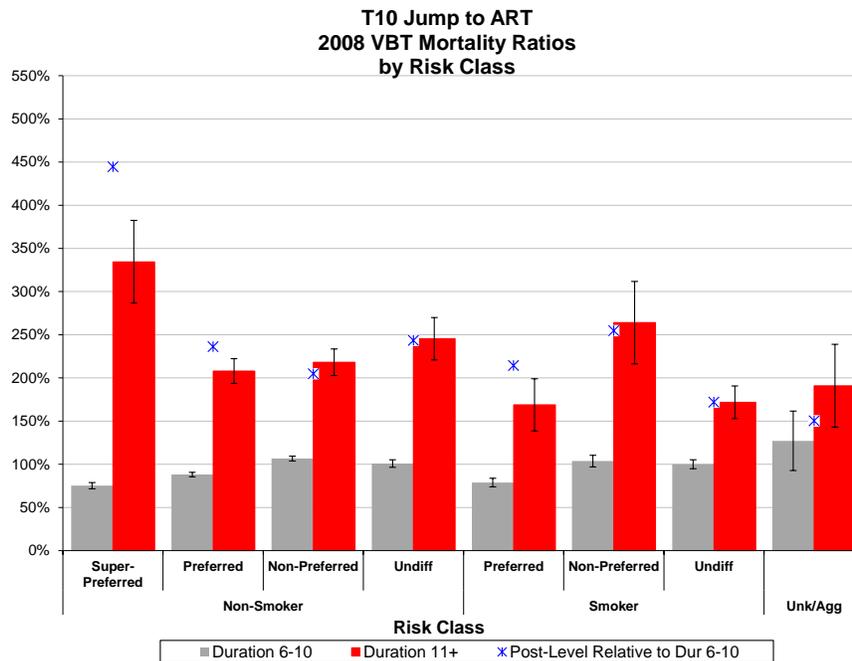
Face Amount

<u>T10 (All)</u>

During the level period, the smallest policy sizes often have the highest mortality levels due to fewer underwriting requirements and lower socio-economic conditions. As policy size increases, mortality generally improves, although the mortality is slightly higher above $1 million.

While the post-level period does not show any clear trends by policy face amount, the ratio of the post-level versus the level period does show higher mortality deterioration as face amount increases.

Policy Face Amount	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
< $50k	44,185	195	131%	108%	92%	54,779	86	153%	114%	100%	117%	5.0	19.3
$50k - $99k	318,166	1,563	107%	85%	71%	206,295	700	144%	96%	77%	135%	4.0	41.8
$100k - $249k	2,777,533	6,653	92%	67%	50%	587,244	1,749	146%	96%	72%	159%	5.5	40.9
$250k - $999k	2,289,884	4,031	82%	56%	39%	233,299	732	134%	87%	60%	163%	7.0	41.6
$1 M +	460,284	900	84%	57%	38%	25,408	113	145%	93%	64%	173%	8.6	43.9
Grand Total	5,890,051	13,342	90%	64%	47%	1,107,024	3,380	143%	94%	70%	159%	6.1	41.2

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

**T10 2008 VBT Mortality Ratios
by Face Amount Band**

RGA Reinsurance Company
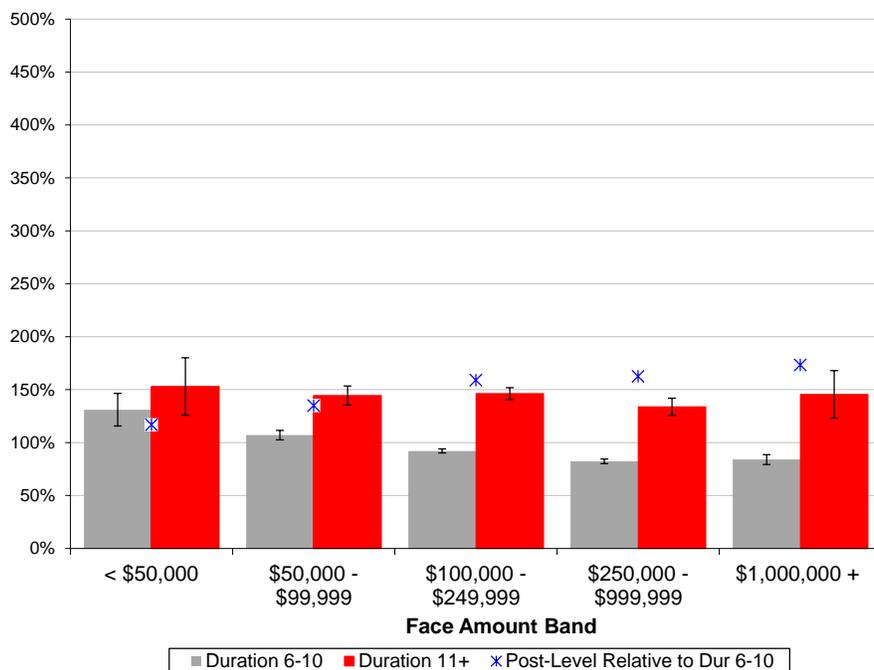
Face Amount (cont.)

T10 (Jump to ART)

For the Jump to ART products, similar results are noted in the level period with lower mortality as face amount increases. For the post-level period, higher mortality can be seen as face amount band increases.

Policy Face Amount	Duration 6-10					Duration 11+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
< $50k	42,603	192	131%	109%	93%	52,805	72	146%	111%	99%	111%	5.6	18.5
$50k - $99k	164,562	1,323	106%	87%	73%	22,923	226	220%	155%	141%	207%	6.0	49.4
$100k - $249k	2,304,177	6,127	95%	70%	53%	227,914	1,072	221%	148%	113%	232%	7.1	41.7
$250k - $999k	1,874,476	3,656	90%	62%	43%	114,395	502	208%	138%	98%	232%	8.5	41.5
$1 M +	376,334	818	90%	62%	41%	11,221	81	279%	185%	129%	310%	10.2	44.0
Grand Total	4,762,152	12,116	95%	68%	50%	429,259	1,953	215%	145%	111%	227%	7.8	41.8

(1) Weighted Average duration 11/10 premium jump ratio by duration 10 exposure for policies with premium data available

(2) Weighted Average issue age by duration 10 exposure

T10 Jump to ART
2008 VBT Mortality Ratios
by Face Amount Band

RGA Reinsurance Company
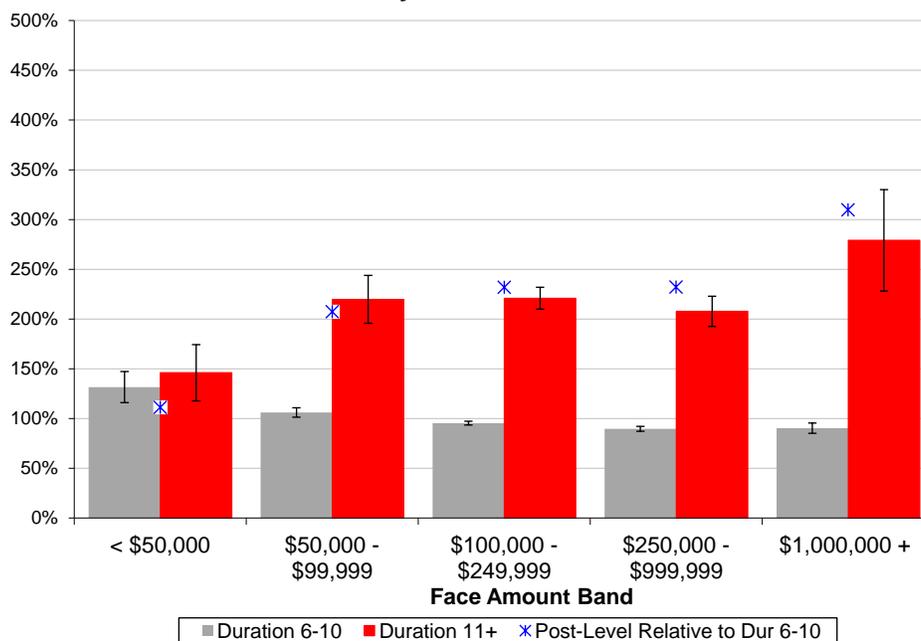
Face Amount (cont.)

T15 (All)

T15 experience is similar to T10 Jump to ART, with higher post-level mortality at higher face amounts.

However, results are very thin in the post-level period in the $1M+ band.

Policy Face Amount	Duration 11-15					Duration 16+						Average Prem Jump Ratio [1]	Average Issue Age [2]
	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality					
			08 VBT	01 VBT	7580			08 VBT	01 VBT	7580	vs LP		
< $50k	4,882	80	118%	83%	82%	3,961	108	160%	116%	93%	136%	5.7	54.3
$50k - $99k	31,923	386	103%	73%	66%	6,576	67	189%	120%	92%	183%	5.6	48.4
$100k - $249k	331,636	1,770	86%	57%	48%	36,563	196	167%	105%	73%	194%	8.0	44.3
$250k - $999k	284,486	832	69%	45%	33%	9,614	66	202%	130%	85%	291%	9.8	42.7
$1 M +	43,644	164	85%	55%	40%	518	7	347%	221%	142%	411%	11.0	44.0
Grand Total	696,570	3,232	83%	55%	44%	57,231	444	174%	114%	82%	210%	8.7	44.1

(1) Weighted Average duration 16/15 premium jump ratio by duration 15 exposure for policies with premium data available

(2) Weighted Average issue age by duration 15 exposure

T15 2008 VBT Mortality Ratios by Face Amount Band

RGA Reinsurance Company
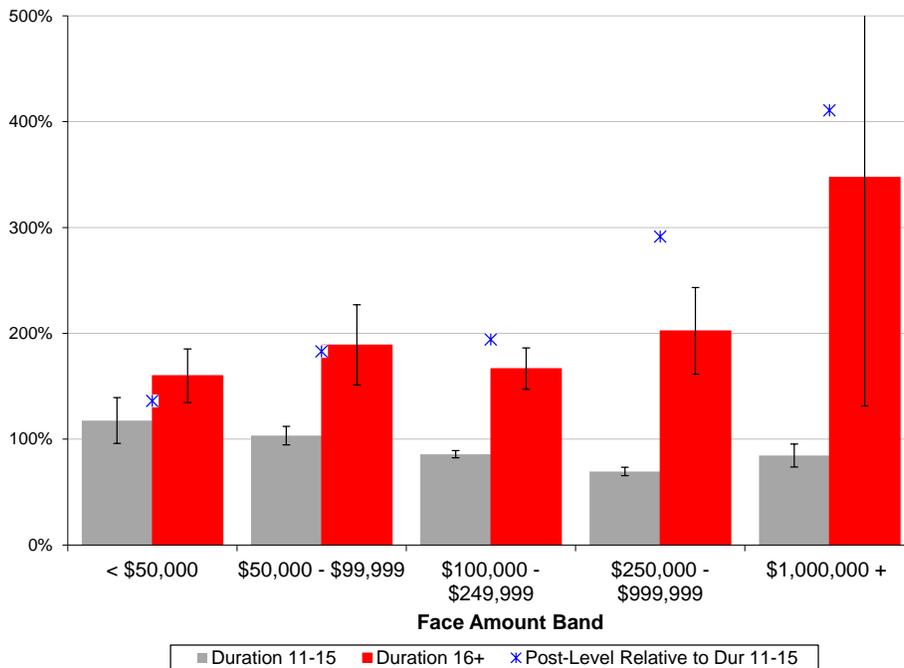
Cause of Death

<u>T10 All</u>

Companies were asked to provide the cause of death information if available. This data was provided for roughly 56% of all deaths in the study and 42% of post-level period deaths. Cause of death codes were mapped into common groupings in order to aggregate across companies. The following chart shows the raw cause-specific mortality rates and cause-specific claims as a percentage of total claims by duration for the companies that were able to provide cause of death. Since these rates are not age/duration adjusted, they generally increase by duration even during the level period.

The expectation is that policyholders with known impairments might be more likely to persist beyond the level period due to anti-selection. Currently, the data does not show any single cause of death increasing as a percentage of a duration's total claims compared to other causes during the post-level period.

RGA Reinsurance Company

Cause of Death (cont.)

<u>T10 (All)</u>

Looking at the first graph below, it is not surprising that mortality rates increase gradually by duration in the level period as mentioned previously. The significant increase in duration 11 is the result of both the anti-selective lapsation and the additional deaths in the grace period. Durations 12+ return to previous levels as the grace period impact is not as significant because of the decreased lapse rates. This will be analyzed in more detail later in the document. Please note this business is not age adjusted and includes all post-level premium structures, which can cause fluctuations such as the drop in duration 12 compared to 10.

T10 Raw Mortality Rate by Cause of Death

RGA Reinsurance Company
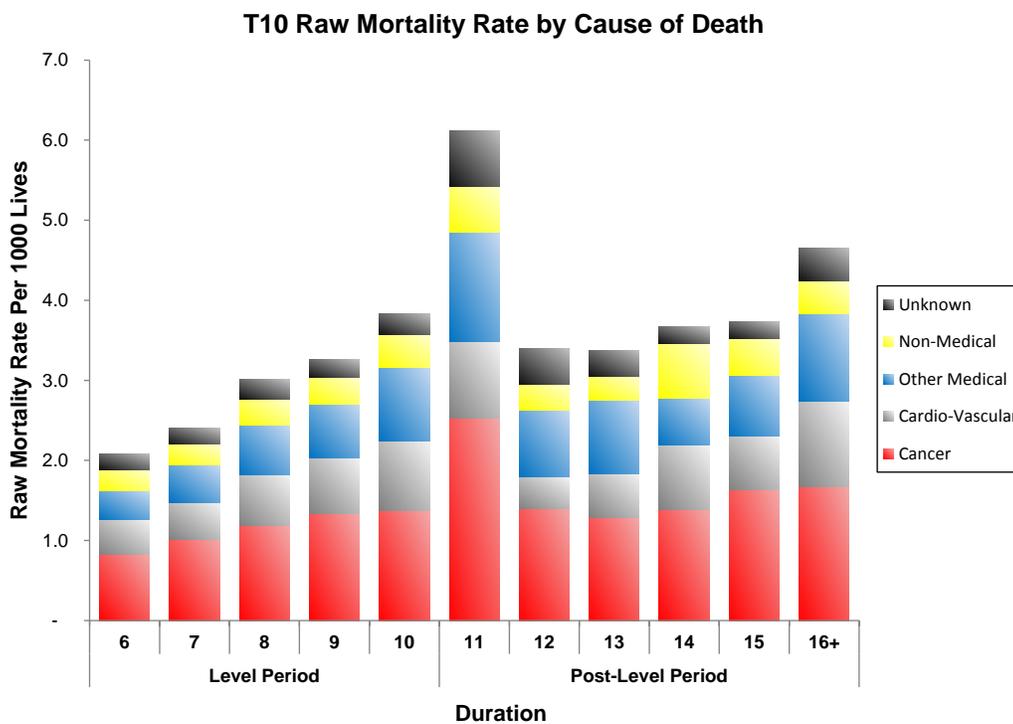
Cause of Death (cont.)

T10 (All)

Looking at cause of death as a percentage of total deaths, it does not appear that any one cause of death is significantly impacting the post-level period any differently than the level period. This observation differs from experience in the 2010 study, which seemed to imply more evidence of anti-selection in cancer deaths.

T10 Death Count by Known Cause of Death
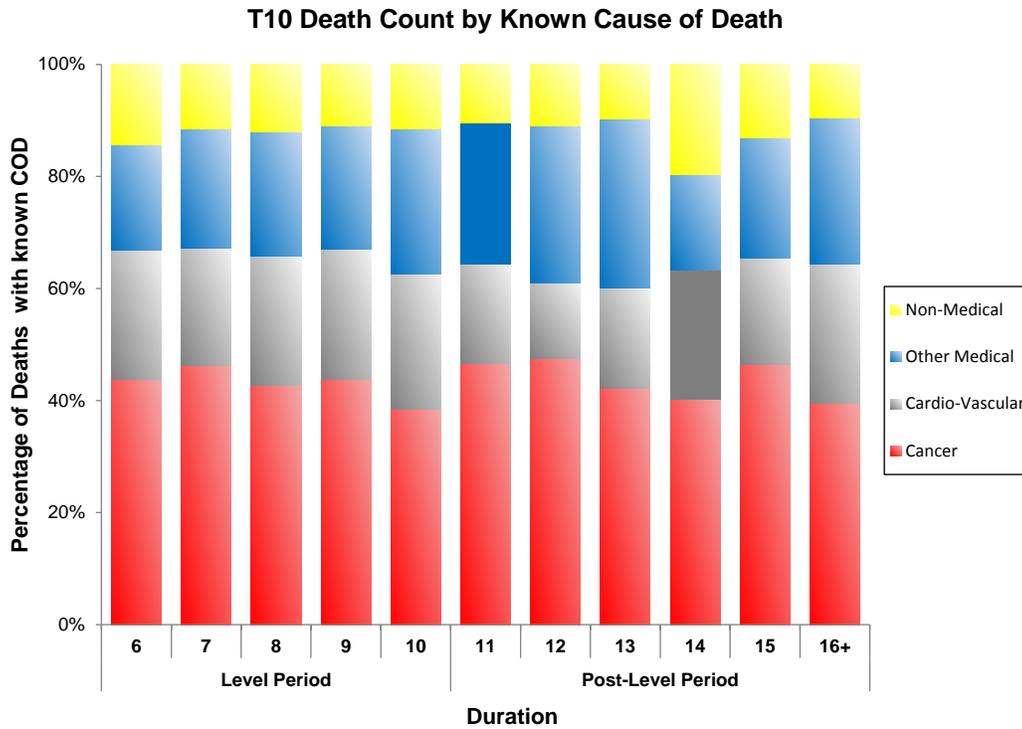
Cause of Death (cont.)

<u>T15 (All)</u>

Consistent with T10, raw mortality increases slightly in the level period with a significant increase in the first duration of the post-level period (duration 16). Again, this is caused not only by the anti-selective lapsation at the end of the level period, but significantly impacted by the grace period. Following the large mortality shock, duration 17 experience shows a drop in mortality as the grace period impact is less impactful and the average age has decreased.

T15 Raw Mortality Rate by Cause of Death
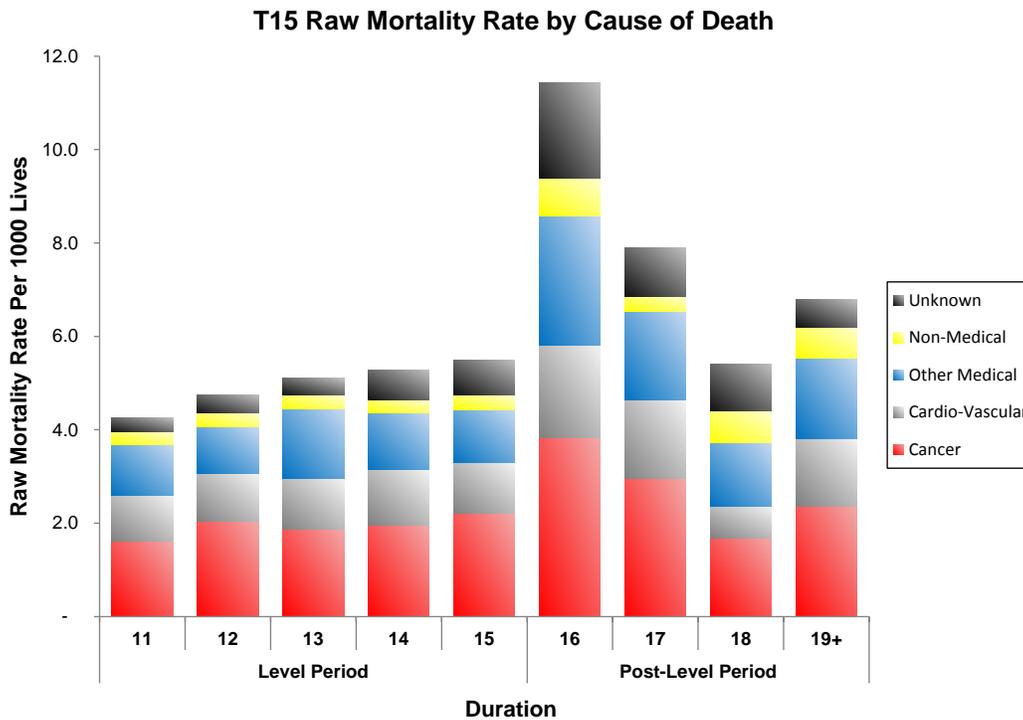
Cause of Death (cont.)

T15 (All)

Once again, no single cause of death appears to be impacting the post-level period any differently than the level period.

T15 Death Count by Known Cause of Death
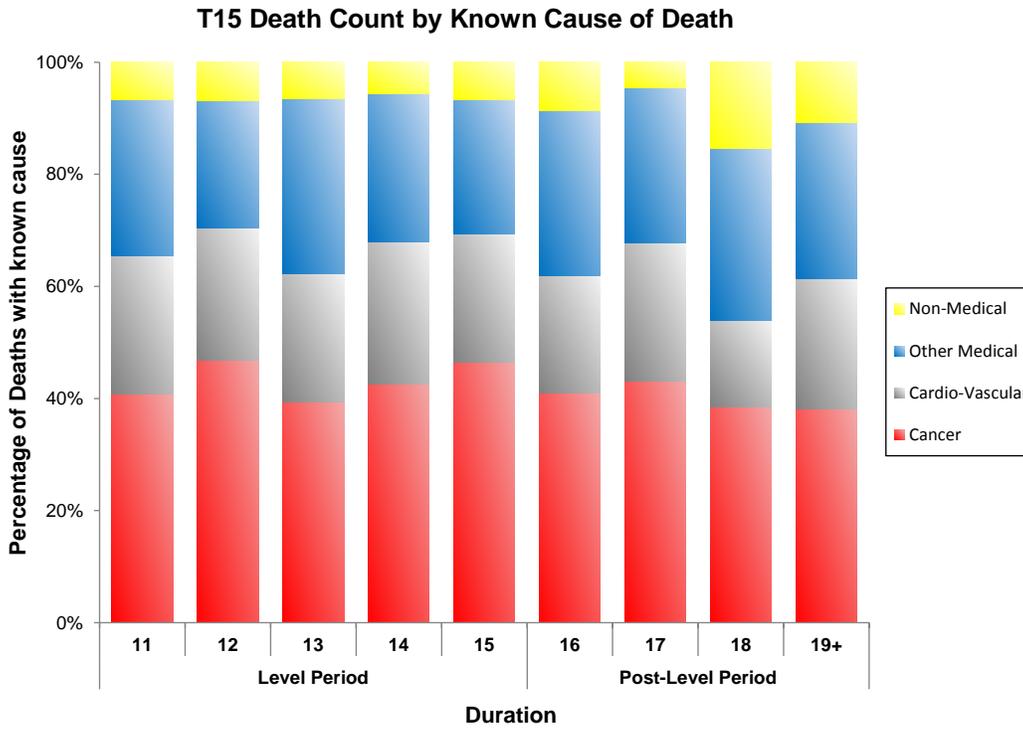
Grace Period Analysis

<u>T10 (All)</u>

The grace period in life insurance can cause excess mortality by providing "free" life insurance to all policies, specifically to those that would have planned to lapse. This is extremely evident when lapse rates are elevated, as can be seen on term business once it reaches the post-level period where lapse rates can exceed 90%. Additional analysis was completed in order to help quantify the excess mortality caused by the grace period. Please note that this analysis only included business where the data provided was not adjusted for the grace period so as to not inadvertently bias the results.

As can be seen in the graphs below, there are additional claims in the first two months of duration 11 which would be the typical grace period of those policies lapsing at the end of their 10th anniversary. In order to quantify these results in combination with changing exposures, a monthly mortality study was completed on T10 business using a Monthly Anniversary Study approach.

In addition to showing elevated claims in months one and two, the first graph illustrates the annual qx per 1,000. The first two months are seeing additional mortality of 1.5 per thousand relative to months three through 12.

T10 Duration 11
Qx per 1000 by Month
Companies without Grace Period Adjustments
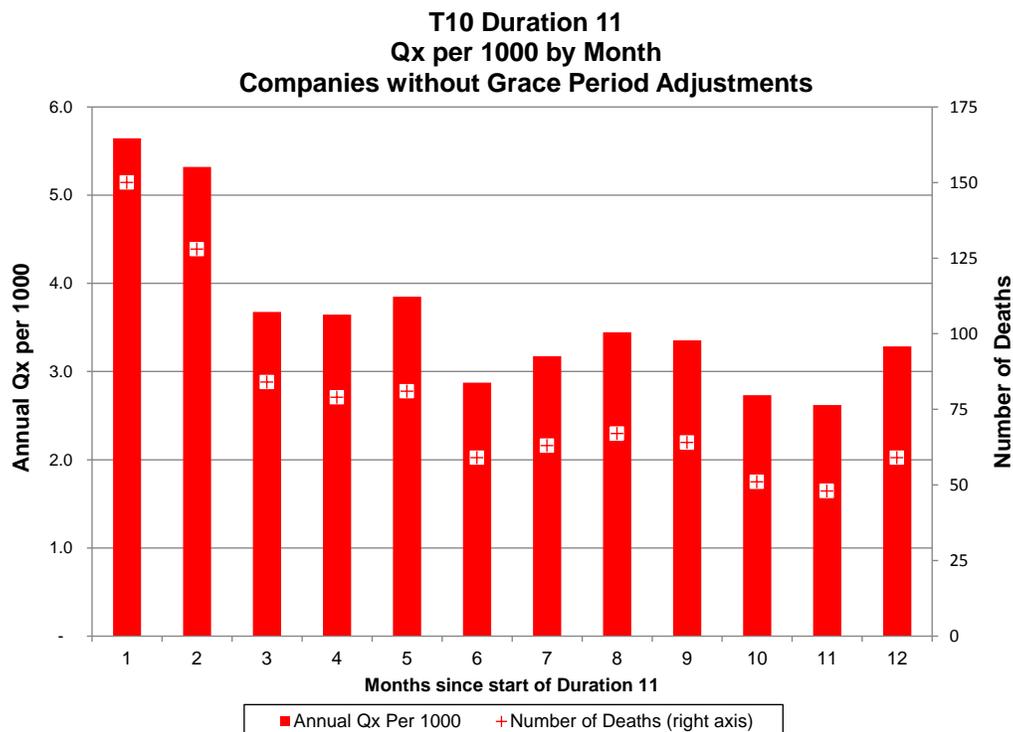
Grace Period Analysis (cont.)

In addition, actual to expected ratios by month were calculated to remove any impacts of age or gender mix. A/E ratios are nearly 100% higher in months one and two compared to durations three through 12.

T10 Duration 11
2008 VBT Mortality Ratios by Month
Companies without Grace Period Adjustments

RGA Reinsurance Company
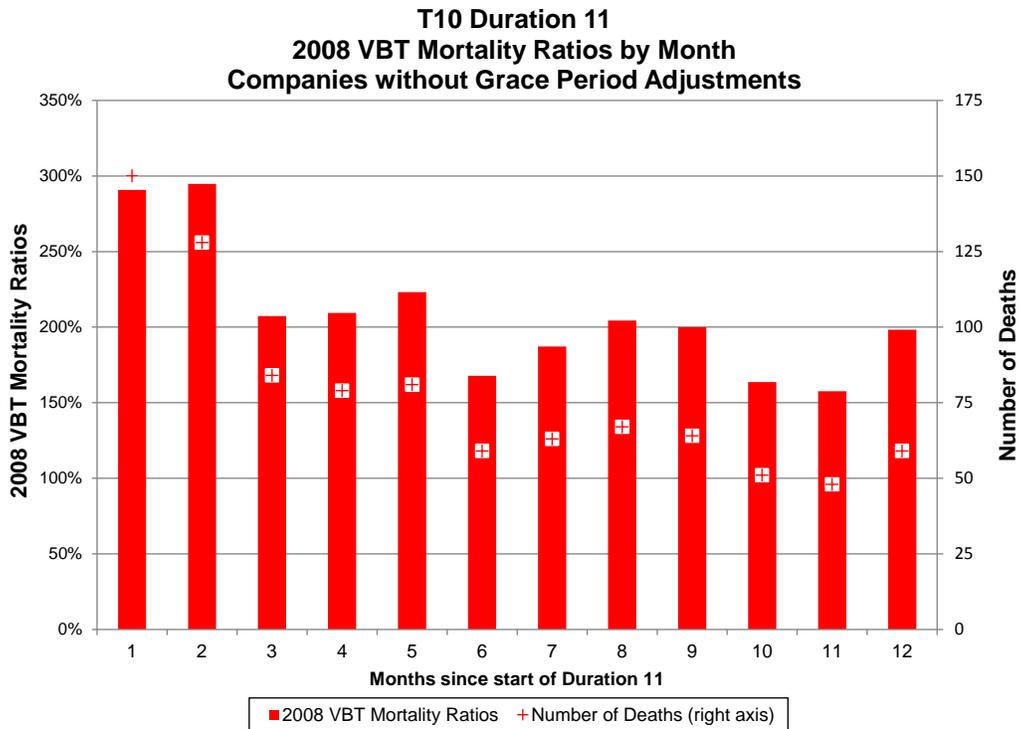
Comparison to 2010 Study

Overview

Credibility on post-level mortality experience is considerably higher compared to the 2010 study. For T10, there are nearly 3,400 post-level claims compared to just over 750 claims in the prior study. Of those claims, over 2,600 claims provided premium information. For T15, there are just over 440 claims compared to around 160 claims in 2010. Of those, nearly all provided premium history.

		2014 Study	2010 Study	Change
10-Year Term	Number of Companies w/ Post Level Experience	36	24	150%
	Post-Level Claims with Premiums	2,651	382	694%
	Post-Level Claims without Premiums	729	381	191%
15-Year Term	Number of Companies w/ Post Level Experience	6	5	120%
	Post-Level Claims with Premiums	432	145	298%
	Post-Level Claims without Premiums	12	13	92%

Comparison to 2010 Study (cont.)

Mortality by Duration – T10

Mortality by duration compared to the prior study is similar. The only significant difference is in the later durations where mortality has decreased relative to the prior study. This can be attributed to much higher credibility at these points. This is true for T10 in total as well as broken out by "Jump to ART".

RGA Reinsurance Company
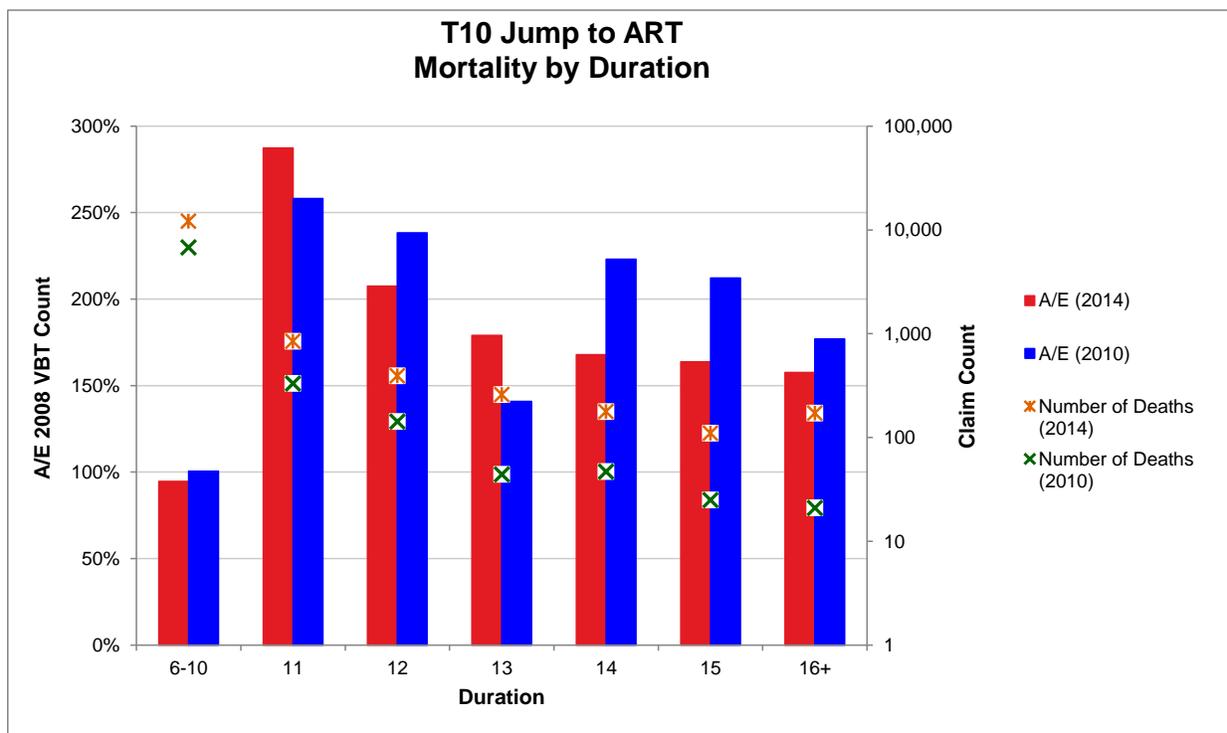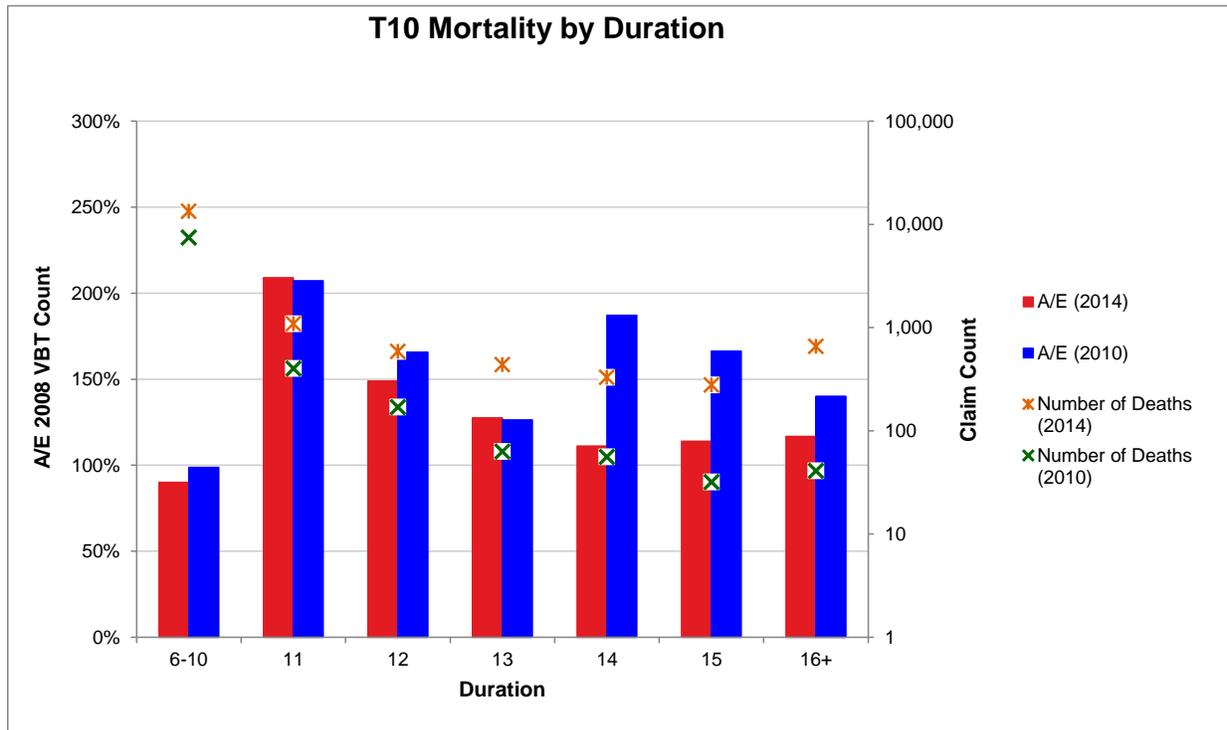
Comparison to 2010 Study (cont.)

Mortality by Duration – T15

Results for T15 are similar to the prior study. A higher initial shock mortality is demonstrated in this study as average premium jumps for policies entering the post-level period have increased for T15. Results in durations 17+ are a bit smoother as credibility has increased, although compared to T10 the data is still thin.

T15 Mortality by Duration
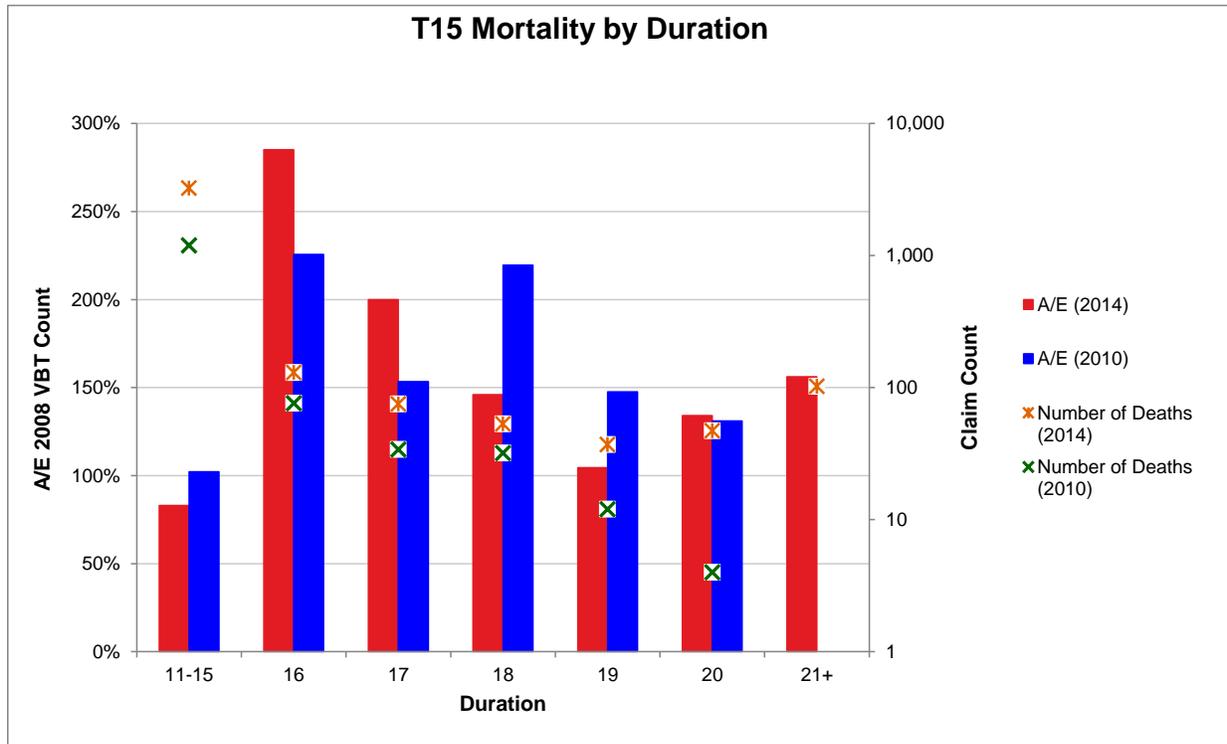
Comparison to 2010 Study (cont.)

Premium Jump Ratio – T10

Credibility has increased significantly, especially at the higher premium jumps. Mortality is increasing steadily by premium jump, even at the higher levels.

RGA Reinsurance Company
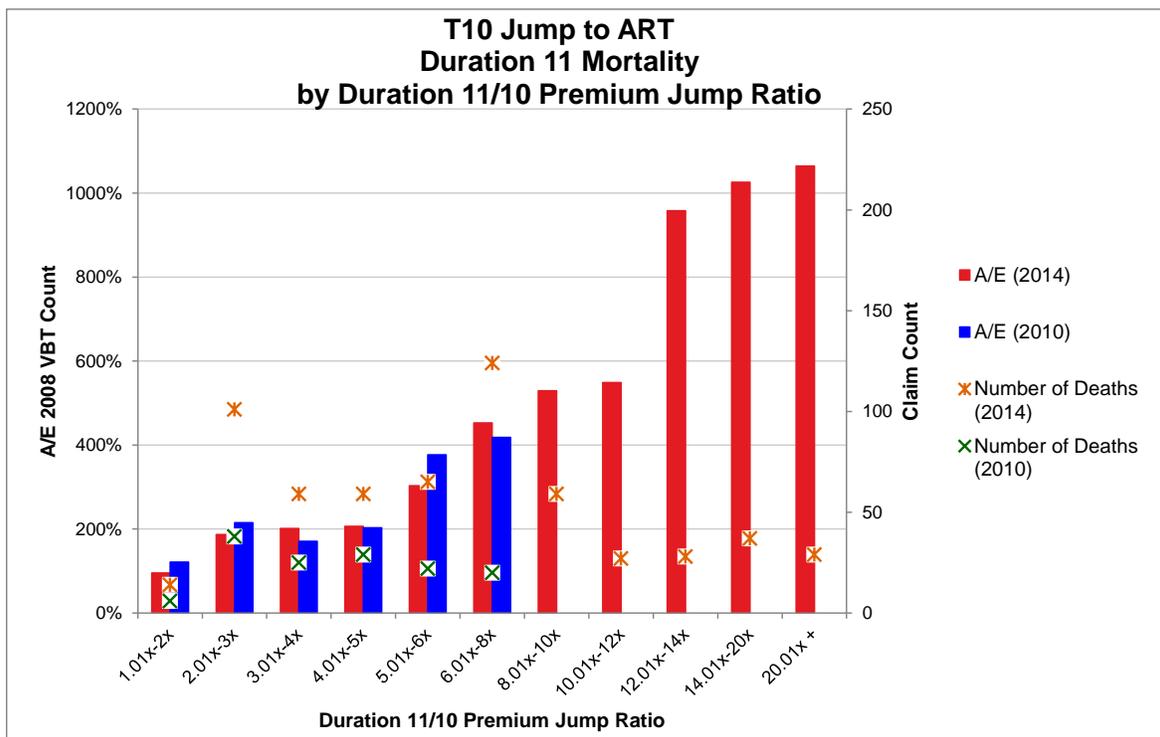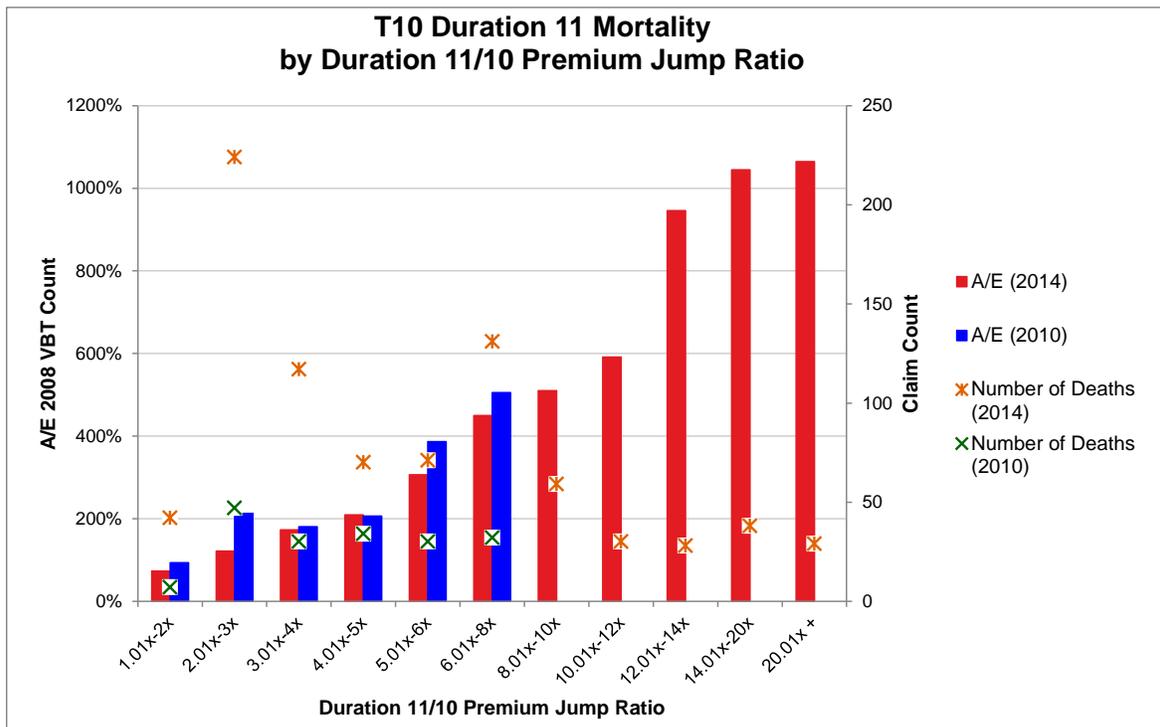
Shock Lapse vs. Mortality Deterioration

Throughout this document, it has been suggested that there is a strong relationship between the size of the shock lapse at the end of the level period and the amount of mortality deterioration beyond the level period. The clearest way to illustrate this relationship is by looking at both of these metrics for each company on an XY scatter plot. The following charts show the shock lapse in duration 10 and the 2008 VBT mortality ratio for durations 11 and 11+ for each company with at least 10 post-level period deaths.

Shock Lapse vs. Mortality Deterioration (cont.)

T10 (All)

For T10, as the shock lapse increases, so does the post-level mortality relative to the level period. While there are a wide range of results, it is clear that the mortality is increasing more quickly at the highest shock lapses, consistent with comments made earlier in the document. In addition, it is important to note mortality is significantly worse when only looking at duration 11 vs. 11+ due to the extra grace period mortality. Please note, an exponential trend line was added to the graphs only to aid the visual display.

T10 Dur 10 Shock Lapse vs. Dur 11 Mortality Deterioration by Company

Duration 11 Mortality Relative to Duraitons 6-10 (y-axis)
Duration 10 Shock Lapse (x-axis)

- ▲ >=35 claims
- △ <35 claims
- — Expon. ()

T10 Dur 10 Shock Lapse vs. Dur 11+ Mortality Deterioration by Company

Duration 11+ Mortality Relative to Duraitons 6-10 (y-axis)
Duration 10 Shock Lapse (x-axis)

- ▲ >=35 claims
- △ <35 claims
- — Expon. ()

RGA Reinsurance Company
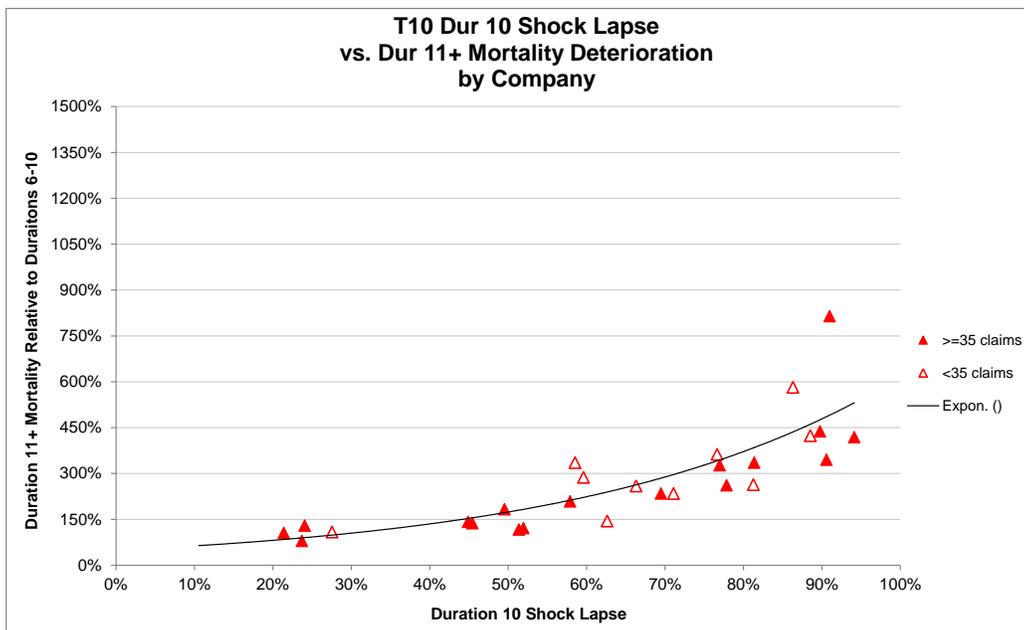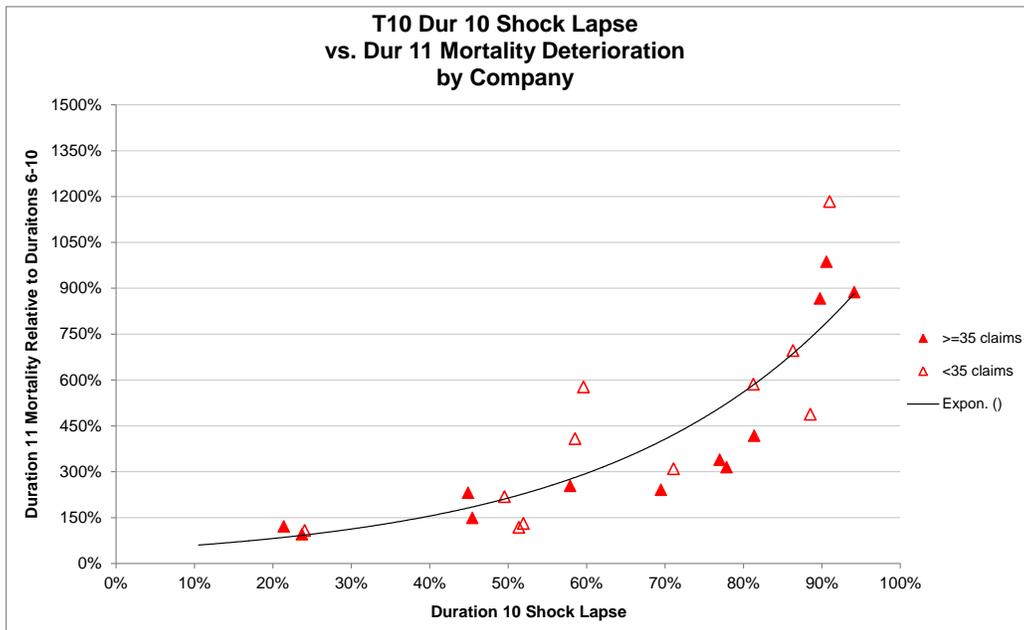
Shock Lapse vs. Mortality Deterioration (cont.)

T10 (Jump to ART)

T10 with a jump to ART is very consistent to T10 in total, although the mortality is higher at the highest

shock lapse levels. Once again, the exponential trend line is only added to aid the visual display.

RGA Reinsurance Company
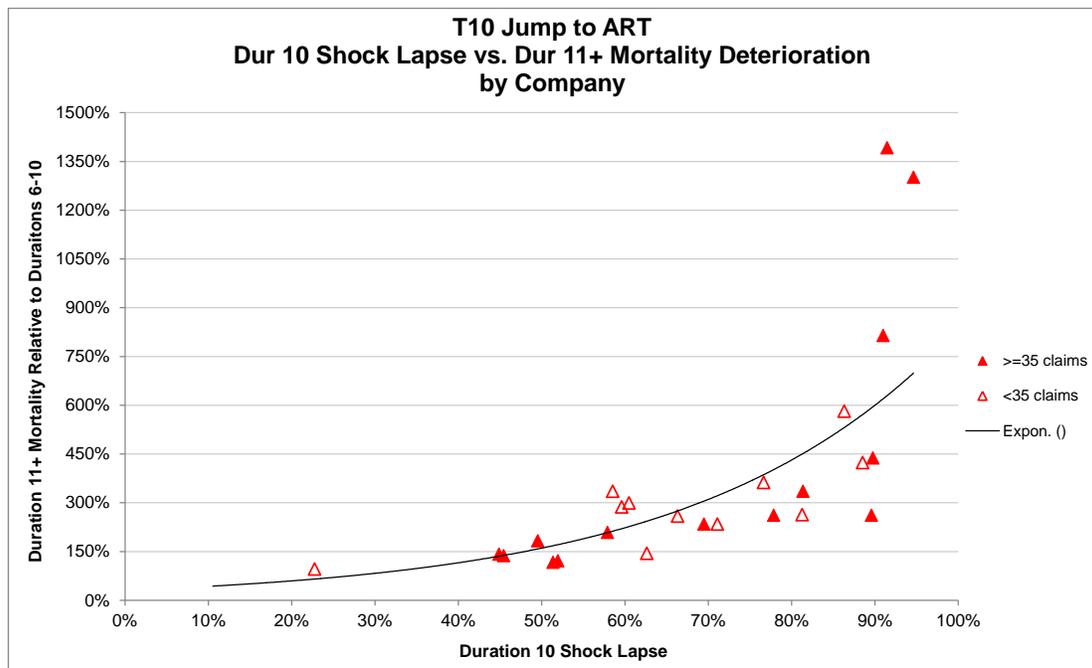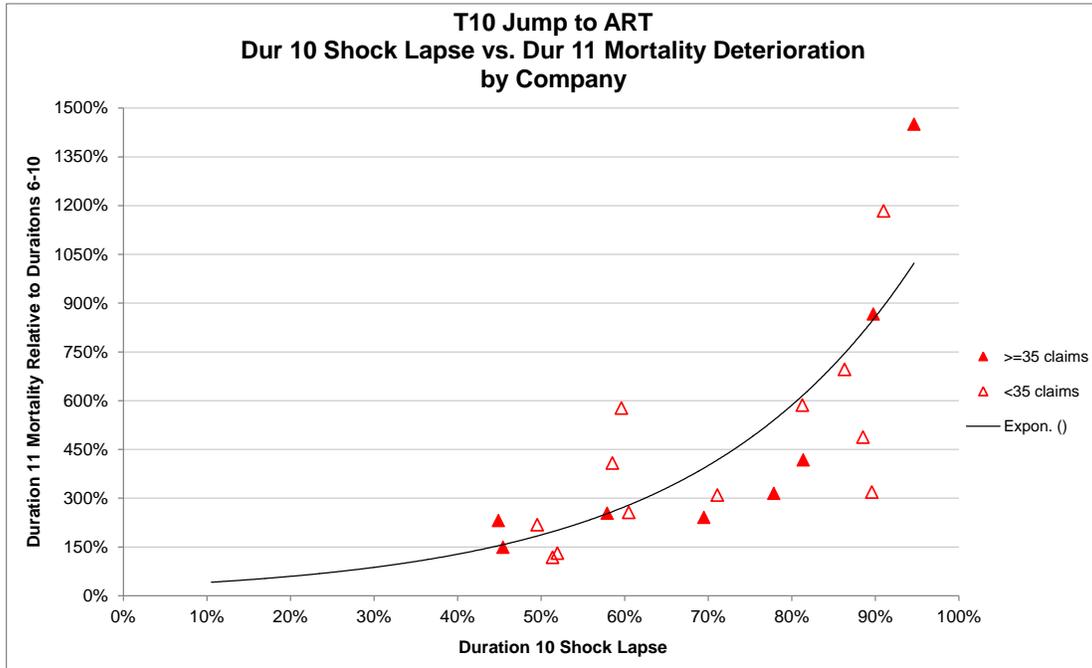
Comparisons to Phase 1 Assumption Survey

The following pages will provide a side-by-side comparison of the Phase 1 assumption survey results to the Phase 2 experience results. When comparing these results, it is important to note that there are significant differences between the product design characteristics of level term products issued today versus those contributing experience to the Phase 2 study that were issued more than 10 years ago – particularly as it relates to the size of the premium jump at the end of the level period.

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Comparison to Assumption Survey (cont.)

Shock Lapse – T10 (Jump to ART)

In total, the median shock lapse at the end of the level period for T10 is higher in the assumption survey than the experience results. This is in-line with the expectation that newer products with larger premium jumps will exhibit higher shock lapses. The results in duration 11 are flipped with the experience results showing higher median lapse rates than the pricing assumptions.

T10 Jump to ART
Lapse Rates by Duration
Phase 1 vs. Phase 2

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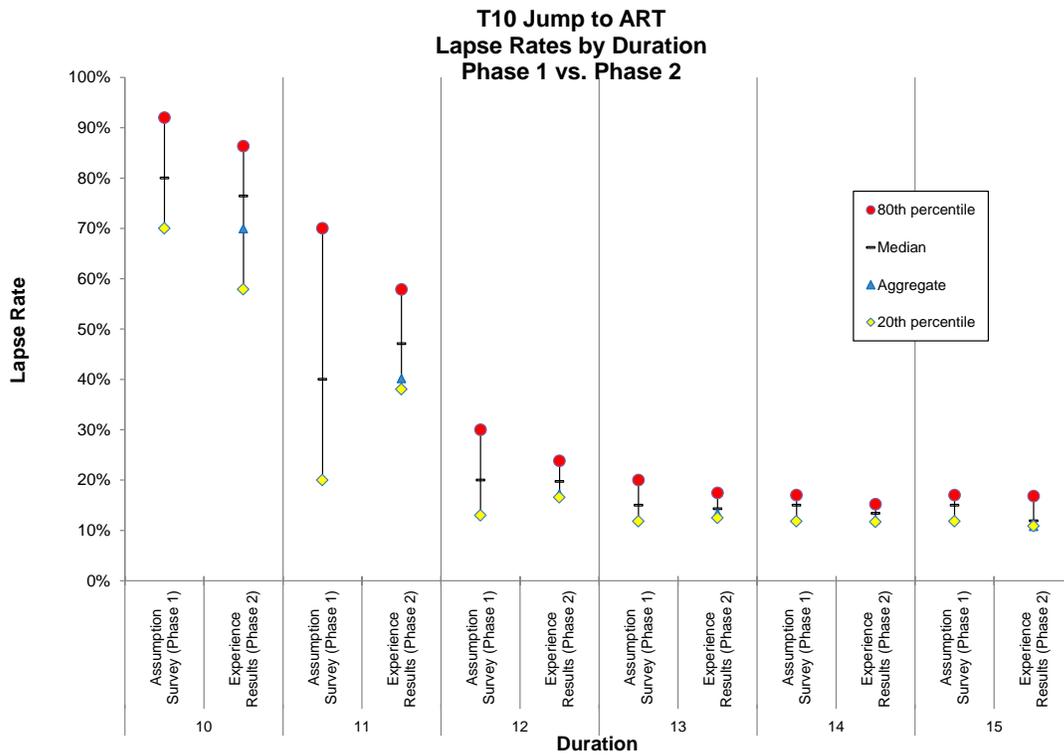
Comparison to Assumption Survey (cont.)

Shock Lapse – T15 (All)

T15 also sees the initial median shock lapse in the survey higher than that of the experience study. In addition, duration 16 is flipped again with the experience study illustrating a higher median lapse rate than the survey.

T15 Lapse Rates by Duration
Phase 1 vs. Phase 2
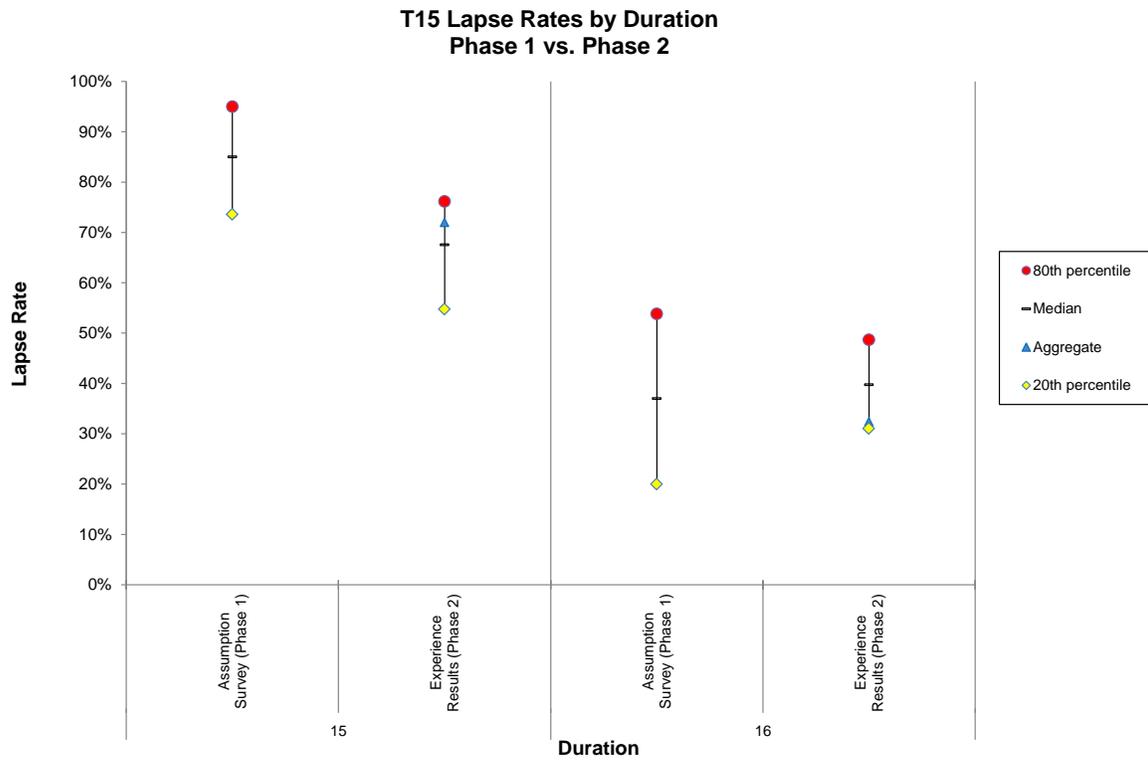
Comparison to Assumption Survey (cont.)

Shock Lapse by Issue Age – T10 (Jump to ART)

The most significant difference between the Phase 1 assumptions and the Phase 2 experience results seems to be in the shape of the shock lapse by issue age. Most company responses did not directly vary pricing assumptions by issue age, while the experience study results show a significant increase in the median shock lapse rates by issue age. The largest differences can be seen at ages 25 and 35.

T10 Jump to ART
Duration 10 Lapse Rates by Issue Age
Phase 1 vs. Phase 2

RGA Reinsurance Company
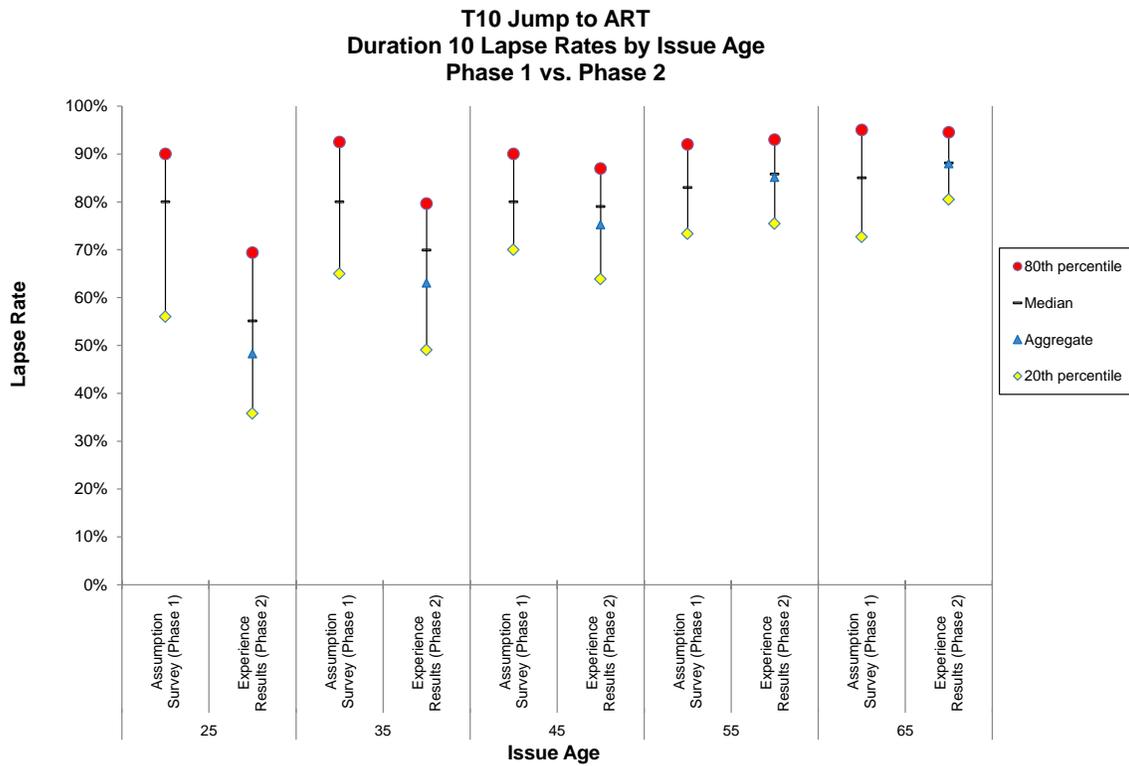
Comparison to Assumption Survey (cont.)

Mortality Deterioration – T10 (Jump to ART)

The median level of mortality deterioration is higher in the experience study than in the assumption

survey for duration 11. In durations 12+, the survey shows higher mortality deterioration than the study.

T10 Jump to ART
Mortality Deterioration by Duration
Phase 1 vs. Phase 2
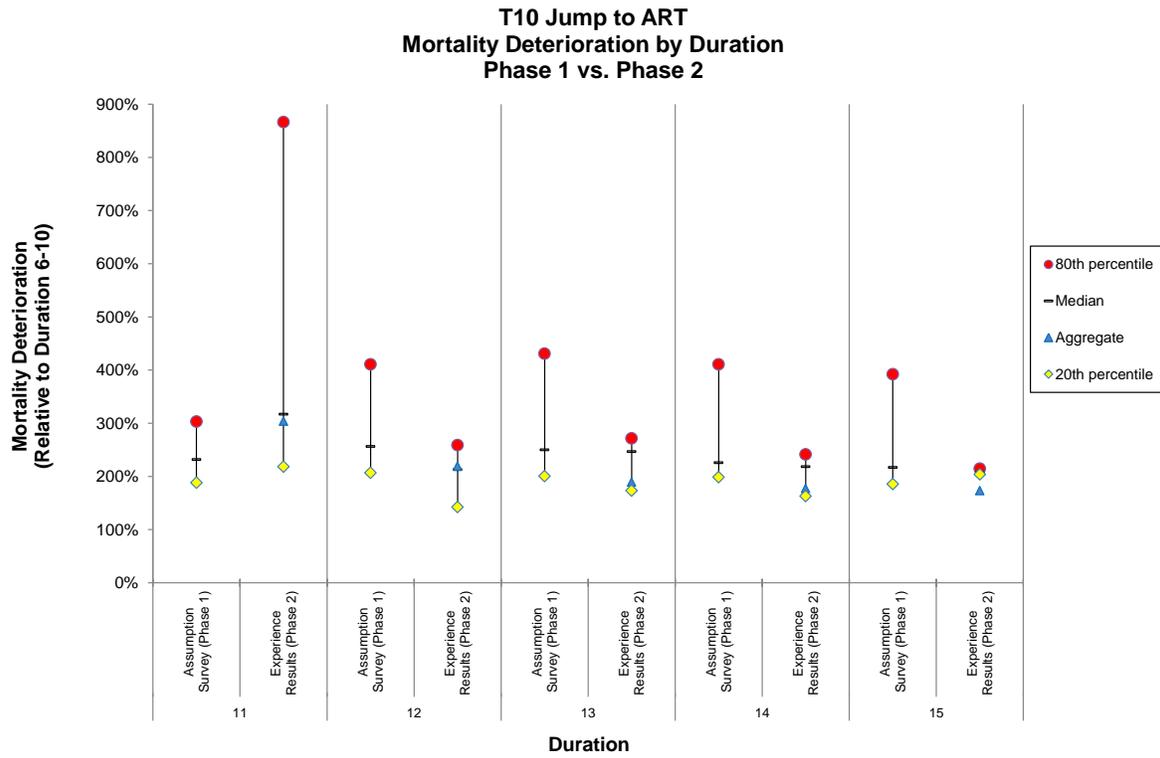
Comparison to Assumption Survey (cont.)

Mortality Deterioration by Issue Age – T10 (Jump to ART)

In duration 11, the median mortality deterioration is much higher in the experience study than the survey for all ages illustrated below. The deviation between the two is exaggerated at the higher issue ages.

T10 Duration 11
Mortality Deterioration by Issue Age
Phase 1 vs. Phase 2

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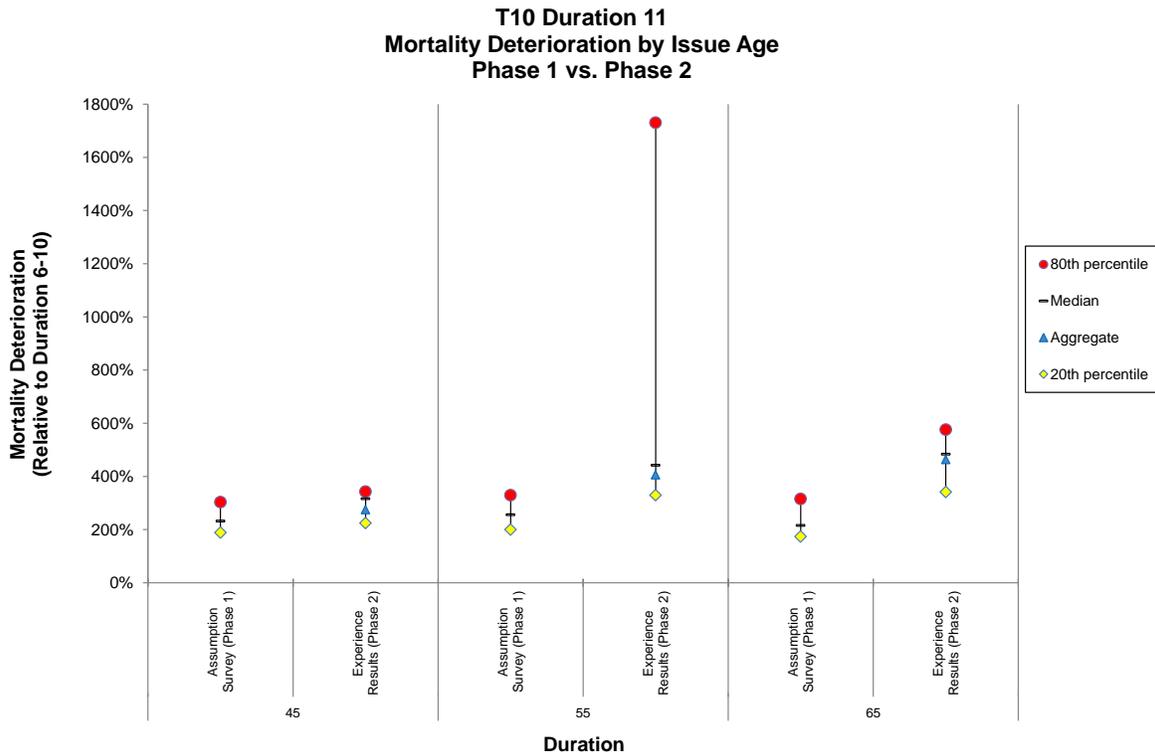
Comparison to Assumption Survey (cont.)

Shock Lapse vs. Mortality Deterioration

Both the assumption survey and the experience results showed a generally positive correlation between the size of the shock lapse and the amount of mortality deterioration.

In general, Phase 2 mortality deterioration is somewhat similar to the Phase 1 survey results except at the highest lapse rates. At the highest lapse rates, the Phase 2 results increase dramatically compared to the survey.

T10 Jump to ART Cumulative Duration 10-11 Shock Lapse vs. Dur 11+ Mortality Deterioration by Company Phase 1 vs Phase 2
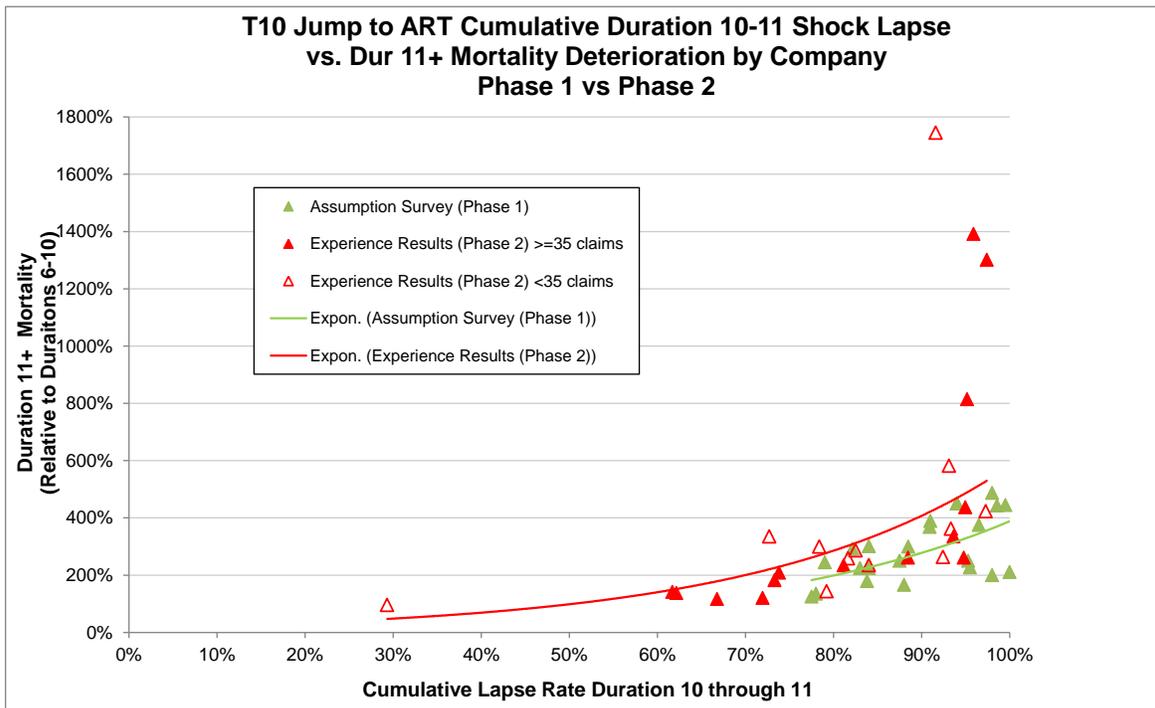
Multivariate Lapse Rate Model for T10 Duration 10 Shock Lapse

Overview

As an addition to traditional actuarial lapse study analysis, a multivariate statistical model can enhance lapse analysis by considering all variables simultaneously. Statistical modeling is a global approach where all predictor variables are included in a mathematic equation under one framework. The resulting equation can be used to calculate lapse rates at different combinations of input variables. Compared to traditional uni-variate analysis, a statistical modeling approach has the following advantages:

- Elimination of possible bias from a uni-variate approach that may lead to over-/under-estimation, especially when certain variables are highly correlated;

- A systematic way of controlling lapse assumption complexity and goodness of fit of the estimates;

- More transparent insight into the true drivers of lapse rates;

- Distribution of target variables which becomes increasingly important for quantifying assumption uncertainty for risk management; and

- Efficient and reliable ways of working with large and small datasets.

Model and Data

Most experience studies utilize the Generalized Liner Model (GLM). In the GLM framework, the target variable is assumed to follow a distribution in the exponential family. One major advantage of GLM is that it is based on the extension of linear modeling. The results are generally transparent and relatively easy to interpret. We can identify key drivers in the model variables and provide business insights. For the lapse models covered in this paper, the total observed lapse count is identified as the response variable and assumed to follow a Poisson distribution, which is a part of the exponential family.

Under a GLM framework, the expected occurrence of a lapse can be formulated as $\mu_i = E_i \exp(x_i' \beta)$, where:

- μ_i denotes the estimated mean lapse count for the ith record;

- E_i is the exposure of the corresponding records;

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- $x_i = (x_{i0}, x_{i1}, x_{i2}...x_{ip})$ are the contributing predictors such as issue age, duration, face amount etc.;

- β is the parameter vector and is optimized by maximizing the log-likelihood function; and

- The exponential term $\exp(x_i'\beta)$ implies the lapse rate when given a predictor x_i. For categorical variables x_i, $\exp(\beta$) is the factor for the presence of that category relative to the baseline.

The same dataset used to create the traditional experience analysis in this report was also used in this model. However, the focus of the model was limited to the T10 duration 10 shock lapse for business with a "Jump to ART" post-level premium structure. As it has been demonstrated in the previous analysis, premium jump is a key variable when it comes to the size of the shock lapse. Because this information is not always available when setting an assumption, two models were built. The first model excludes premium jump as predictor variable and the second model includes premium jump. In the latter case, records without premium jump information were excluded from the model.

To understand the model's predictive power, part of the data was used for the validation of the models. The original dataset was divided into two parts. The first part accounted for 70% of the records and was used for model development while the remaining 30% was held for model validation. The modeling results presented in this report are from the model validation, which is a more reliable indication of the model's performance.

Model Results

Statistical procedures were used to select variables that have predictive power. Interaction terms between variables are also tested to address non-linear correlations. Some categories within a given variable are grouped together and kept as categorical variables, such as underwriting decision, premium mode, face amount, distribution channels, etc. Other variables remain numerical, such as issue age and premium jump ratio.

T10 Duration 10 Shock Lapse Model excluding Premium Jump

The model variables and their corresponding variable type and coefficients are presented in the left chart.

To the right, we present the proportion of data for each category within a group as well as the actual lapse

rate observed, predicted lapse rate from the model, and actual/predicted ratio.

Model Parameter						Validation of Results			
Variable	Type	Coefficient	Factor	P-Value		Data Proportion	Actual Lapse Rate	Predicted Lapse Rate	Actual / Predicted
Intercept	-	-2.676		<2.0E-16					
Issue Age	Numerical	0.0552		<2.0E-16					
(Issue Age)^2	Numerical	-0.000316		<2.0E-16					
Risk Class	Categorical								
Super-Pref NS		0	1.00	0		11.3%	82.6%	82.6%	100.1%
NS		-0.06736	0.93	<2e-16		76.9%	69.1%	68.8%	100.4%
SM		-0.01296	0.99	0.0339		11.8%	63.5%	63.5%	100.0%
Face Amount	Categorical								
<50K		0	1.00	0		1.2%	14.9%	17.9%	83.2%
50-100K		0.600	1.82	<2.0E-16		3.9%	61.8%	62.7%	98.5%
100K-250K		1.262	3.53	<2.0E-16		51.9%	67.5%	67.4%	100.1%
250K-1M		1.559	4.75	<2.0E-16		36.9%	74.4%	73.8%	100.8%
>1M		1.585	4.88	<2.0E-16		6.1%	80.7%	80.4%	100.4%
Premium Mode	Categorical								
Annual		0	1.00	0		22.9%	85.8%	85.3%	100.5%
Semi/Quarter		-0.1365	0.87	<2.0E-16		24.5%	74.9%	75.1%	99.7%
Monthly/BiWeekly		-0.3506	0.70	<2.0E-16		45.4%	56.9%	56.6%	100.5%
Other/Unknown		-0.08481	0.92	<2.0E-16		7.2%	85.3%	84.8%	100.7%
Cross Term	Mixed								
Issue Age:Face Amt <50		0		0					
Issue Age:Face Amt 50-100K		-0.001288		0.3162					
Issue Age:Face Amt 100-250K		-0.01074		<2e-16					
Issue Age:Face Amt 250K-1M		-0.01653		<2e-16					
Issue Age:Face Amt >1M		-0.0172		<2e-16					

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<u>T10 Duration 10 Shock Lapse Model excluding Premium Jump (cont.)</u>

To demonstrate the fit of the model to actual experience, lapse rates by issue age are illustrated in the chart below. The fit is generally very good for all ages, although the model does remove some volatility seen in actual experience.
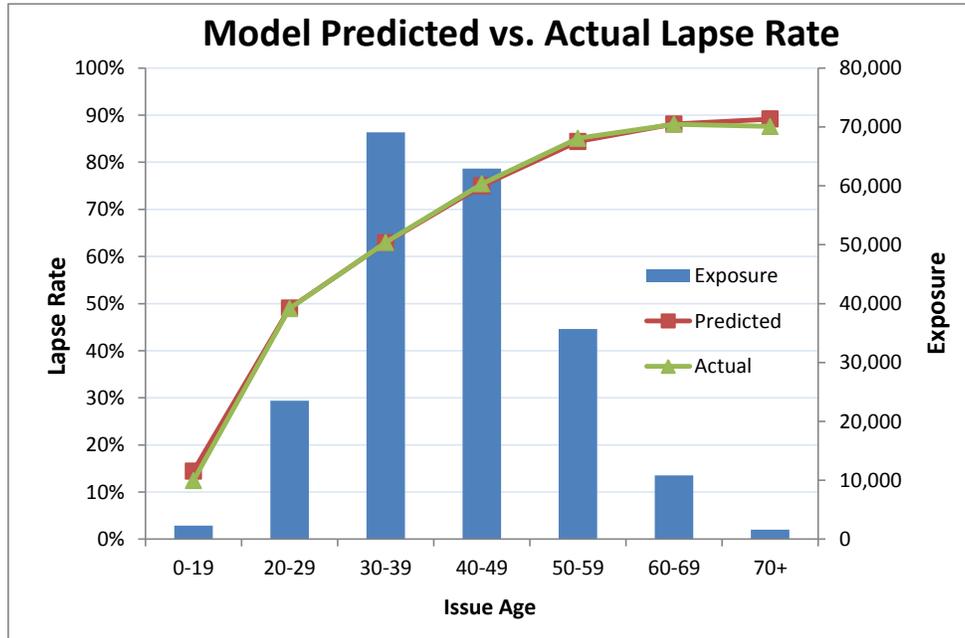
T10 Duration 10 Shock Lapse Model including Premium Jump

Once again, the model variables and their corresponding variable type and coefficients are presented in the left chart. To the right, we present the proportion of data for each category within a group as well as the actual lapse rate observed, predicted lapse rate from the model, and actual/predicted ratio. In the model, the premium jump is a numerical variable.

Model Parameter					Validation of Results			
Variable	Type	Coefficient	Factor	P-Value	Data Proportion	Actual Lapse	Predicted Lapse	Actual / Predicted
Intercept	-	3.246		2.03E-14				
Issue Age	Numerical	0.1621		<2.00E-16				
(Issue Age)^2	Numerical	-0.0006419		<2.00E-16				
log(Issue Age)	Numerical	-2.7250000		<2.00E-16				
Risk Class	Categorical							
Super-Pref NS		0	1.00	-	17.0%	82.4%	82.5%	99.9%
NS		0.03427	1.03	0.00	70.5%	68.7%	68.2%	100.7%
SM		0.1205	1.13	<2.00E-16	12.5%	67.4%	68.3%	98.6%
Face Amount	Categorical							
<50K		0	1.00	-	0.3%	49.5%	55.7%	88.9%
50-100K		0.3153	1.37	0.00	6.4%	63.4%	63.0%	100.7%
100K-250K		0.3437	1.41	<2.00E-16	43.9%	69.2%	68.9%	100.4%
250K-1M		0.3652	1.44	<2.00E-16	41.2%	72.3%	72.1%	100.3%
>1M		0.3645	1.44	<2.00E-16	8.2%	79.0%	79.3%	99.6%
Premium Mode	Categorical							
Annual		0	1.00	-	22.8%	85.5%	85.0%	100.6%
Semi/Quarter		-0.03244	0.97	0.00	39.8%	76.1%	75.8%	100.4%
Monthly/BiWeekly		-0.2755	0.76	<2.00E-16	34.4%	53.3%	53.5%	99.6%
Other/Unknown		0.02057	1.02	0.06	3.0%	91.1%	90.5%	100.7%
Premium Jump	Categorical							
Premium Jump 1.01-2x		0	1.00	-				
Premium Jump 2.01-3x		1.135	3.11	<2.00E-16				
Premium Jump 3.01-4x		1.492	4.45	<2.00E-16				
Premium Jump 4.01-5x		1.826	6.21	<2.00E-16				
Premium Jump 5.01-6x		2.082	8.02	<2.00E-16				
Premium Jump 6.01-7x		2.118	8.31	<2.00E-16				
Premium Jump 7.01-8x		2.176	8.81	<2.00E-16				
Premium Jump 8.01-10x		2.246	9.45	<2.00E-16				
Premium Jump 10.01-12x		2.304	10.01	<2.00E-16				
Premium Jump 12.01-16x		2.342	10.40	<2.00E-16				
Premium Jump 16.01-20x		2.385	10.86	<2.00E-16				
Premium Jump 20.01x+		2.356	10.55	<2.00E-16				
Cross Term	Mixed							
Issue Age:Premium Jump 1.01-2x		0		0				
Issue Age:Premium Jump 2.01-3x		-0.02241		<2.00E-16				
Issue Age:Premium Jump 3.01-4x		-0.02589		<2.00E-16				
Issue Age:Premium Jump 4.01-5x		-0.03042		<2.00E-16				
Issue Age:Premium Jump 5.01-6x		-0.03383		<2.00E-16				
Issue Age:Premium Jump 6.01-7x		-0.03381		<2.00E-16				
Issue Age:Premium Jump 7.01-8x		-0.03479		<2.00E-16				
Issue Age:Premium Jump 8.01-10x		-0.03567		<2.00E-16				
Issue Age:Premium Jump 10.01-12x		-0.03615		<2.00E-16				
Issue Age:Premium Jump 12.01-16x		-0.03665		<2.00E-16				
Issue Age:Premium Jump 16.01-20x		-0.03687		<2.00E-16				
Issue Age:Premium Jump 20.01x+		-0.03601		<2.00E-16				

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<u>T10 Duration 10 Shock Lapse Model including Premium Jump (cont.)</u>

To demonstrate the fit of the model to actual experience, lapse rates by issue age and premium jump are illustrated in the two charts below. Similar to the prior model, the fit of lapse rates to issue age is generally very good with some fluctuations between the model and actual experience and the highest and lowest age groups. By premium jump, the model is a nearly a perfect fit at all premium jump levels.

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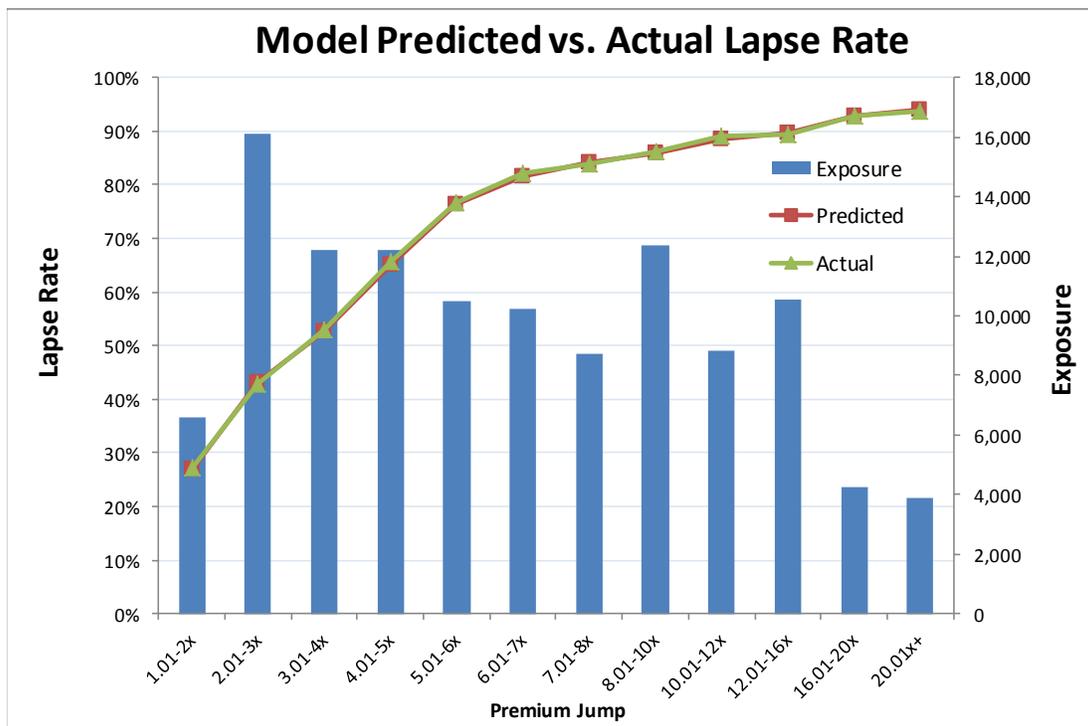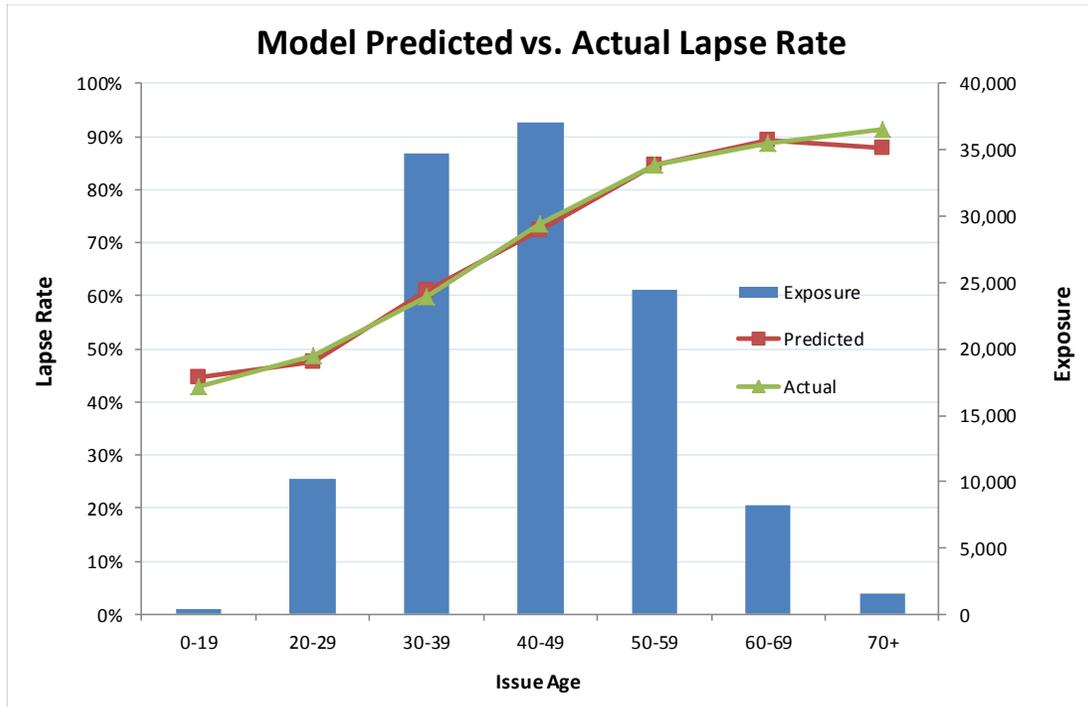
T10 Duration 10 Shock Lapse Model Interpretation and Application

Examples are provided below to show how to calculate the lapse rates from the model for a sample cell.

Since the number of significant digits presented below may be insufficient to recreate the modeled lapse rates, a spreadsheet is provided separately on the SOA website to recreate these calculations.

T10 Duration 10 Shock Lapse Model excluding Premium Jump — Example

Assumptions	
Issue Age	45
Risk Class	NS
Face Amount	250K-999k
Premium Mode	Annual

Model Variables	Beta Coefficients (a)	Sample Value of x_i (b)	Sample Calculation (c) = (a) * (b)
Variables			
Intercept	-2.676320	1	(2.6763)
Issue Age	0.055202	45	2.4841
(Issue Age)^2	-0.000316	45 ^ 2 = 2,025	(0.6406)
Risk Class			
Super-Pref NS	0.000000	0	-
NS	-0.067357	1	(0.0674)
SM	-0.012958	0	-
Face Amount			
<50K	0.000000	0	-
50-99K	0.600437	0	-
100K-249K	1.262284	0	-
250K-999k	1.558807	1	1.5588
1M+	1.585466	0	-
Premium Mode			
Annual	0.000000	1	-
Semi/Quarter	-0.136511	0	-
Monthly/BiWeekly	-0.350608	0	-
Other/Unknown	-0.084814	0	-
Cross Term			
Issue Age:Face Amt <50	0.000000	45 * 0 = 0	-
Issue Age:Face Amt 50-100K	-0.001288	45 * 0 = 0	-
Issue Age:Face Amt 100-250K	-0.010744	45 * 0 = 0	-
Issue Age:Face Amt 250K-1M	-0.016526	45 * 1 = 45	(0.7437)
Issue Age:Face Amt >1M	-0.017199	45 * 0 = 0	-

Results	
Linear Predictor = Sum(Beta$_i$ * x$_i$) = Sum (c)	(0.0851)
Modeled Lapse Rate = e$^{Linear Predictor}$	91.8%
Actual Lapse Rate Experience	90.2%
Actual Lapse Rate / Modeled Lapse Rate	98.2%

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T10 Duration 10 Shock Lapse Model including Premium Jump — Example

Assumptions	
Issue Age	45
Risk Class	NS
Face Amount	250K-999k
Premium Mode	Annual
Premium Jump	Premium Jump 8.01-10x

Model Variables		Beta Coefficients (a)	Sample Value of x_i (b)	Sample Calculation (c) = (a) * (b)
Variables				
Intercept		3.2460468406	1	3.2460
Issue Age		0.1620764522	45	7.2934
(Issue Age)^2		-0.0006419533	45 ^ 2 = 2,025	(1.3000)
log(issue Age)		-2.7246684047	ln(45)	(10.3719)
Risk Class				
	Super-Pref NS	0.0000000000	0	-
	NS	0.0342716521	1	0.0343
	SM	0.1204694398	0	-
Face Amount				
	<50K	0.0000000000	0	-
	50-99K	0.3153176726	0	-
	100K-249K	0.3436644806	0	-
	250K-999k	0.3651595476	1	0.3652
	1M+	0.3645073212	0	-
Premium Mode				
	Annual	0.0000000000	1	-
	Semi/Quarter	-0.0324429782	0	-
	Monthly/BiWeekly	-0.2754860904	0	-
	Other/Unknown	0.0205676242	0	-
Premium Jump				
	Premium Jump 1.01-2x	0.0000000000	0	-
	Premium Jump 2.01-3x	1.1346066041	0	-
	Premium Jump 3.01-4x	1.4915714326	0	-
	Premium Jump 4.01-5x	1.8259985157	0	-
	Premium Jump 5.01-6x	2.0823058090	0	-
	Premium Jump 6.01-7x	2.1180488165	0	-
	Premium Jump 7.01-8x	2.1759679756	0	-
	Premium Jump 8.01-10x	2.2456634786	1	2.2457
	Premium Jump 10.01-12x	2.3042436895	0	-
	Premium Jump 12.01-16x	2.3424735883	0	-
	Premium Jump 16.01-20x	2.3845090119	0	-
	Premium Jump 20.01x+	2.3560022176	0	-
Cross Term				
	Issue Age:Premium Jump 1.01-2x	0.0000000000	45 * 0 = 0	-
	Issue Age:Premium Jump 2.01-3x	-0.0224086364	45 * 0 = 0	-
	Issue Age:Premium Jump 3.01-4x	-0.0258942527	45 * 0 = 0	-
	Issue Age:Premium Jump 4.01-5x	-0.0304205710	45 * 0 = 0	-
	Issue Age:Premium Jump 5.01-6x	-0.0338345132	45 * 0 = 0	-
	Issue Age:Premium Jump 6.01-7x	-0.0338073701	45 * 0 = 0	-
	Issue Age:Premium Jump 7.01-8x	-0.0347925252	45 * 0 = 0	-
	Issue Age:Premium Jump 8.01-10x	-0.0356704787	45 * 1 = 45	(1.6052)
	Issue Age:Premium Jump 10.01-12x	-0.0361533190	45 * 0 = 0	-
	Issue Age:Premium Jump 12.01-16x	-0.0366500058	45 * 0 = 0	-
	Issue Age:Premium Jump 16.01-20x	-0.0368730873	45 * 0 = 0	-
	Issue Age:Premium Jump 20.01x+	-0.0360120152	45 * 0 = 0	-

Results	
Linear Predictor = Sum(Beta$_i$ * x_i) = Sum (c)	(0.0924)
Modeled Lapse Rate = e$^{Linear\ Predictor}$	91.2%
Actual Lapse Rate Experience	91.5%
Actual Lapse Rate / Modeled Lapse Rate	100.4%

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Special Thanks

The authors would again like to extend our thanks to all participating companies for making this project a success. Without your support, such research projects would not be possible. Your contributions have led to this broad industry benchmark of the experience results for term shock lapse rates and mortality rates beyond the level premium period.

We would like to thank the SOA and the following members of the Project Oversight Group and SOA staff for their guidance and support on this research project. Their comments, feedback and direction have greatly improved the value of this project.

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Brian Carteaux	David Wylde
Tatiana Berezin	

Finally, the authors express our sincere thanks to Scott Rushing, Minyu Cao and Kathleen Broom of RGA for their significant contributions during the experience study phase of this research project.

Appendix A: Companies Contributing Data

Allstate	Modern Woodmen of America
American Family	MTL Life
American National	NACOLAH
Americo	Nationwide
Amica	New York Life
American United Life	Northwestern Mutual
AXA - Equitable	Ohio National
Banner Life	Pekin Life
Conseco	Penn Mutual
Columbus Life	Principal Financial Group
Empire General	Protective Life
Erie Family	Prudential
Fidelity Investments	State Farm
John Hancock	Symetra
Lafayette Life	Vantis
Lincoln Benefit	West Coast Life
Massachusetts Mutual	William Penn
Midland National	Woodmen of the World
Missouri Farm Bureau	

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Appendix B: Grace Period Adjustment

In order to develop a consistent approach to displaying lapse study results, an adjustment was made to some companies' data submissions to account for grace period processing. Each individual lapse was adjusted X days where X varied by company (many companies were not adjusted at all.) The number of days used for this adjustment was based on each company's specific grace period and was confirmed with contributing companies. An illustration of the impact of this is shown below. Notice for example Companies 1, 3, and 6 which would have had significantly lower duration 10 lapse rates and higher duration 11 lapse rates if calculated based on the termination dates provided. The cumulative lapse in duration 10-11 is relatively unchanged.

Lapse Rates by Company - No Grace Period Adjustment

Lapse Rates by Company - With Grace Period Adjustment

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