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

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

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

Section 1: Background

The Canadian Institute of Actuaries (CIA) and the Society of Actuaries (SOA) engaged RGA Reinsurance Company (RGA) to undertake a research project on Canadian 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 similar to the SOA-sponsored research completed by RGA for U.S. term plans in 2010 and updated September 2013 and May 2014. Links to studies as follows:

(https://www.soa.org/globalassets/assets/Files/Research/Projects/research-shock-lapse-survey-report.pdf) and

(https://www.soa.org/globalassets/assets/files/research/exp-study/research-2014-post-level-shock-report.pdf

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 2017. The report published April 2020 summarizes the findings from the 15 survey responses received in Phase 1. (https://www.soa.org/resources/experience-studies/2020/post-level-premium-period/)
- 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 2014 experience studies done on US data 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
4) Comparisons to the US study d one in 2014
5) A proposed generalized linear predictive model of shock lapse rates (Appendix D)

Section 2: 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 Canadian life insurance companies. The actuary responsible for preparing this report is Steve Schumacher, 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 Reinsurance Company (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 Canadian Institute of Actuaries (CIA) and the Society of Actuaries (SOA) and contains information based on input from companies engaged in the Canadian 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 CIA, SOA, or their members. The CIA and SOA makes no representations regarding the accuracy or completeness of the content of this Study. It is for informational purposes only. The CIA and the SOA do 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 CIA and SOA make no warranty, express or implied, guarantee or representation whatsoever and assumes no liability or responsibility in connection with the use or misuse of this Study.

Section 3: Executive Summary

Most Canadian Term plans are the step premium rate design whereby premiums are level for subsequent premium periods until some attained age. For example, Term 10 plans have an initial level premium for 10 years, followed by a higher premium for the next 10 years, and so on.

3.1 Shock Lapses

The aggregate duration 10 shock lapse rate for all 10 year level term plans (T10) was 53.4% by count, although there was a wide range of results by company, product structure, and policy attributes. The median of company-specific shock lapse rate results was 55.9%. For 20 year level term plans (T20), the duration 20 shock lapse was 51.5% with a median shock lapse of 56.5%. Both products experience an initial shock lapse at the end of the level period that is followed by a smaller secondary shock lapse. This secondary shock lapse is heavily skewed toward the first three months of that duration. Lapse rates tend to grade down to fairly level rates in later durations, until the next premium increase.

The policy attribute most highly correlated with shock lapse is the premium movement from the level period to the next level period, both in terms of the premium jump ratio and the premium jump amount in dollars. This is shown in both the traditional lapse study as well as the predictive model. 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 following a premium increase are more heavily skewed toward the beginning of the policy year, indicating a disproportionate amount of off-anniversary lapse activity compared to the non-renewal years.

3.2 Mortality Deterioration

The median of company-specific experience for T10 showed duration 11 mortality as 160% of CIA9704 by count compared to 59% for durations 6-9, although there was a wide range of results by company. Mortality deterioration grades down by duration after the shock lapse. As with shock lapses, mortality deterioration seems to increase by issue age and by the size of the premium jump. These dimensions are important considerations when applying shock lapse and mortality deterioration assumptions for pricing new products.

Section 4: 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 the 12 participants is included in Appendix A (p. 96).

4.1 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 2012-2017 anniversary year lapse study and a 2012-2017 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. The primary analysis focused on the 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 to validate. 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.

4.2 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 lapse. 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 some of the shock lapses that were reported up to 65 days into the first duration of the post-level period back into the final duration of the level period. These adjustments were only done on lapses and conversions after approval from the company. In addition, a 3-day adjustment was made if a policy lapsed within 3 days of the anniversary to account for delays in reporting due to weekends and holidays. 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. All companies were contacted to confirm the policy lapses reflected the moment when premiums were no longer applied. An illustration of the impact of the grace period adjustments can be found in Appendix B (p. 97). All displays in the remainder of the document exclude the grace period when appropriate.

4.3 Post-Level Premium Structure Mapping

Contributors were asked to describe the structure of the premium rates after the end of the level premium period. The vast majority of companies said the premium rates jumped to a new level period. The only other answer given was a jump to Annually Renewable Term (ART). Due to credibility concerns, we do not provide any analysis on the jump to ART policies separately as these policies accounted for less than 0.3% of the exposure in duration 10. We did, however, investigate these separately and found no material impact differences in their lapse rates or mortality. Because of this, these policies were included in the overall results shown in this document.

4.4 Lapse Study Specifications

The lapse study covered policy anniversaries beginning in 2012 to policy anniversaries ending in 2017. 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. 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. No information was given to identify partial lapses so they are included in this study.

4.5 Mortality Study Specifications

The mortality study covered calendar years 2012 through 2017. 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 two industry standard tables: CIA9704 and CIA8692. Actual/Tabular ratios were calculated as the ratio of the actual number of deaths to the tabular expected number of deaths. Results presented in this document will use CIA9704 unless otherwise stated. Results were shown by count throughout the paper unless otherwise stated.

Relative mortality ratios are also provided to compare the post-level period mortality to the preceding level period mortality. These values are calculated as the CIA9704 actual/tabular ratio for a given post-level period duration to the CIA9704 actual/tabular ratio during the last 5 durations of the preceding level period.

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

$$\left(\frac{Actual\ Claims}{E_{Tab}}\right) \pm 1.645 * \left(\frac{\sqrt{\sigma^2}}{E_{Tab}}\right)$$

where:

- E_{Tab} is the expected number of deaths according to the CIA9704 basis.
- σ^2 at the policy level is the variance of a Bernoulli distribution: $(q_x)(1- q_x)$
    - Variance for grouped data is the sum of policy variances: $\sum(q_x)(1- q_x)$

Section 5: Lapse Experience

5.1 Overview

This section will present the combined lapse experience from the 12 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 T20 experience, so these results will only be shown when the dimensions being analyzed are credible and represent an appropriate cross-section of companies. Data was submitted for other level term plans, but results will not be provided since there were not multiple companies contributing credible experience.

5.2 Total Lapse Rates by Duration

T10 (1st Premium Shock)

The following table and chart show the lapse experience for T10 by duration. The aggregate shock lapse at the end of the initial level period (duration 10) is 53.4% with a smaller secondary shock lapse in duration 11 of 43.5%. Median lapses rates were also included to illustrate that larger companies were not skewing the results very much. Lapse Skewness is covered on page 30 of the document. In summary, duration 10 is heavily skewed toward the end of the policy year and duration 11 is skewed toward the beginning of the policy year. Lapse rates continue to drift down by duration until converging toward an ultimate lapse rate until the next premium jump. This ultimate lapse rate is similar to the initial level period lapse rates prior to the end of the term.

It is interesting to note that the average premium jump ratio drops steadily by policy duration. This is due to the fact that those policies with larger premium jump ratios have higher lapse rates and those policies with smaller premium jump ratios are the ones that are persisting.

Table 1

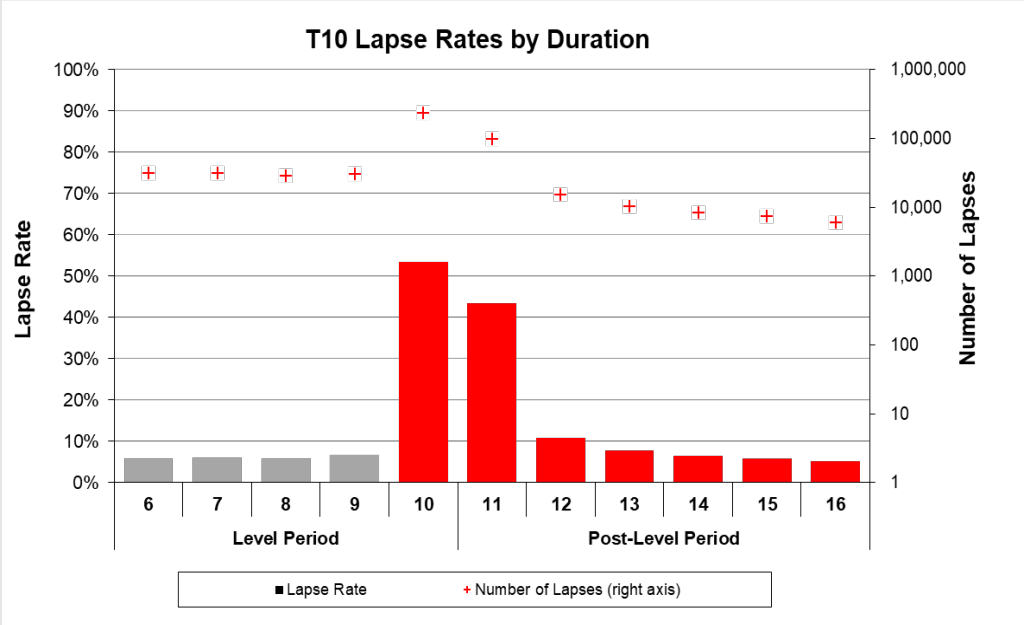
T10 LAPSE EXPERIENCE BY DURATION

Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate(1)	Average Prem Jump Ratio(2)
6	545,260	31,289	5.7%	5.2%	5.2
7	523,801	31,182	6.0%	5.1%	5.1
8	489,291	28,708	5.9%	5.3%	4.9
9	461,755	31,051	6.7%	6.2%	4.7
10	443,994	237,237	53.4%	55.9%	4.5
11	225,199	97,940	43.5%	42.4%	3.9
12	140,592	15,175	10.8%	10.5%	3.5
13	135,302	10,401	7.7%	7.5%	3.3
14	132,569	8,474	6.4%	6.4%	3.1
15	126,498	7,491	5.9%	6.2%	2.9
16	115,545	6,089	5.3%	5.7%	2.7
Grand Total	3,339,806	505,037	15.1%	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.

Figure 1

T10 LAPSE RATES BY DURATION



T10 (2nd Premium Shock)

The lapse rates for T10 plans in the second level period follow a similar pattern of high shocks around the initial premium jump and then level off until the following premium jump. A second shock lapse occurs in duration 20 with a lapse rate of 26.6%, followed by a slightly lower lapse rate in duration 21 at 21.2%. This second shock lapse rate is about half the first shock lapse rate and could be attributed to a larger number of policies persisting that have smaller premium jumps. This pattern of a lower 2nd shock lapse is observed consistently across all companies in the study.

Table 2

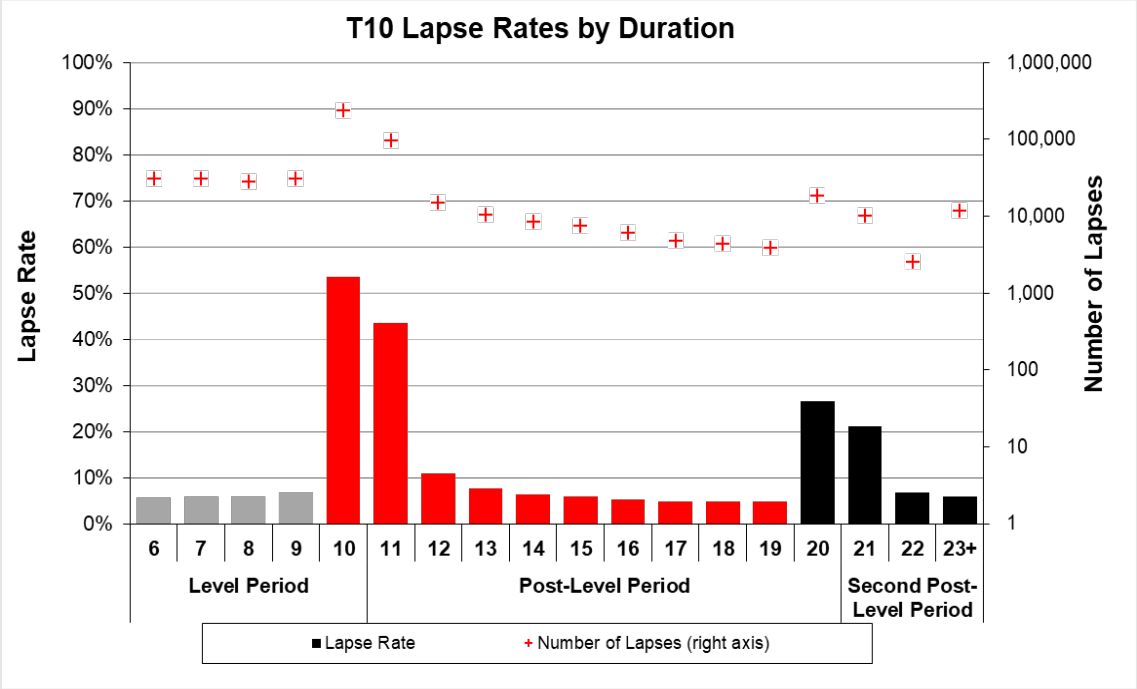
T10 LAPSE EXPERIENCE BY DURATION

Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate(1)	Average Prem Jump Ratio(2)
6	545,260	31,289	5.7%	5.2%	5.2
7	523,801	31,182	6.0%	5.1%	5.1
8	489,291	28,708	5.9%	5.3%	4.9
9	461,755	31,051	6.7%	6.2%	4.7
10	443,994	237,237	53.4%	55.9%	4.5
11	225,199	97,940	43.5%	42.4%	3.9
12	140,592	15,175	10.8%	10.5%	3.5
13	135,302	10,401	7.7%	7.5%	3.3
14	132,569	8,474	6.4%	6.4%	3.1
15	126,498	7,491	5.9%	6.2%	2.9
16	115,545	6,089	5.3%	5.7%	2.7
17	103,609	4,871	4.7%	4.9%	2.5
18	91,654	4,331	4.7%	4.6%	2.3
19	80,533	3,897	4.8%	4.7%	2.2
20	70,275	18,686	26.6%	27.9%	2.1
21	47,603	10,094	21.2%	20.6%	2.0
22	37,384	2,533	6.8%	6.4%	2.0
23+	200,320	11,762	5.9%	6.0%	1.9
Grand Total	3,971,184	561,211	14.1%	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.

Figure 2

T10 LAPSE RATES BY DURATION



T20

The T20 product also experiences a large shock lapse at the end of the initial level period (duration 20). Consistent with T10, a secondary shock occurs in the duration following the initial shock in duration 21. This is followed by decreasing lapse rates until settling at an ultimate lapse rate. The credibility in durations 22+ gets fairly small but is included to show results beyond the initial shock.

Table 3

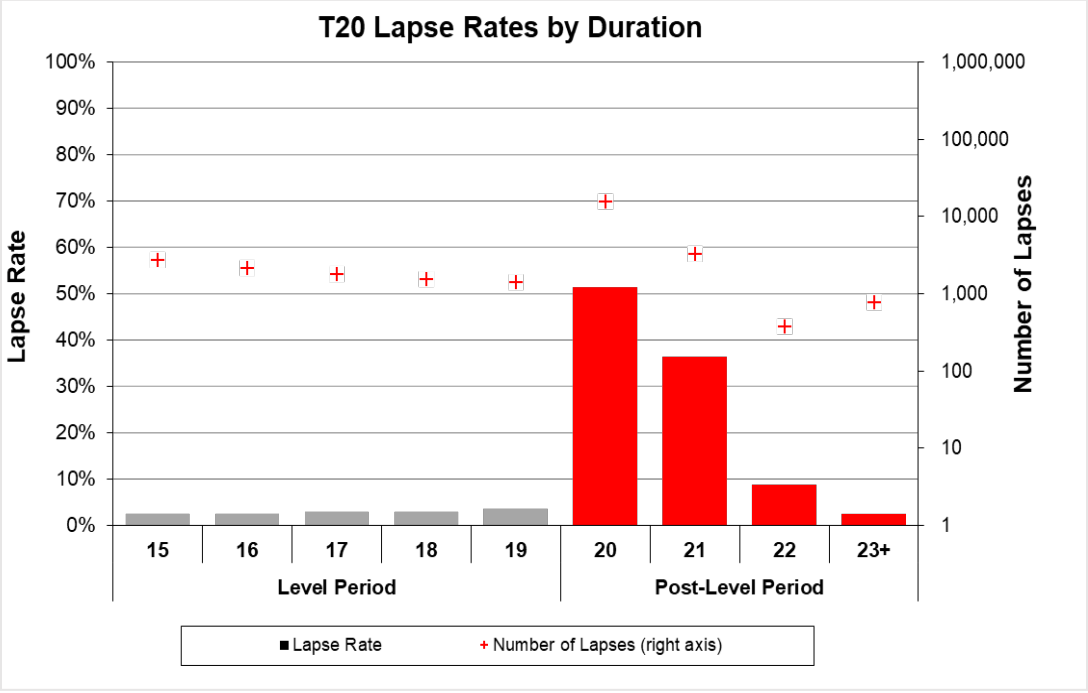
T20 LAPSE EXPERIENCE BY DURATION

Policy Duration	Policy-Years Exposed	Total Lapses	Lapse Rate	Median Lapse Rate[1]	Average Prem Jump Ratio[2]
15	111,813	2,760	2.5%	2.5%	8.0
16	83,833	2,140	2.6%	2.5%	7.3
17	64,410	1,822	2.8%	2.7%	6.4
18	51,067	1,531	3.0%	2.9%	5.8
19	40,383	1,429	3.5%	3.3%	5.6
20	30,201	15,545	51.5%	56.5%	5.6
21	8,966	3,266	36.4%	32.5%	5.1
22	4,294	379	8.8%	9.9%	5.0
23+	31,425	767	2.4%	9.9%	5.6
Grand Total	426,391	29,639	7.0%	n/a	n/a

(1) Median lapse rate for companies with 100 or more lapses in given duration.
(2) Weighted average duration 21/20 premium jump ratio by exposure for policies with premium data available.

Figure 3

T20 LAPSE RATES BY DURATION



5.3 Distribution of Results

T10

The following table and chart plot the company specific T10 durational lapse rates at different percentiles.

Table 4

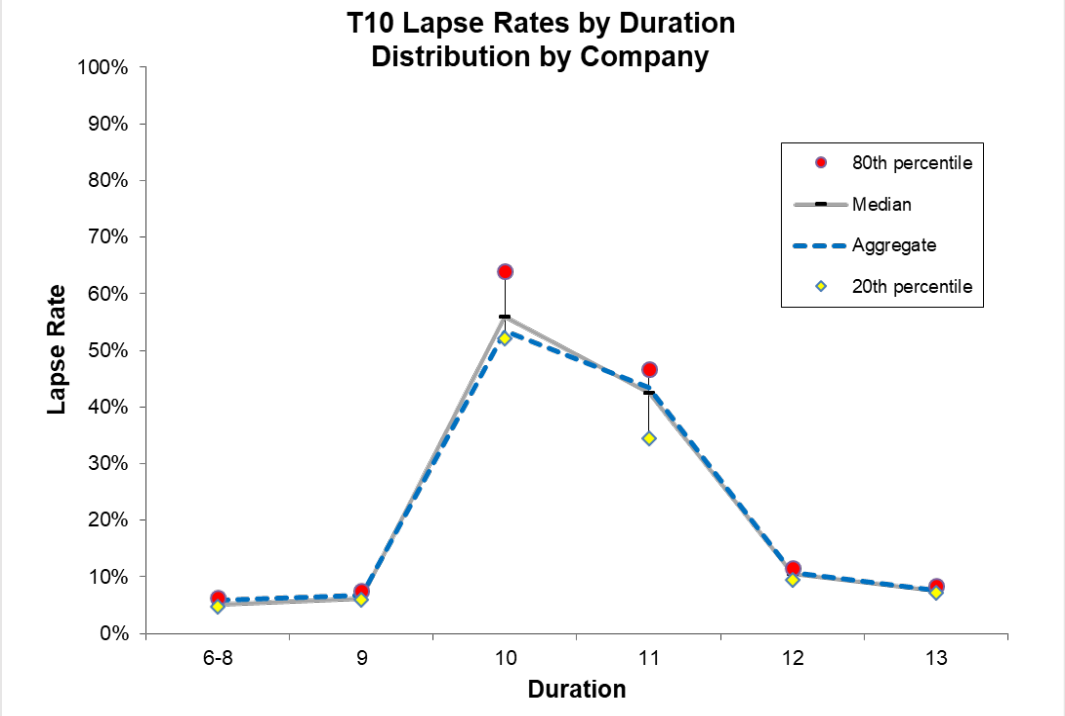
T10 DURATIONAL LAPSE RATE DISTRIBUTION

Lapse Rate Range	Duration					
	6–8	9	10	11	12	13
# of Companies	12	11	12	12	9	7
20th percentile	4.8%	6.0%	52.0%	34.5%	9.5%	7.1%
Median	5.1%	6.2%	55.9%	42.4%	10.5%	7.5%
Aggregate	5.9%	6.7%	53.4%	43.5%	10.8%	7.7%
80th percentile	6.4%	7.5%	64.0%	46.8%	11.5%	8.4%

Companies with 100 or more lapses in given duration

Figure 4

T10 LAPSE RATES BY DURATION DISTRIBUTION BY COMPANY



T20

The number of companies contributing T20 business is much smaller than that of T10.

Table 5

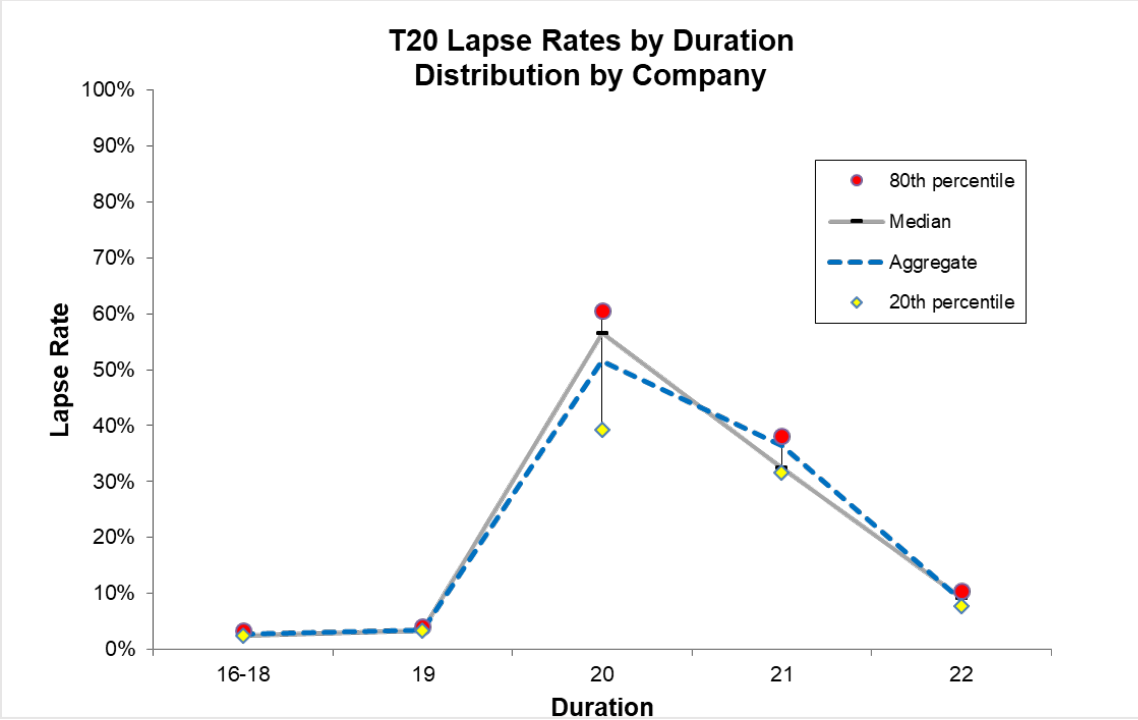
T20 DURATIONAL LAPSE RATE DISTRIBUTION

Lapse Rate Range	Duration				
	16–18	19	20	21	22
# of Companies	7	5	6	5	4
20th percentile	2.4%	3.3%	39.3%	31.6%	7.7%
Median	2.5%	3.3%	56.5%	32.5%	9.2%
Aggregate	2.8%	3.5%	51.5%	36.4%	8.8%
80th percentile	3.3%	4.0%	60.5%	38.2%	10.5%

Companies with 100 or more lapses in given duration

Figure 5

T20 LAPSE RATES BY DURATION DISTRIBUTION BY COMPANY



5.4 Premium Mode

T10

The dominant premium mode in Canada for term plans is Monthly followed by Annual. Annual policies have a higher lapse rate in duration 10 than the Monthly ones. This relationship holds true for all of the contributing companies. On average, the face amount distribution of Annual is higher than Monthly which could partially explain the higher lapse rate for Annual. Policies were also provided with Semi-Annual and Quarterly premium modes but they did not contribute enough data to add to the analysis by premium mode.

Table 6

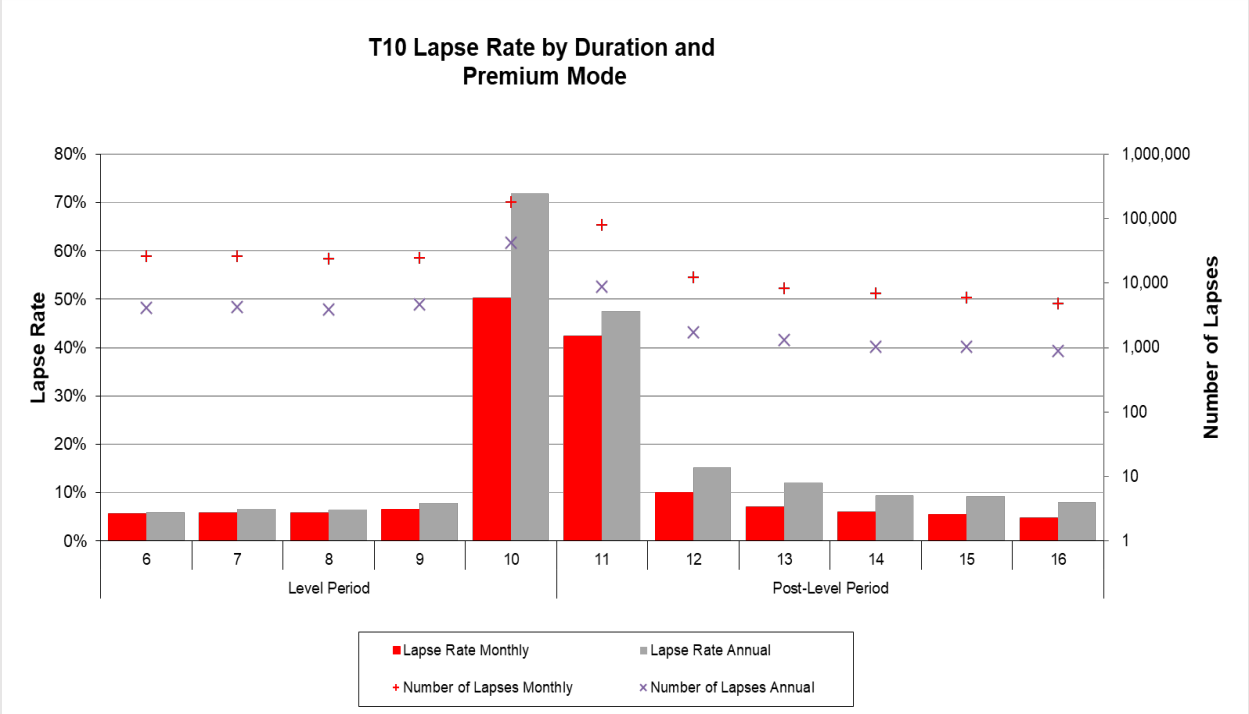
T10 LAPSE EXPERIENCE BY DURATION AND PREMIUM MODE

Policy Duration	Policy-Years Exposed		Total Lapses		Lapse Rate	
	Annual	Monthly	Annual	Monthly	Annual	Monthly
6	68,382	467,171	4,092	26,276	6.0%	5.6%
7	65,485	446,742	4,309	25,916	6.6%	5.8%
8	60,985	411,636	3,910	23,694	6.4%	5.8%
9	59,821	380,928	4,706	24,847	7.9%	6.5%
10	59,654	357,506	42,848	179,480	71.8%	50.2%
11	18,409	191,189	8,763	80,949	47.6%	42.3%
12	11,349	121,300	1,725	12,246	15.2%	10.1%
13	11,094	117,692	1,335	8,358	12.0%	7.1%
14	11,084	116,186	1,033	6,901	9.3%	5.9%
15	11,211	111,178	1,042	6,045	9.3%	5.4%
16	11,030	101,354	886	4,873	8.0%	4.8%
Grand Total	388,503	2,822,880	74,649	399,585	19.2%	14.2%

(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.

Figure 6

T10 LAPSE RATES BY DURATION AND PREMIUM MODE



5.5 Premium Jump Ratio and Amount

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 11 of the 12 participating companies, representing approximately 87% 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 1 and 2 times the premium rate in duration 10.

The researchers also wanted to study how the actual premium jump amount affected the shock lapse. Premium bands were developed such that similar counts of policies would be in each group. These amounts are based on an annual premium amount even though monthly is the primary premium payment mode.

The results on the following pages provide a calculation of the "Average Prem Jump Ratio" and the "Average Issue Age." As expected, the average premium jump is near the midpoint of each premium jump ratio band.

T10—Premium Jump Ratio

Lapse rates by premium jump ratio are presented below by amount and count. Lapse rates increase steadily as the premium jump ratio increases.

Table 7

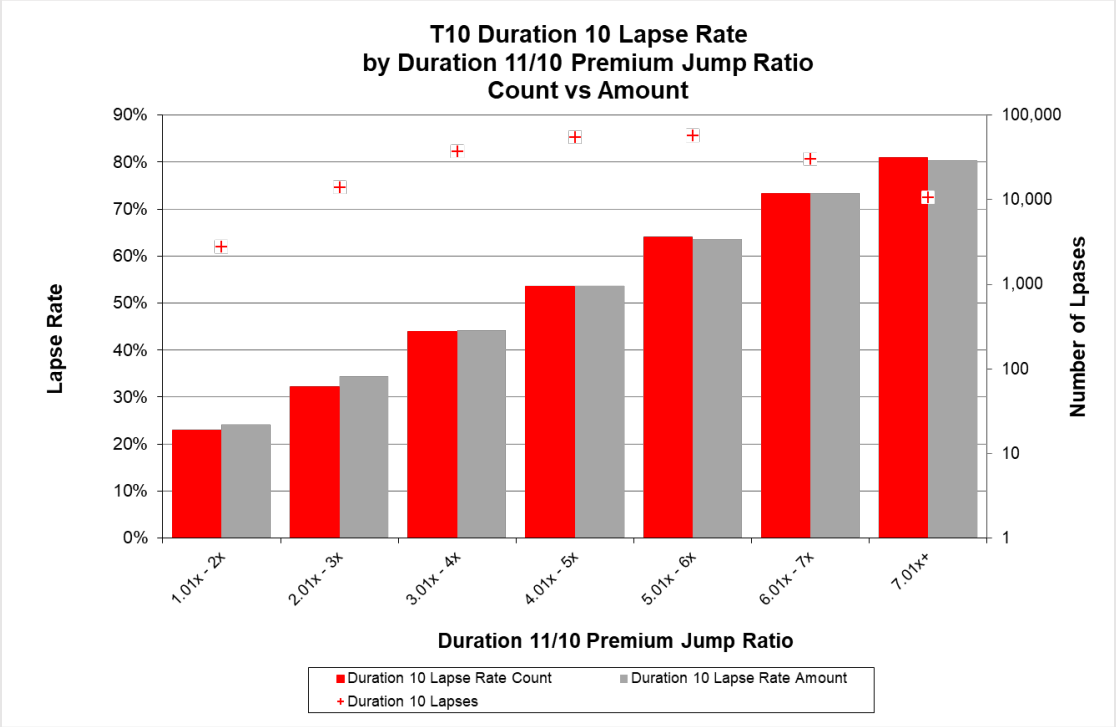
T10 LAPSE RATES BY PREMIUM JUMP RATIO

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	12,112	2,772	22.9%	24.2%	1.7	22.1
2.01x–3x	43,577	14,064	32.3%	34.4%	2.6	29.7
3.01x–4x	83,988	36,853	43.9%	44.2%	3.5	37.7
4.01x–5x	101,511	54,452	53.6%	53.6%	4.5	42.5
5.01x–6x	90,258	57,734	64.0%	63.6%	5.5	46.2
6.01x–7x	41,065	30,072	73.2%	73.4%	6.4	50.6
7.01x+	13,166	10,657	80.9%	80.3%	7.6	55.0
Subtotal Prem Data Available	385,677	206,604	53.6%	56.6%	4.5	41.5
No Prem Data Available	58,317	30,633	52.5%	57.8%	n/a	41.9
Grand Total	443,994	237,237	53.4%	56.7%	n/a	41.6

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

Figure 7

T10 DURATION 10 LAPSE RATE BY DURATION 11/10 PREMIUM JUMP RATIO COUNT VS. AMOUNT



T10—Premium Jump Amount

Lapse rates increase steadily as the premium jump amount increases. The variation in lapse rate by count vs. amount is driven by the correlation of the premium jump and face amount band. The higher face amounts have a lower premium jump ratio within the same premium jump amount band.

Table 8

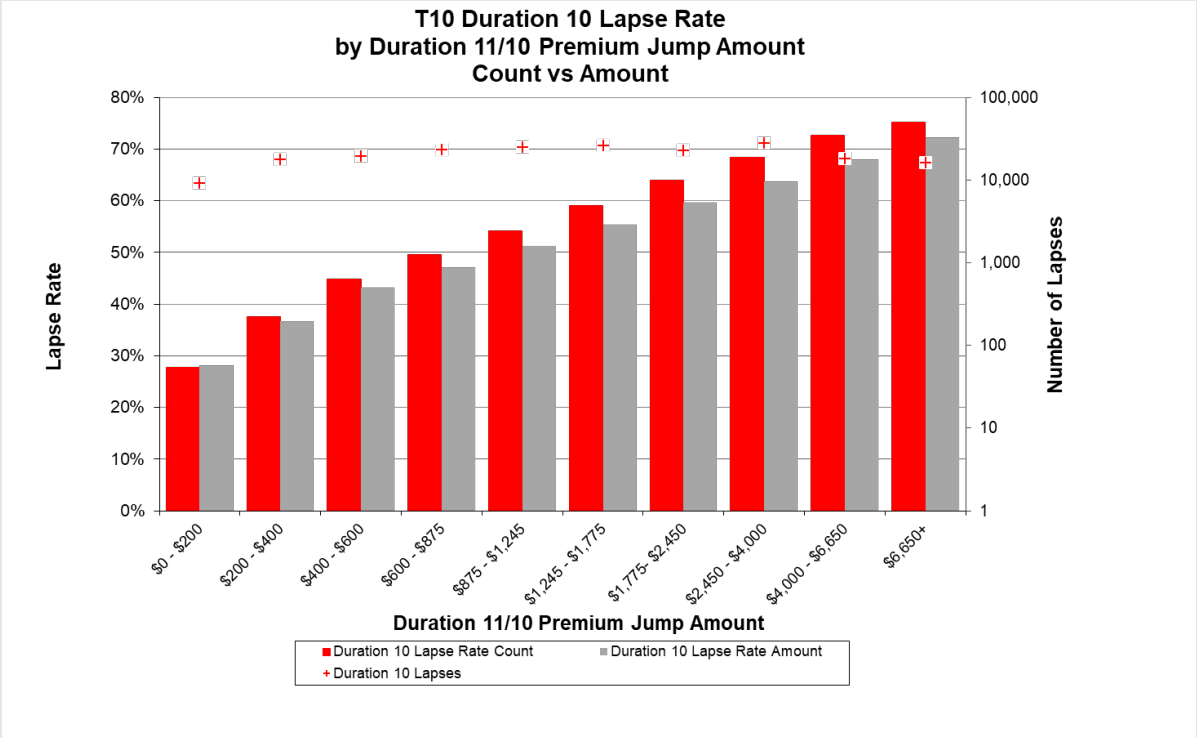
T10 LAPSE RATES BY DURATION 11/10 PREMIUM JUMP AMOUNT

Duration 11/10 Premium Jump Amount 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)
$0–$200	33,465	9,295	27.8%	28.2%	2.4	26.2
$200–$400	47,536	17,807	37.5%	36.7%	3.3	33.8
$400–$600	43,168	19,352	44.8%	43.2%	3.8	37.5
$600–$875	47,281	23,467	49.6%	47.2%	4.2	40.1
$875–$1,245	46,584	25,253	54.2%	51.2%	4.6	42.3
$1,245–$1,775	44,866	26,449	59.0%	55.4%	5.0	44.3
$1,775- $2,450	35,348	22,624	64.0%	59.6%	5.3	46.3
$2,450–$4,000	40,822	27,941	68.4%	63.7%	5.6	48.5
$4,000–$6,650	25,183	18,302	72.7%	68.0%	5.9	50.8
$6,650+	21,424	16,114	75.2%	72.2%	6.3	53.7
Subtotal Prem Data Available	385,676	206,604	53.6%	56.6%	4.5	41.5
No Prem Data Available	58,318	30,633	52.5%	57.8%	n/a	41.9
Grand Total	443,994	237,237	53.4%	56.7%	n/a	41.6

(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.

Figure 8

T10 DURATION 10 LAPSE RATE BY DURATION 11/10 PREMIUM JUMP AMOUNT COUNT VS. AMOUNT



T20—Premium Jump Ratio

The number of T20 lapses is quite a bit smaller than for T10 policies so credibility needs to be taken into consideration when looking at these results. With that said, the pattern of T20 experience is very similar to that of T10. The one difference that stands out is the T20 shock lapse rates came in lower at each average premium jump compared to the T10. The average issue age is lower for T20 which may at least partially explain the results. Also, renewal premiums for a new policy by dollar amount would be much higher for the policyholder of a T20 policy hitting the premium jump relative to a T10 policy due to the attained age being 10 years older.

Table 9

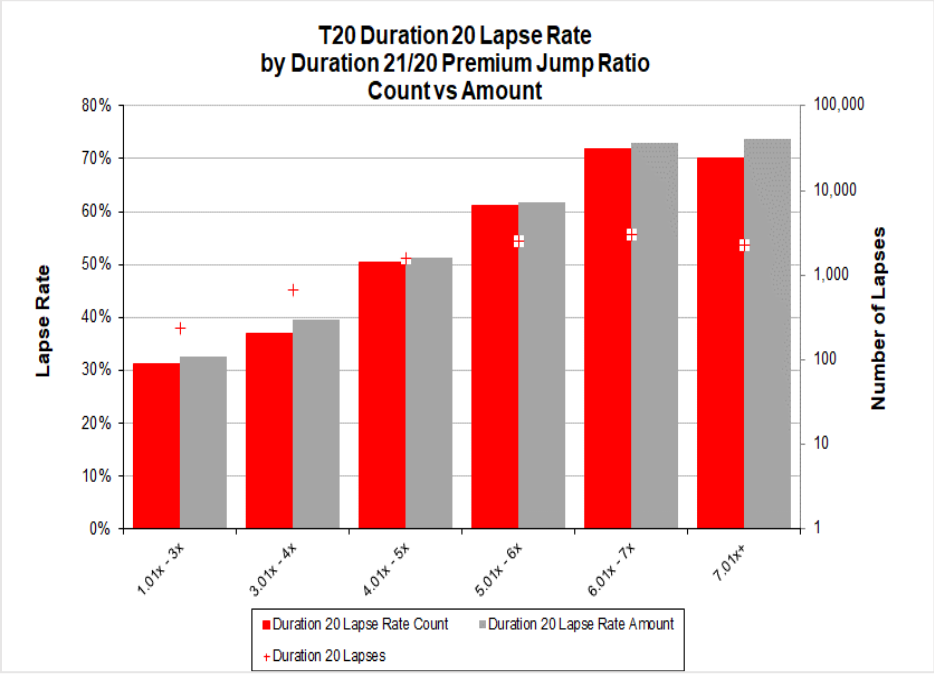
T20 LAPSE RATES BY DURATION 21/20 PREMIUM JUMP AMOUNT

Duration 21/20 Premium Jump Ratio Band	Policy-Years Exposed	Duration 20 Lapses	Duration 20 Lapse Rate Count	Duration 20 Lapse Rate Amount	Average Prem Jump Ratio[(1)]	Average Issue Age[(2)]
1.01x–3x	747	233	31.2%	32.6%	2.4	21.9
3.01x–4x	1,792	664	37.1%	39.5%	3.6	30.2
4.01x–5x	3,083	1,551	50.3%	51.2%	4.5	34.3
5.01x–6x	4,076	2,495	61.2%	61.7%	5.5	38.2
6.01x–7x	4,255	3,054	71.8%	73.1%	6.5	40.5
7.01x+	3,229	2,264	70.1%	73.7%	7.1	40.0
Subtotal Prem Data Available	17,181	10,261	59.7%	64.6%	5.5	36.9
No Prem Data Available	13,019	5,284	40.6%	43.9%	n/a	36.8
Grand Total	30,201	15,545	51.5%	55.2%	n/a	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 9

T20 DURATION 20 LAPSE RATE BY DURATION 21/20 PREMIUM JUMP RATIO COUNT VS. AMOUNT



T20 – Premium Jump Amount

Table 10

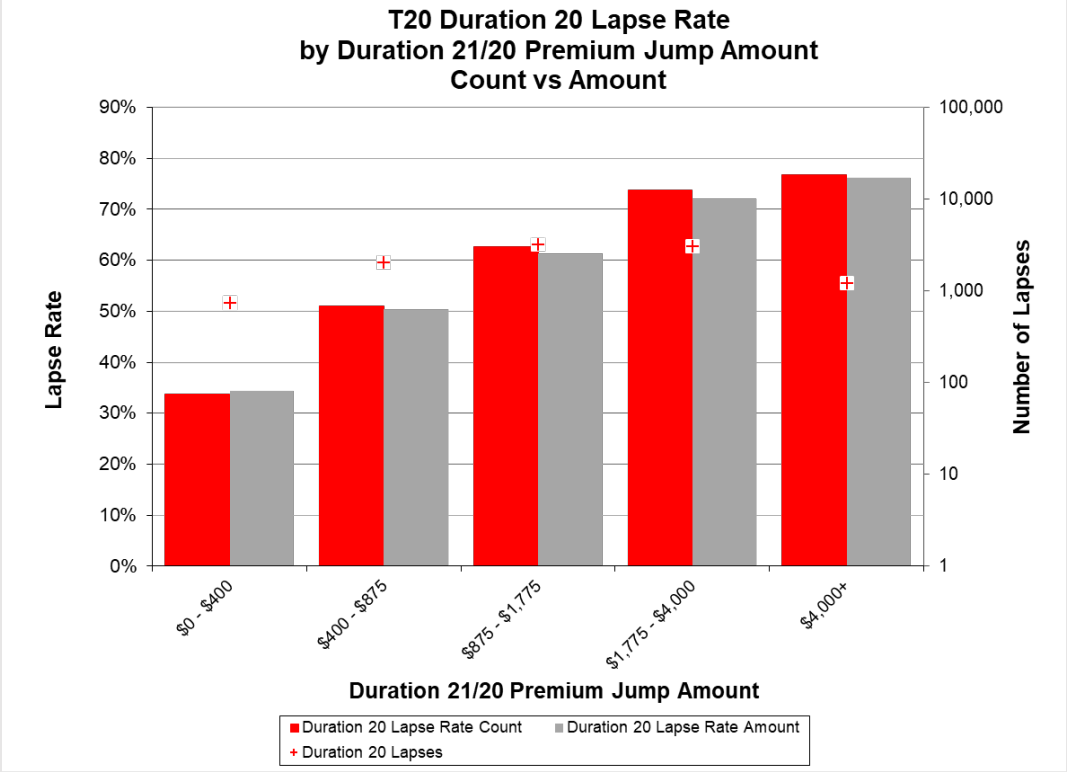
T20 LAPSE RATES BY DURATION 21/20 PREMIUM JUMP AMOUNT

Duration 21/20 Premium Jump Amount Band	Policy-Years Exposed	Duration 20 Lapses	Duration 20 Lapse Rate Count	Duration 20 Lapse Rate Amount	Average Prem Jump Ratio[(1)]	Average Issue Age[(2)]
$0–$400	2,184	739	33.8%	34.3%	3.4	27.3
$400–$875	4,022	2,053	51.0%	50.4%	4.9	33.6
$875–$1,775	5,114	3,206	62.7%	61.3%	6.0	37.8
$1,775–$4,000	4,129	3,049	73.8%	72.1%	6.5	41.2
$4,000+	1,578	1,211	76.7%	76.1%	6.0	37.8
Subtotal Prem Data Available	17,028	10,258	60.2%	64.9%	5.6	36.9
No Prem Data Available	13,173	5,287	40.1%	43.7%	n/a	36.9
Grand Total	30,201	15,545	51.5%	55.2%	n/a	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 10

T20 DURATION 20 LAPSE RATE BY DURATION 21/20 PREMIUM JUMP AMOUNT COUNT VS. AMOUNT



T10—Premium Jump Ratio and Duration

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 between the different years.

Table 11

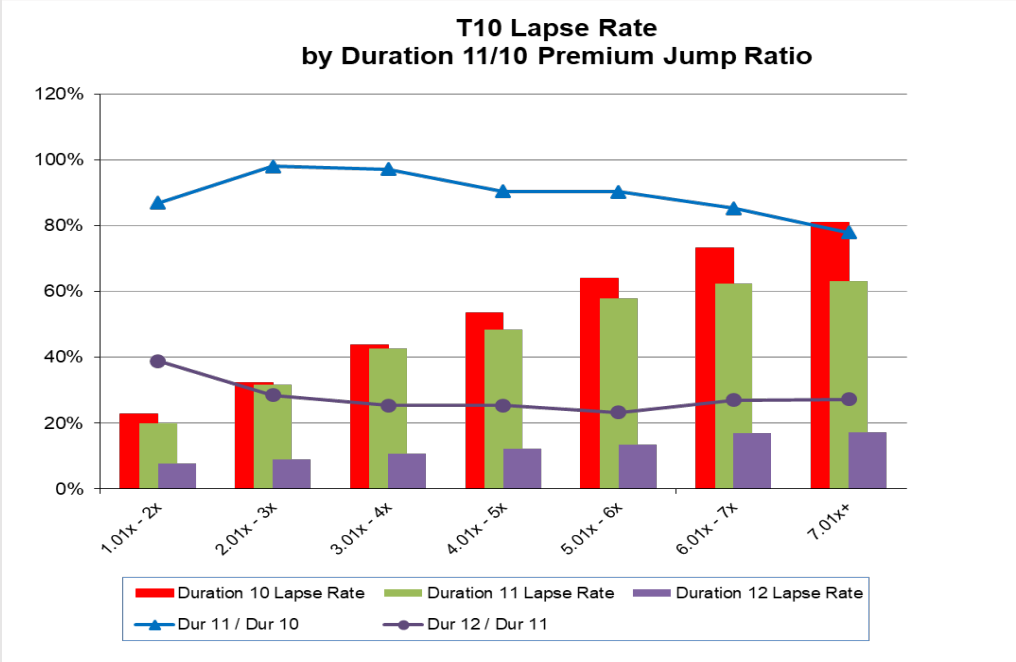
T10 PREMIUM JUMP RATIO AND LAPSE RATE BY DURATION

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	2,772	2,243	833	22.9%	19.9%	7.7%	86.9%	38.8%	1.7	22.1
2.01x–3x	14,064	10,825	2,439	32.3%	31.6%	9.0%	98.0%	28.5%	2.6	29.7
3.01x–4x	36,853	21,516	3,421	43.9%	42.6%	10.8%	97.1%	25.4%	3.5	37.7
4.01x–5x	54,452	21,094	2,603	53.6%	48.5%	12.3%	90.4%	25.4%	4.5	42.5
5.01x–6x	57,734	15,170	1,244	64.0%	57.8%	13.5%	90.3%	23.3%	5.5	46.2
6.01x–7x	30,072	4,824	343	73.2%	62.5%	16.9%	85.3%	27.0%	6.4	50.6
7.01x+	10,657	1,095	83	80.9%	63.1%	17.2%	77.9%	27.2%	7.6	55.0
Subtotal Prem Data Available	206,604	76,767	10,966	53.6%	43.8%	10.7%	81.8%	24.5%	4.5	41.5
No Prem Data Available	30,633	21,173	4,209	52.5%	42.4%	11.0%	80.6%	26.0%	n/a	41.9
Grand Total	237,237	97,940	15,175	53.4%	43.5%	10.8%	81.4%	24.8%	n/a	41.6

(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.

Figure 11

T10 LAPSE RATE BY DURATION 11/10 PREMIUM JUMP RATIO



T10—Premium Jump Amount and Duration

Similar trends are also found when analyzing lapses by premium jump amount.

Table 12

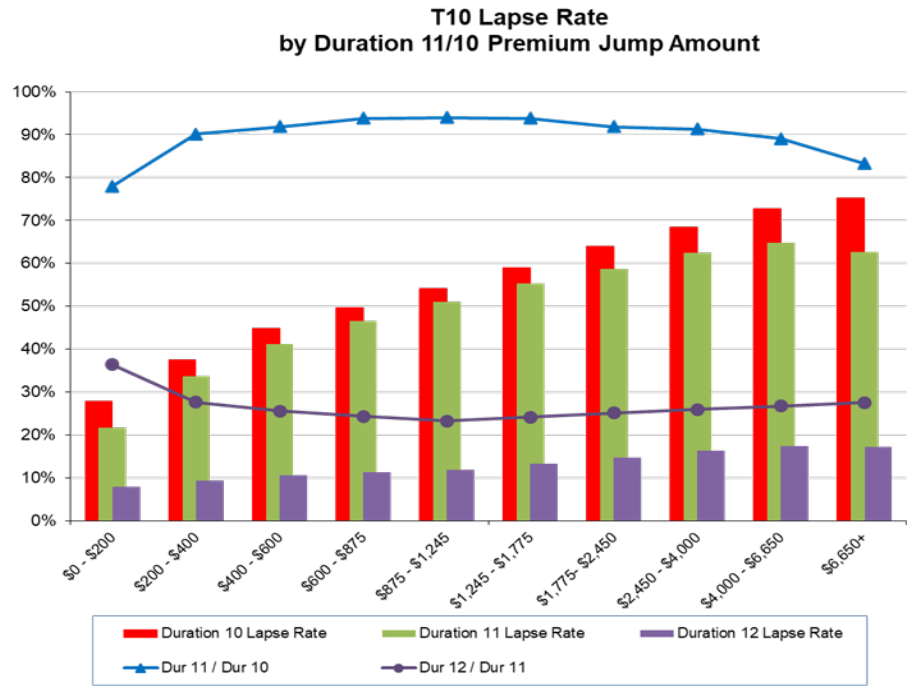
T10 PREMIUM JUMP AMOUNT AND LAPSE RATE BY DURATION

Duration 11/10 Premium Jump Amount 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]
$0–$200	9,295	5,696	1,768	27.8%	21.7%	7.9%	78.0%	36.4%	2.4	26.2
$200–$400	17,807	10,739	2,143	37.5%	33.7%	9.3%	90.1%	27.6%	3.3	33.8
$400–$600	19,352	10,044	1,586	44.8%	41.2%	10.5%	91.8%	25.5%	3.8	37.5
$600–$875	23,467	11,067	1,457	49.6%	46.5%	11.3%	93.8%	24.3%	4.2	40.1
$875–$1,245	25,253	10,340	1,181	54.2%	51.0%	11.8%	94.0%	23.2%	4.6	42.3
$1,245–$1,775	26,449	9,320	988	59.0%	55.3%	13.3%	93.8%	24.1%	5.0	44.3
$1,775–$2,450	22,624	6,575	651	64.0%	58.7%	14.7%	91.8%	25.1%	5.3	46.3
$2,450–$4,000	27,941	6,813	631	68.4%	62.5%	16.2%	91.3%	25.9%	5.6	48.5
$4,000–$6,650	18,302	3,608	319	72.7%	64.8%	17.3%	89.1%	26.7%	5.9	50.8
$6,650+	16,114	2,565	242	75.2%	62.6%	17.2%	83.2%	27.5%	6.3	53.7
Subtotal Prem Data Available	206,604	76,767	10,966	53.6%	43.8%	10.7%	81.8%	24.5%	4.5	41.5
No Prem Data Available	30,633	21,173	4,209	52.5%	42.4%	11.0%	80.6%	26.0%	n/a	41.9
Grand Total	237,237	97,940	15,175	53.4%	43.5%	10.8%	81.4%	24.8%	n/a	41.6

(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.

Figure 12

T10 LAPSE RATE BY DURATION 11/10 PREMIUM JUMP AMOUNT



T20 – Premium Jump Ratio and Duration

Consistent with T10, T20 also experiences increasing lapse rates within each post-level duration when comparing to the premium jump ratio and amount at the end of duration 20. It is worth noting that we are losing credibility with some of the smaller bands and durations.

Table 13

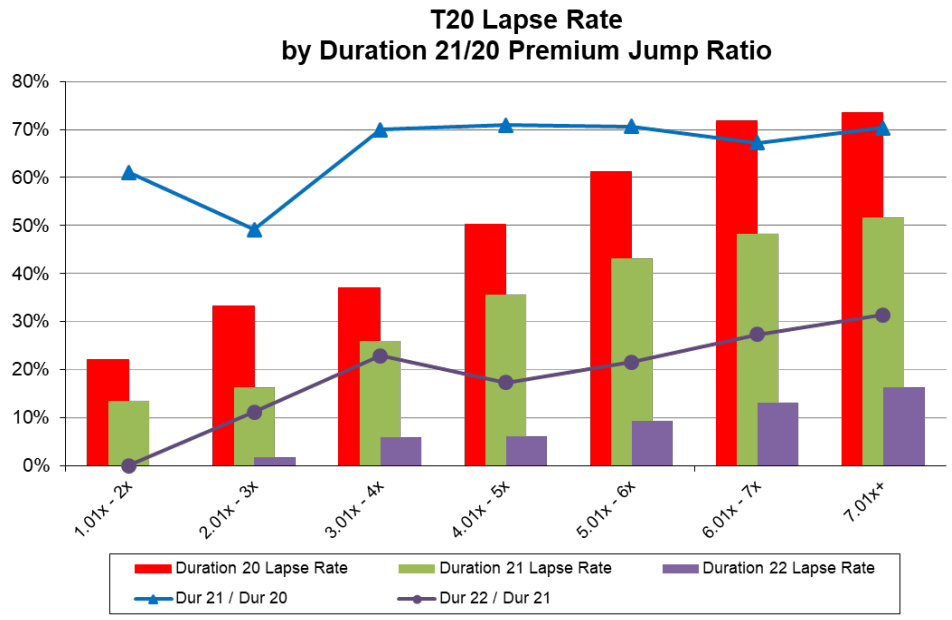
T20 INITIAL PREMIUM RATIO AND LAPSE RATE BY DURATION

Duration 21/20 Premium Jump Ratio Band	Duration 20 Lapses	Duration 21 Lapses	Duration 22 Lapses	Duration 20 Lapse Rate	Duration 21 Lapse Rate	Duration 22 Lapse Rate	Dur 21 / Dur 20	Dur 22 / Dur 21	Average Prem Jump Ratio (1)	Average Issue Age (2)
1.01x–2x	30	11	0	22.1%	13.5%	0.0%	61.1%	0.0%	1.8	24.4
2.01x–3x	203	52	3	33.2%	16.3%	1.8%	49.1%	11.2%	2.6	21.4
3.01x–4x	664	243	30	37.1%	25.9%	5.9%	70.0%	22.9%	3.6	30.2
4.01x–5x	1,551	440	36	50.3%	35.7%	6.2%	70.9%	17.3%	4.5	34.3
5.01x–6x	2,495	546	50	61.2%	43.2%	9.3%	70.6%	21.5%	5.5	38.2
6.01x–7x	3,054	442	51	71.8%	48.2%	13.2%	67.2%	27.3%	6.5	40.5
7.01x+	2,264	354	47	73.5%	51.8%	16.3%	70.4%	31.4%	7.4	40.1
Subtotal Prem Data Available	10,261	2,088	217	59.7%	38.4%	8.6%	64.3%	22.4%	5.5	36.9
No Prem Data Available	5,284	1,178	162	40.6%	33.4%	9.1%	82.2%	27.3%	n/a	36.8
Grand Total	15,545	3,266	379	51.5%	36.4%	8.8%	70.8%	24.2%	n/a	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 13

T20 LAPSE RATE BY DURATION 21/20 PREMIUM JUMP RATIO



T20–Premium Jump Amount and Duration

Table 14

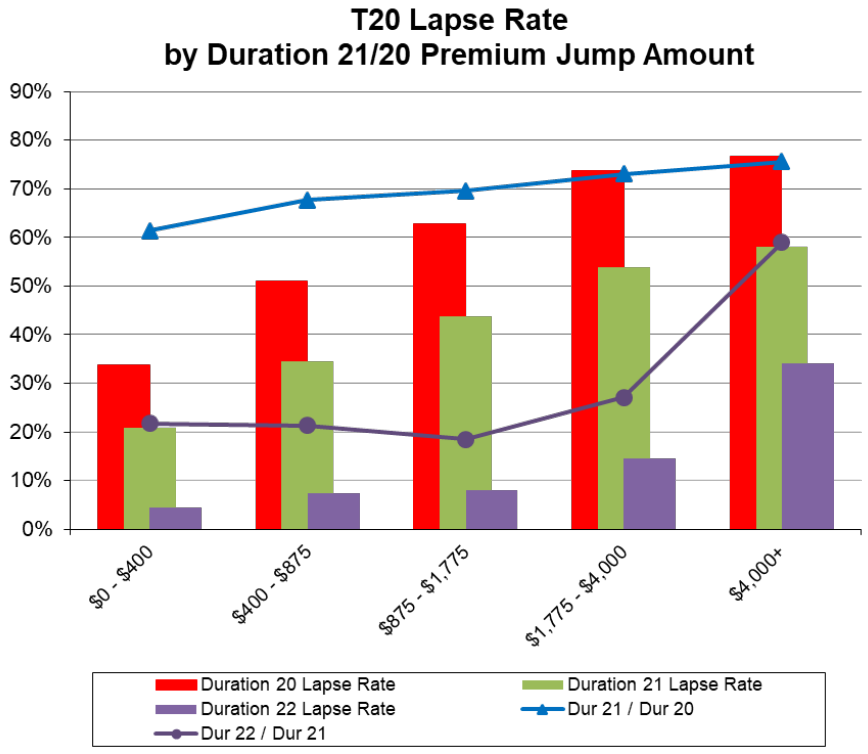
T20 PREMIUM JUMP AMOUNT AND LAPSE RATE BY DURATION

Duration 21/20 Premium Jump Amount Band	Duration 20 Lapses	Duration 21 Lapses	Duration 22 Lapses	Duration 20 Lapse Rate	Duration 21 Lapse Rate	Duration 22 Lapse Rate	Dur 21 / Dur 20	Dur 22 / Dur 21	Average Prem Jump Ratio (1)	Average Issue Age (2)
$0–$400	739	251	32	33.8%	20.8%	4.5%	61.4%	21.8%	3.4	27.3
$400–$875	2,053	532	58	51.0%	34.6%	7.4%	67.7%	21.3%	4.9	33.6
$875–$1,775	3,206	661	51	62.7%	43.7%	8.1%	69.6%	18.5%	6.0	37.8
$1,775–$4,000	3,049	475	43	73.8%	53.9%	14.6%	73.0%	27.1%	6.5	41.2
$4,000+	1,211	169	33	76.7%	58.0%	34.2%	75.6%	58.9%	6.7	43.9
Subtotal Prem Data Available	10,258	2,088	217	64.1%	43.5%	10.2%	67.8%	23.5%	5.9	38.3
No Prem Data Available	5,287	1,178	162	40.1%	33.4%	9.1%	83.1%	27.3%	n/a	41.4
Grand Total	15,545	3,266	379	51.5%	36.4%	8.8%	70.8%	24.2%	n/a	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 14

T20 LAPSE RATE BY DURATION 21/20 PREMIUM JUMP AMOUNT

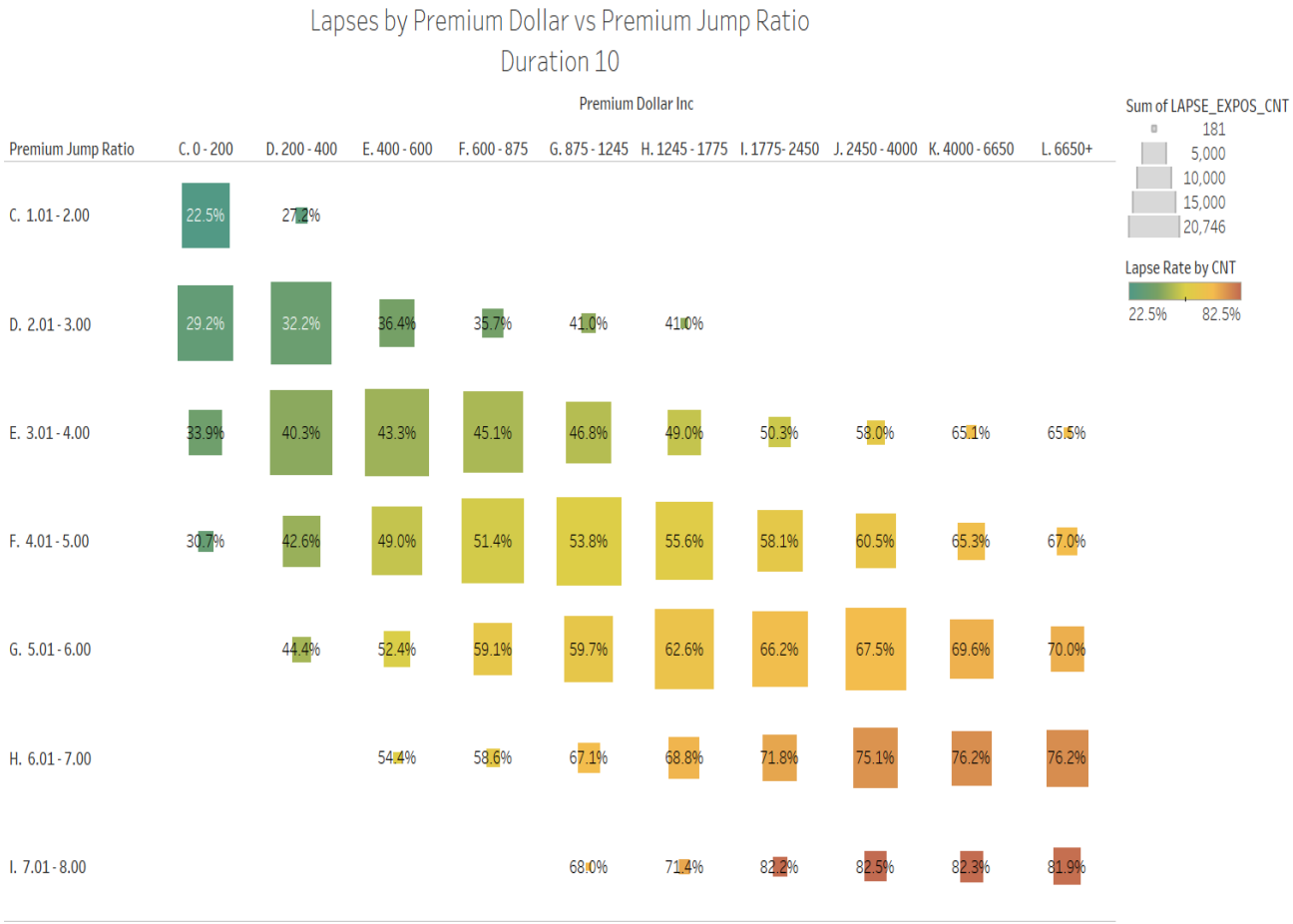


T10 – Premium Jump Ratio compared with Premium Jump Amount

The following three charts show the lapse rates based on premium jump ratio and premium jump amount. The charts also show the relative size for each cohort. For durations 6–9, the lapse rates tend to increase by the premium jump amount but decrease by the premium jump ratio.

Figure 15

LAPSES BY PREMIUM DOLLAR VS.PREMIUM JUMP RATIO DURATION 6–9



For durations 10 and 11, the lapse rates increase with both a higher premium jump amount and a higher premium jump ratio. It is also interesting to note the change of the size of each cohort from duration 10 to duration 11.

Figure 16

LAPSES BY PREMIUM DOLLAR VS.PREMIUM JUMP RATIO DURATION 10

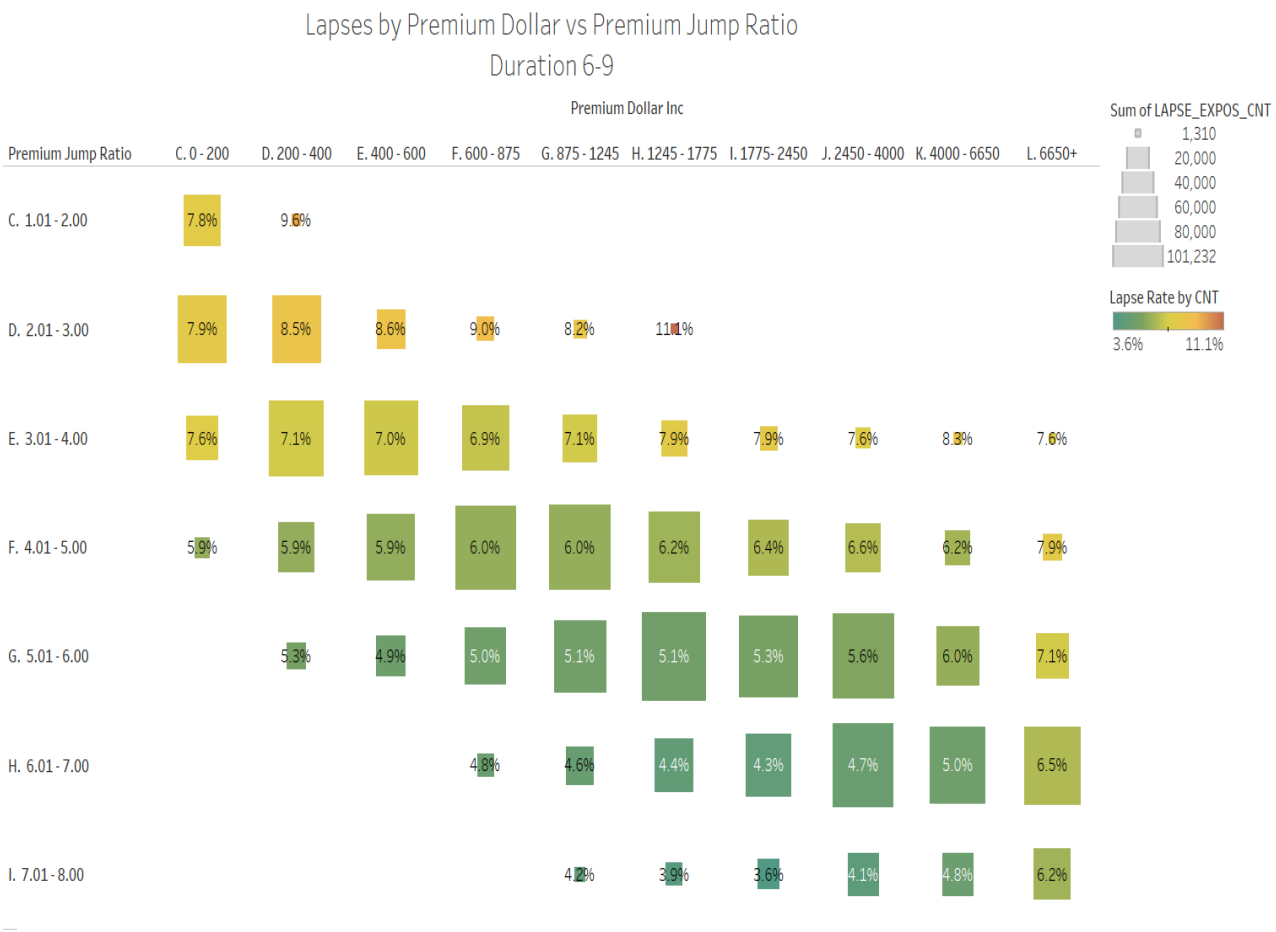
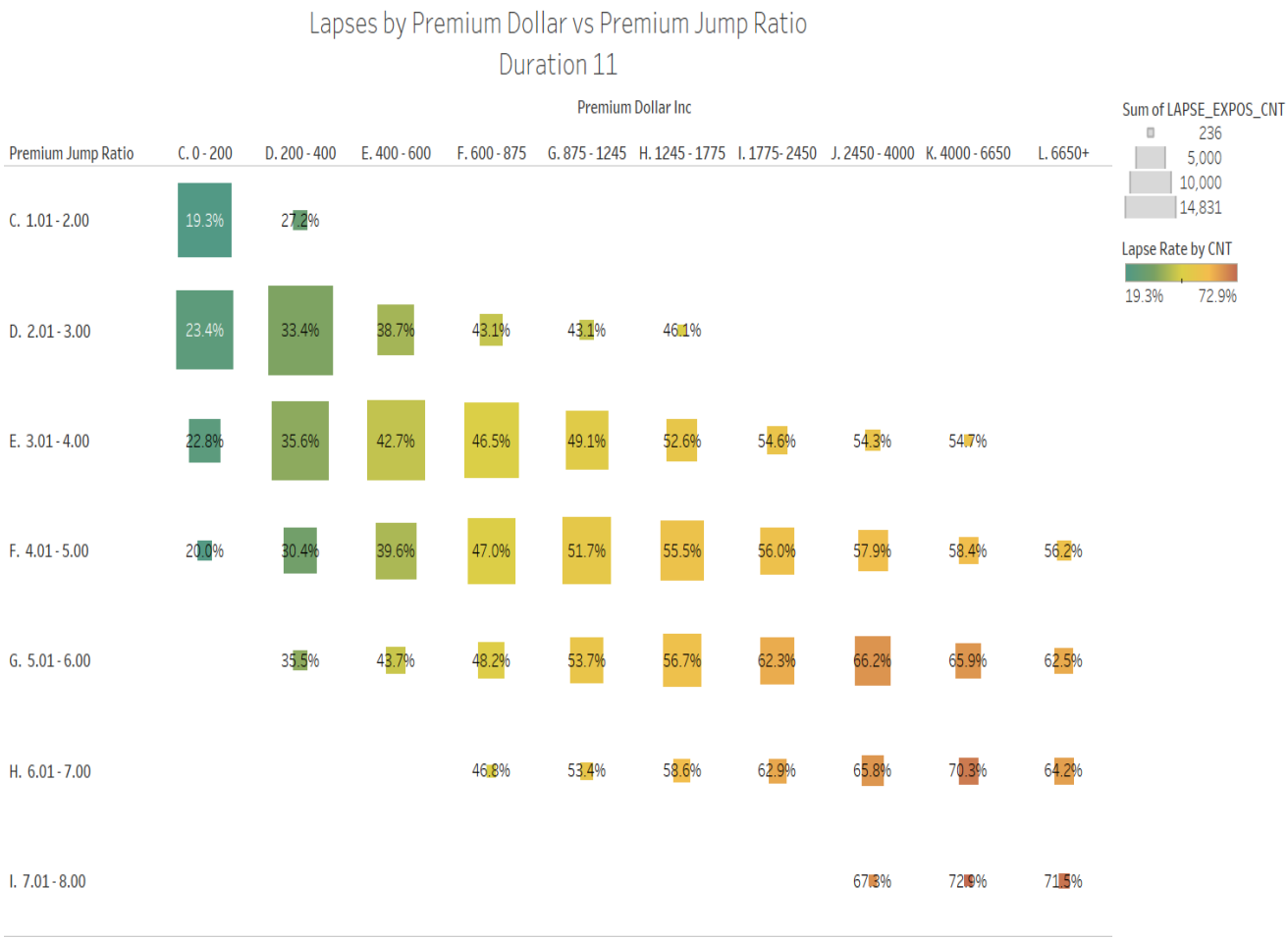


Figure 17

LAPSES BY PREMIUM DOLLAR VS. PREMIUM JUMP RATIO DURATION 11



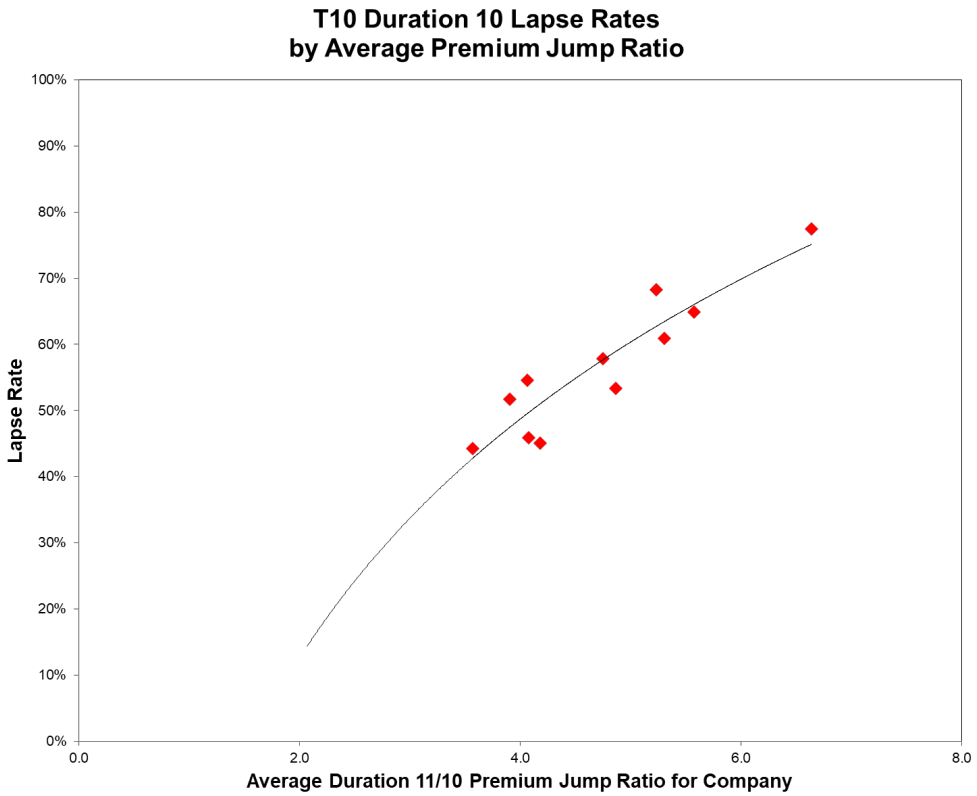
5.6 Premium Jump Ratio by Company

T10

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 spread of shock lapse results can be seen from company to company. This spread is attributable to a number of company-specific factors including product design, target market, age distribution, and policyholder retention programs. 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. A logarithmic trend line has been added to the graph only to aid the visual display.

Figure 18

T10 DURATION 10 LAPSE RATES BY AVERAGE PREMIUM JUMP RATIO



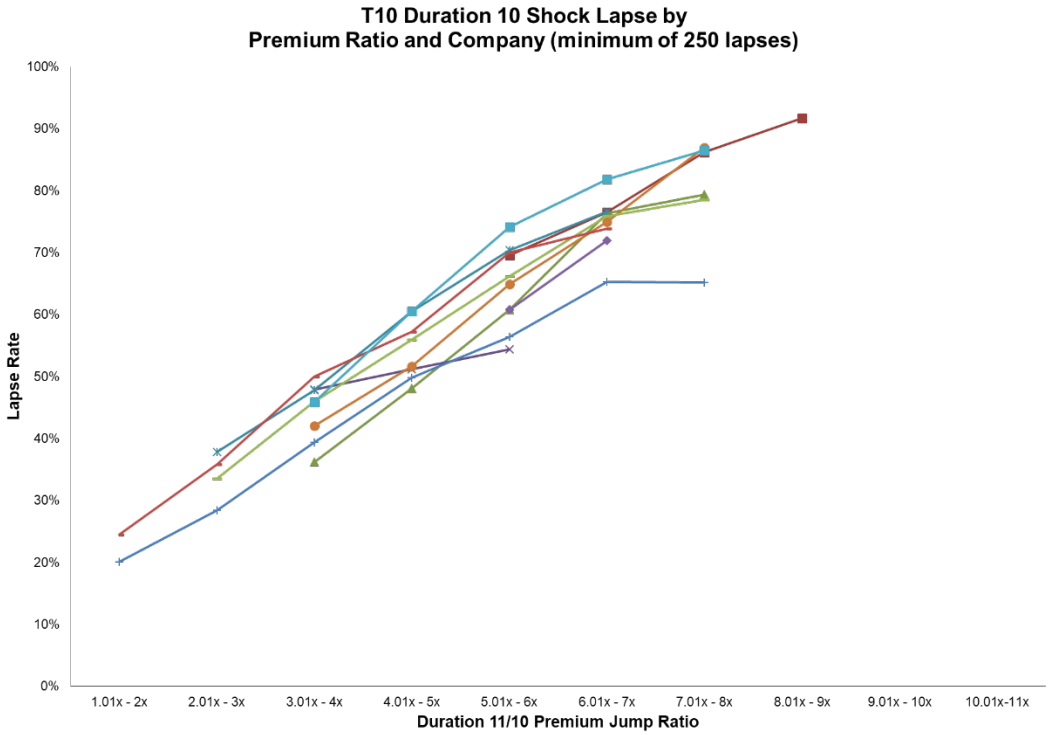
T10

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 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 graph below, plots company-specific lapse rates at each premium jump level. The graph requires a minimum of 250 lapses at any given point. While there can be significant differences by individual company, the general trend is consistent with what has been demonstrated in previous pages. Shock lapse rates increase steadily at the lowest premium jumps, and then increase at a slower pace at the highest premium jump levels.

Figure 19

T10 DURATION 10 SHOCK LAPSE BY PREMIUM RATIO AND COMPANY (MINIMUM OF 250 LAPSES)



5.7 Lapse Skewness

Analysis was done to help quantify how lapses were skewed by month in the policy years before and after the shock lapse. Responses from the Phase 1 Survey for the year of the shock were consistent, with most companies assuming lapses occur at or near the end of the policy year. They were also consistent for the duration immediately after the shock with most companies assuming lapses occurred toward the beginning of the policy year.

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

Table 15

SELECTED RESPONSES FROM PAHSE 1 SURVEY

Description	Number of Repsonses[1]
Monthly Lapse Skewness During Level Premium Period (1 to L–1)	
Lapses are Uniformly Distributed	11
Lapses Occur on Premium Payment Modes	4
Lapses Occur at the End of the Year	0
Graded Monthly with Shock in Month 12	2
No Response or N/A	0
Monthly Lapse Skewness During Year of Shock Lapse	
Lapses are Uniformly Distributed	1
Lapses Occur on Premium Payment Modes	2
Lapses Occur at the End of the Year	2
Lapses Graded Toward End of the Year with Shock in Month 12	12
Lapses Skewed to Beginning of Year	0
No Response or N/A	0
Monthly Lapse Skewness During First Year After Post-Level Period	
Lapses are Uniformly Distributed	1
Lapses Occur on Premium Payment Modes	3
Lapses Occur at the End of the Year	0
Lapses Skewed to Beginning of Year	13
Lapses Graded Monthly with Shock in Month 12	0
No Response or N/A	0
Monthly Lapse Skewness Beyond Post-Level Period (L+2 and Later)	
Lapses are Uniformly Distributed	9
Lapses Occur on Premium Payment Modes	2
Lapses Occur at the End of the Year	0
Lapses Graded Monthly with Shock in Month 12	1
No Response or N/A	3
Monthly Lapse Skewness During Level Premium Period (1 to L-1)	

(1) Companies may have multiple responses.

The tables and charts on the following pages show the proportion of T10 lapses within each policy month of lapse. Grace period adjustments to lapse dates were made for some companies, as discussed earlier, so that all companies are on the same basis. In total, it is clear that lapses in duration 10 are skewed heavily toward the end of the policy year. The most significant finding 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. This is consistent with the results found in the US PLT studies. To the extent that the distribution of off-anniversary lapses during the post-level term period is different from the level period, this should be an important consideration in developing new business pricing and valuation assumptions.

T10

More than two thirds of duration 11 lapses occurred in the first 3 policy months following the policy's 10th anniversary, compared to less than 25% during the first 3 months of durations 6–9. The monthly distribution of lapses for durations 12+ is similar to the distribution during durations 6–9. More than three times as many lapses occur in month 11 of duration 10 compared to month 11 of durations 6–9 in anticipation of the upcoming higher premium. Although the duration 11 lapse rate is not that much lower than duration 10, the combined impact does show just how many more actual lapses occur around the 10th anniversary.

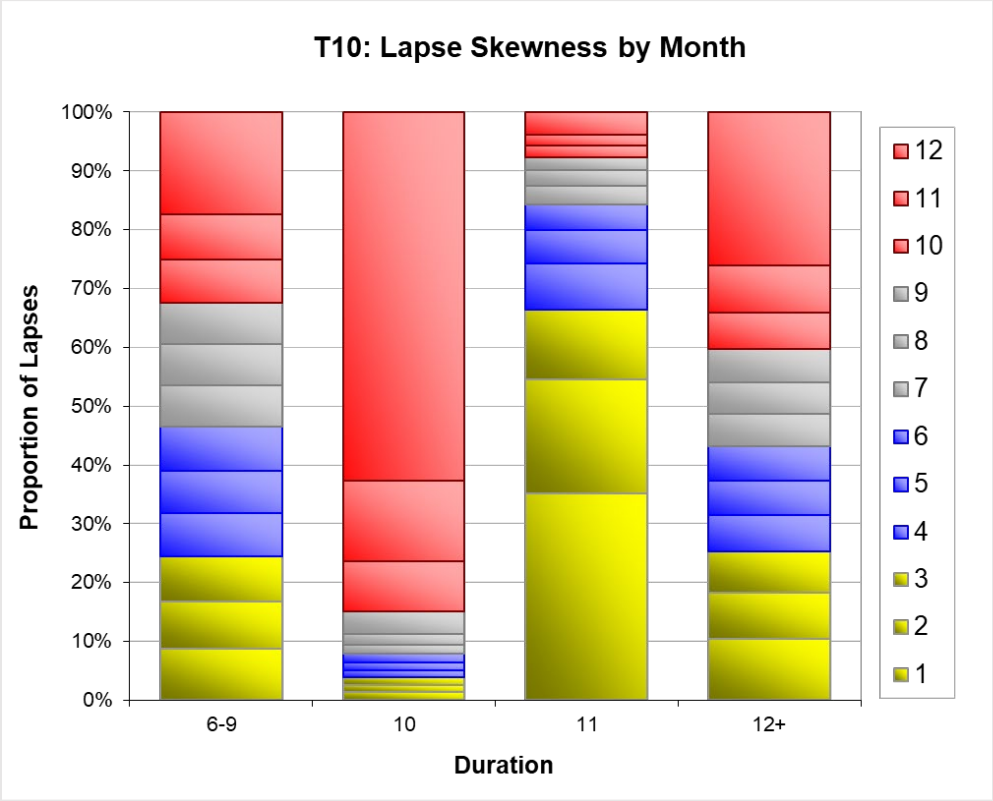
Table 16

PROPORTION OF T10 LAPSES

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+
1	10,671	3,132	34,364	10,968	9%	1%	35%	10%
2	9,887	2,982	19,056	8,133	8%	1%	19%	8%
3	9,353	3,025	11,651	7,393	8%	1%	12%	7%
4	8,951	3,057	7,692	6,416	7%	1%	8%	6%
5	8,882	3,021	5,489	6,098	7%	1%	6%	6%
6	9,060	3,557	4,264	6,209	7%	1%	4%	6%
7	8,562	3,503	3,216	5,774	7%	1%	3%	6%
8	8,577	4,497	2,551	5,614	7%	2%	3%	5%
9	8,654	8,992	2,171	5,836	7%	4%	2%	6%
10	9,084	20,265	1,967	6,468	7%	9%	2%	6%
11	9,395	32,569	1,732	8,398	8%	14%	2%	8%
12	21,154	148,637	3,787	27,331	17%	63%	4%	26%
Total	122,230	237,237	97,940	104,638	100%	100%	100%	100%

Figure 20

T10: LAPSE SKEWNESS BY MONTH

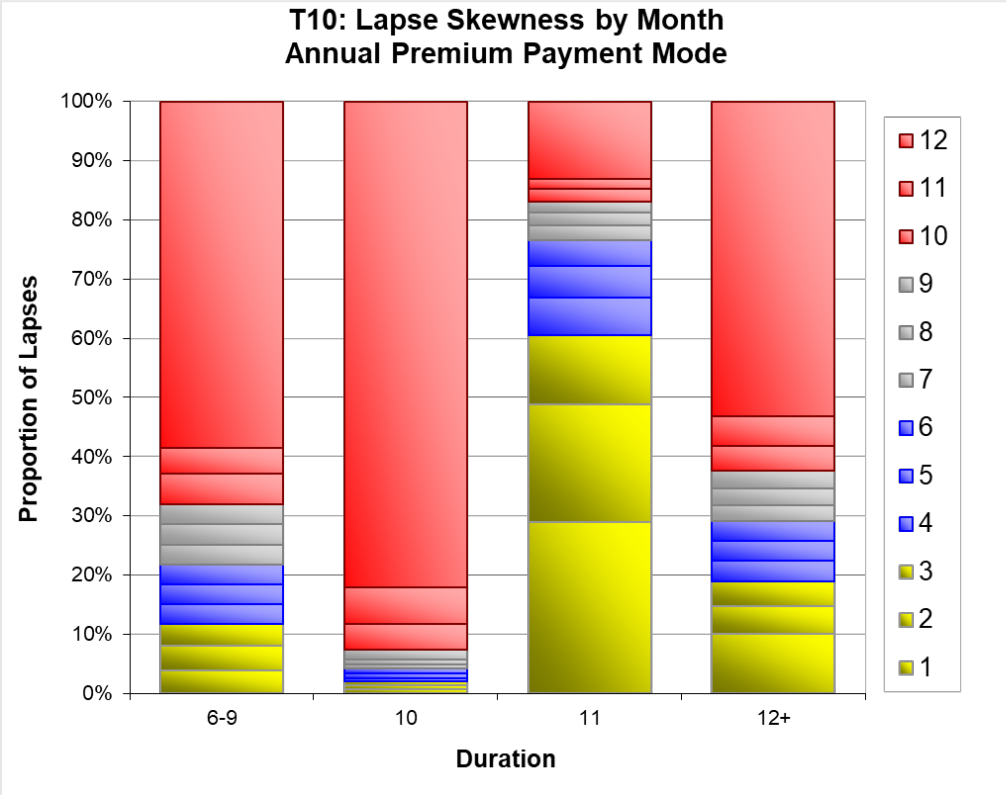


T10 (Annual Premium Payment Mode)

Premium payment mode is also a fundamental driver of lapse skewness. The following display covers 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.

Figure 21

T10: LAPSE SKEWNESS BY MONTH ANNUAL PREMIUM PAYMENT MODE

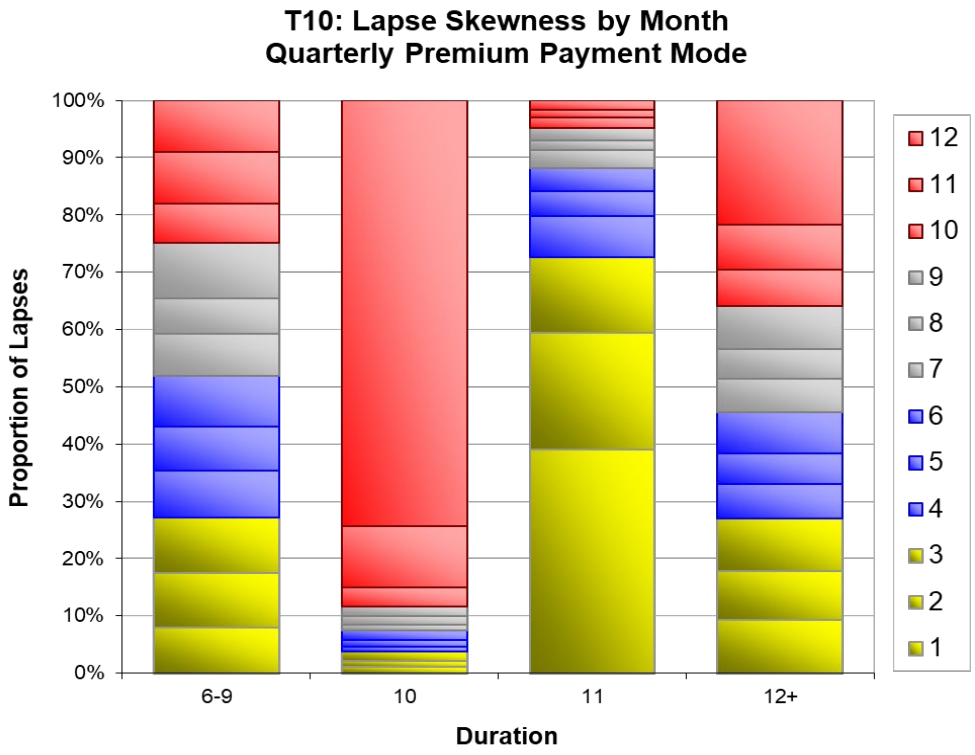


T10 (Quarterly Premium Payment Mode)

The following display covers business that was reported as having a quarterly premium payment mode. Lapses are much more evenly spread out for durations 6-9 relative to the annual premium mode. There is still a large shock lapse at the end of duration 10 and consistent with the other displays, duration 11 lapses are skewed toward the beginning of the policy year.

Figure 22

T10: LAPSE SKEWNESS BY MONTH QUARTERLY PREMIUM PAYMENT MODE

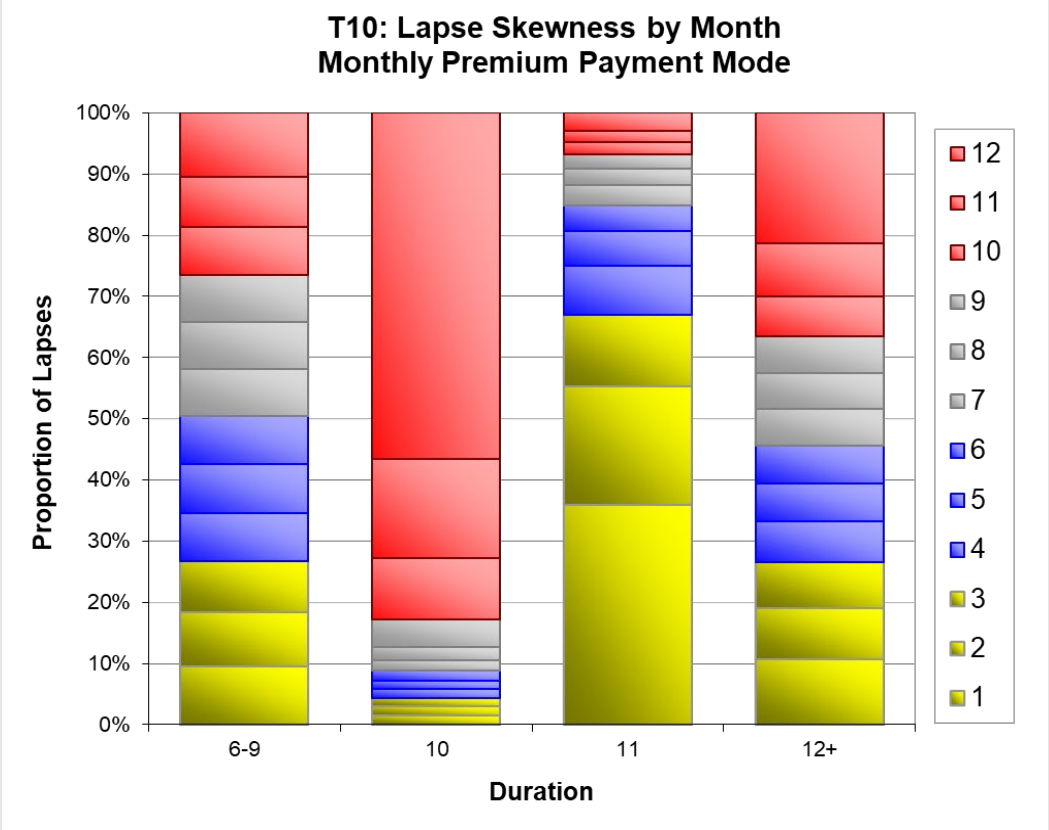


T10 (Monthly Premium Payment Mode)

The following display covers 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 as for the other premium modes.

Figure 23

T10: LAPSE SKEWNESS BY MONTH MONTHLY PREMIUM PAYMENT MODE



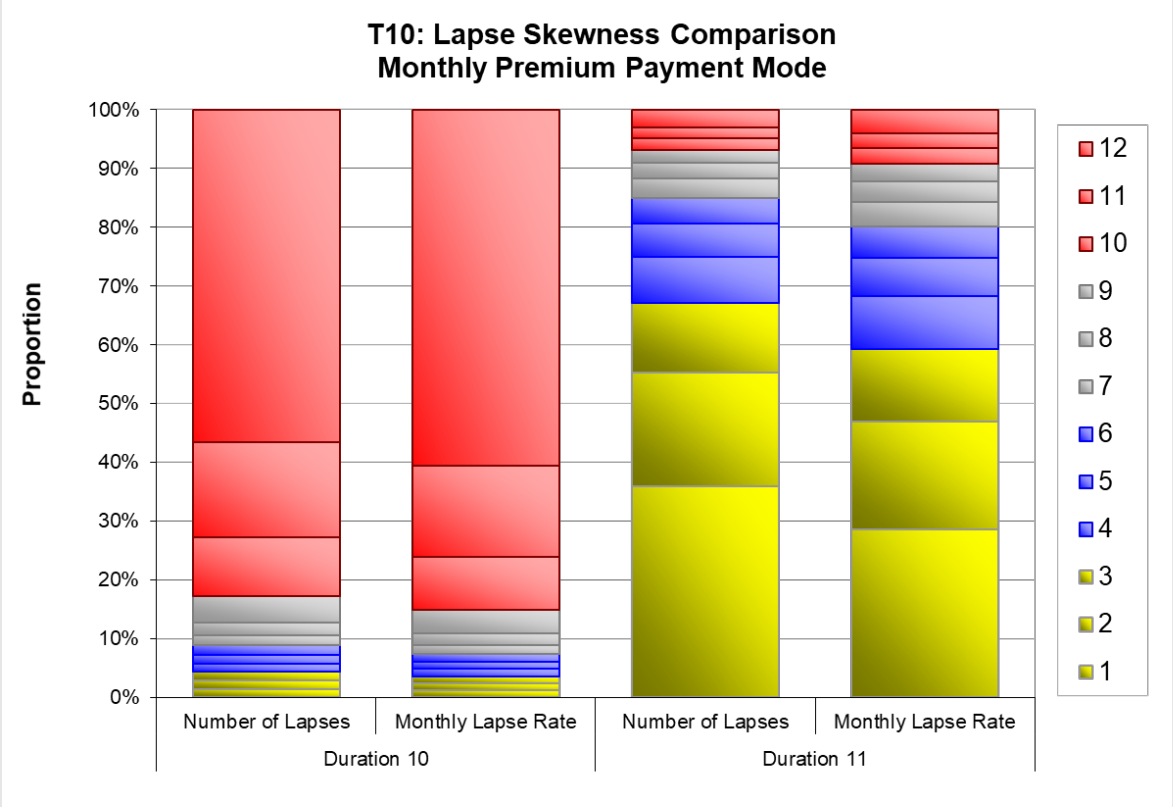
While the distribution of the number of lapses paints a directionally correct picture of the skewness of lapses by policy month, it can be slightly overstated due to the rapidly decreasing exposure associated with extremely high lapse rates. In order to more accurately quantify lapse skewness adjusted 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.

T10 (Monthly Premium Payment Mode)

This chart shows that both the monthly lapse rate and lapse number have similar portions in duration 10, but in duration 11, the high lapse rate in the first few months lead to a higher monthly lapse rate in the later months due to a smaller exposure when looking at the study with monthly calculated exposure.

Figure 24

T10: LAPSE SKEWNESS COMPARISON MONTHLY PREMIUM PAYMENT MODE

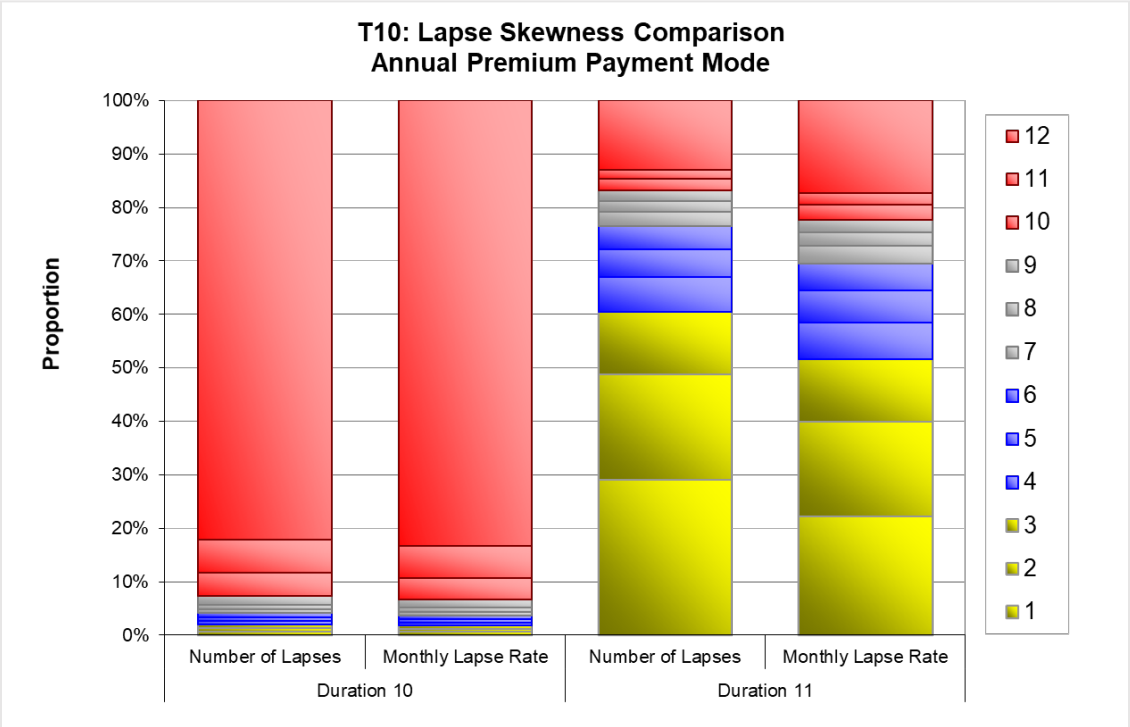


T10 (Annual Premium Payment Mode)

A very similar pattern is found in the annual premium payment mode compared to the monthly.

Figure 25

T10: LAPSE SKEWNESS COMPARISON ANNUAL PREMIUM PAYMENT MODE

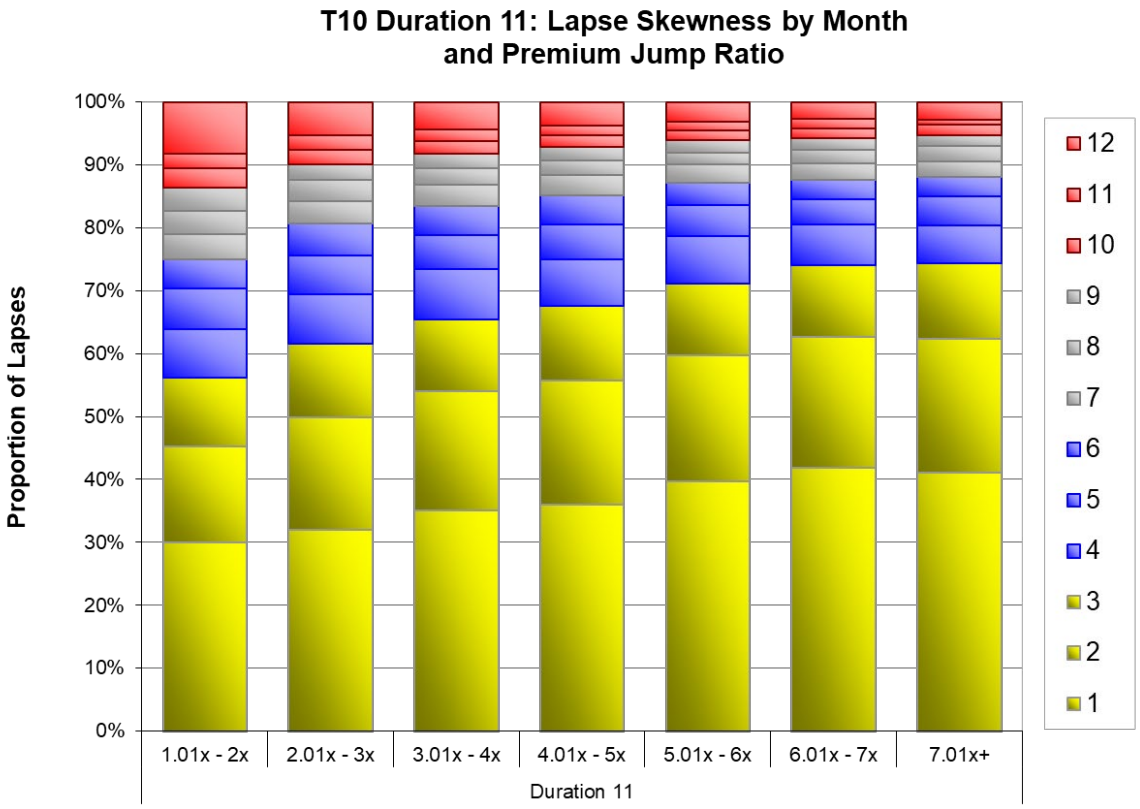


T10 Premium Jump Ratio

This chart shows that the duration 11 lapses get skewed more toward the beginning of the year with higher premium jumps.

Figure 26

T10 DURATION 11: LAPSE SKEWNESS BY MONTH AND PREMIUM JUMP RATIO

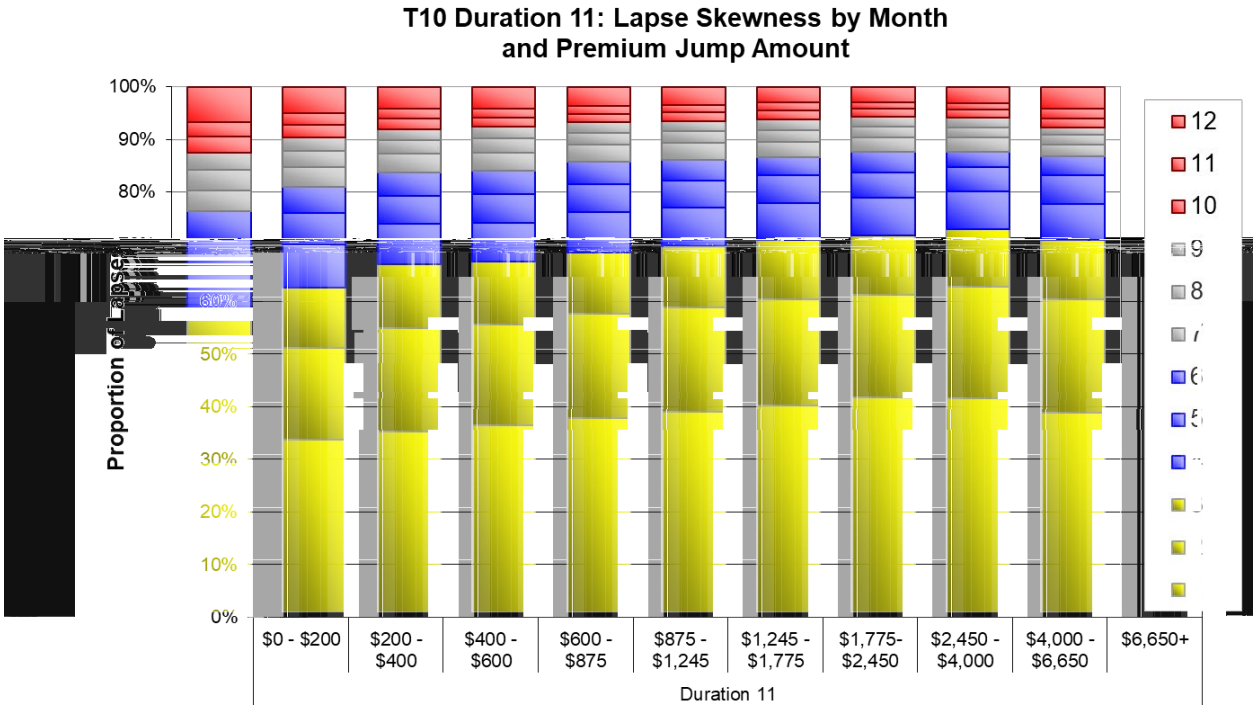


T10 Premium Jump Amount

Similar to the chart above, duration 11 lapses are skewed more toward the beginning of the year with larger premium jump amounts.

Figure 27

T10 DURATION 11: LAPSE SKEWNESS BY MONTH AND PREMIUM JUMP AMOUNT

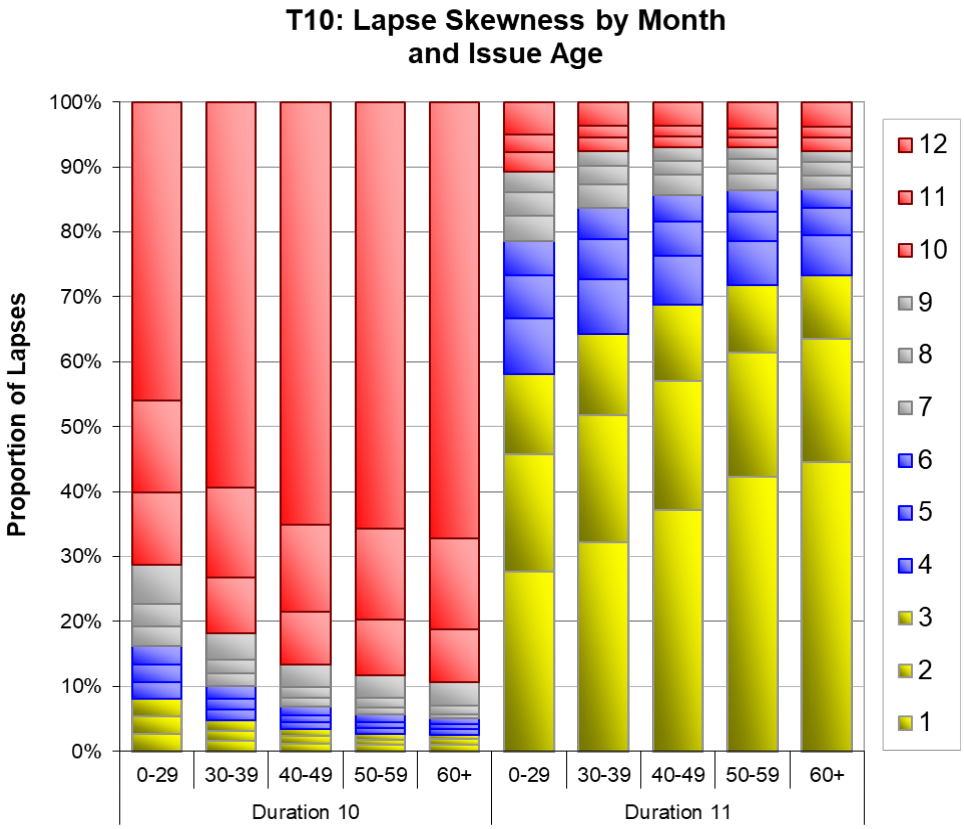


T10 Issue Age

As issue age increases, the lapses get more concentrated around end of policy year 10. This is probably mainly due to the increase in premium jump ratio and amount at the older ages.

Figure 28

T10: LAPSE SKEWNESS BY MONTH AND ISSUE AGE

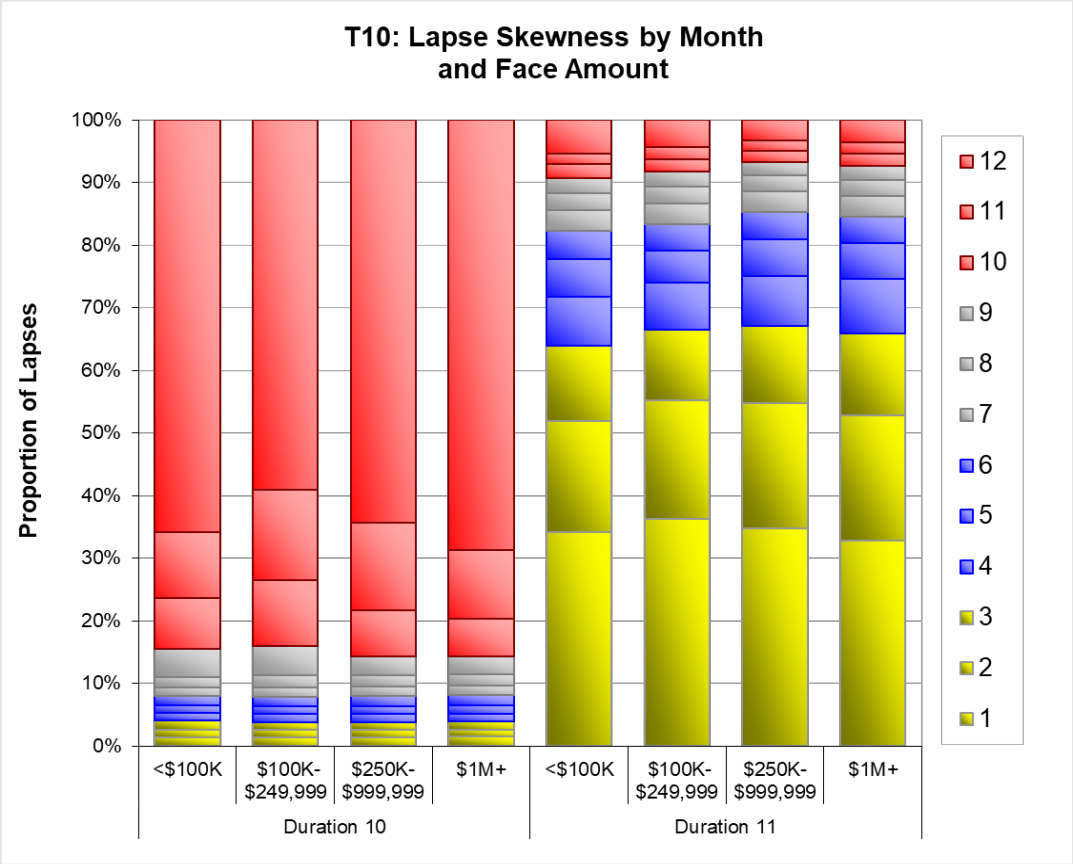


T10 Face Amount

There does not seem to be a strong correlation between lapse skewness and policy size. The skewness seems to be fairly level between the different face amount bands.

Figure 29

T10: LAPSE SKEWNESS BY MONTH AND FACE AMOUNT



5.8 Lapse Rates by Policy Attributes

5.8.1 Issue Age

T10

Shock lapse rates in duration 10 and the secondary shock in duration 11 tend to increase dramatically by increasing issue age. This is likely a result of issue age being also strongly correlated with the premium jump ratios. Premiums tend to jump more for older attained ages for the increased mortality risk. 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.

Table 17

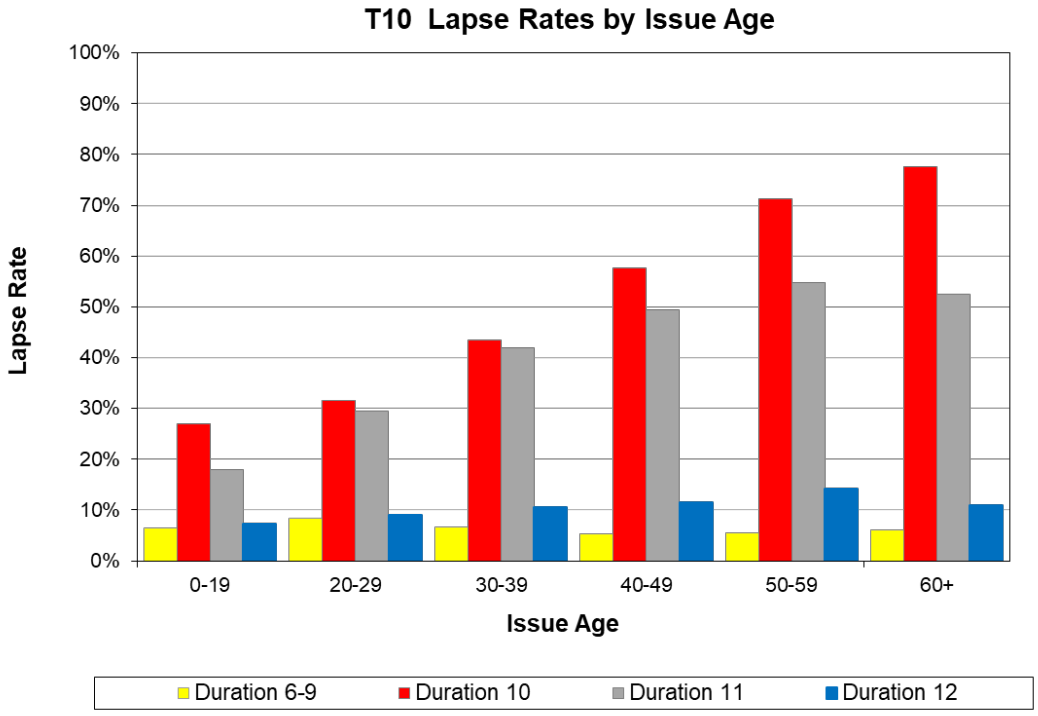
T10 LAPSE RATES BY ISSUE AGE

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	27,056	1,760	6.5%	5,322	1,437	27.0%	3,810	683	17.9%	2,998	222	7.4%	2.1	13.4
20–29	210,153	17,414	8.3%	46,740	14,790	31.6%	34,644	10,173	29.4%	26,093	2,376	9.1%	2.7	26.1
30–39	554,510	36,539	6.6%	136,332	59,135	43.4%	86,757	36,299	41.8%	56,518	5,926	10.5%	4.0	34.8
40–49	680,199	35,986	5.3%	155,473	89,489	57.6%	72,368	35,737	49.4%	40,966	4,720	11.5%	4.9	44.3
50–59	438,756	23,988	5.5%	82,842	58,985	71.2%	24,340	13,324	54.7%	12,336	1,748	14.2%	5.5	53.7
60+	109,433	6,543	6.0%	17,286	13,401	77.5%	3,281	1,724	52.6%	1,682	183	10.9%	6.2	62.8
Grand Total	2,020,107	122,230	6.1%	443,994	237,237	53.4%	225,199	97,940	43.5%	140,592	15,175	10.8%	4.5	41.6

(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.

Figure 30

T10 LAPSE RATES BY ISSUE AGE



T10 – Company Percentiles of Shock Lapse

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

Table 18

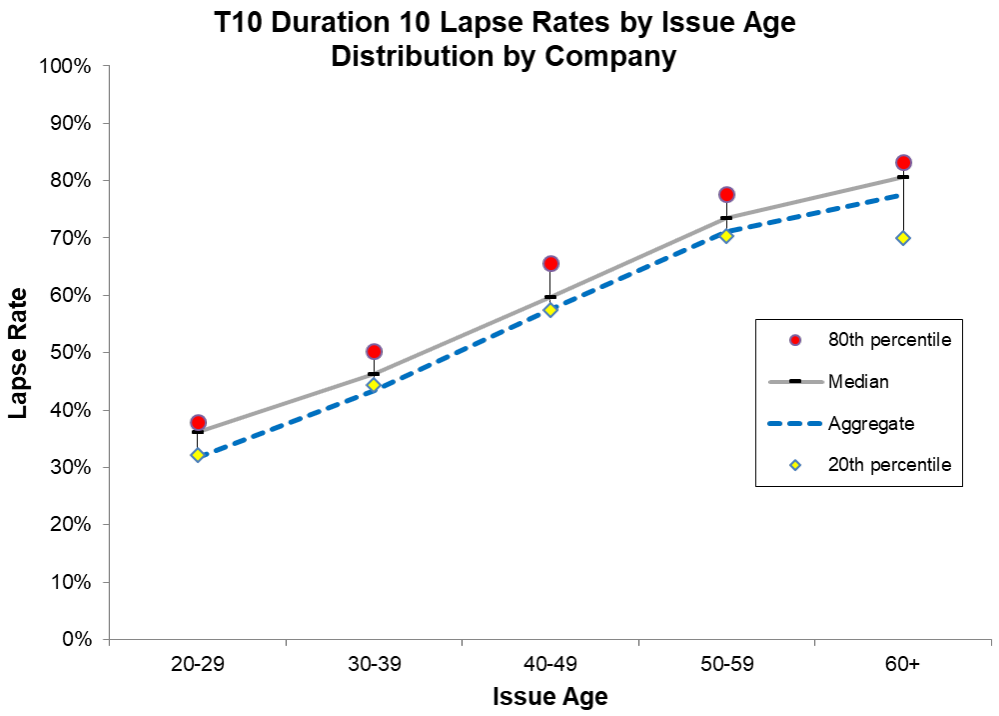
T10 DURATION 10 LAPSE RATES BY ISSUE AGE DISTRIBUTION BY COMPANY

Lapse Rate Range	Issue Age				
	20–29	30–39	40–49	50–59	60+
Number of Companies	10	12	12	12	10
20th percentile	32.2%	44.3%	57.4%	70.4%	70.0%
Median	36.1%	46.3%	59.6%	73.5%	80.7%
Aggregate	31.6%	43.4%	57.6%	71.2%	77.5%
80th percentile	38.0%	50.3%	65.6%	77.6%	83.2%

Companies with 100 or more lapses in given duration.

Figure 31

T10 DURATION 10 LAPSE RATES BY ISSUE AGE DISTRIBUTION BY COMPANY



T20

Similar trends are seen in the T20 experience compared to the T10 with lapses increasing by issue age. Due to the lower number of companies in T20, we have not included percentiles by company.

Table 19

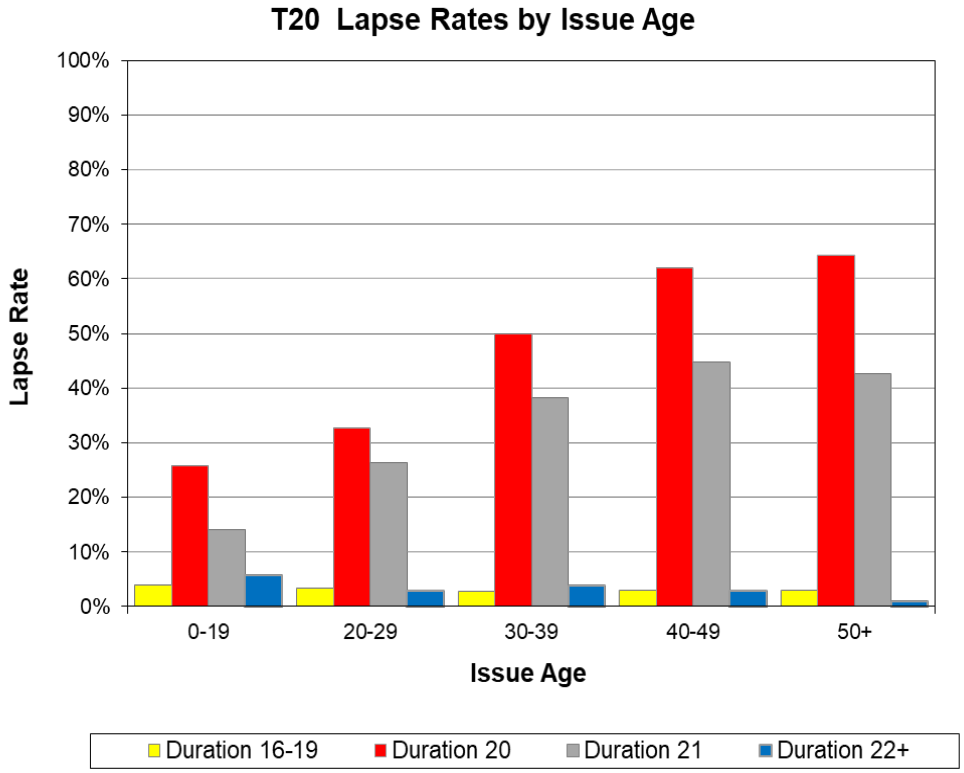
T20 LAPSE RATES BY ISSUE AGE

Issue Age	Duration 16–19			Duration 20			Duration 21			Duration 22			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	3,058	118	3.9%	306	79	25.8%	164	23	14.0%	334	19	5.7%	2.4	12.6
20–29	31,660	1,027	3.2%	4,217	1,375	32.6%	2,012	528	26.2%	11,486	333	2.9%	3.7	26.6
30–39	112,790	3,016	2.7%	15,525	7,759	50.0%	4,814	1,837	38.2%	15,279	588	3.8%	5.7	34.6
40–49	70,857	2,148	3.0%	8,292	5,135	61.9%	1,735	775	44.7%	6,429	187	2.9%	6.3	43.5
50+	21,328	613	2.9%	1,860	1,197	64.3%	242	103	42.6%	2,190	19	0.9%	5.8	53.5
Grand Total	239,693	6,922	2.9%	30,201	15,545	51.5%	8,966	3,266	36.4%	35,719	1,146	3.2%	5.6	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 32

T20 LAPSE RATES BY ISSUE AGE



5.9 Issue Age and Premium Jump

T10—Premium Jump Ratio

When looking at the shock lapse by premium jump ratio and issue age, the lapse rate continues to increase by age even within a premium jump band. This is likely due to the increasing dollar amount at the older ages as well as aging out of need for insurance, both increasing the motivation to lapse.

Table 20

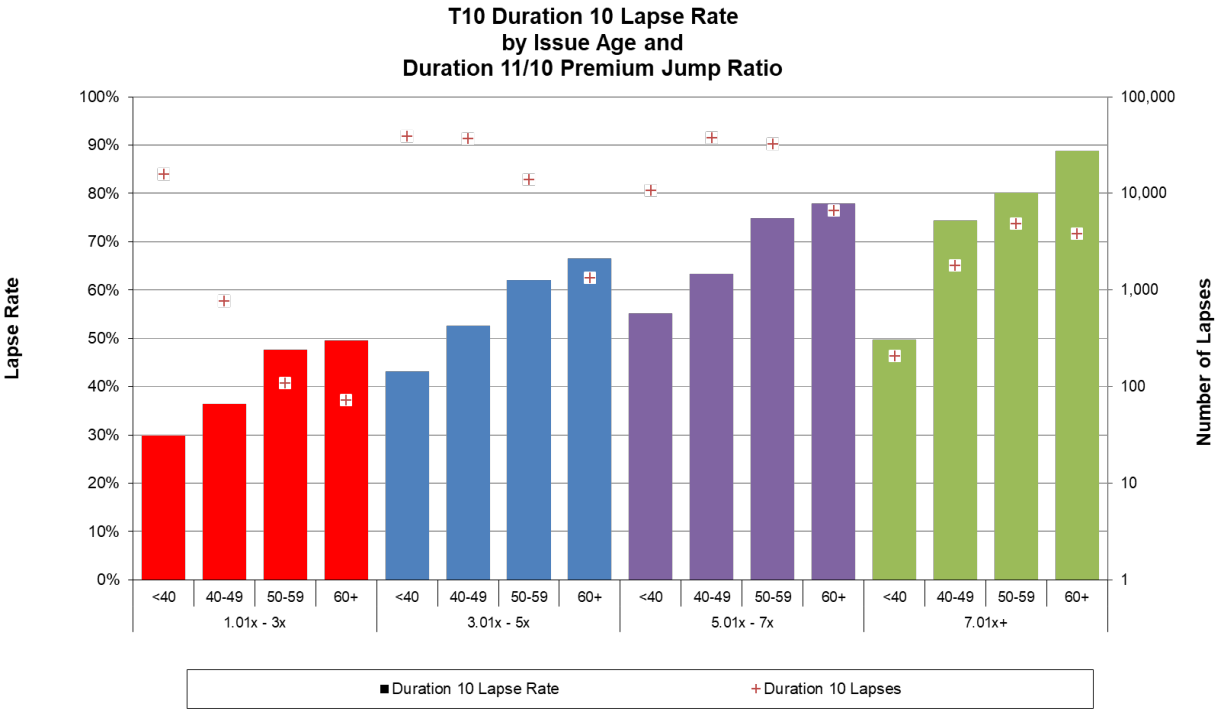
T10 DURATION 10 LAPSE RATE BY ISSUE AGE AND DURATION 11/10 PREMIUM JUMP RATIO

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	53,196	15,883	29.9%	2.4
	40–49	2,119	772	36.4%	2.8
	50–59	229	109	47.7%	2.7
	60+	146	72	49.5%	2.5
3.01x–5x	<40	91,035	39,212	43.1%	3.9
	40–49	69,876	36,732	52.6%	4.2
	50–59	22,571	14,019	62.1%	4.3
	60+	2,016	1,342	66.6%	4.2
5.01x–7x	<40	19,599	10,826	55.2%	5.5
	40–49	59,769	37,858	63.3%	5.7
	50–59	43,414	32,474	74.8%	5.9
	60+	8,540	6,648	77.8%	6.0
7.01x+	<40	421	209	49.6%	8.3
	40–49	2,418	1,800	74.4%	7.6
	50–59	6,030	4,833	80.1%	7.4
	60+	4,296	3,815	88.8%	7.8
Subtotal Prem Data Available		385,677	206,604	53.6%	4.5
No Prem Data Available		58,317	30,633	52.5%	n/a
Grand Total		443,994	237,237	53.4%	n/a

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

Figure 33

T10 DURATION 10 LAPSE RATE BY ISSUE AGE AND DURATION 11/10 PREMIUM JUMP RATIO



T20–Premium Jump Ratio

T20 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.

Table 21

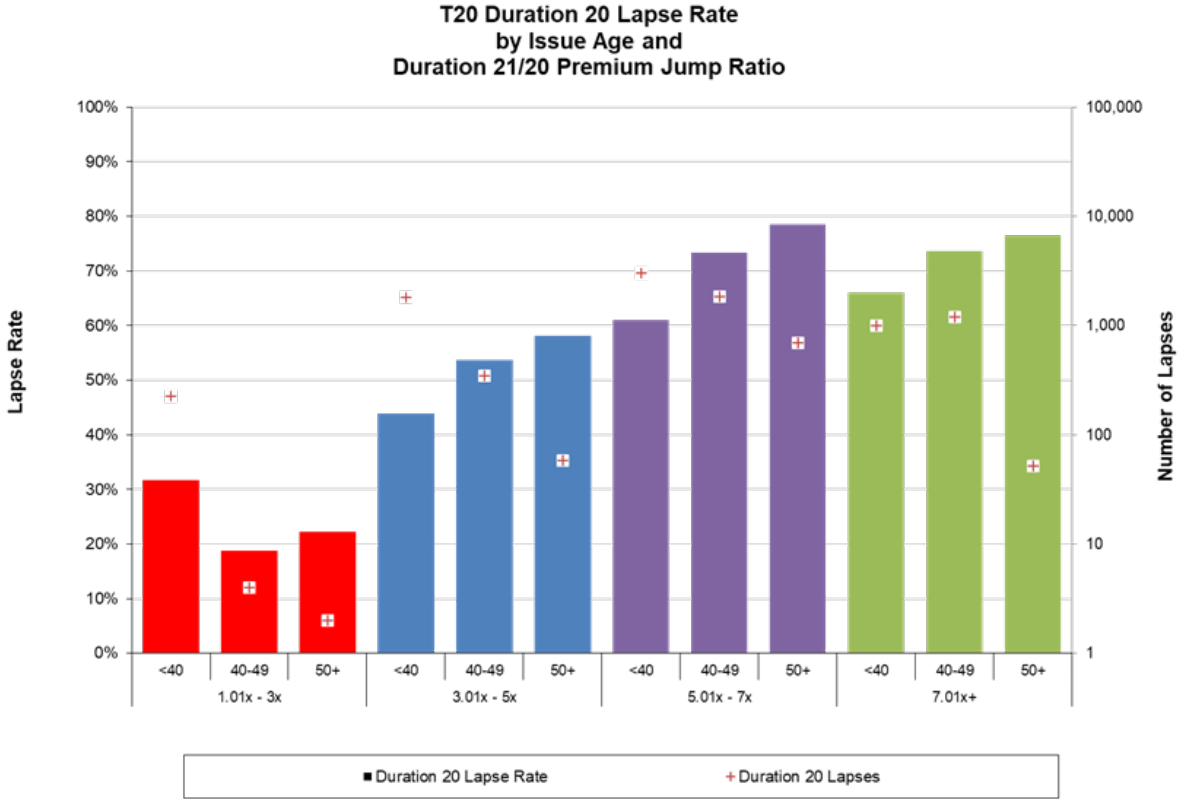
T20 DURATION 20 LAPSE RATE BY ISSUE AGE AND DURATION 21/20 PREMIUM JUMP RATIO

Duration 21/20 Premium Jump Ratio Band	Issue Age	Policy-Years Exposed	Duration 20 Lapses	Duration 20 Lapse Rate	Average Prem Jump Ratio[(1)]
1.01x–3x	<40	716	227	31.7%	2.4
	40–49	21	4	18.8%	2.1
	50+	9	2	22.2%	1.9
3.01x–5x	<40	4,128	1,810	43.8%	4.2
	40–49	646	347	53.7%	4.4
	50+	100	58	58.2%	4.3
5.01x–7x	<40	4,935	3,013	61.0%	5.9
	40–49	2,512	1,843	73.4%	6.2
	50+	883	693	78.5%	6.0
7.01x+	<40	1,521	1,005	66.1%	7.4
	40–49	1,640	1,207	73.6%	7.3
	50+	68	52	76.5%	7.3
Subtotal Prem Data Available		17,181	10,261	59.7%	5.5
No Prem Data Available		13,019	5,284	40.6%	n/a
Grand Total		30,201	15,545	51.5%	n/a

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.

Figure 34

T20 DURATION 20 LAPSE RATE BY ISSUE AGE AND DURATION 21/20 PREMIUM JUMP RATIO



T10–Premium Jump Amount

We see similar lapse patterns when we look at premium jump amount, however the results are not as pronounced. For the smaller premium amount bands, the issue age 60+ lapses are actually lower than the 50-59 band. This could be explained by the premium jump ratio which is also smaller for the 60+ than the 50-59 band in those smaller amount bands.

Table 22

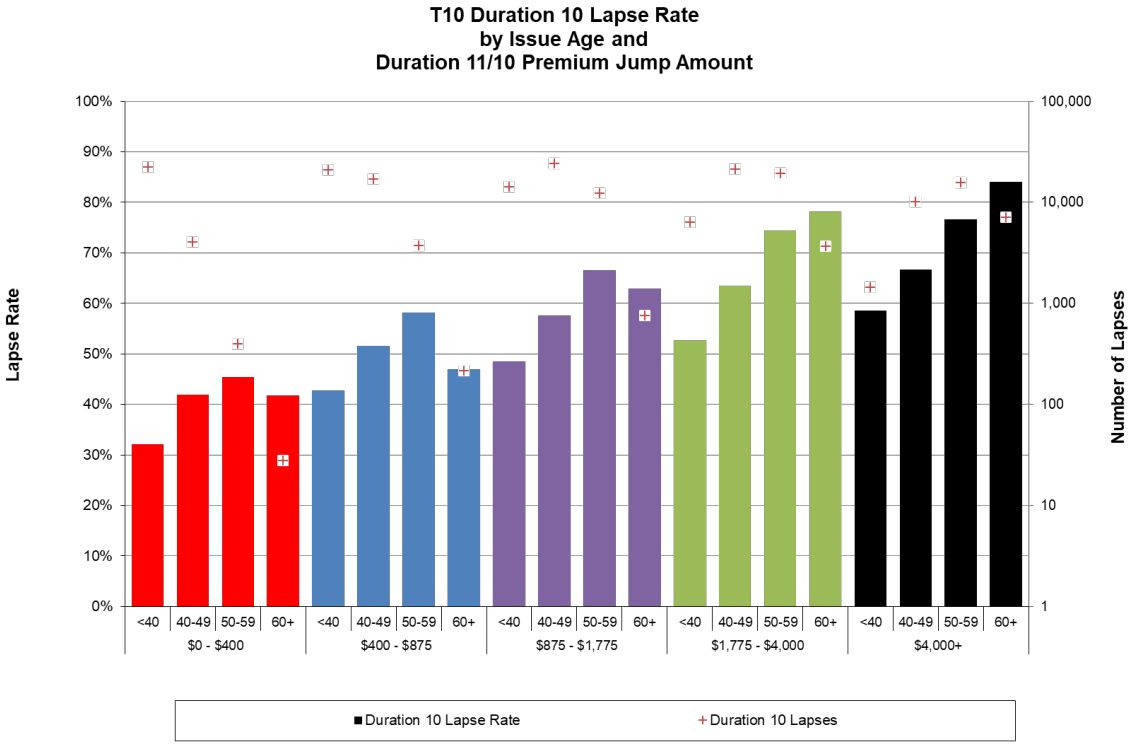
T10 DURATION 10 LAPSE RATE BY ISSUE AGE AND DURATION 11/10 PREMIUM JUMP RATIO

Duration 11/10 Premium Jump Ratio Band	Issue Age	Policy-Years Exposed	Duration 10 Lapses	Duration 10 Lapse Rate	Average Prem Jump Ratio[(1)]
$0–$400	<40	70,279	22,579	32.1%	2.8
	40–49	9,760	4,087	41.9%	3.7
	50–59	895	408	45.6%	4.0
	60+	67	28	41.7%	3.8
$400–$875	<40	49,787	21,374	42.9%	3.9
	40–49	33,682	17,432	51.8%	4.3
	50–59	6,513	3,792	58.2%	4.5
	60+	467	221	47.3%	4.2
$875–$1,775	<40	29,588	14,343	48.5%	4.4
	40–49	42,162	24,304	57.6%	5.0
	50–59	18,493	12,295	66.5%	5.0
	60+	1,207	760	63.0%	5.0
$1,775–$4,000	<40	12,140	6,394	52.7%	4.8
	40–49	33,460	21,258	63.5%	5.5
	50–59	25,836	19,212	74.4%	5.7
	60+	4,733	3,701	78.2%	6.0
$4,000+	<40	2,457	1,440	58.6%	5.2
	40–49	15,120	10,081	66.7%	5.7
	50–59	20,506	15,728	76.7%	6.3
	60+	8,524	7,167	84.1%	6.7
Subtotal Prem Data Available		385,676	206,604	53.6%	4.5
No Prem Data Available		58,318	30,633	52.5%	n/a
Grand Total		443,994	237,237	53.4%	n/a

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

Figure 35

T10 DURATION 10 LAPSE RATE BY ISSUE AGE AND DURATION 11/10 PREMIUM JUMP AMOUNT



5.10 Gender

T10

Shock lapses are higher for males than females. This may be explained by the fact that males have higher average issue ages and premium jump ratios.

Table 23

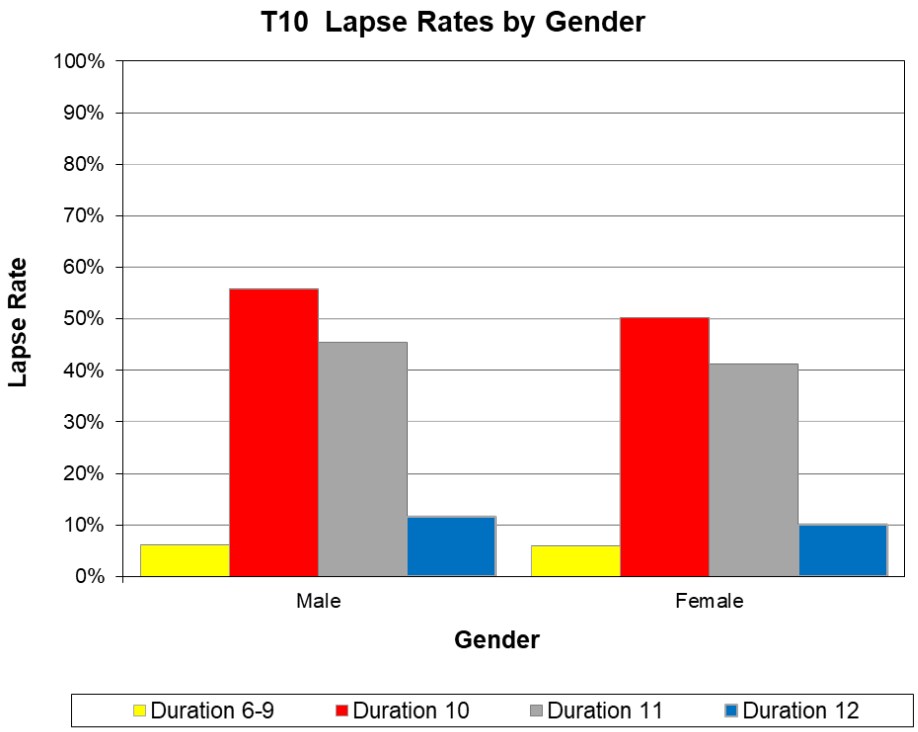
T10 LAPSE RATES BY GENDER

Gender	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		
Male	1,151,314	71,075	6.2%	252,225	140,761	55.8%	121,082	54,964	45.4%	73,765	8,476	11.5%	4.8	42.7
Female	868,793	51,155	5.9%	191,769	96,476	50.3%	104,118	42,976	41.3%	66,827	6,699	10.0%	4.2	40.0
Grand Total	2,020,107	122,230	6.1%	443,994	237,237	53.4%	225,199	97,940	43.5%	140,592	15,175	10.8%	4.5	41.6

(1) Weighted average duration 11/10 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 10 exposure.

Figure 36

T10 LAPSE RATES BY GENDER



T20

The differential between male and female shock lapses is similar for T20 compared to T10. Once again, males have a higher average premium jump and average issue age.

Table 24

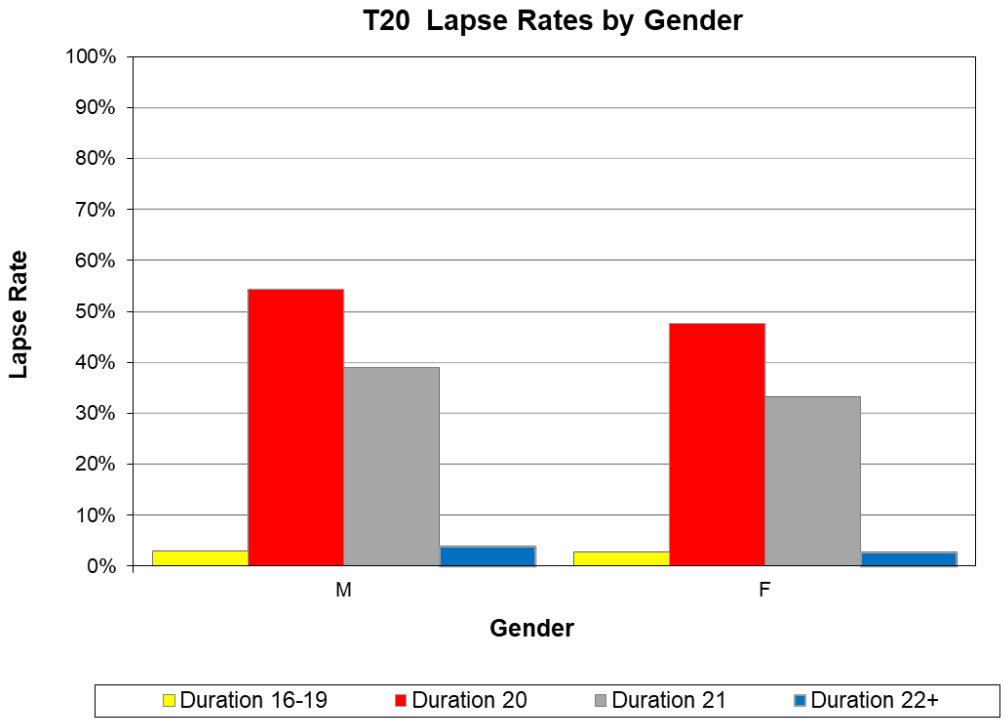
T20 LAPSE RATES BY GENDER

Gender	Duration 16–19			Duration 20			Duration 21			Duration 22			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	131,862	3,897	3.0%	17,333	9,407	54.3%	4,840	1,891	39.1%	17,105	644	3.8%	6.0	37.7
Female	107,832	3,025	2.8%	12,868	6,138	47.7%	4,126	1,375	33.3%	18,614	502	2.7%	5.0	35.8
Grand Total	239,693	6,922	2.9%	30,201	15,545	51.5%	8,966	3,266	36.4%	35,719	1,146	3.2%	5.6	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 37

T20 LAPSE RATES BY GENDER



5.11 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. For this reason, the researchers decided to combine all smokers together, regardless of risk class. The researchers also combined all preferred risk classes together. Not all companies provided risk class information, and those companies have been excluded from this analysis.

Policies were mapped into the following risk classes.

Table 25

RISK CLASSES

Risk Class	Description
Preferred	Non-Smoker, better than Residual
Standard/Residual	Non-Preferred Non-Smoker
Smoker	All Smoker Classes

T10

There is not a big difference in lapse rates in most durations between the different risk classes. Smokers tend to have slightly higher lapses in the years before the premium jump compared to the non-smokers but were lapsing slightly less in durations 10 and 11.

Table 26

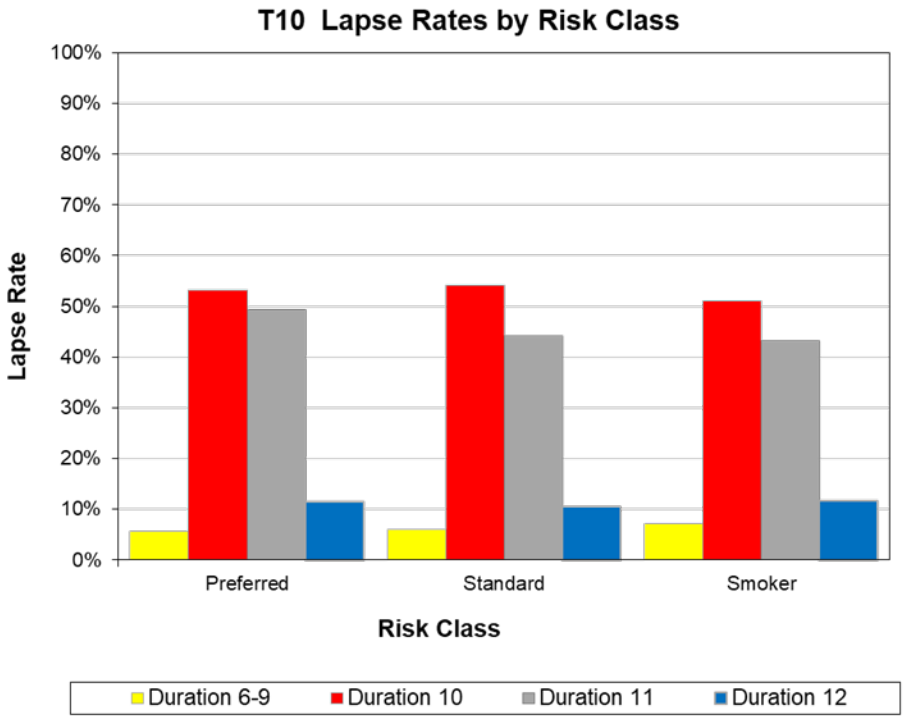
T10 LAPSE RATES BY RISK CLASS

Risk Class	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		
Preferred	317,054	17,852	5.6%	69,729	37,024	53.1%	36,397	17,990	49.4%	20,727	2,371	11.4%	4.8	39.8
Standard	1,133,315	67,196	5.9%	249,898	135,293	54.1%	126,510	55,769	44.1%	78,720	8,289	10.5%	4.6	42.9
Smoker	306,496	22,115	7.2%	68,358	34,973	51.2%	36,120	15,612	43.2%	22,649	2,649	11.7%	4.0	38.5
Grand Total	1,756,866	107,163	6.1%	387,986	207,290	53.4%	199,028	89,371	44.9%	122,096	13,309	10.9%	4.5	41.6

(1) Weighted average duration 11/10 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 10 exposure.

Figure 38

T10 LAPSE RATES BY RISK CLASS



T20

Unlike the T10 lapse rates, preferred classes see the lowest shock lapse rates of any group. This could be because this group has the lowest average premium jump.

Table 27

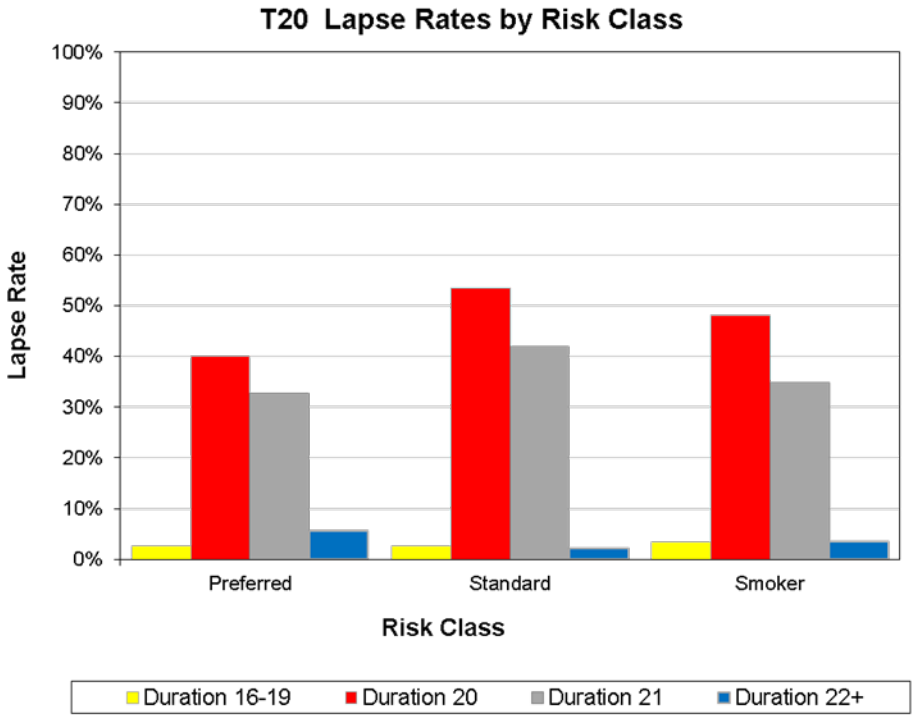
T20 LAPSE RATES BY RISK CLASS

Risk Class	Duration 16–19			Duration 20			Duration 21			Duration 22			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		
Preferred	42,524	1,094	2.6%	4,472	1,790	40.0%	1,259	413	32.8%	3,569	199	5.6%	4.7	37.8
Standard	127,641	3,440	2.7%	14,581	7,804	53.5%	3,930	1,649	42.0%	17,785	399	2.2%	6.0	37.8
Smoker	29,499	998	3.4%	4,044	1,943	48.1%	1,344	468	34.8%	3,141	107	3.4%	4.9	34.3
Grand Total	199,665	5,532	2.8%	23,097	11,537	50.0%	6,533	2,530	38.7%	24,495	705	2.9%	5.8	37.2

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 39

T20 LAPSE RATES BY RISK CLASS



5.12 Face Amount

T10

Post-renewal lapse rates generally increase with policy size in all durations. This could be due to the average premium jump ratio also increasing with policy face amount. The premium jump amount would also increase with policy size. The lapses are slightly lower when looking at face amount because a low number of policies were provided without face amount information.

Table 28

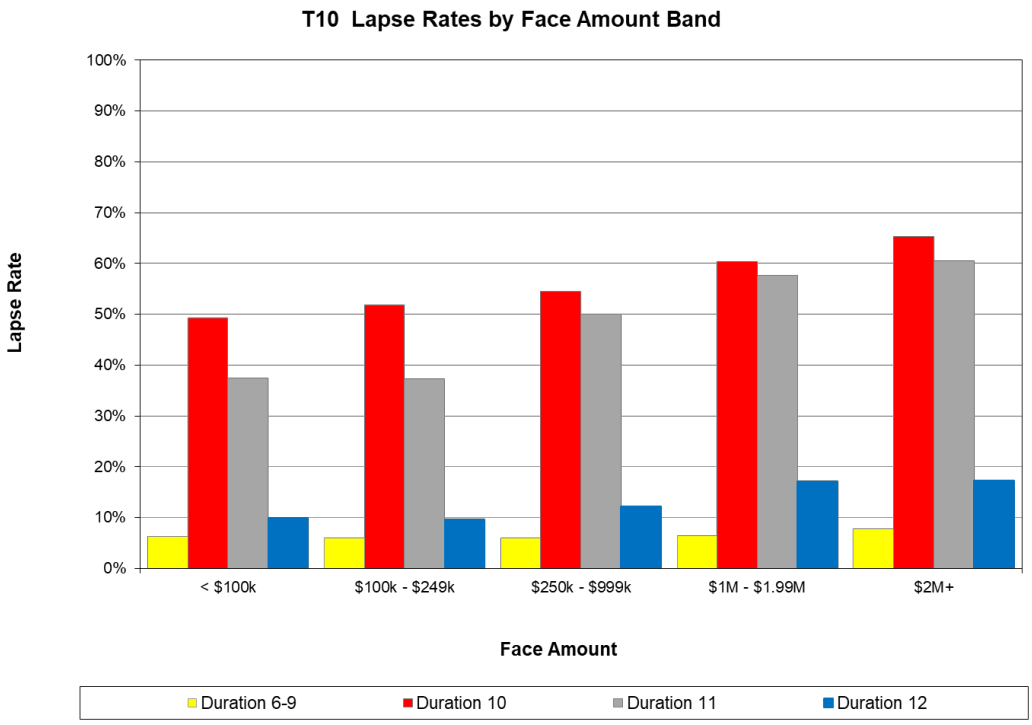
T10 LAPSE RATES BY FACE AMOUNT

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		
< $100k	115,860	7,265	6.27%	43,535	21,422	49.2%	27,380	10,243	37.4%	19,691	1,968	10.0%	4.0	44.2
$100k–$249k	681,753	40,413	5.93%	168,694	87,281	51.7%	94,768	35,308	37.3%	68,597	6,586	9.6%	4.2	42.7
$250k–$999k	1,054,273	62,947	5.97%	204,277	111,486	54.6%	93,649	46,856	50.0%	48,527	5,955	12.3%	4.7	40.1
$1M–$1.99M	138,251	8,920	6.45%	22,378	13,498	60.3%	7,944	4,583	57.7%	3,263	557	17.1%	5.1	41.3
$2M+	29,450	2,288	7.77%	4,297	2,807	65.3%	1,265	765	60.5%	476	82	17.2%	5.5	43.6
Grand Total	2,019,587	121,833	6.03%	443,182	236,494	53.36%	225,006	97,755	43.4%	140,554	15,148	10.78%	4.5	41.5

(1) Weighted average duration 11/10 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 10 exposure.

Figure 40

T10 LAPSE RATES BY FACE AMOUNT BAND



T20

The correlation between face amount and shock lapse is still present for T20. This could be due to the higher premium jumps on average for each band.

Table 29

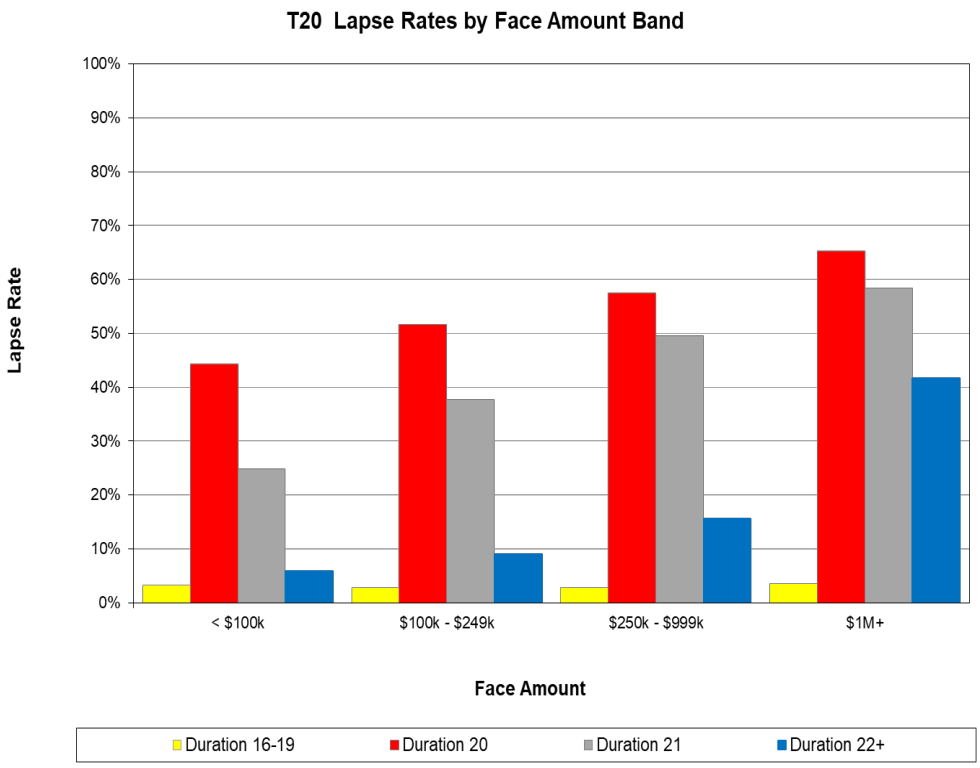
T20 LAPSE RATES BY FACE AMOUNT

Policy Face Amount	Duration 16–19			Duration 20			Duration 21			Duration 22			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		
< $100k	35,252	1,134	3.2%	5,514	2,441	44.3%	2,130	529	24.8%	1,297	76	5.9%	4.6	37.9
$100k–$249k	143,874	4,039	2.8%	19,064	9,854	51.7%	5,531	2,087	37.7%	2,518	225	8.9%	5.7	36.5
$250k–$999k	56,909	1,608	2.8%	5,397	3,103	57.5%	1,269	629	49.6%	467	73	15.6%	6.3	36.9
$1M+	3,647	131	3.6%	225	147	65.3%	36	21	58.4%	12	5	41.7%	7.1	40.2
Grand Total	239,682	6,912	2.88%	30,201	15,545	51.5%	8,966	3,266	36.4%	4,294	379	8.8%	5.6	36.9

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 41

T20 LAPSE RATES BY FACE AMOUNT BAND



5.13 Face Amount and Premium Jump

T10–Premium Jump Ratio

The shock lapse increases with face amount, but the trend within each premium jump band is not as clear, suggesting that the premium jump ratio is a bigger factor.

Table 30

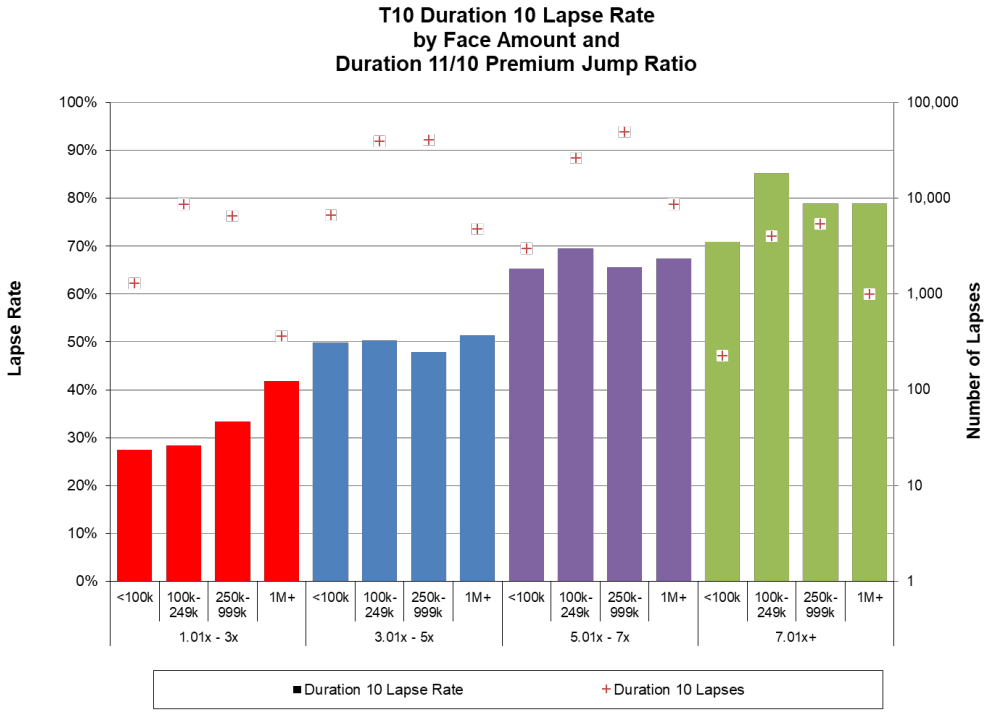
T10 DURATION 10 LAPSE RATE BY ISSUE AGE AND DURATION 11/10 PREMIUM JUMP RATIO

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	4,730	1,297	27.4%	2.2
	100k–249k	30,399	8,615	28.3%	2.3
	250k–999k	19,683	6,558	33.3%	2.6
	1M+	876	366	41.8%	2.6
3.01x–5x	<100k	13,459	6,706	49.8%	4.0
	100k–249k	78,019	39,252	50.3%	4.1
	250k–999k	84,747	40,577	47.9%	4.1
	1M+	9,275	4,770	51.4%	4.2
5.01x–7x	<100k	4,564	2,976	65.2%	5.6
	100k–249k	38,284	26,597	69.5%	5.7
	250k–999k	75,514	49,506	65.6%	5.8
	1M+	12,961	8,727	67.3%	5.9
7.01x+	<100k	319	226	70.9%	7.7
	100k–249k	4,721	4,022	85.2%	7.8
	250k–999k	6,872	5,419	78.9%	7.5
	1M+	1,254	990	78.9%	7.4
Subtotal Prem Data Available		385,677	206,604	53.6%	4.5
No Prem Data Available		57,505	29,890	52.0%	n/a
Grand Total		443,182	236,494	53.4%	n/a

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

Figure 42

T10 DURATION 10 LAPSE RATE BY FACE AMOUNT AND DURATION 11/10 PREMIUM JUMP RATIO



T10 – Premium Jump Amount

Looking at premium jump band and face amount together, we still see lapse rates increasing as the premium jump amount increases, but data shows that the lapse rates tend to go down as the policy face amount goes up within each premium jump amount band. This is correlated with the premium jump ratio as those appear to be getting smaller within each size band except for the $0–$400 band.

Table 31

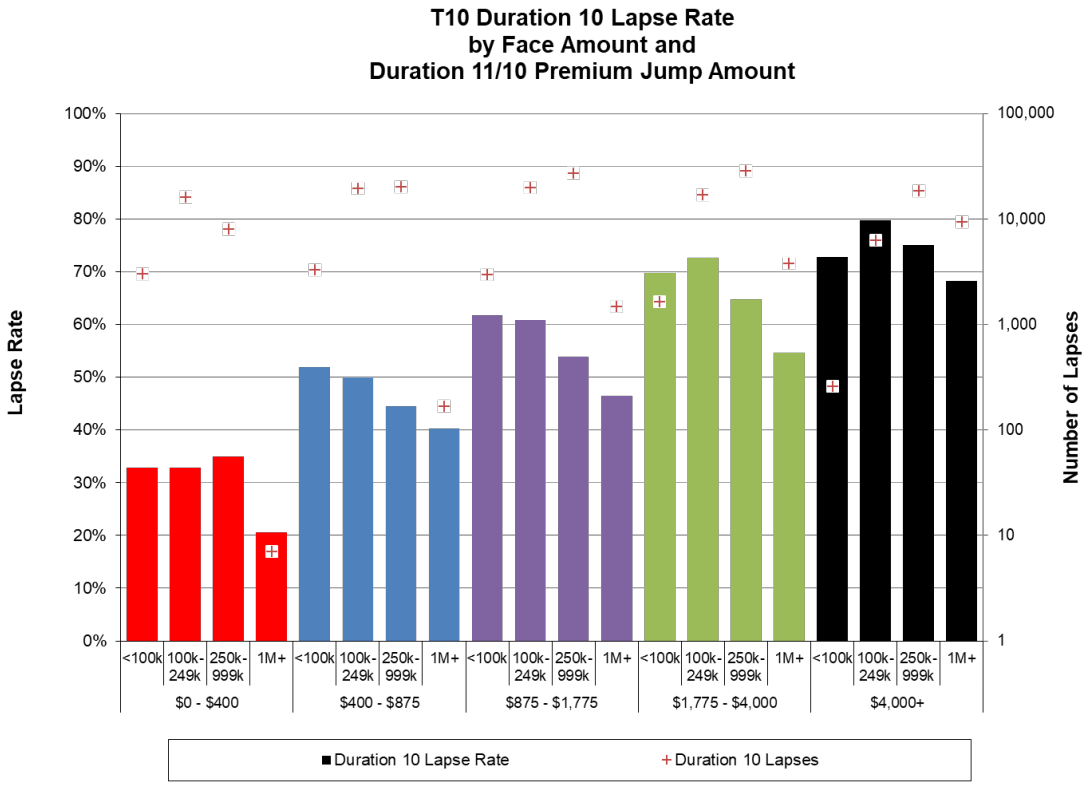
T10 DURATION 10 LAPSE RATE BY FACE AMOUNT AND DURATION 11/10 PREMIUM JUMP AMOUNT

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)]
$0–$400	<100k	9,142	3,002	32.8%	3.0
	100k–249k	48,949	16,106	32.9%	2.9
	250k–999k	22,876	7,987	34.9%	3.0
	1M+	34	7	20.6%	3.3
$400–$875	<100k	6,371	3,304	51.9%	4.2
	100k–249k	38,633	19,302	50.0%	4.2
	250k–999k	45,026	20,045	44.5%	3.9
	1M+	418	168	40.2%	3.2
$875–$1,775	<100k	4,837	2,988	61.8%	4.8
	100k–249k	32,799	19,953	60.8%	4.8
	250k–999k	50,634	27,284	53.9%	4.9
	1M+	3,179	1,477	46.5%	3.7
$1,775–$4,000	<100k	2,365	1,652	69.8%	5.4
	100k–249k	23,138	16,819	72.7%	5.5
	250k–999k	43,755	28,318	64.7%	5.6
	1M+	6,911	3,776	54.6%	4.7
$4,000+	<100k	356	259	72.8%	6.2
	100k–249k	7,903	6,306	79.8%	6.3
	250k–999k	24,524	18,426	75.1%	6.2
	1M+	13,824	9,425	68.2%	5.8
Subtotal Prem Data Available		385,676	206,604	53.6%	4.5
No Prem Data Available		57,506	29,890	52.0%	n/a
Grand Total		443,182	236,494	53.4%	n/a

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

Figure 43

T10 DURATION 10 LAPSE RATE BY FACE AMOUNT AND DURATION 11/10 PREMIUM JUMP AMOUNT



5.14 Premium Mode

T10

The duration 10 shock lapse seems to decrease with increasing premium payment frequency. This could be a function of the larger dollar amount increase in premium for the less frequent premium payment options or possibly due to PAC (Pre-Authorized Collection) being less likely to lapse. Only Annual and Monthly are shown due to the small amount of Semi-annual and Quarterly policies. Although Monthly has a smaller shock lapse in year 10 than annual, these same policies have a higher year 11 lapse with most of these lapses occurring the first three months of policy year 11.

Table 32

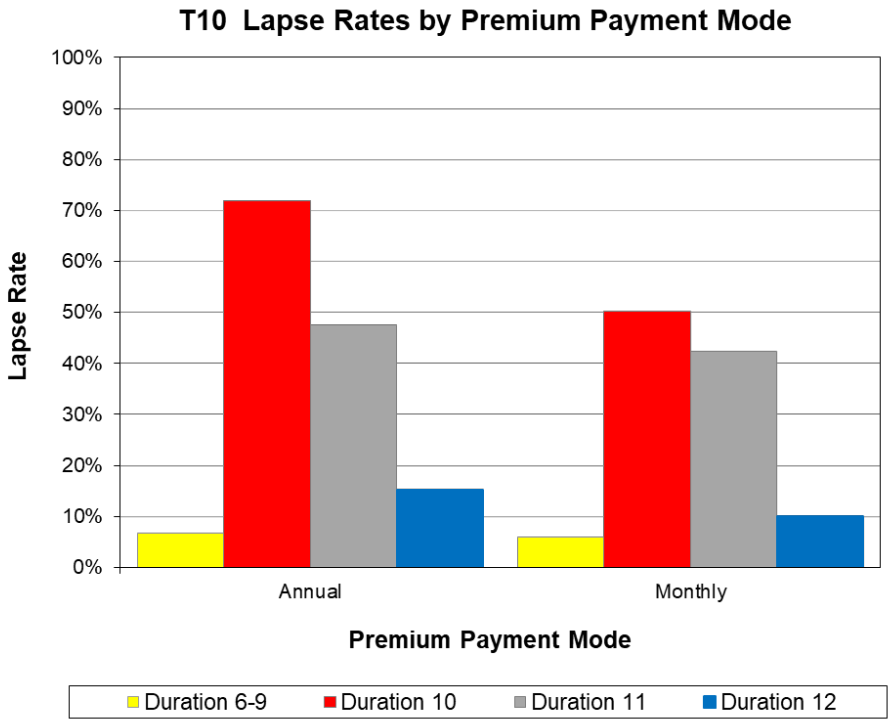
T10 LAPSE RATES BY PREMIUM PAYMENT MODE

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	254,673	17,017	6.7%	59,654	42,848	71.8%	18,409	8,763	47.6%	11,349	1,725	15.2%	4.9	43.4
Monthly	1,706,476	100,733	5.9%	357,506	179,480	50.2%	191,189	80,949	42.3%	121,300	12,246	10.1%	4.4	41.2
Other/Unknown	58,958	4,480	7.6%	26,834	14,909	55.6%	15,602	8,228	52.7%	7,943	1,204	15.2%	5.4	42.6
Grand Total	2,020,107	122,230	6.1%	443,994	237,237	53.4%	225,199	97,940	43.5%	140,592	15,175	10.8%	4.5	41.5

(1) Weighted average duration 11/10 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 10 exposure.

Figure 44

T10 LAPSE RATES BY PREMIUM PAYMENT MODE



T20

Results for T20 also illustrate a decreasing shock lapse by increasing premium frequency. Similar to T10, the Monthly mode has a smaller average premium jump in year 20, but a larger lapse rate in year 21.

Table 33

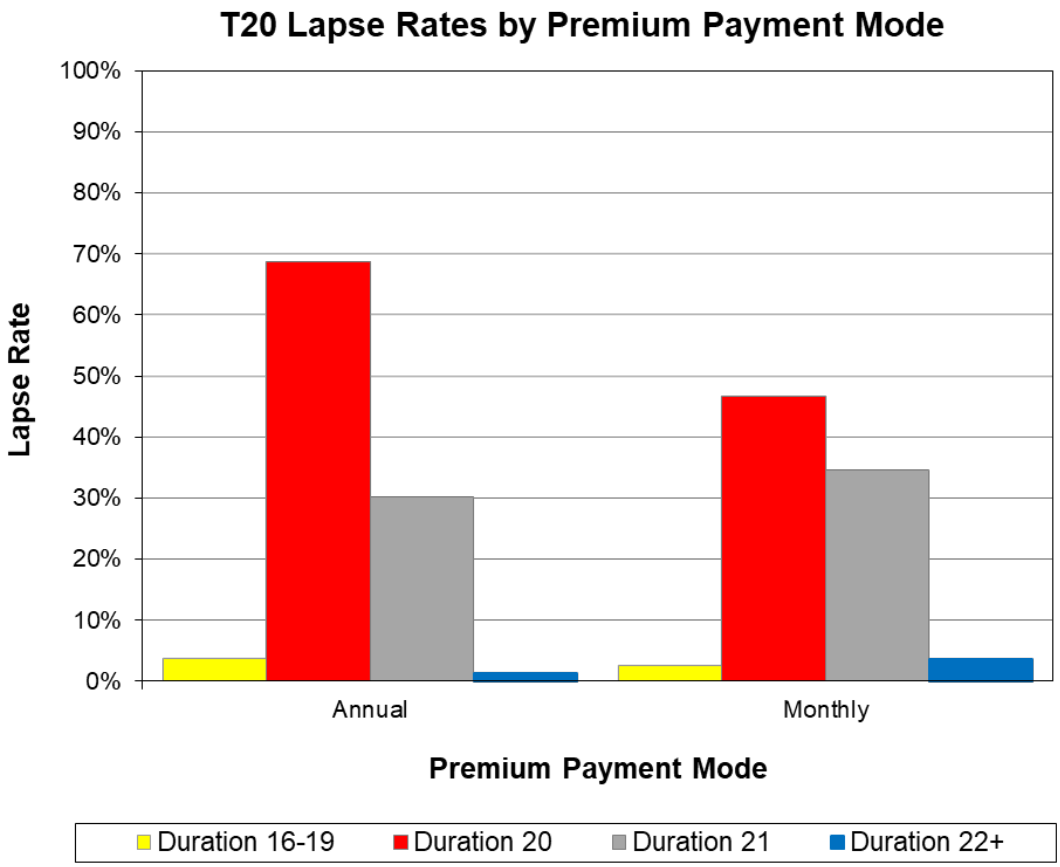
T20 LAPSE RATES BY PREMIUM PAYMENT MODE

Premium Payment Mode	Duration 16–19			Duration 20			Duration 21			Duration 22			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	35,395	1,305	3.7%	5,148	3,538	68.7%	751	226	30.1%	11,401	151	1.3%	5.8	37.8
Monthly	194,452	5,147	2.6%	22,938	10,709	46.7%	7,537	2,600	34.5%	23,145	831	3.6%	5.5	36.4
Other/Unknown	9,847	470	4.8%	2,115	1,298	61.4%	678	440	64.9%	1,173	164	14.0%	6.0	39.2
Grand Total	239,693	6,922	2.9%	30,201	15,545	51.5%	8,966	3,266	36.4%	35,719	1,146	3.2%	5.5	36.7

(1) Weighted average duration 21/20 premium jump ratio by duration 20 exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 45

T20 LAPSE RATES BY PREMIUM PAYMENT MODE



Section 6: Mortality Deterioration

6.1 Overview

This section will analyze the mortality experience from the 12 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 despite 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, all 12 companies provided experience that included at least one post-level period death claim in durations 11-14 combined, 8 companies provided at least 50 death claims, and 7 companies provided at least 100 death claims. For T20, 6 companies provided experience that included at least one post-level period death claim and 1 provided at least 50. Because the data for T20 is generally thin, only certain views will be presented.

The displays in this section include mortality ratios on two different industry-standard tabular bases: CIA9704 and CIA8692. In addition to this, a relative ratio is provided, which normalizes the CIA9704 mortality ratio in the post-level period as a percentage of the ratio for the last 5 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” (for T10), or “Mortality Relative to Durations 16-20” (for T20) on the displays.

The vast majority of products in the study had a ‘Jump to a New Level Period’ design. The data for the Jump to ART was very limited and did not materially change the overall results, so they are all included in our analysis. Since the ‘Jump to ART’ data came from one participating company, we do not show the results separately and we did not opine on any differences between the two product designs.

Note, confidence intervals (CI) will be shown throughout the mortality deterioration section as error bars in the graphs. These confidence intervals are consistent with the definition outlined in the Introduction on page 9.

6.2 Mortality by Duration

T10

In total, the post-level period mortality is roughly 176% of the level period (durations 6-10) mortality on a CIA9704 basis. For duration 11 alone, the mortality is 267% of the level period. The post level period mortality trends lower each year until duration 15 where it appears to level off. Then in duration 21 there is another mortality spike after the second premium jump, followed by another slow drop in mortality.

Table 34

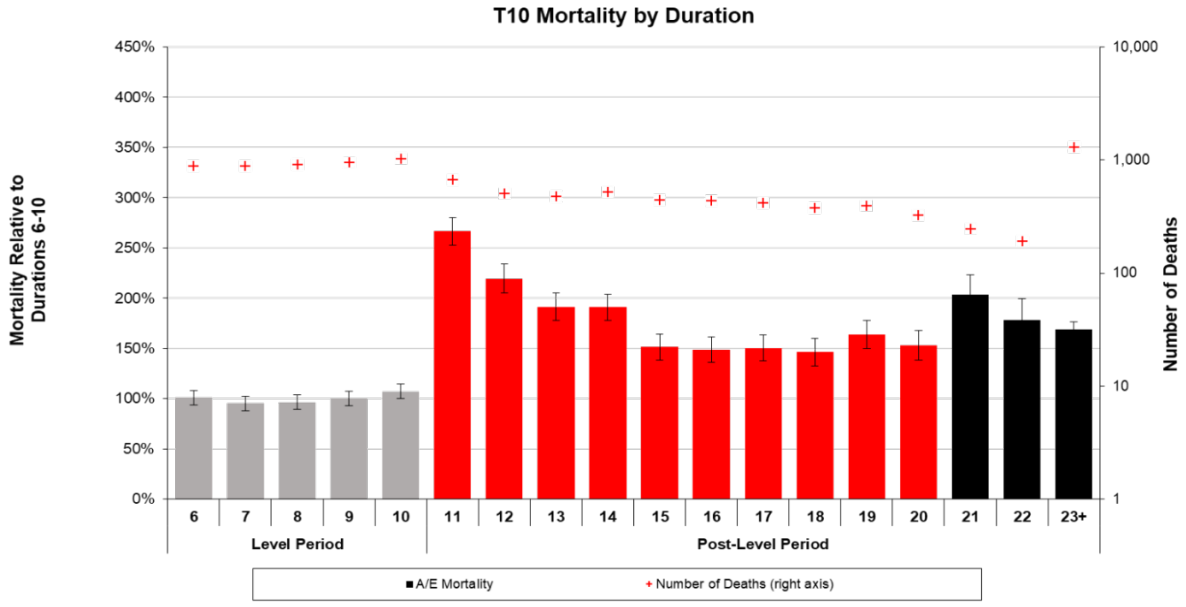
T10 MORTALITY EXPERIENCE BY DURATION

Policy Duration	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality				Average Prem Jump Ratio [2]
			CIA9704	CIA8692	vs LP	Median CIA9704 [1]	
6	637,248	889	58%	46%	101%	59%	5.2
7	612,789	883	55%	43%	95%	59%	5.1
8	576,213	913	56%	43%	96%	59%	4.9
9	540,790	958	58%	44%	100%	54%	4.7
10	506,038	1,021	62%	46%	107%	62%	4.5
Subtotal 6–10	2,873,078	4,664	58%	44%	100%	59%	n/a
11	185,593	670	154%	111%	267%	160%	3.8
12	157,756	507	127%	91%	220%	118%	3.5
13	154,057	480	110%	78%	191%	111%	3.3
14	150,975	521	110%	77%	191%	104%	3.1
15	146,407	442	87%	60%	151%	86%	2.9
16	134,489	437	86%	59%	149%	87%	2.7
17	120,033	418	87%	59%	150%	86%	2.5
18	107,788	379	84%	58%	146%	89%	2.4
19	95,461	392	95%	65%	164%	95%	2.2
20	83,002	327	88%	61%	153%	92%	2.2
21	50,579	244	117%	80%	203%	119%	2.0
22	44,294	192	103%	70%	179%	105%	2.0
23+	234,530	1,307	97%	68%	169%	108%	1.9
Subtotal 11+	1,664,963	6,316	101%	71%	176%	108%	n/a

(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.

Figure 46

T10 MORTALITY BY DURATION



T20

In total, post-level mortality relative to durations 16-20 of the level period is 141% on a CIA9704 basis. In addition, duration 21 experience is 224% of the 16-20 level period. It is worth noting that the claim count is very thin, especially in the post level term period, which is of most interest to this study. We do still see a similar pattern to that of the T10 experience with a jump in mortality for duration 21 and a gradual decrease in durations 22+. No data was given for any second premium jump for any T20 product.

Table 35

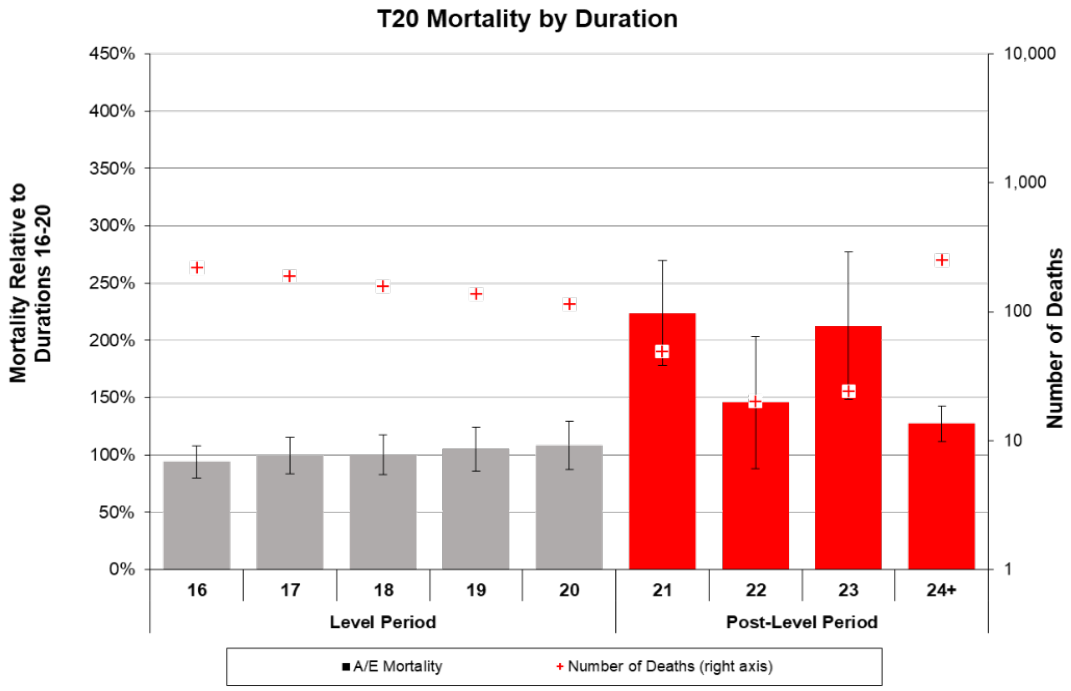
T20 MORTALITY EXPERIENCE BY DURATION

Policy Duration	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality				Average Prem Jump Ratio [2]
			CIA9704	CIA8692	vs LP	Median CIA9704 [1]	
16	105,439	220	55%	37%	94%	58%	7.5
17	79,083	188	58%	39%	99%	58%	6.7
18	61,464	158	58%	40%	100%	61%	6.0
19	47,251	137	61%	42%	105%	60%	5.7
20	35,723	114	63%	43%	108%	61%	5.6
Subtotal 16–20	328,960	817	58%	40%	100%	58%	n/a
21	8,967	49	130%	91%	224%	137%	5.0
22	5,373	20	85%	60%	146%	102%	5.0
23	4,286	24	124%	86%	213%	159%	5.1
24+	33,476	253	74%	53%	127%	86%	5.6
Subtotal 21+	52,103	346	82%	59%	141%	105%	n/a
Grand Total	381,063	1,163	64%	44%	109%	70%	n/a

(1) Median mortality ratio for companies with 10 or more deaths in given duration.
(2) Weighted average duration 21/20 premium jump ratio by exposure for policies with premium data available.

Figure 47

T20 MORTALITY BY DURATION



6.3 Distribution of Results

T10

There is a wide spread of company-specific mortality experience in year 11. The following charts show this distribution of any company that provided at least 10 death claims in a given duration. These percentages are all based off CIA9704.

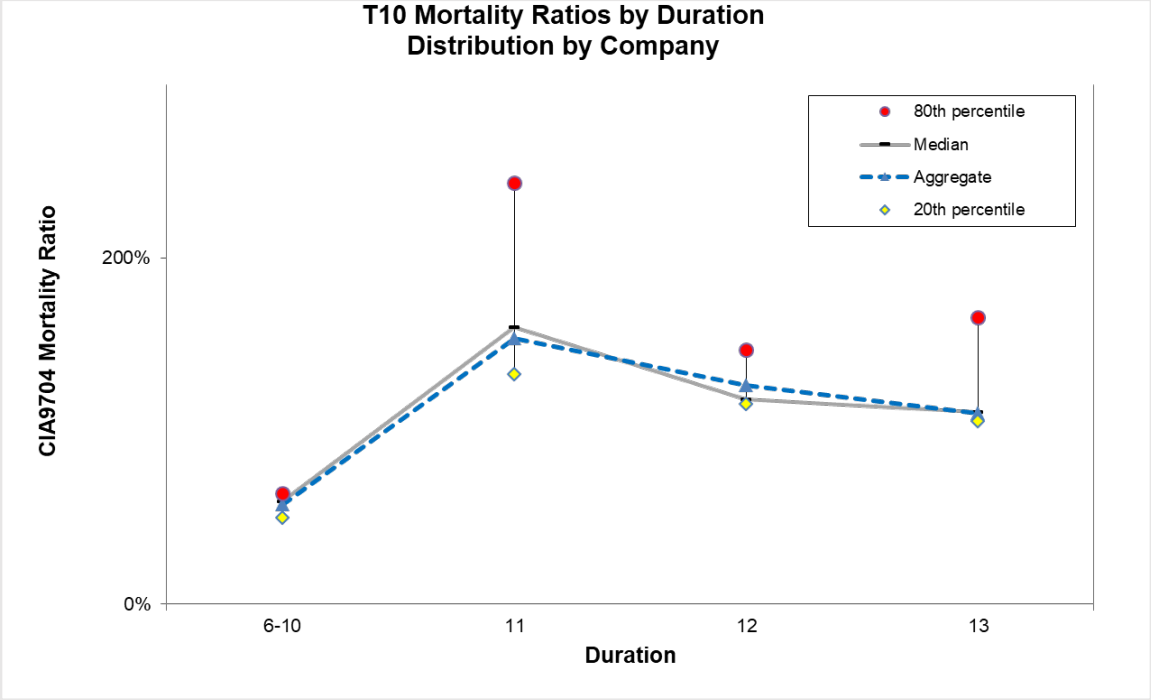
Table 36

CIA9704 Ratio Range	Duration			
	6–10	11	12	13
Number of Companies	12	8	7	8
20th percentile	50%	133%	116%	106%
Median	59%	160%	118%	111%
Aggregate	58%	154%	127%	110%
80th percentile	64%	244%	147%	166%

Companies with 10 or more deaths in given duration.

Figure 48

T10 MORTALITY RATIOS BY DURATION DISTRIBUTION BY COMPANY



6.4 Premium Jump Ratio

T10—Durations 11–14

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 how 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. It is worth noting that the number of deaths in both the smallest premium jump band and the largest are quite small with less than 50 deaths in each.

Table 37

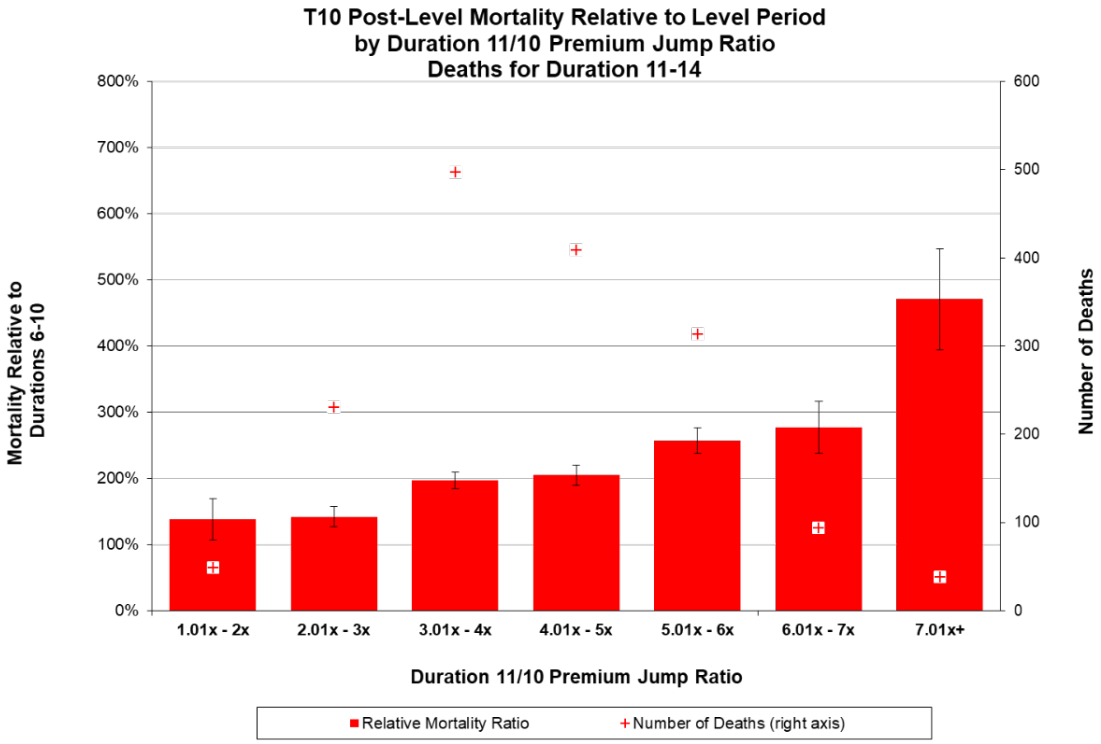
T10 DURATION 11–14 MORTALITY EXPERIENCE BY PREMIUM JUMP RATIO

Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Average Prem Jump Ratio (1)	Average Issue Age (2)
			CIA9704	CIA8692	vs LP		
1.01x–2x	55,753	49	110%	75%	138%	1.7	22.3
2.01x–3x	128,077	231	104%	74%	142%	2.6	30.1
3.01x–4x	137,117	497	127%	91%	197%	3.5	37.8
4.01x–5x	88,526	409	126%	89%	205%	4.5	42.5
5.01x–6x	41,560	314	147%	108%	257%	5.5	46.2
6.01x–7x	9,697	94	142%	104%	277%	6.4	50.6
7.01x+	2,326	38	216%	155%	471%	7.6	54.8
Subtotal Prem Data Available	463,056	1,632	128%	91%	227%	4.5	41.6
No Prem Data Available	185,324	546	117%	82%	153%	n/a	41.4
Grand Total	648,380	2,178	125%	89%	216%	n/a	41.6

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

Figure 49

T10 POST-LEVEL MORTALITY RELATIVE TO LEVEL PERIOD BY DURATION 11/10 PREMIUM JUMP RATIO DEATHS FOR DURATION 11-14



6.5 Premium Jump Amount

T10—Durations 11-14

Like the premium jump ratio mortality, the premium jump by amount shows a similar trend where the mortality tends to increase as the amount of premium jump increases. The correlation does not seem to be as strong as by premium jump ratio, however.

Table 38

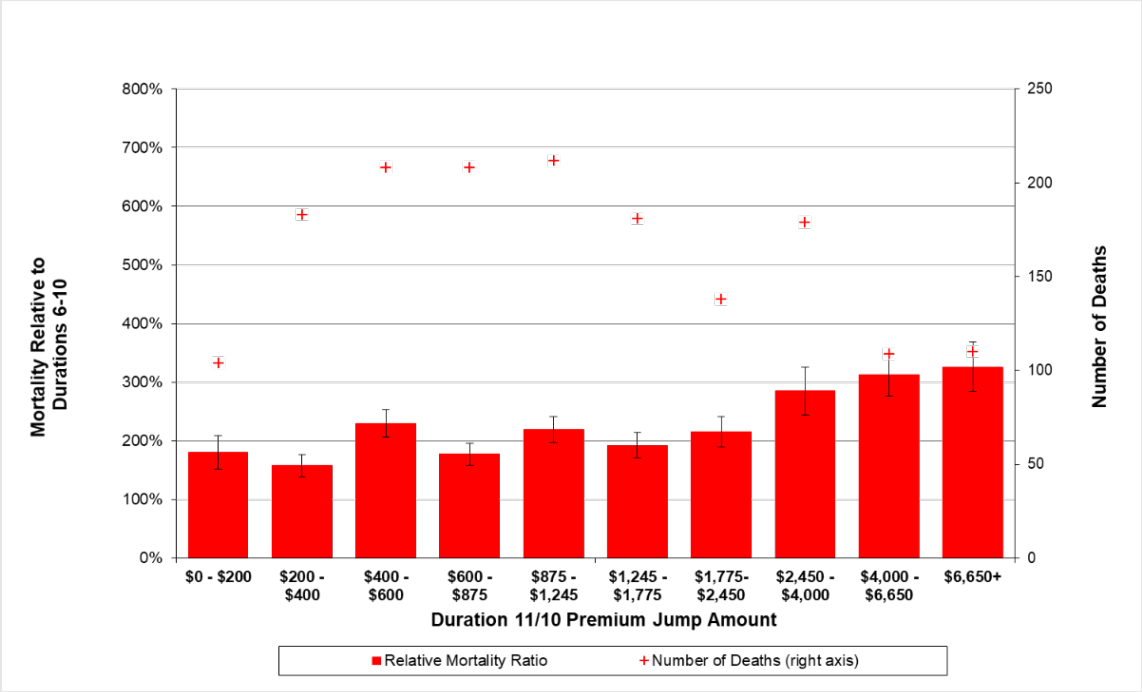
T10 DURATION 11-14 MORTALITY EXPERIENCE BY PREMIUM JUMP AMOUNT

Duration 11/10 Premium Jump Amount Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Average Prem Jump Ratio [1]	Average Issue Age [2]
			CIA9704	CIA8692	vs LP		
$0–$200	105,302	104	107%	75%	180%	2.4	26.3
$200–$400	104,467	183	104%	75%	158%	3.3	33.9
$400–$600	67,482	208	125%	90%	229%	3.8	37.6
$600–$875	57,348	208	122%	87%	177%	4.2	40.1
$875–$1,245	44,276	212	126%	90%	219%	4.6	42.4
$1,245–$1,775	32,502	181	120%	87%	192%	5.0	44.3
$1,775- $2,450	19,600	138	136%	96%	215%	5.3	46.3
$2,450–$4,000	17,493	179	162%	114%	285%	5.6	48.5
$4,000–$6,650	8,308	109	177%	124%	313%	6.0	50.8
$6,650+	6,277	110	144%	108%	326%	6.3	53.7
Subtotal Prem Data Available	463,056	1,632	128%	91%	227%	4.5	41.6
No Prem Data Available	185,325	546	117%	82%	153%	n/a	41.4
Grand Total	648,380	2,178	125%	89%	216%	n/a	41.6

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

Figure 50

T10 POST-LEVEL MORTALITY RELATIVE TO LEVEL PERIOD BY DURATION 11/10 PREMIUM JUMP AMOUNT DEATHS FOR DURATION 11–14



T10—Duration 11 Only

Mortality for duration 11 only is illustrated below. The credibility gets a little thin in some of the cells with small death counts, but a pattern is still evidenced of increased mortality with increased premium jumps.

Table 39

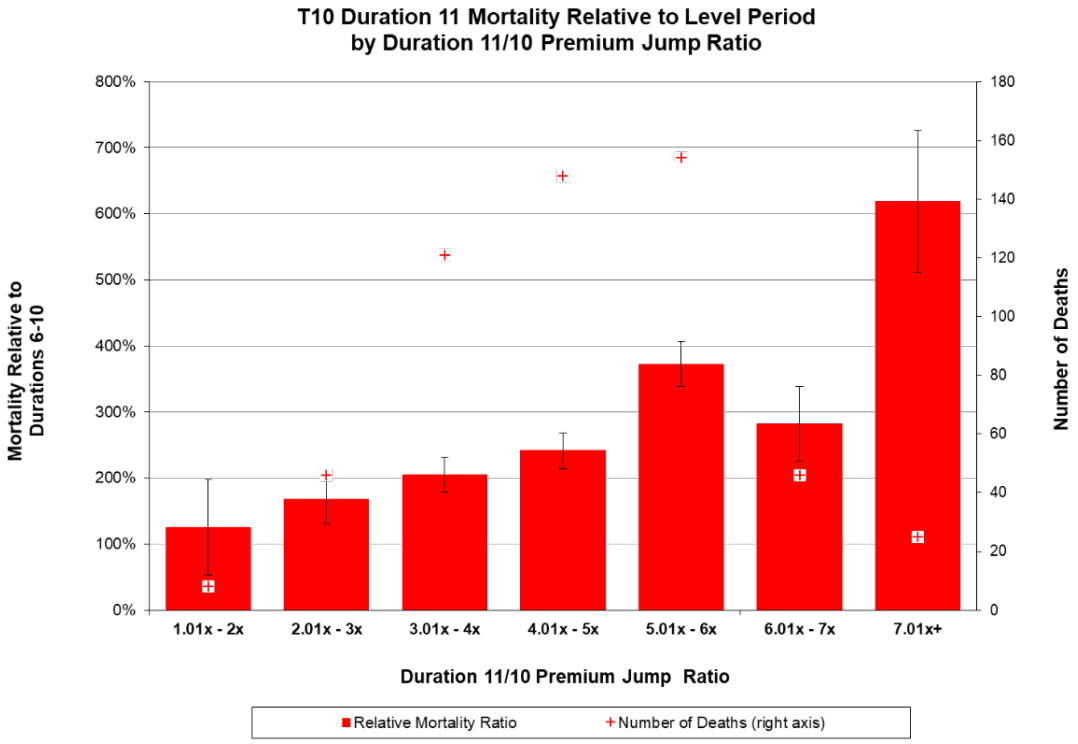
T10 DURATION 11 MORTALITY EXPERIENCE BY PREMIUM JUMP RATIO

Duration 11/10 Premium Jump Ratio Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Average Prem Jump Ratio [1]	Average Issue Age [2]
			CIA9704	CIA8692	vs LP		
1.01x - 2x	11,733	8	100%	71%	125%	1.7	22.3
2.01x - 3x	32,168	46	123%	89%	168%	2.6	30.1
3.01x - 4x	42,029	121	133%	97%	205%	3.5	37.8
4.01x - 5x	33,524	148	148%	107%	241%	4.5	42.5
5.01x - 6x	18,401	154	213%	155%	372%	5.5	46.2
6.01x - 7x	5,191	46	144%	107%	282%	6.4	50.6
7.01x+	1,235	25	284%	206%	619%	7.6	54.8
Subtotal Prem Data Available	144,281	548	157%	114%	279%	4.5	41.6
No Prem Data Available	41,313	122	141%	100%	184%	n/a	41.4
Grand Total	185,593	670	154%	111%	267%	n/a	41.6

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

Figure 51

T10 DURATION 11 MORTALITY RELATIVE TO LEVEL PERIOD BY DURATION 11/10 PREMIUM JUMP RATIO



T10—Duration 11 Only

These charts show a similar pattern for premium jump amount, but once again not as pronounced as the premium ump ratio results. The credibility is once again somewhat thin in some areas.

Table 40

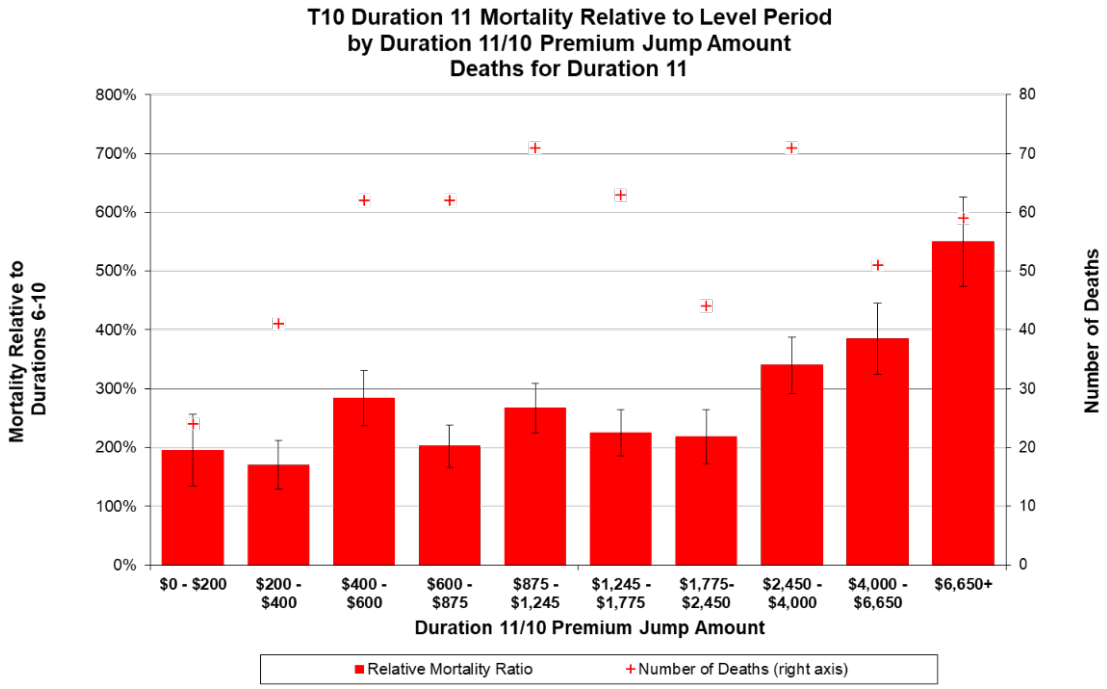
T10 DURATION 11 MORTALITY EXPERIENCE BY PREMIUM JUMP AMOUNT

Duration 11/10 Premium Jump Amount Band	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality			Average Prem Jump Ratio [1]	Average Issue Age [2]
			CIA9704	CIA8692	vs LP		
$0 - $200	27,005	24	116%	83%	195%	2.4	26.3
$200 - $400	29,262	41	112%	81%	170%	3.3	33.9
$400 - $600	20,647	62	154%	113%	284%	3.8	37.6
$600 - $875	18,889	62	139%	101%	202%	4.2	40.1
$875 - $1,245	15,340	71	154%	113%	267%	4.6	42.4
$1,245 - $1,775	12,072	63	141%	104%	225%	5.0	44.3
$1,775- $2,450	7,623	44	138%	100%	218%	5.3	46.3
$2,450 - $4,000	7,117	71	193%	139%	340%	5.6	48.5
$4,000 - $6,650	3,554	51	218%	157%	385%	6.0	50.8
$6,650+	2,771	59	242%	175%	550%	6.3	53.7
Subtotal Prem Data Available	144,280	548	157%	114%	279%	4.5	41.6
No Prem Data Available	41,313	122	141%	100%	184%	n/a	41.4
Grand Total	185,593	670	154%	111%	267%	n/a	41.6

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

Figure 52

T10 DURATION 11 MORTALITY RELATIVE TO LEVEL PERIOD BY DURATION 11/10 PREMIUM JUMP AMOUNT DEATHS FOR DURATION 11



6.6 Issue Age

T10

Actual vs. Tabular 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 similar trend was also seen in the shock lapse experience results by issue age.

Table 41

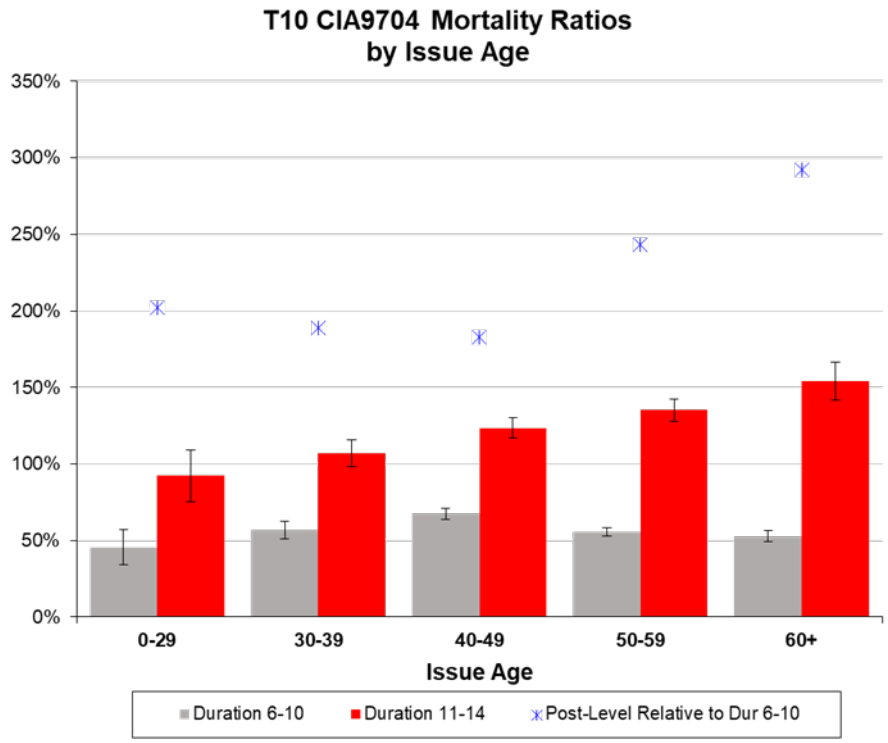
T10 MORTALITY RATIOS BY ISSUE AGE

Issue Age	Duration 6–10				Duration 11–14					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				
			CIA9704	CIA8692			CIA9704	CIA8692	vs LP		
0-29	332,465	97	46%	35%	130,374	88	92%	65%	202%	2.6	24.9
30-39	802,747	440	57%	42%	262,919	380	107%	72%	189%	4.0	34.8
40-49	977,291	1,335	68%	49%	190,433	763	124%	85%	183%	4.9	44.3
50-59	611,401	1,770	56%	44%	56,863	677	135%	103%	243%	5.6	53.7
60+	149,174	1,022	53%	42%	7,791	270	154%	108%	292%	6.2	62.9
Grand Total	2,873,078	4,664	58%	44%	648,380	2,178	125%	89%	216%	4.5	41.6

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

Figure 53

T10 CIA9704 MORTALITY RATIOS BY ISSUE AGE



T20

T20 post-level mortality deterioration generally increases by issue age, relative to durations 16-20, except for issue ages 60+. With that said, the data is very thin for issue ages 60+, probably because many do not have a renewal option at some of these older ages as they hit the expiry age in the contracts.

Table 42

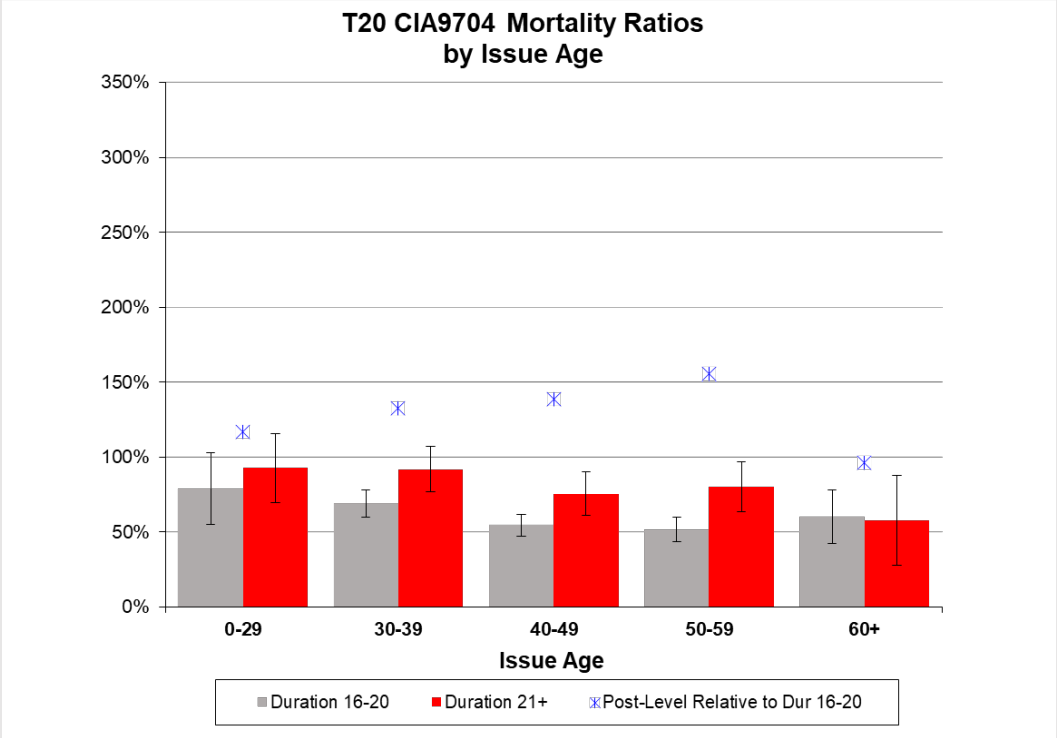
T20 MORTALITY RATIOS BY ISSUE AGE

Issue Age	Duration 16–20				Duration 21+					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				
			CIA9704	CIA8692			CIA9704	CIA8692	vs LP		
0-29	47,684	37	79%	51%	16,559	48	93%	65%	117%	3.6	25.6
30-39	155,030	225	69%	44%	23,125	107	92%	66%	133%	5.7	34.6
40-49	97,299	298	55%	38%	9,465	96	75%	55%	138%	6.4	43.5
50-59	26,469	207	51%	37%	2,714	78	80%	53%	155%	5.8	53.0
60+	2,479	50	60%	38%	241	17	58%	52%	96%	n/a	62.4
Grand Total	328,960	817	58%	40%	52,103	346	82%	59%	141%	5.6	37.0

(1) Weighted average duration 21/210 premium jump ratio by exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 54

T20 CIA9704 MORTALITY RATIOS BY ISSUE AGE



6.7 Gender

T10

Post-level period mortality deterioration for males and females is very similar. On average, the premium jump and average issue age is higher for males. However, males seem to have had slightly better experience compared to CIA9704 than females in both the years before and after the shock lapse. The increase in relative mortality is almost identical after the shock lapse relative to their pre-shock mortality.

Table 43

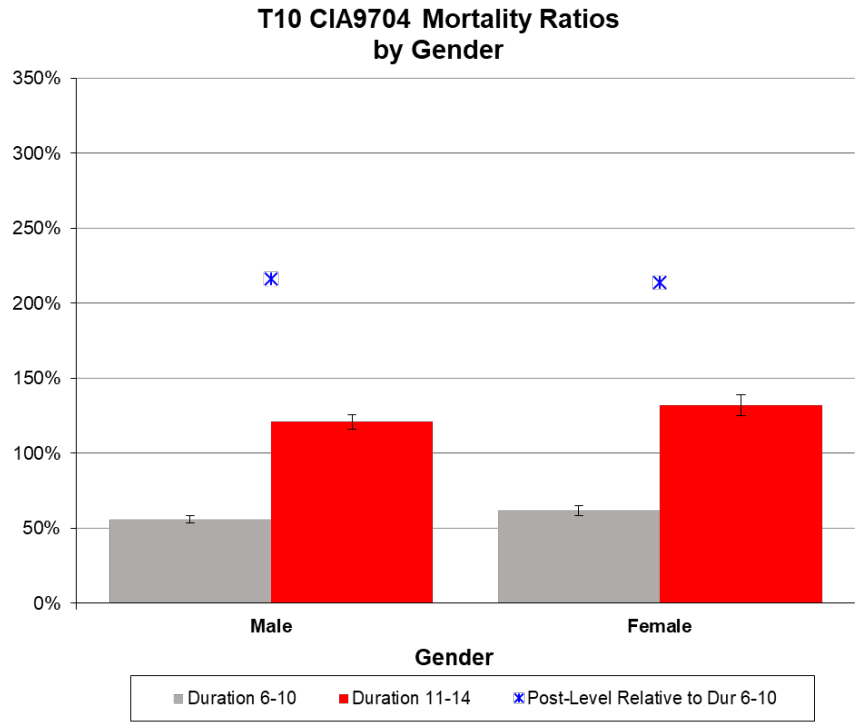
T10 MORTALITY RATIOS BY GENDER

	Duration 6–10				Duration 11–14						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Gender	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
Male	1,635,977	3,211	56%	42%	340,913	1,396	121%	82%	216%	4.8	42.7
Female	1,237,101	1,453	62%	52%	307,468	782	132%	102%	214%	4.2	40.0
Grand Total	2,873,078	4,664	58%	44%	648,380	2,178	125%	89%	216%	4.5	41.6

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

Figure 55

T10 CIA9704 MORTALITY RATIOS BY GENDER



T20

T20 results show similar mortality between males and females prior to the shock, however males appear to have higher mortality deterioration in the post-level period. The difference may be due to the higher average premium jump, but the data is somewhat thin.

Table 44

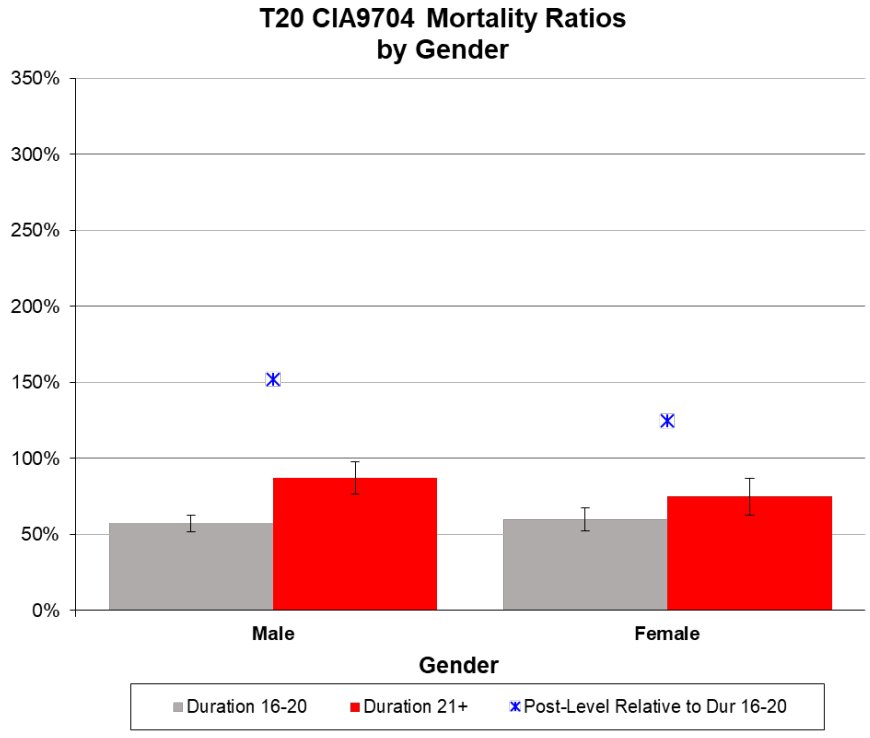
T20 MORTALITY RATIOS BY GENDER

	Duration 16–19				Duration 21+						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Gender	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
Male	181,577	541	57%	37%	25,390	211	87%	60%	152%	6.0	37.8
Female	147,383	276	60%	45%	26,712	135	75%	57%	125%	5.1	35.8
Grand Total	328,960	817	58%	40%	52,103	346	82%	59%	141%	5.6	37.0

(1) Weighted average duration 21/20 premium jump ratio by exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 56

T20 CIA9704 MORTALITY RATIOS BY GENDER



6.8 Risk Class

The following pages will display mortality results by underwriting risk class. For a description of the mapping process used, see page 51 in the lapse section.

T10

In the post level period, the standard class shows the largest increase in relative mortality. This is contrary to what we saw in the lapse section where the preferred class had the highest average duration 11 premium jump and shock lapse.

Table 45

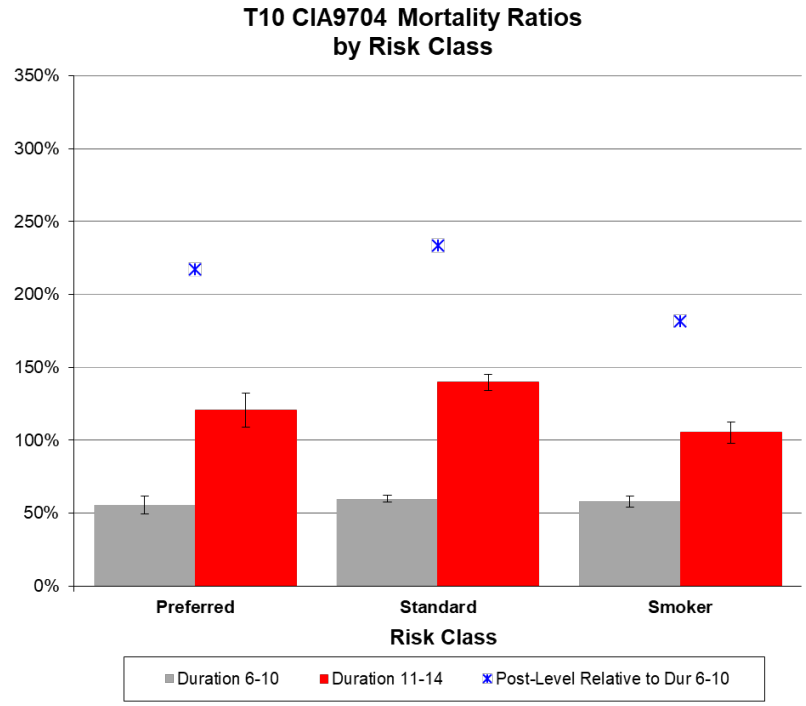
T10 MORTALITY RATIOS BY RISK CLASS

	Duration 6–10				Duration 11–14						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Risk Class	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
Preferred	455,951	379	56%	40%	103,527	229	121%	83%	217%	4.8	39.8
Standard	1,616,066	2,693	60%	45%	355,332	1,192	140%	97%	234%	4.6	42.9
Smoker	434,177	1,085	58%	49%	104,193	503	105%	78%	182%	4.0	38.5
Grand Total	2,506,193	4,157	59%	45%	648,380	1,924	126%	90%	215%	4.5	41.6

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

Figure 57

T10 CIA9704 MORTALITY RATIOS BY RISK CLASS



T20

Preferred has the largest relative deterioration in post level period mortality, but the data in preferred is rather thin at only 20 deaths. All the relative mortality deterioration by underwriting class were smaller than their T10 counterpart, which may coincide with the lower lapse rates of T20 in general. Also, although the average premium jump ratio is higher for the T20 policies, it is probably not comparable to the T10 premium jump ratios because of the 10-year difference in attained age.

Table 46

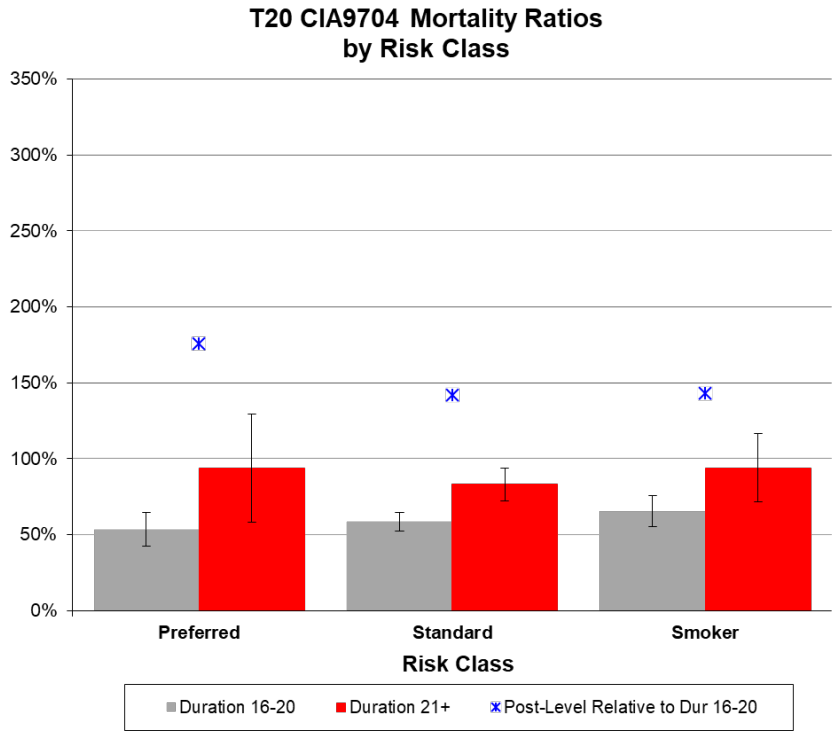
T20 MORTALITY RATIOS BY RISK CLASS

	Duration 16–19				Duration 21+						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Risk Class	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
Preferred	57,306	117	53%	36%	5,920	20	94%	63%	176%	7.6	37.9
Standard	175,344	424	59%	40%	25,125	194	83%	58%	142%	6.0	37.8
Smoker	39,972	173	66%	46%	5,136	50	94%	68%	143%	4.9	34.2
Grand Total	272,623	714	59%	41%	52,103	264	86%	60%	145%	5.8	37.2

(1) Weighted average duration 21/20 premium jump ratio by exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 58

T20 CIA9704 MORTALITY RATIOS BY RISK CLASS



6.9 Face Amount

T10

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.

The post-level period trends by policy face amount are not as clear as the mortality before the shock, but the ratio of the post-level versus the level period is the opposite of what we have come to expect in the level period. The post level mortality shows higher mortality deterioration as face amount increases.

Table 47

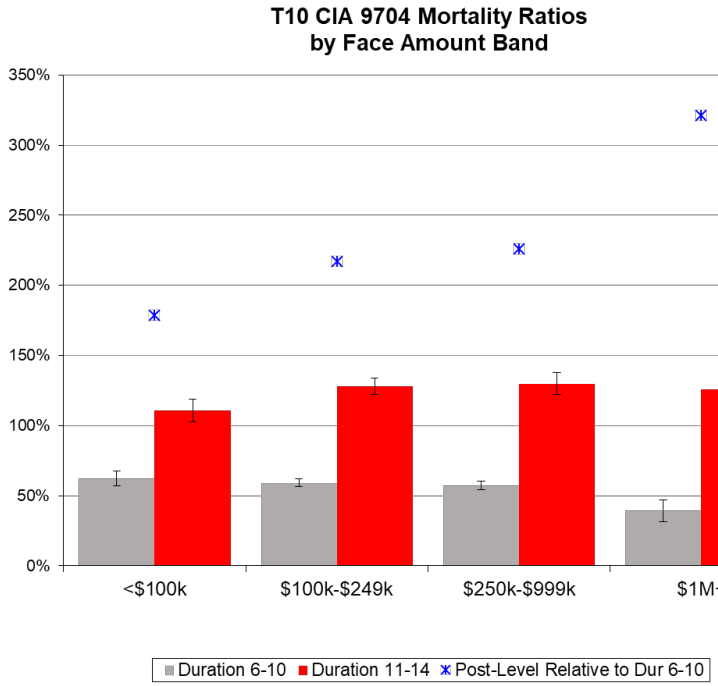
T10 MORTALITY RATIOS BY FACE AMOUNT

	Duration 6–10				Duration 11–14						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Policy Face Amount	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
<$100k	191,587	590	62%	50%	90,355	471	111%	81%	179%	4.0	44.2
$100k–$249k	993,006	2,070	59%	46%	323,455	1,058	128%	91%	217%	4.2	42.6
$250k–$999k	1,461,431	1,731	57%	43%	217,601	567	130%	90%	226%	4.8	40.1
$1M+	225,162	239	39%	30%	16,800	70	126%	92%	321%	5.2	41.7
Grand Total	2,871,187	4,630	57%	44%	648,211	2,166	124%	88%	217%	4.5	41.6

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

Figure 59

T10 CIA9704 MORTALITY RATIOS BY FACE AMOUNT BAND



6.10 Face Amount and Premium Jump

T10

Table 48

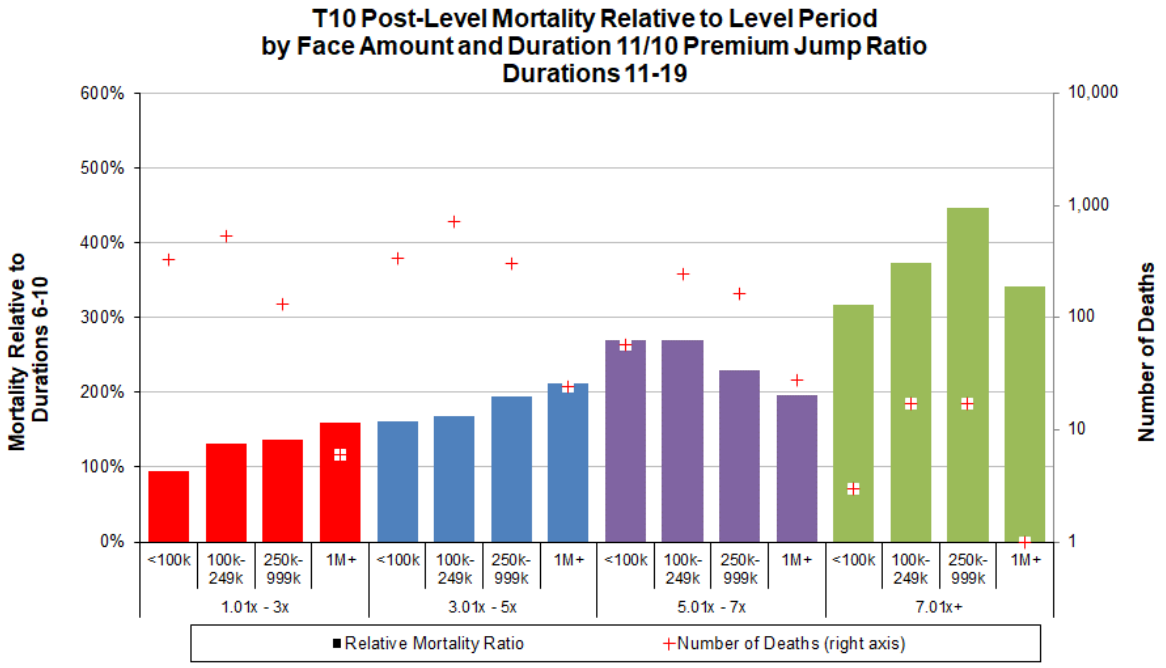
T10 POST-LEVEL MORTALITY EXPERIENCE BY PREMIUM JUMP RATIO FOR DURATION 11–19

T10 Post-Level Mortality Experience by Premium Jump Ratio for Duration 11–19						
Duration 11/10 Premium Jump Ratio Band	Policy Face Amount	Policy-Years Exposed	Total Deaths	Actual/Tabular Mortality		Average Prem Jump Ratio
				CIA9704	Vs LP	
1.01x–3x	<100k	75,633	333	89%	95%	2.2
	100k–249k	274,559	529	96%	132%	2.3
	250k–999k	96,168	133	90%	136%	2.6
	1M+	3,212	6	108%	146%	2.6
3.01x–5x	<100k	35,520	337	109%	161%	4.0
	100k–249k	161,471	716	109%	169%	4.0
	250k–999k	116,073	308	109%	195%	4.1
	1M+	9,541	24	118%	196%	4.2
5.01x–7x	<100k	3,282	58	132%	269%	5.7
	100k–249k	24,467	245	147%	269%	5.7
	250k–999k	28,838	166	136%	229%	5.8
	1M+	3,695	28	70%	151%	5.9
7.01x+	<100k	135	3	188%	317%	7.7
	100k–249k	1,252	17	169%	373%	7.8
	250k–999k	1,066	17	214%	446%	7.5
	1M+	157	1	128%	347%	7.5
Subtotal Prem Data Available		835,069	2,921	106%	189%	4.5
No Prem Data Available		417,218	1,304	96%	134%	n/a
Grand Total		1,252,287	4,225	103%	180%	n/a

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

Figure 60

T10 POST-LEVEL MORTALITY RELATIVE TO LEVEL PERIOD BY FACE AMOUNT AND DURATION 11/10 PREMIUM JUMP RATIO DURATIONS 11–19



T20

T20 experience has a similar pattern to T10 experience with higher post-level mortality at higher face amounts. However, results are very thin in the post-level period in all bands. It is interesting to note that the <100k band has very similar mortality before and after the shock lapse.

Table 49

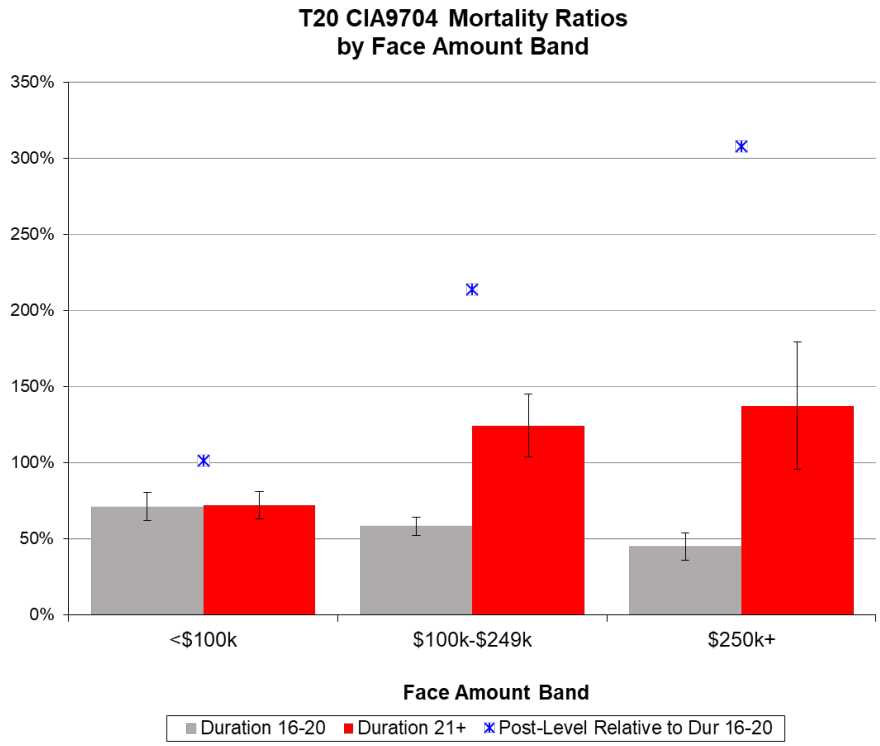
T20 MORTALITY RATIOS BY FACE AMOUNT

	Duration 16–19				Duration 21+						
			Actual/Tabular Mortality				Actual/Tabular Mortality				
Policy Face Amount	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	Policy-Years Exposed	Total Deaths	CIA9704	CIA8692	vs LP	Average Prem Jump Ratio[1]	Average Issue Age[2]
<$100k	48,965	221	71%	50%	32,488	248	72%	52%	101%	4.6	37.9
$100k–$249k	196,005	456	58%	40%	16,868	78	124%	84%	214%	5.7	36.6
$250k+	83,977	138	45%	30%	2,746	20	137%	100%	308%	6.4	37.2
Grand Total	328,947	815	58%	40%	52,103	346	82%	59%	141%	5.6	37.0

(1) Weighted average duration 21/20 premium jump ratio by exposure for policies with premium data available.
(2) Weighted average issue age by duration 20 exposure.

Figure 61

T20 CIA9704 MORTALITY RAIOS BY FACE AMOUNT BAND



6.11 Grace Period Analysis

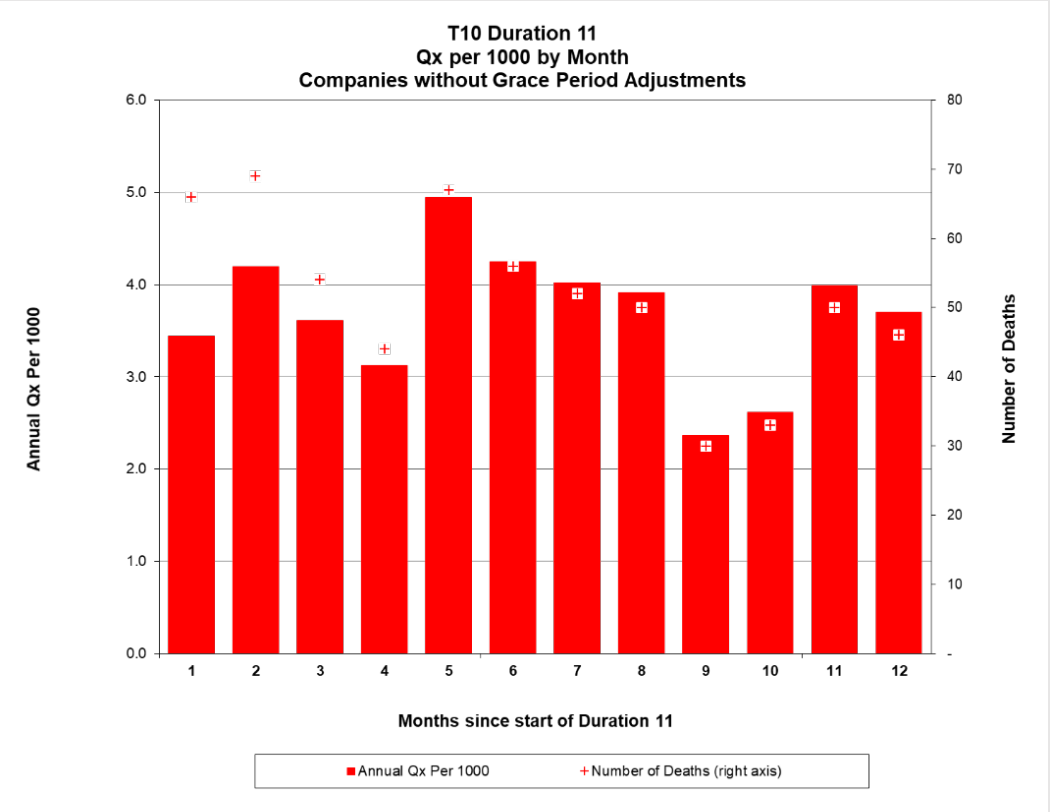
T10

The grace period in life insurance contracts can cause excess mortality by providing "free" life insurance, specifically to those that would have planned to lapse. Additional analysis was completed in order to help quantify the excess mortality caused by the grace period.

As can be seen in the graphs below, there doesn't seem to be too much of an increase in mortality in the early months of duration 11. This is surprising as the US study done in 2014 showed a strong case for this increased mortality in the first two months of year 11. This could be explained by a larger shock lapse rate in the US and more healthy Canadian lives sticking around a few more months into the 11th year.

Figure 62

T10 DURATION 11 QX PER 1000 BY MONTH COMPANIES WITHOUT GRACE PERIOD ADJUSTMENTS

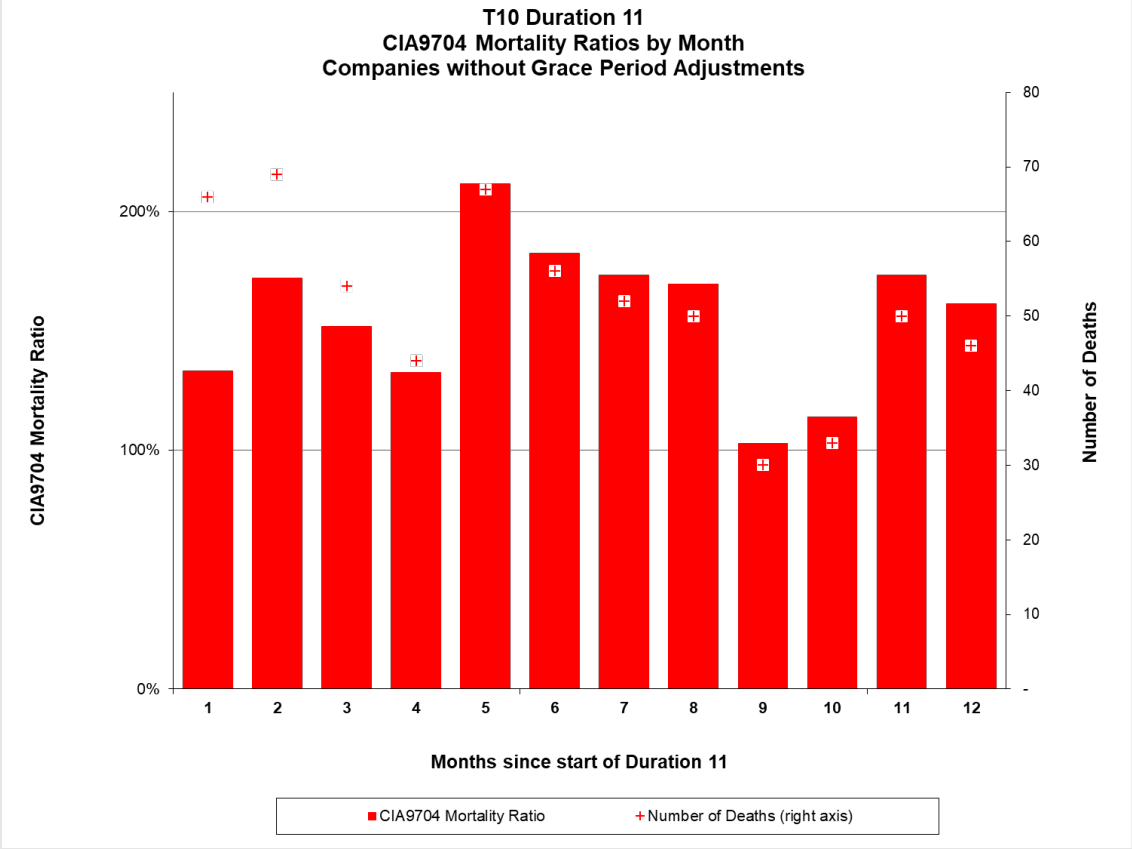


T10

In addition, actual to expected ratios by month were calculated to remove any impacts of age or gender mix. Once again, we do not see the increased mortality in the first two months like the US study showed.

Figure 63

T10 DURATION 11 CIA9704 MORTALITY RATIOS BY MONTH COMPANIES WITHOUT GRACE PERIOD ADJUSTMENTS



Section 7: 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 shows the shock lapse in duration 10 and the relative CIA9704 mortality ratio for durations 11 and 11-14 for each company with at least 5 post-level period deaths.

T10

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 in the first duration 11 graph, it is clear that the mortality is increasing more quickly at the highest shock lapses as seen in the second graph for durations 11-14. Please note, an exponential trend line was added to the graphs only to aid the visual display. Individual companies are only shown if they had 5 or more deaths.

Figure 64

T10 DUR 10 SHOCK LAPSE VS. DUR 11 MORTALITY DETERIORATION BY COMPANY

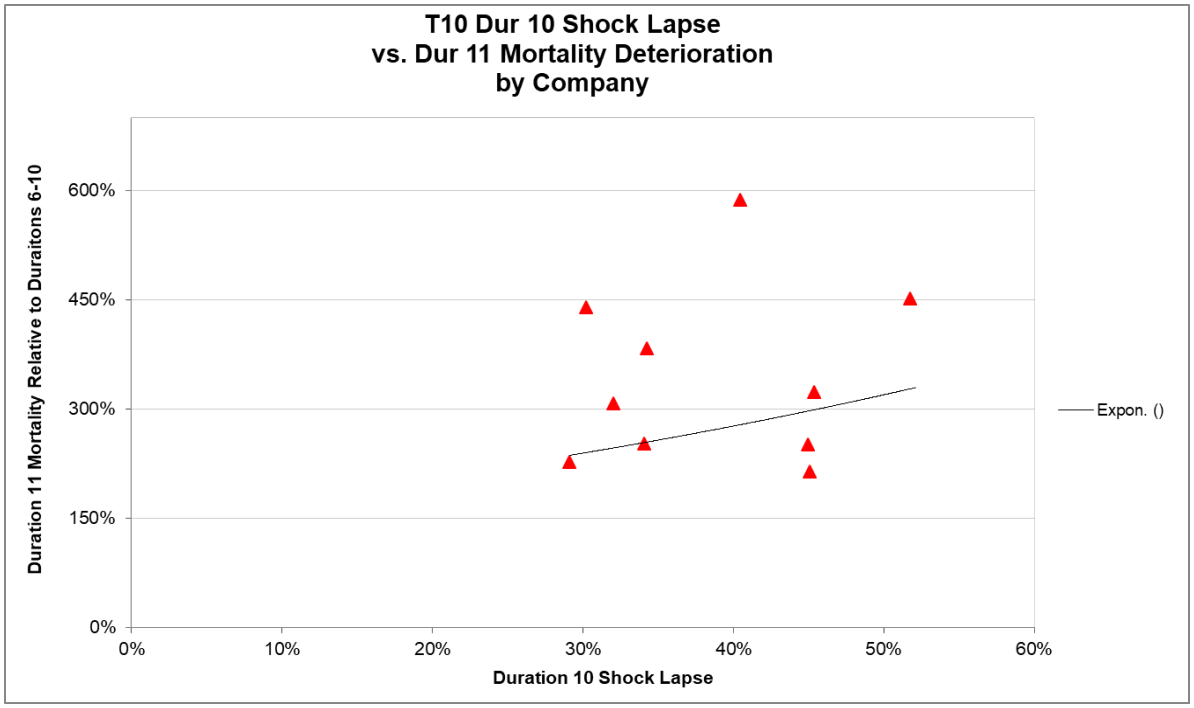
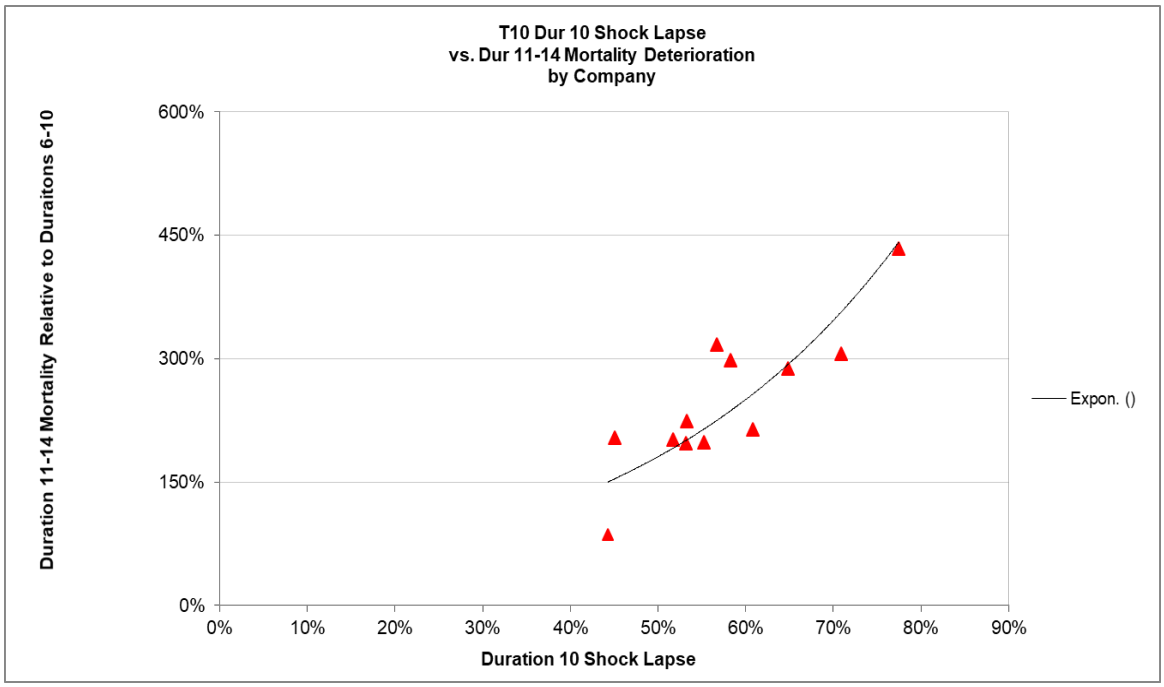


Figure 65

T10 DUR 10 SHOCK LAPSE VS. DUR 11–14 MORTALITY DETERIORATION BY COMPANY



Section 8: Comparisons to Phase 1 Assumption Survey

The following pages will provide a side-by-side comparison of the Phase 2 experience results outlined in this report to the Phase 1 assumption survey results. When comparing these results, it is important to note that there can be differences between the product design characteristics of level term products issued today versus those contributing experience to the Phase 2 study that were issued over 10 years ago, particularly as it relates to the size of the premium jump at the end of the level period. Additionally, the participating companies in the Phase 1 study do not fully overlap with the Phase 2 study.

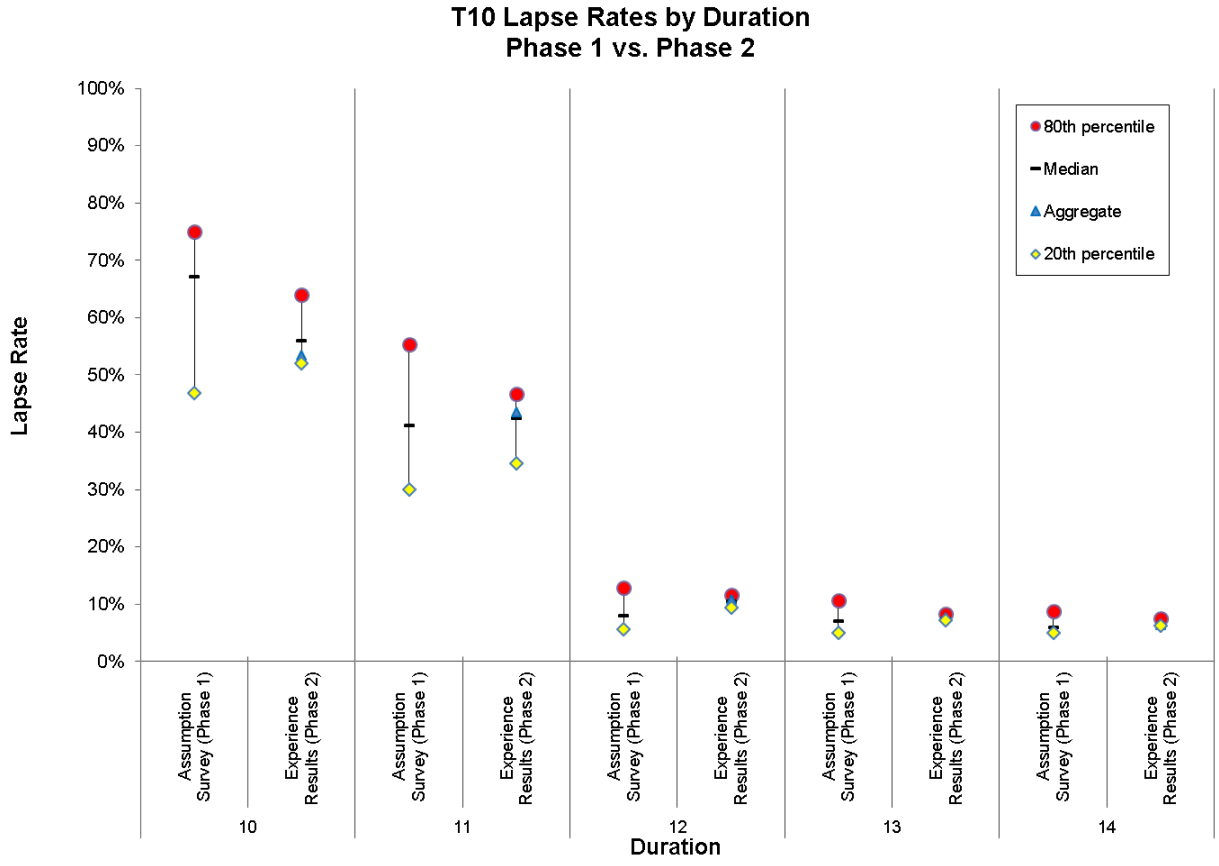
Unless shown in more detail, Phase 1 data in the charts below reference a T10 policy issued to a 45 year old (35 for T20) male standard nonsmoker, with a 500k face amount and an annual premium mode.

Shock Lapse – T10

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. The results in duration 11 are fairly in line with assumptions. For both years 10 and 11, the assumption range is much larger than the experience results.

Figure 66

T10 LAPSE RATES BY DURATION PHASE 1 VS. PHASE 2

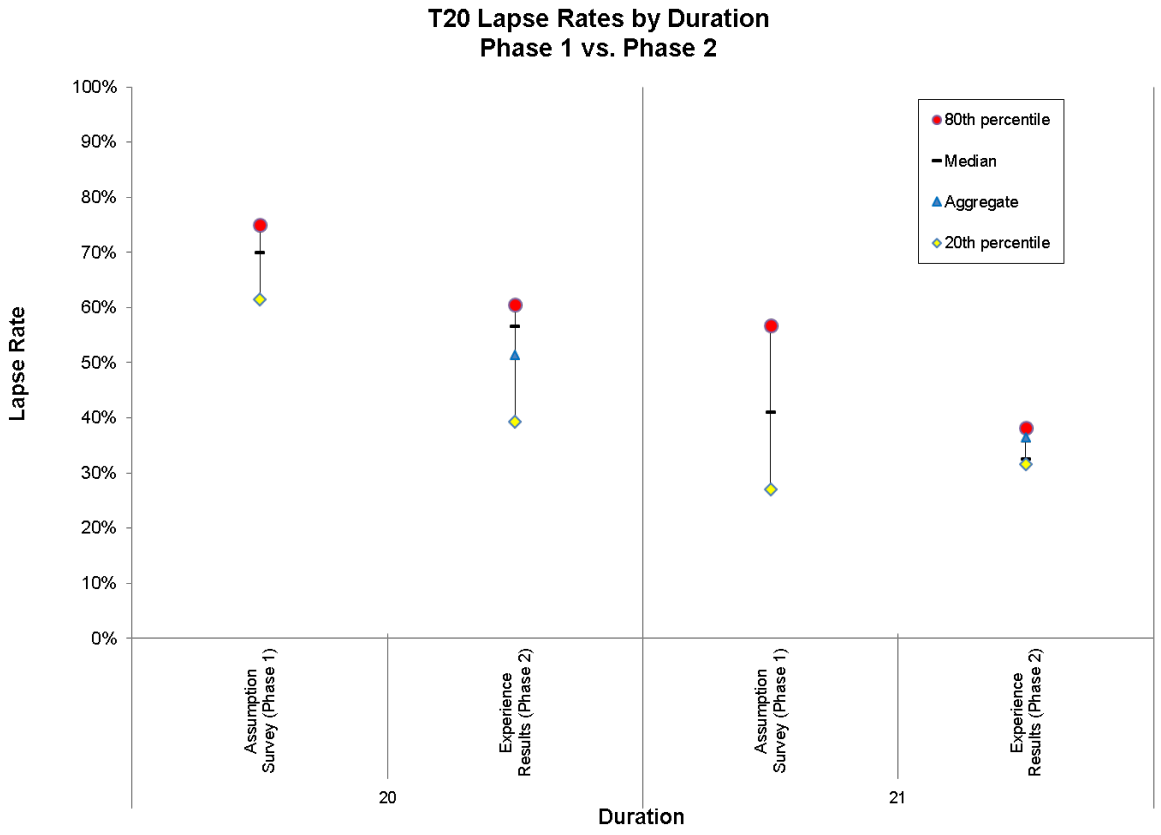


Shock Lapse – T20

For T20 we also see the initial median shock lapse in the survey is higher than the experience study. In addition, duration 21 had a very wide assumption range, while the experience had a fairly tight range in shock lapses. It should be noted that the companies that completed Phase 1 were not always the same companies who participated in Phase 2. The assumptions given in Phase 1 are based on current products sold, not policies that were sold 20+ years ago.

Figure 67

T20 LAPSE RATES BY DURATION PHASE 1 VS. PHASE 2

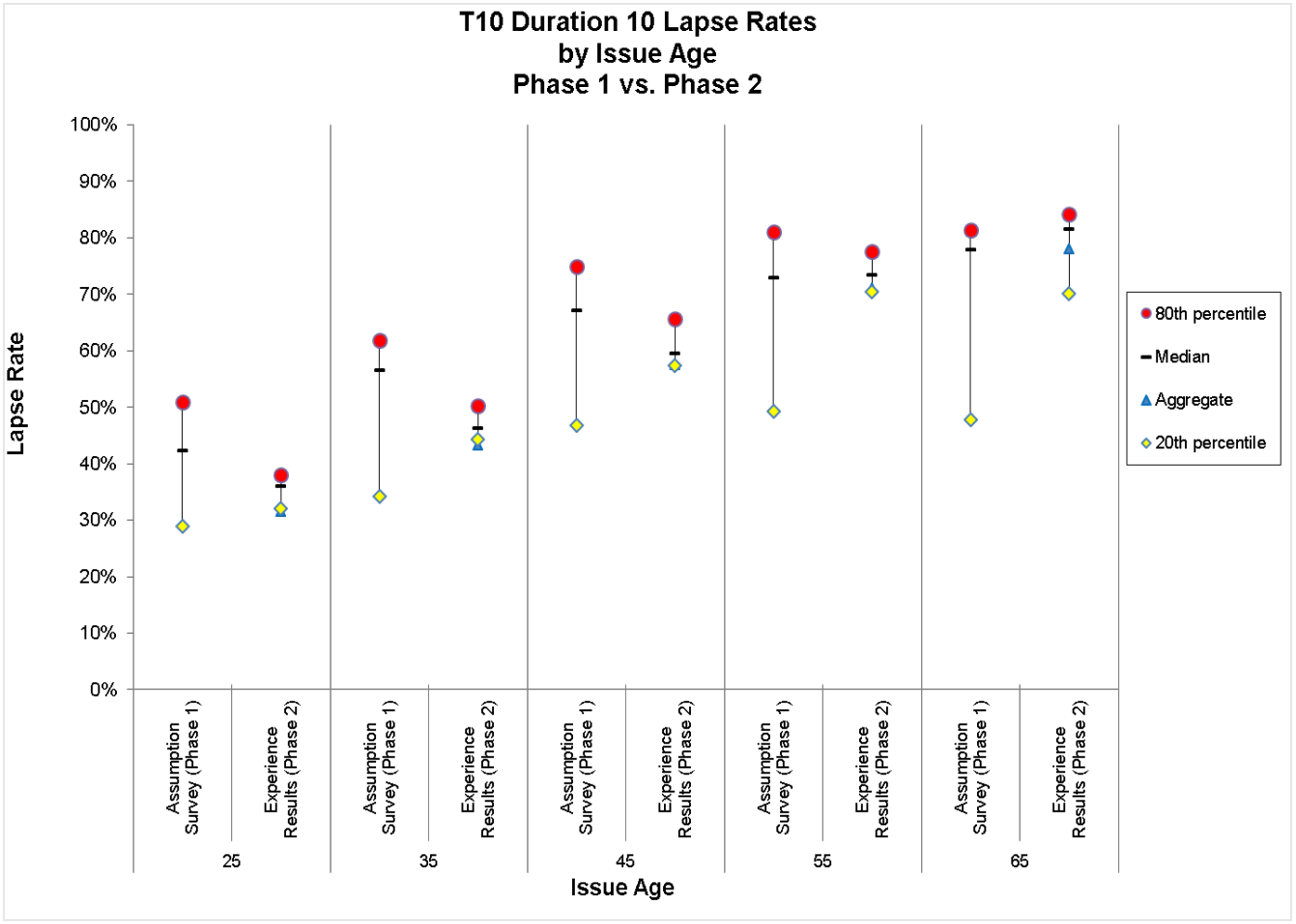


Shock Lapse by Issue Age—T10

The experience lines up with the assumptions as we see shock lapse rates increase with increasing issue age. The experience shows a smaller variance between companies than the assumptions.

Figure 68

T10 DURATION 10 LAPSE RATES BY ISSUE AGE PHASE 1 VS. PHASE 2



The graphs below compare actual shock lapse results in duration 10 and combined durations 10+11 from the Phase 2 study to the assumptions provided in the Phase 1 report. The lapses and premium jumps are based on current assumptions for recently priced products, whereas the experience results are based on policies issued between 2002 and 2007.

Figure 69

ASSUMPTIONS VS. ACTUALS: LAPSE VS. PREMIUM JUMP DURATION 10

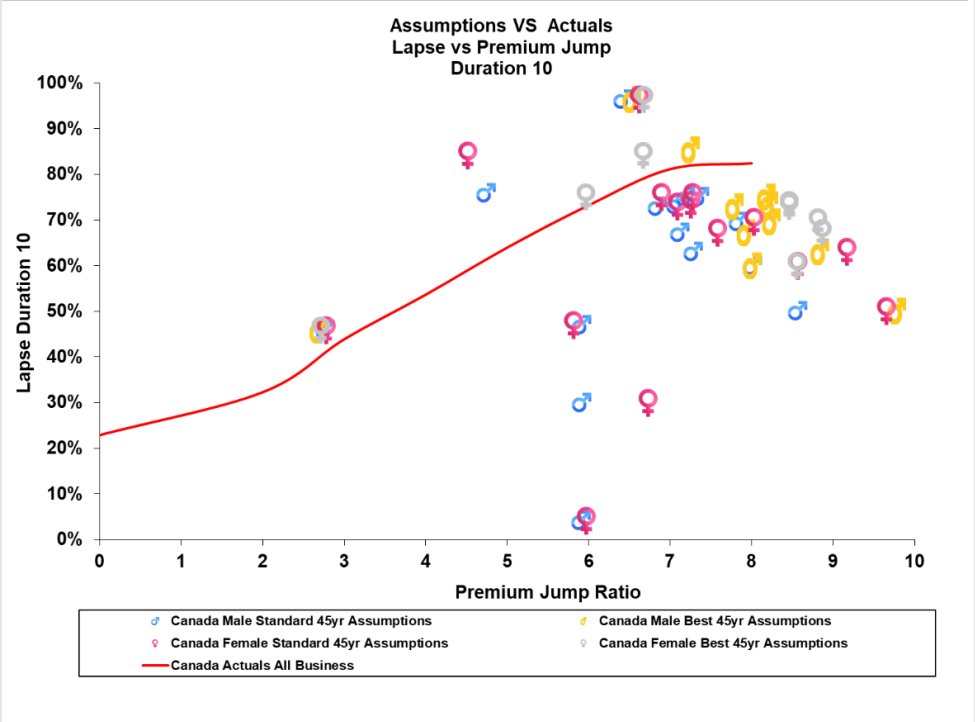
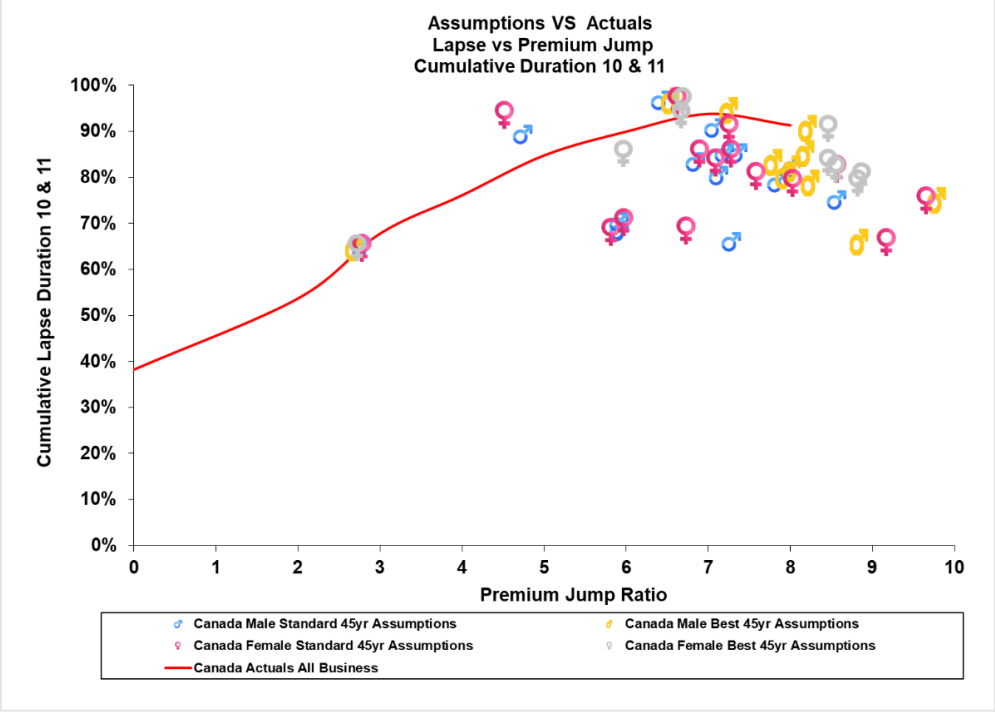


Figure 70

ASSUMPTIONS VS. ACTUALS: LAPSE VS. PREMIUM JUMP CUMULATIVE DURATION 10 AND 11

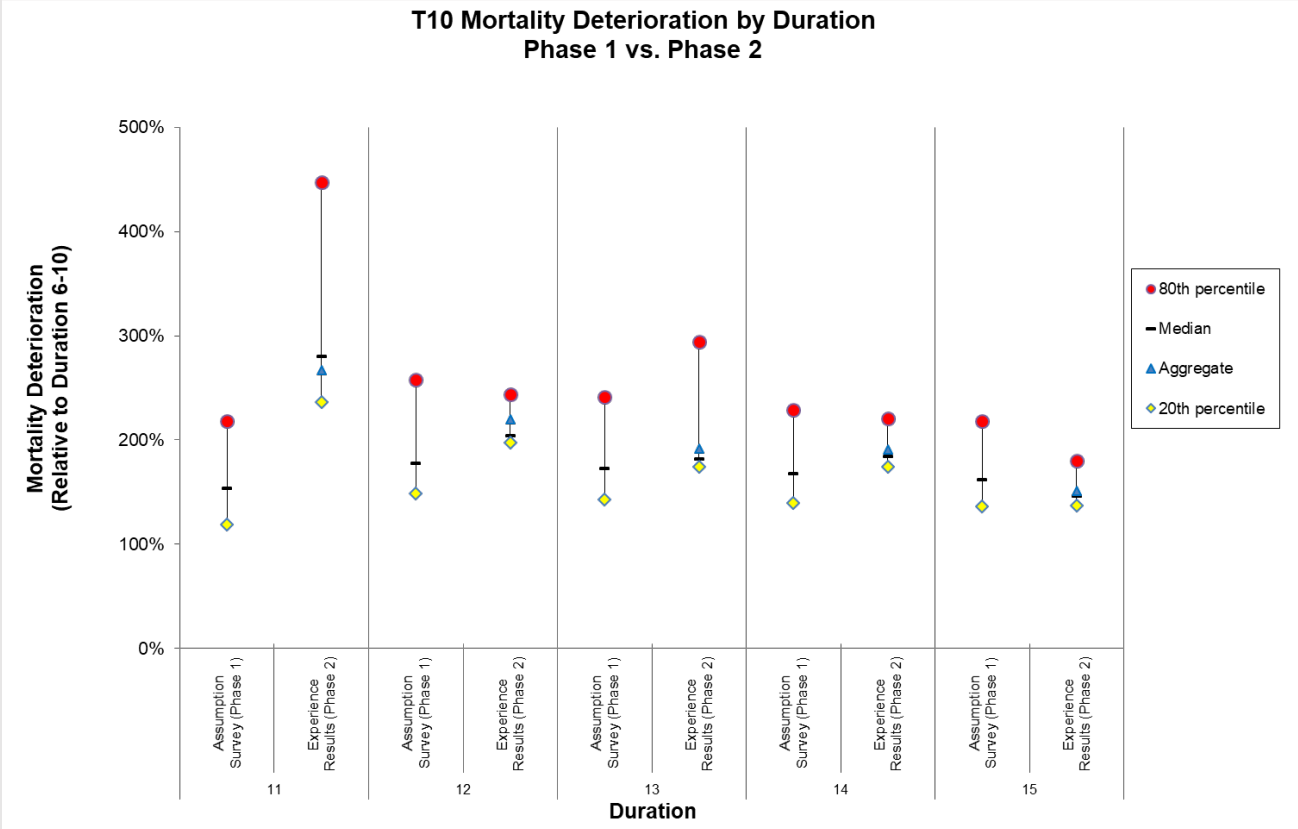


Mortality Deterioration—T10

The mortality deterioration is significantly higher in the experience study than in the assumption survey for duration 11. In durations 12+, the survey shows similar mortality deterioration to the study.

Figure 71

T10 MORTALITY DETERIORATION BY DURATION PHASE 1 VS. PHASE 2

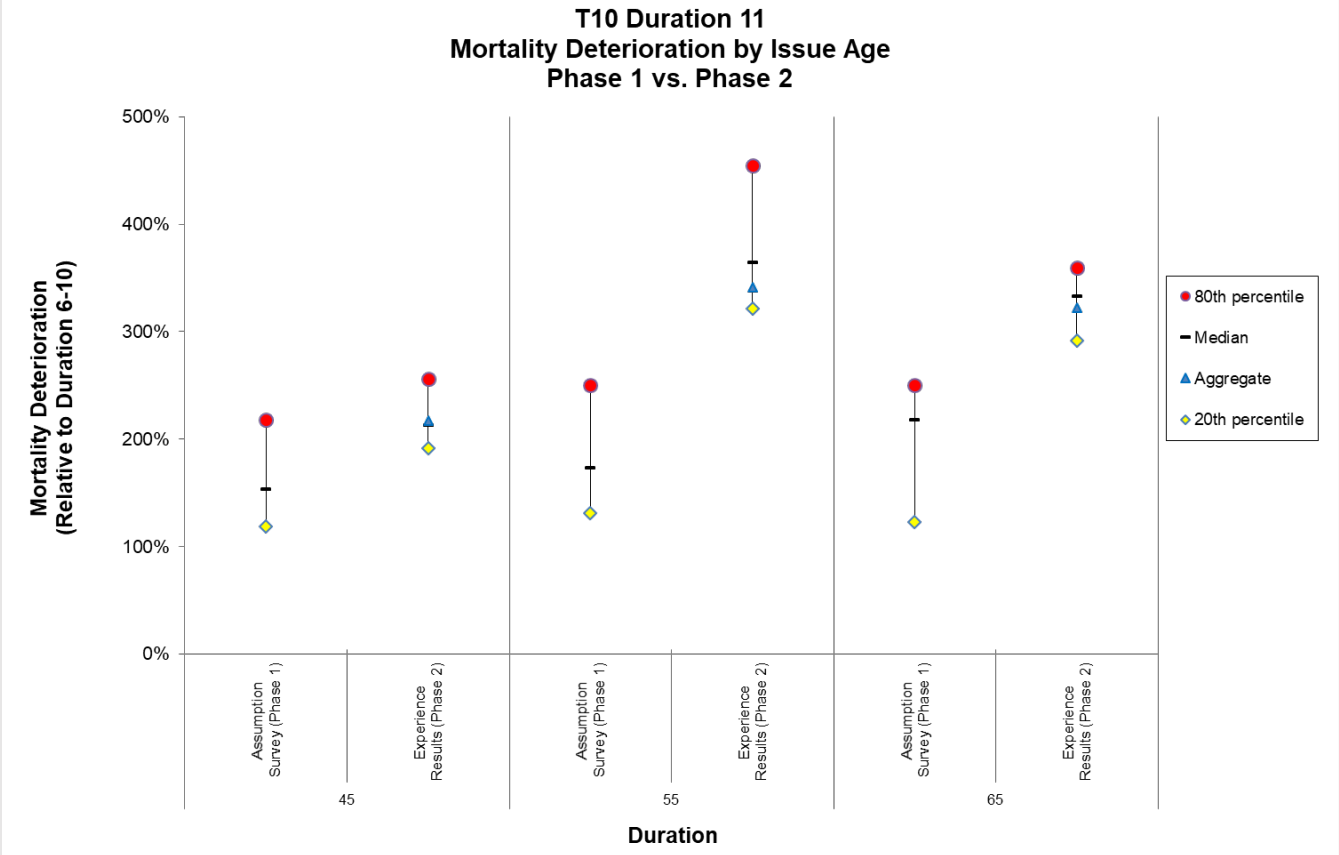


Mortality Deterioration by Issue Age—T10

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.

Figure 72

T10 DURATION 11 MORTALITY DETERIORATION BY ISSUE AGE PHASE 1 VS. PHASE 2

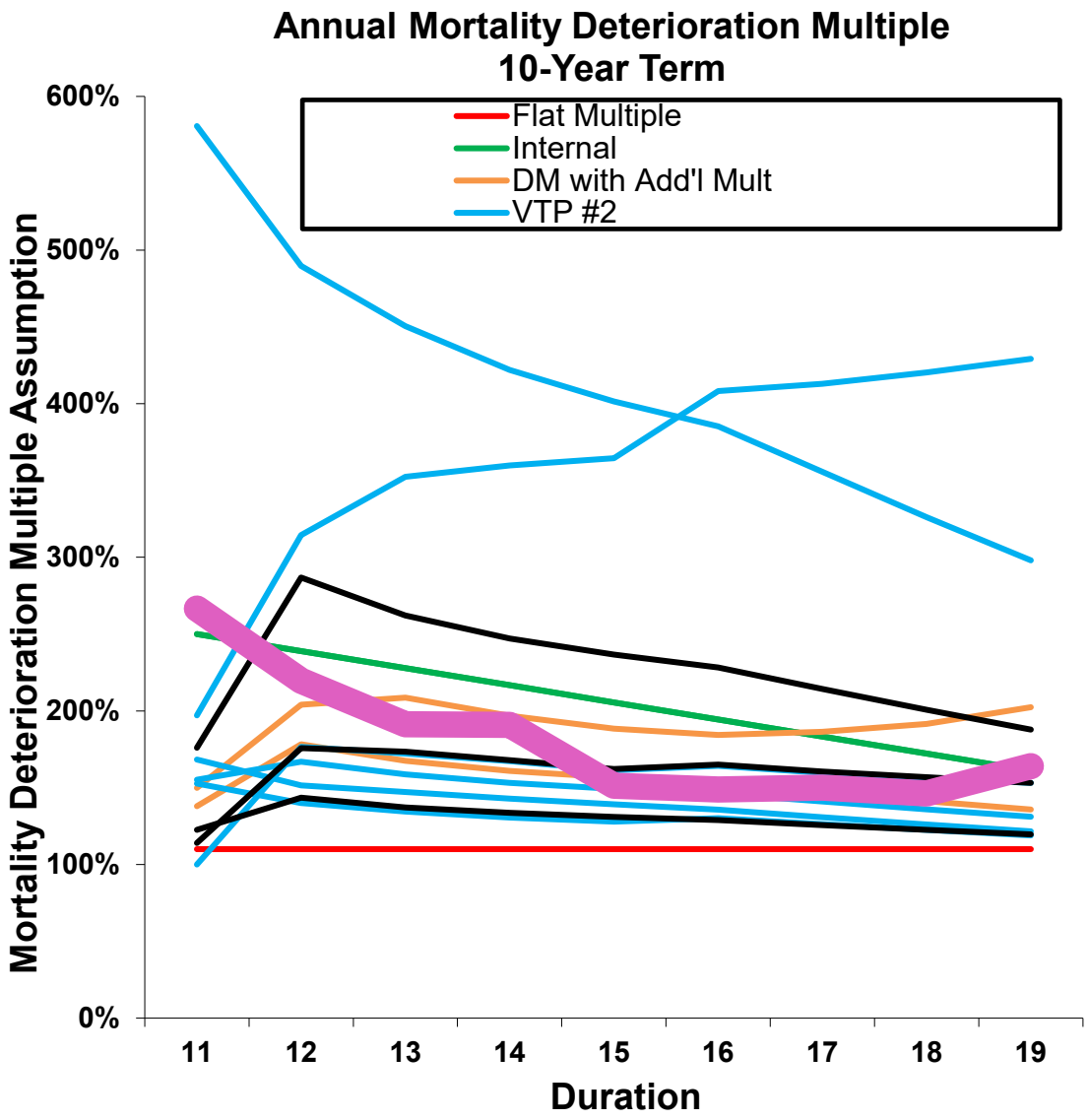


Mortality Deterioration

The table below compares actual results on all business from the Phase 2 study to the assumptions provided in the Phase 1 report. The mortality deterioration is based on current pricing assumptions whereas the experience results are based on policies issued between 2002 and 2007. It is important to note that the highest mortality deterioration is in duration 11 and then gradually decreases down. This is in contrast to VTP#2 revised which has the largest deterioration in duration 12.

Figure 73

ANNUAL MORTALITY DETERIORATION MULTIPLE 10-YEAR TERM



Section 9: Special Thanks

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

We would like to thank the CIA and SOA, along with their staff as well as the following members of the Project Oversight Group (POG) 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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Mervyn Kopinsky
Cynthia MacDonald
Erika Schulty

Appendix A: Companies Contributing Data

Assumption Mutual
BMO
Desjardins
Industrial Alliance
ivari
London Life
Manulife
SSQ Assurance
Sun Life
The Co-operators
Wawanesa Life
Western Life

Appendix B: Grace Period Adjustment

The researchers wanted to see how the lapse rates would look if lapse dates were changed to show how the grace period may be affecting the actual rates. With that said, great strides were taken to get the most accurate study done with regards to the grace period. Not every company treats their lapse dates the same way. Some companies provided the lapse date as the date the policy dropped off their system (at the end of the grace period). Others provided the lapse date as the first working day after the effective date of the lapse. The researchers took the approach that the lapse date should be the last date that premiums were paid through, and that the premiums were not refunded. The researchers reached out to each company and provided examples of policies that had a lapse date ranging from one week after the anniversary date at the end of duration 10 to three months after that anniversary date. The researchers specifically asked these companies to verify the lapse dates provided were correct or if they needed to be adjusted. Their responses provided the researchers the assurance that the adjustments that were being made were appropriate.

Although the researchers were confident in their approach, they still went through the process of running the study with the lapse rates adjusted by various number of days. The following charts show some of the results. Obviously, the more days the lapse date is shifted, the more lapses show up in year 10 and fewer in year 11. These look more like the USA study when the days are shifted 60+ days.

Figure 74
T10 LAPSE RATES BY DURATION
18 DAY GRACE PERIOD ADJUSTMEMT

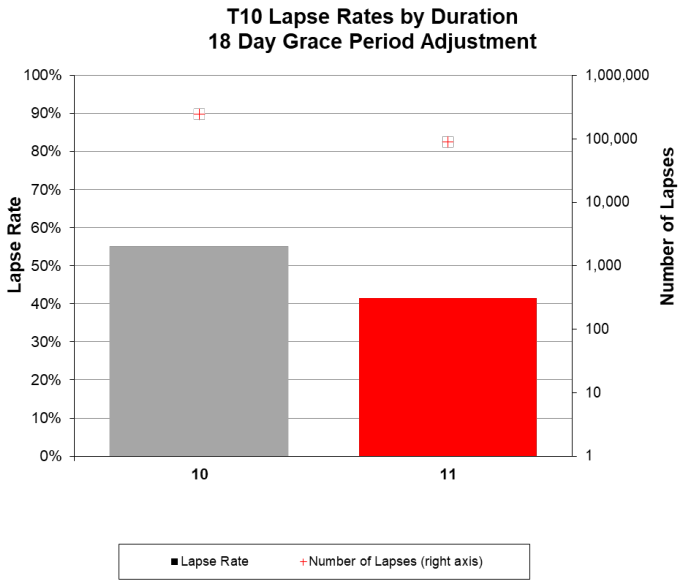


Figure 75
T10 LAPSE RATES BY DURATION
33 DAY GRACE PERIOD ADJUSTMENT

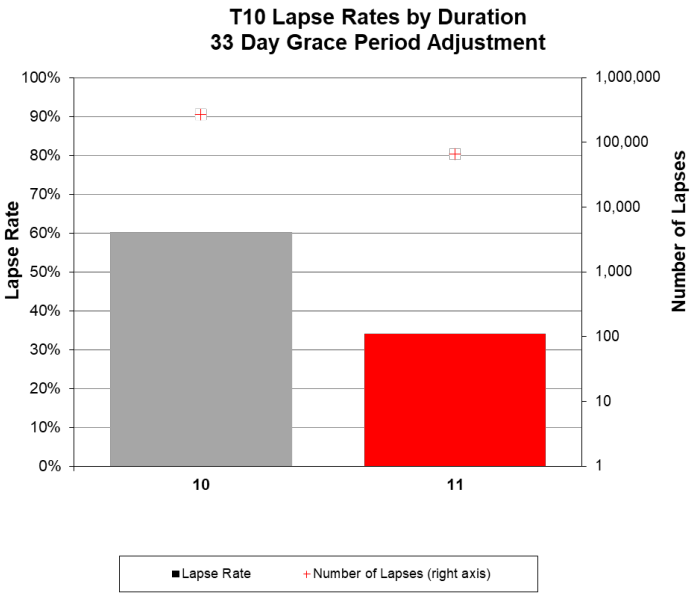


Figure 76
T10 LAPSE RATES BY DURATION
63 DAY GRACE PERIOD ADJUSTMEMT

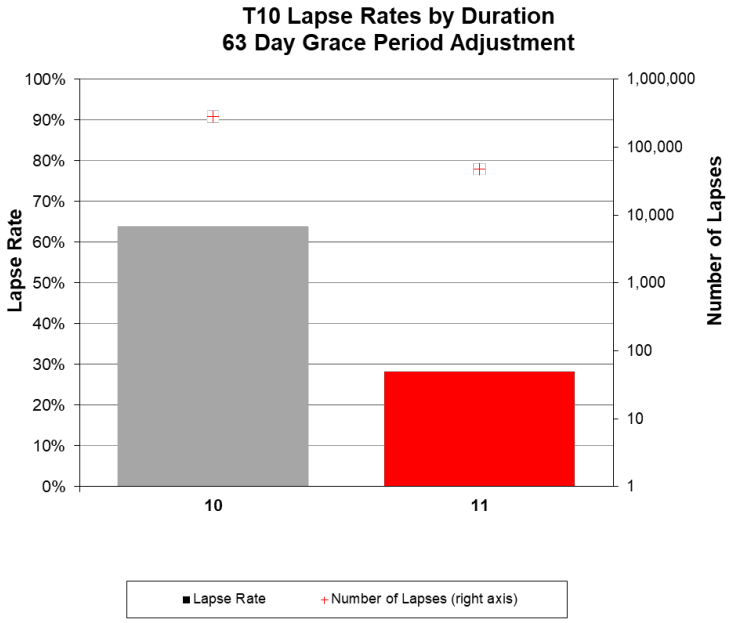
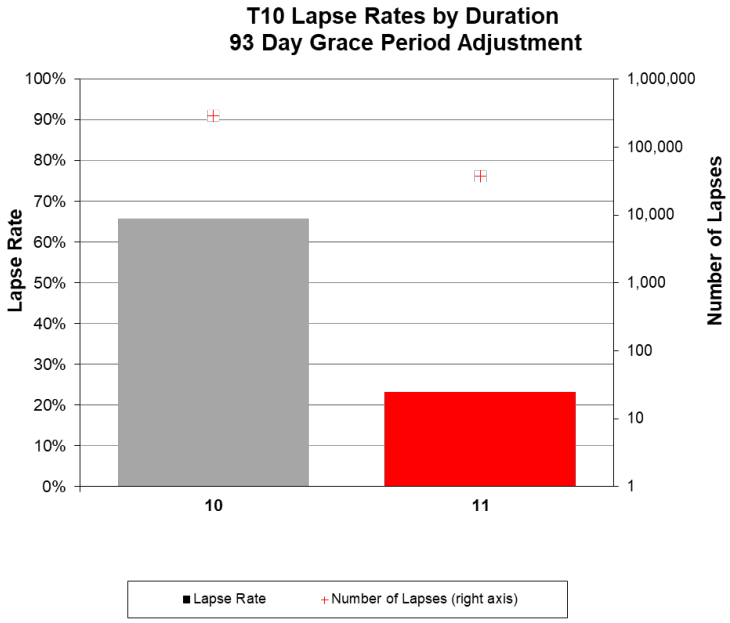


Figure 77
T10 LAPSE RATES BY DURATION
93 DAY GRACE PERIOD ADJUSTMENT



Appendix C: Canada VS USA Study 2014

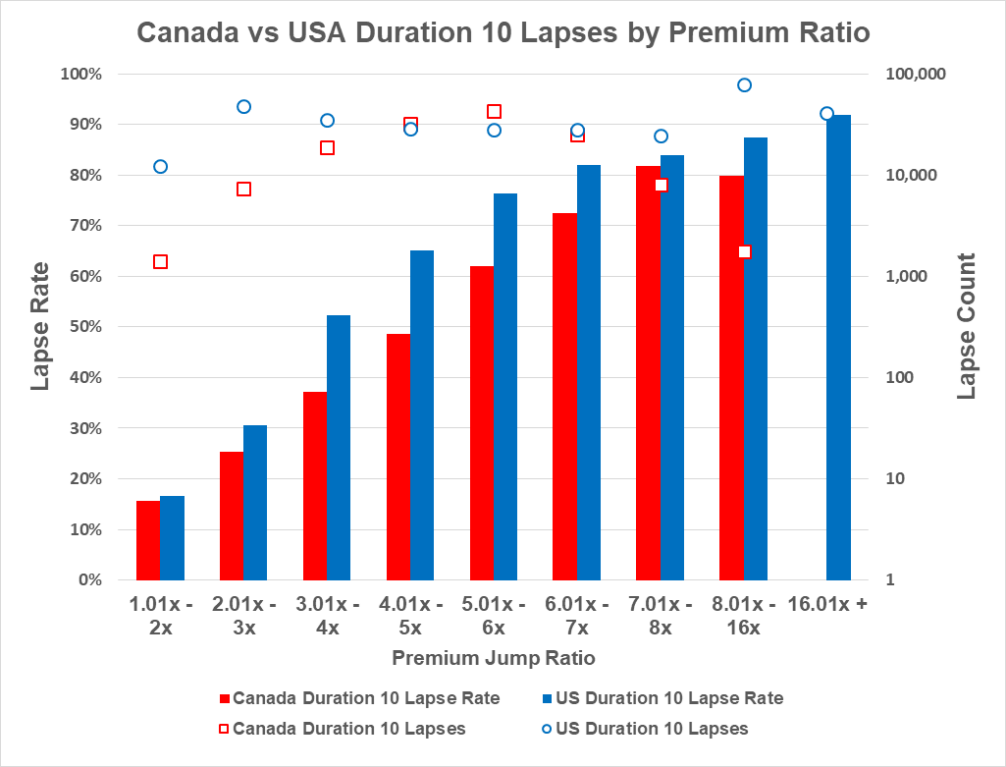
C.1 Shock Lapse

Both the Canada and USA studies show similar patterns of increasing shock lapses as the premium jump ratio increases; however, the USA duration 10 lapses are higher across the board.

One difference between the two studies is the lapse count by premium jump ratio. There are many more lapses in the USA study in total, but it is interesting to note that there are more Canadian lapses in the 4-6x jump bands. The USA companies have many more in the very low end of the premium jump bands and an even greater amount at the very high end.

Figure 78

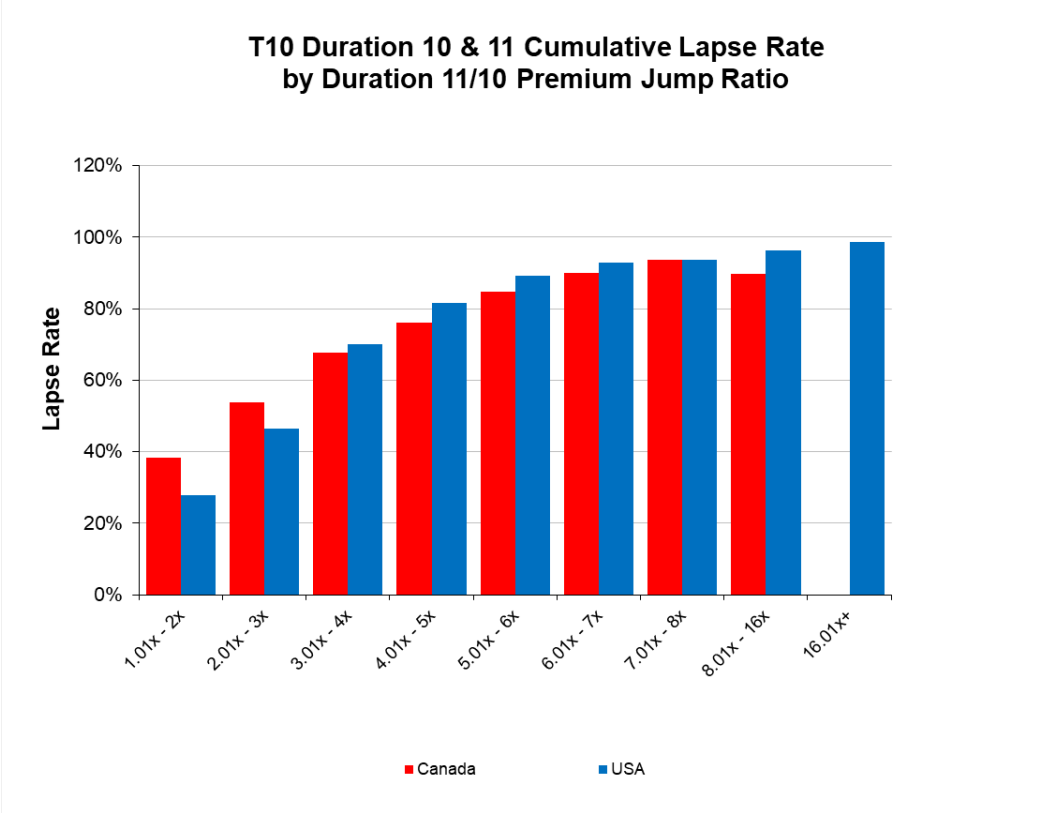
CANADA VS. USA DURATION 10 LAPSE RATES BY PREMIUM RATIO



The researchers noticed that the USA data had a much larger 10 year lapse rate and smaller 11 vs Canada. Below, duration 10 and 11 lapses were combined, and show that the cumulative USA and Canada lapse rate come out fairly similar across the premium jump ratios. There was no Canadian data for 16+.

Figure 79

T10 DURATION 10 & 11 CUMULATIVE LAPSE RATE BY DURATION 11/10 PREMIUM JUMP RATIO



The following two graphs show how the Canadian and USA actual lapses come in higher than the assumptions, both in duration 10 and when looking at cumulative results from duration 10 and 11.

Figure 80

ASSUMPTIONS VS. ACTUALS LAPSE VS. PREMIUM JUMP DURATION 10

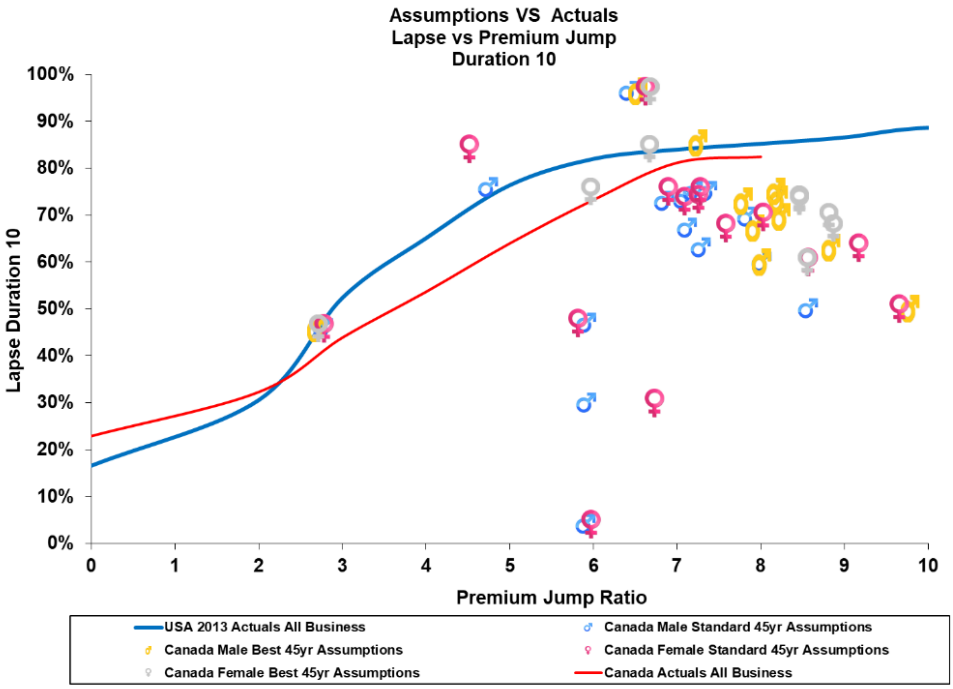
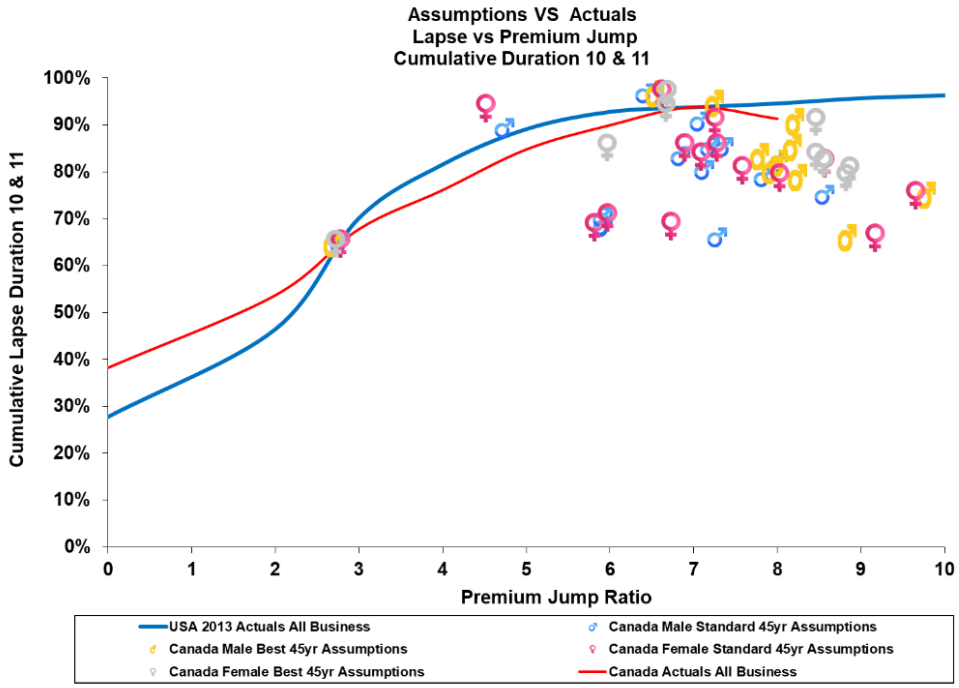


Figure 81

ASSUMPTIONS VS. ACTUALS LAPSE VS. PREMIUM JUMP CUMULATIVE DURATION 10 & 11

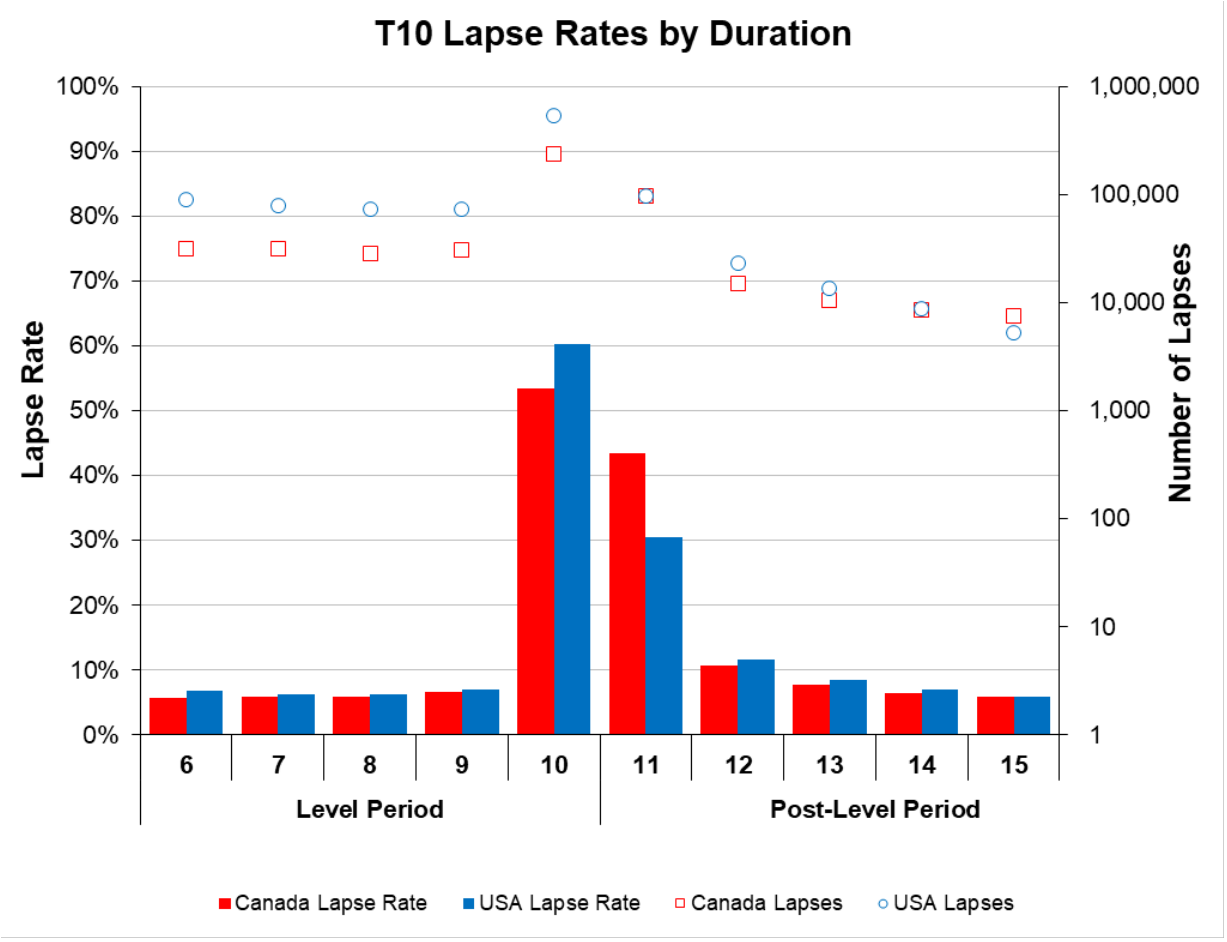


Although the shock lapses are quite a bit higher in the USA study, the lapse rate in duration 11 is higher for the Canadian policies. As mentioned above, most of the duration 11 lapses in Canada occur in the first three months of the year. The USA study showed a similar skewing of the lapses to the beginning of duration 11, but not as much as the Canadian study.

The post-level lapse rates are lower for the Canadian study. This could be driven by the difference in the post-level term premium structure. The vast majority of the USA companies have an ART premium structure after the initial premium jump.

Figure 82

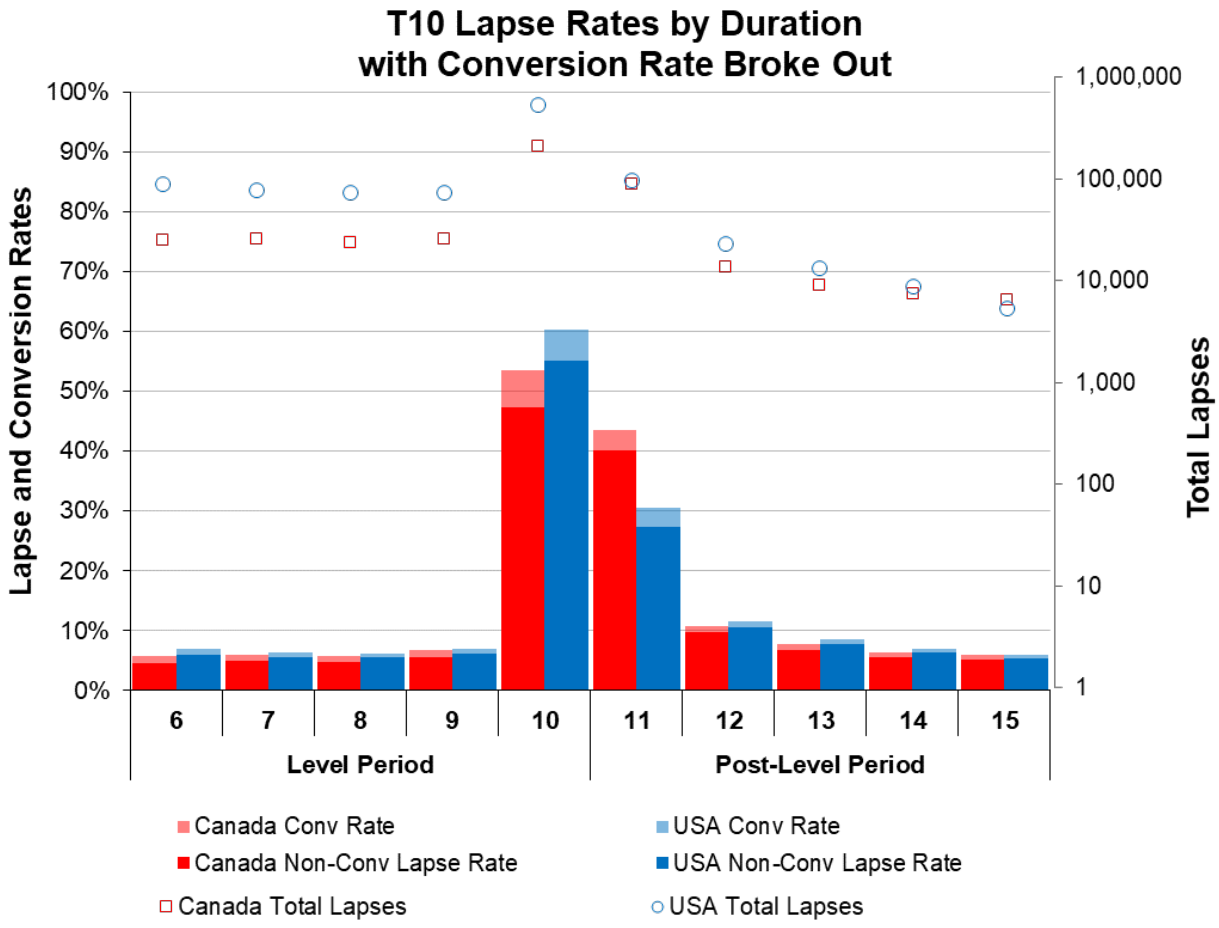
T10 LAPSE RATES BY DURATION



Here are lapse rates split out from the conversions. In this study, as well as the USA study, conversions were included with the lapses in the analysis unless otherwise stated.

Figure 83

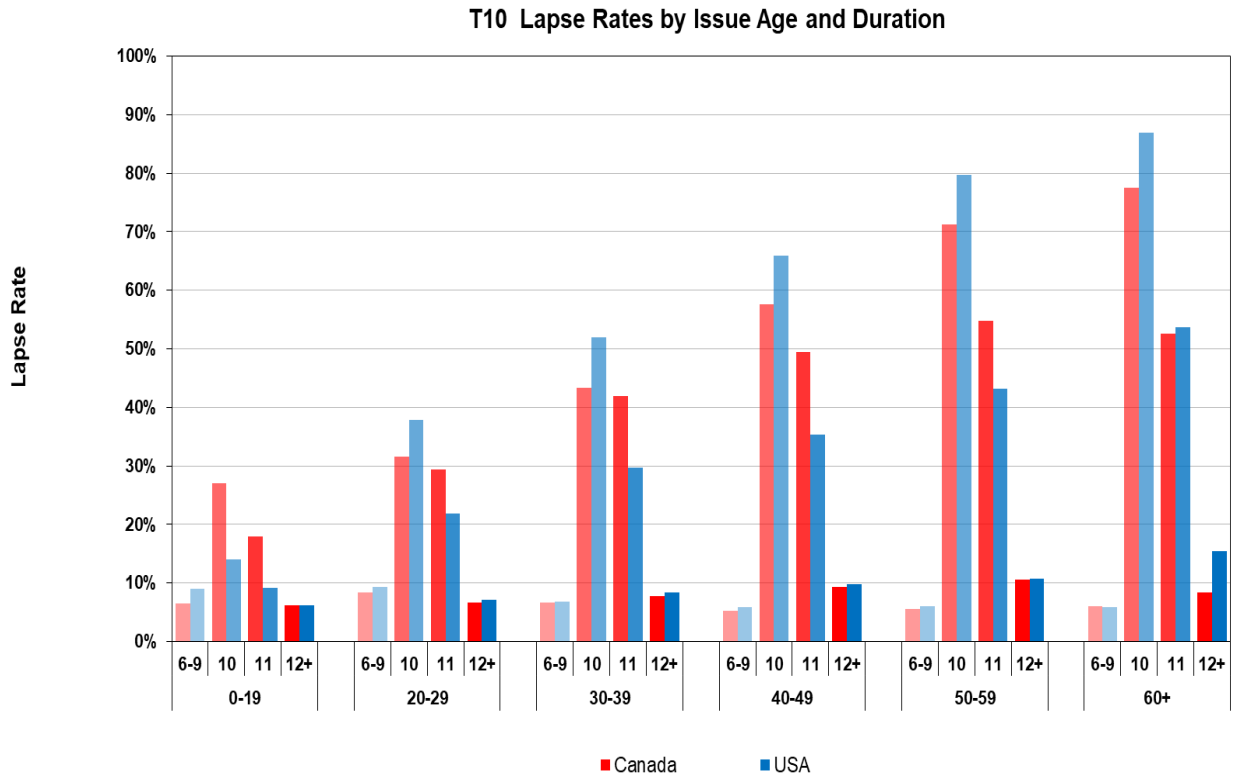
T10 LAPSE RATES BY DURATION WITH CONVERSION RATE BROKE OUT



Here we have the lapse rates split by issue age band and duration. This shows a similar pattern where the lapse rates go up as issue age goes up for both the Canada and USA studies.

Figure 84

T10 LAPSE RATES BY ISSUE AGE AND DURATION



Once again, we see similar trends between Canada and the USA studies when looking at gender.

Figure 85

T10 LAPSE RATES BY DURATION, MALES

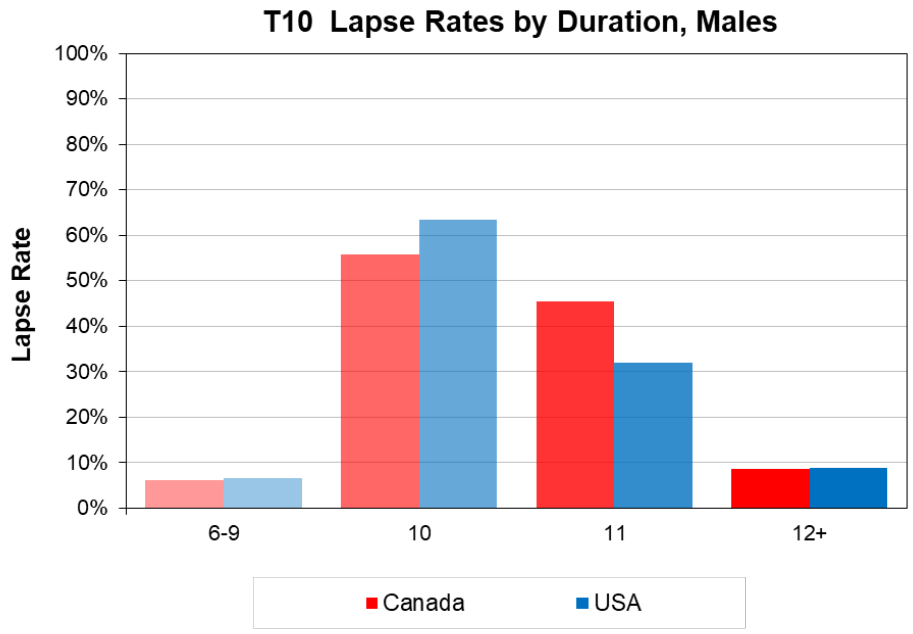
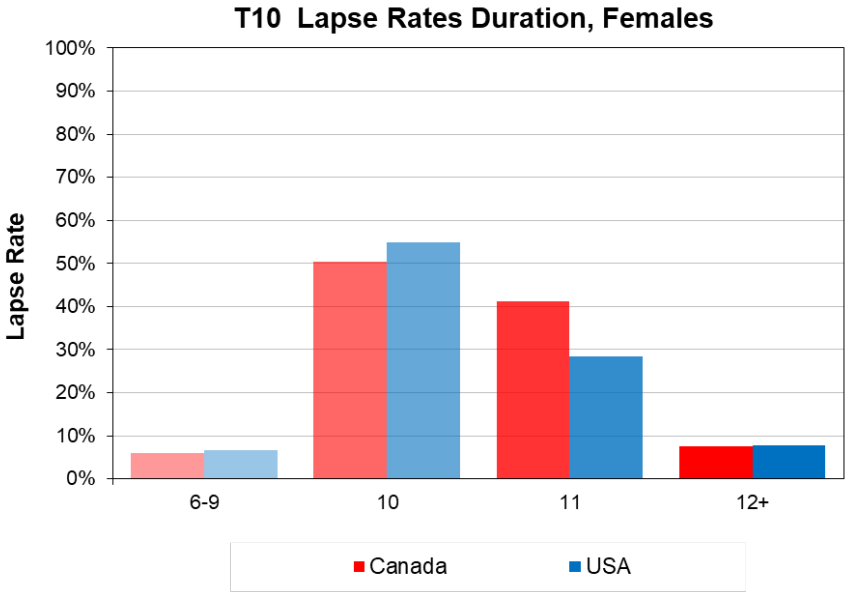


Figure 86

T10 LAPSE RATES BY DURATION, FEMALES



Here are the lapses split by size band and premium mode. Note that although both studies are using dollars, each study is using its own country's dollars, so these are not exactly the same.

Figure 87

T10 LAPSE RATES BY FACE AMOUNT AND DURATION

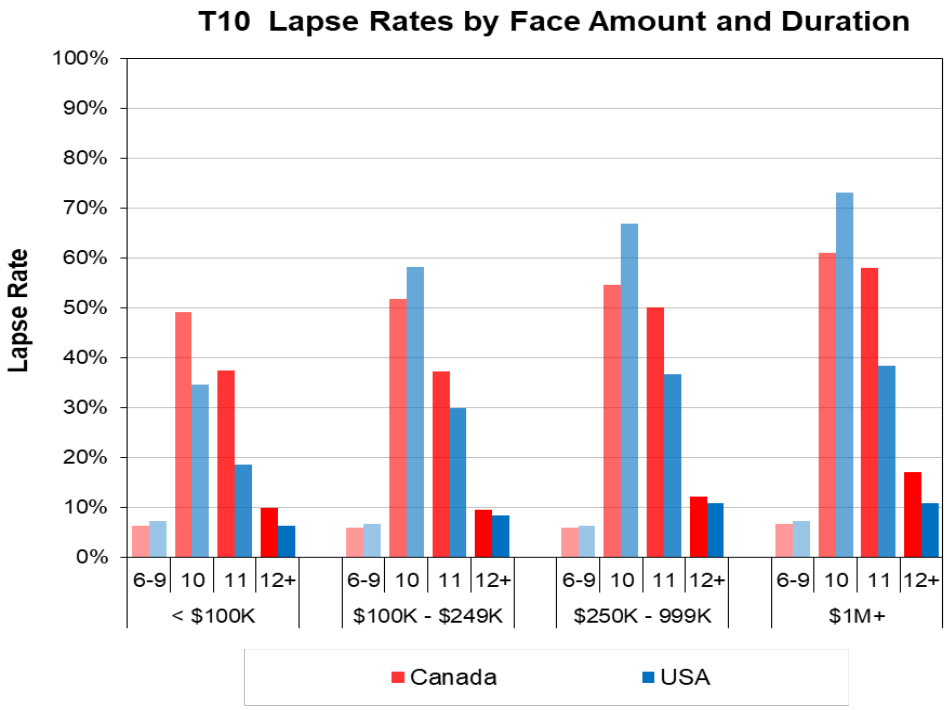
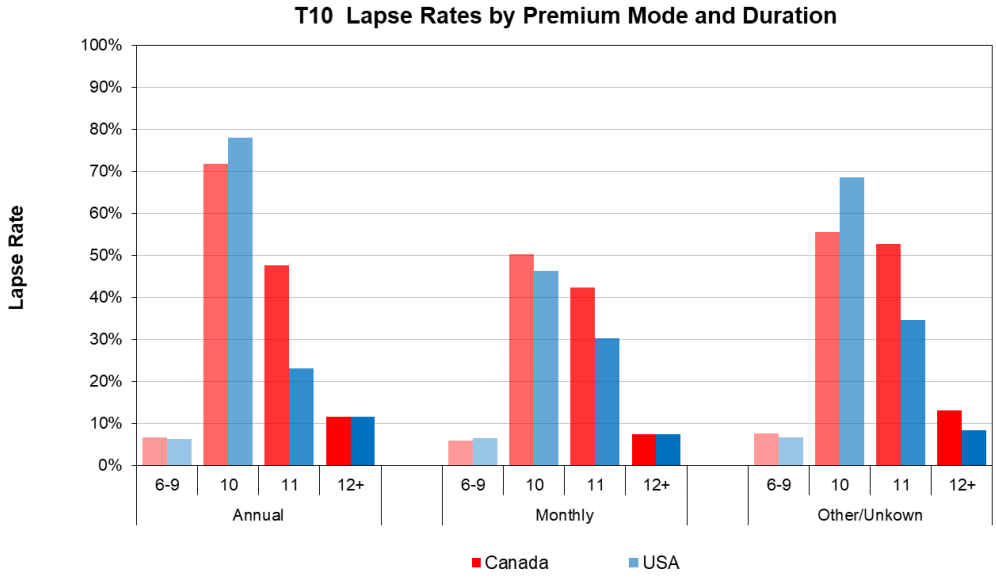


Figure 88

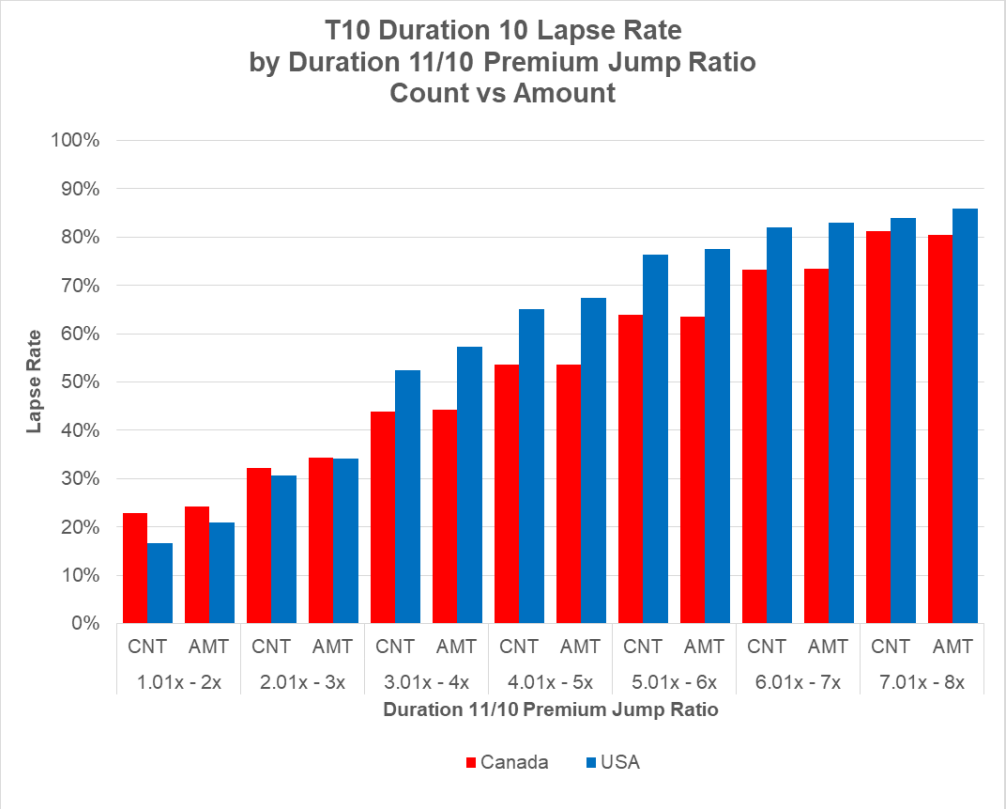
T10 LAPSE RATES BY PREMIUM MODE AND DURATION



This chart shows the Canada vs. USA comparison by premium jump ratio. For the lower premium jumps, the lapse rates are higher in Canada, but as the premium jump increases, the USA lapse rates get bigger than the Canadian lapse rates.

Figure 89

T10 DURATION 10 LAPSE RATE BY DURATION 11/10 PREMIUM JUMP RATIO COUNT VS. AMOUNT

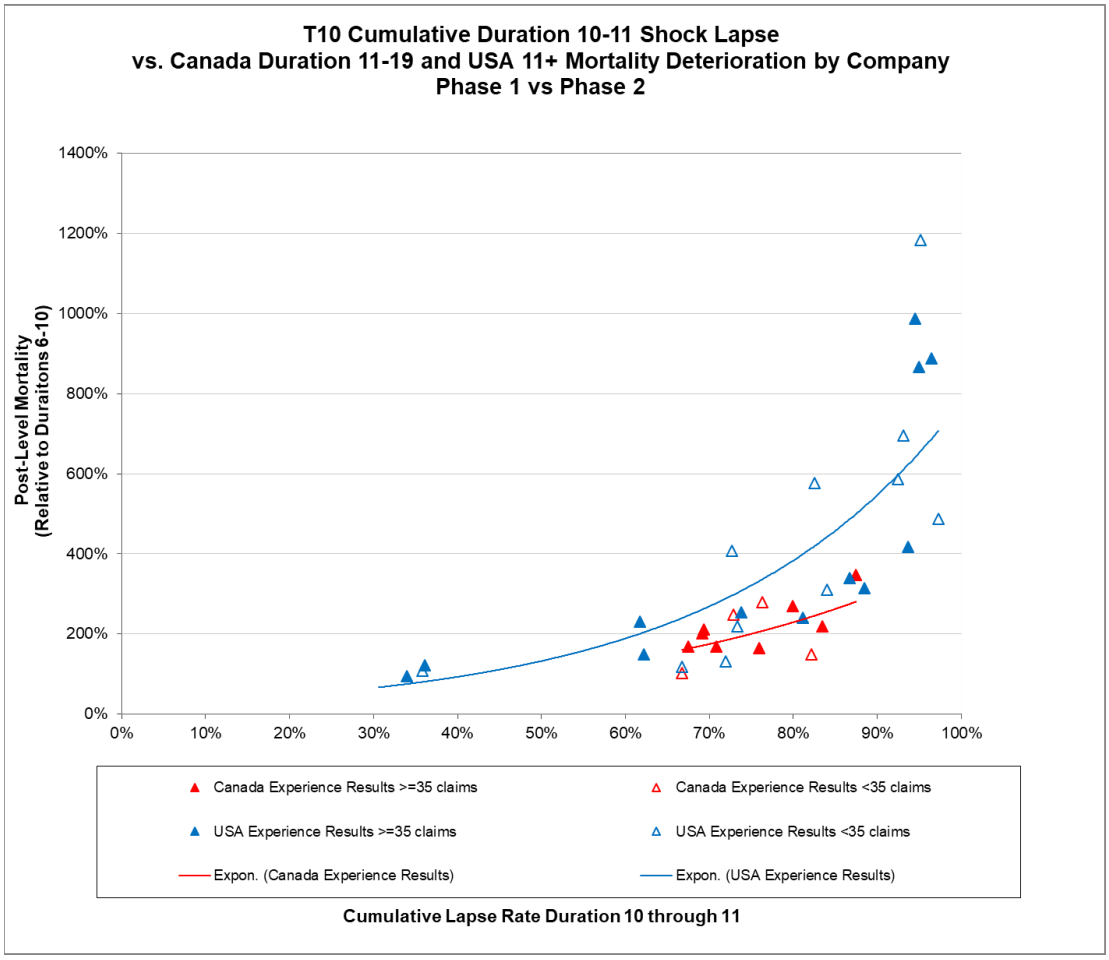


C. 2 Mortality Deterioration

Both Canada and USA studies show an increasing level of mortality deterioration as the shock lapse increases, however the Canada results are lower. The mortality rates used are for durations 11-19 in Canada, but 11+ for the USA. With that said, the vast majority of the USA business is in years 11-17. The USA mortality may be higher due to the increasing premium structure after the initial shock lapse. It is also important to note that the trend line is not weighted by exposure.

Figure 90

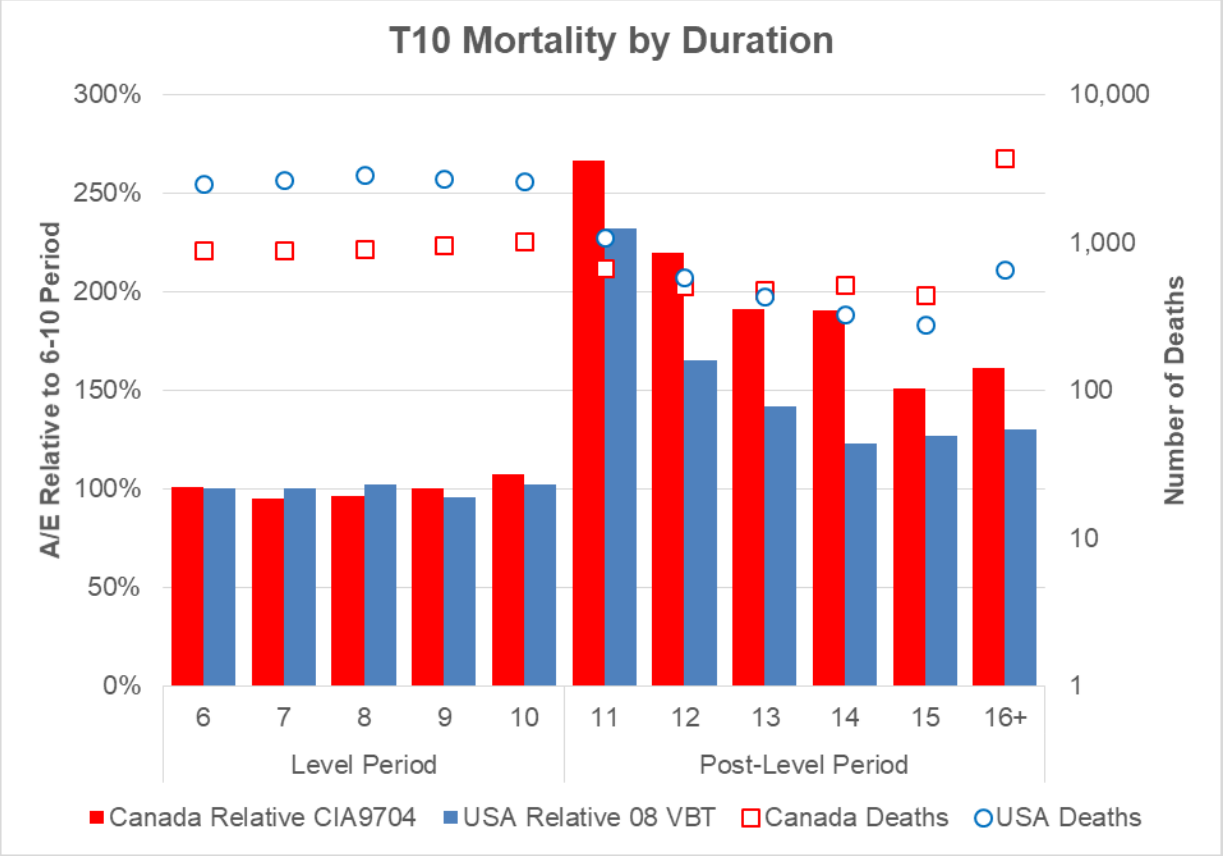
T10 CUMULATIVE DURATION 10-11 SHOCK LAPSE VS. CANADA DURATION 11-19 AND USA 11+ MORTALITY DETERIORATION BY COMPANY PHASE 1 VS. PHASE 2



Although the USA study and the Canada study used different mortality tables, the researchers still wanted to see how similar the post level mortality would be between the two. Because the underlying mortality tables are not the same, these comparisons are not perfect. The researchers adjusted the results such that the A/E for years 6-10 was 100%. This was done to make the comparison of mortality after the shock lapse more comparable. The results would suggest that the Canadian mortality is actually worse than the USA mortality. This seems counterintuitive with the USA companies having such high premium jumps, however there are some very large USA companies that have very small premium jumps with corresponding small shock lapses. This would keep a much larger proportion of these policies inforce. When looking at mortality deterioration, it is vitally important to keep in mind the level of premium jump and the size of the shock lapse.

Figure 91

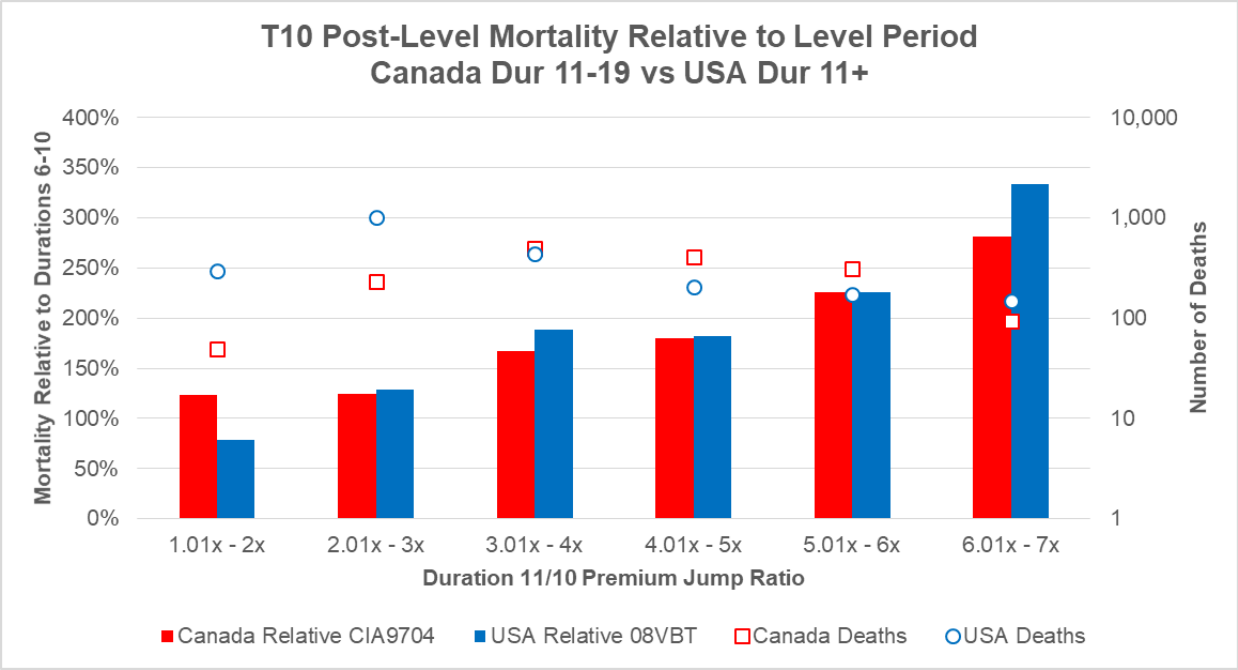
T10 MORTALITY BY DURATION



As stated above, it is more important to compare mortality deterioration within policies that have a similar premium jump. What is still not perfect in this chart is the underlying tables. The USA uses VBT and Canada uses the CIA table. Also, the premium structures are different where the USA generally has an ART structure and Canada has a new level premium period.

Figure 92

T10 POST-LEVEL MORTALITY RELATIVE TO LEVEL PERIOD CANADA DUR 11-19 VS. USA DUR 11+



Appendix D: Predictive Lapse Rate Model for T10 Duration 10 Shock Lapse

D.1 Overview

Traditional actuarial experience studies are a powerful tool to extract insights from experience data. However, these studies rely on univariate approaches, which may lead to over-/under-estimation of assumptions, especially when certain variables are highly correlated. Instead, applying multivariate statistical techniques have become more commonplace as predictive analytics continues to evolve and take center stage in actuarial applications. Compared to traditional methods, predictive models offer the following advantages:

- Multivariate approaches can effectively eliminate biases inherent in univariate analysis
- These methods efficiently use data based on one single global framework that considers all predictor variables simultaneously, instead of cutting data into individual cells for analysis
- The uncertainty associated with estimates is easily obtained from results
- Smooth relationships can be achieved without requiring manual interventions to remove fluctuations
- A systematic method to control complexity and goodness of fit of the estimates

D.2 Model and Data

To analyze an experience study dataset using predictive analytics requires selecting and applying a suitable model type. There is a preference for transparency and highly interpretable models in actuarial experience studies. Simple models allow for increased flexibility in the testing of results that can easily be compared against accumulated industry expertise. As a result, the Generalized Linear Model (GLM) is most often used in these applications. The GLM framework is based on the extension of linear modeling such that we can directly interpret model results, identify key drivers, and extract insights.

The lapse models presented in this paper are defined as follows:

- The observed lapse count is the target variable, and we assume it follows a Poisson distribution that is a part of the exponential family under the GLM framework.
- Our specification of the lapse model is $n_i = E_i * \exp\left(\sum_j \beta_{ij} x_{ij}\right)$, where
  - n_i denotes the expected mean lapse count for the ith cell
  - E_i is the exposure of the corresponding records
  - x_{ij} is the predictor variable for the ith cell, such as duration, risk class, face amount etc.
  - β_{ij} is the parameter to be estimated during modeling process by maximizing the likelihood function.
  - At given predictors x_{ij}, the exponential term $\exp\left(\sum_j \beta_{ij} x_{ij}\right)$ would be the expected lapse rate.

After the traditional actuarial experience study is conducted, the same dataset is used to begin the predictive modeling work. The analysis focuses on T10 duration 10 shock lapse to illustrate the insights and advantages predictive models bring. The traditional actuarial experience study showed that premium jump is a key variable when it comes to the size of the shock lapse. The goals of the modeling exercise are to verify the results and extract additional insights.

Predictive models are evaluated by measuring the accuracy of the predictions provided by the model. In this analysis, we use a standard approach referred to as the test-set method to evaluate model accuracy. The test-set method requires randomly splitting the data into two parts. The first split (containing 70% of the observations) is used for model building. In contrast, the second split (comprising the remaining 30%) is used to measure the performance of the models built. Testing models using data that the model has not seen is a useful way to limit over-engineering models that are unnecessarily complex and begin to fit more noise than signal. This phenomenon is referred to as overfitting. The modeling results presented in this paper are all using the data from the test-set.

D.3 Model Results

In addition to selecting the appropriate model type (e.g., GLM), the model building process requires the creation and selection of variables. Besides ensuring the variables are available, reliable, and reasonable, statistical methods are applied to select variables based on their predictive power. Variable selection requires the examination of interaction effects (the impact of one variable is dependent on the values of another) and other nonlinear relationships between the predictors and the target. Variables are also examined to determine if they are nominal, ordinal, or continuous. Variables such as premium jump ratio and premium jump amount may be treated as ordinal or continuous, depending on what you want to achieve. If the sample size is a concern, you may opt to treat the premium jump ratio and premium jump amount as continuous variables to reduce the degrees of freedom of your model. Sample size limitations may also play a role in the grouping of variable levels to ensure the predictions for each level are reasonable. Some of these variables include the underwriting decision, premium mode, face amount, and distribution channels. Some variables tend to always be treated continuously (e.g., issue age).

D.4 T10 Duration 10 Shock Lapse Model

The model results are summarized in the following table. The top chart presents the variables in the model with their corresponding variable type and coefficients. The "Factor" is the $\exp(\beta)$, which is the relative factor to the base category, and this is consistent with the actuarial approach. The p-value is the probability of obtaining the magnitude of the effect observed assuming the null hypothesis is true. Typically, smaller p-values indicate the results obtained are less likely to be seen if the null is correct and is therefore used as a threshold for including and excluding variables from models. In the second chart, we present the proportion of data for each variable level as well as the actual lapse rate observed, predicted lapse rate from the model and actual/predicted ratio.

The table above shows seven variables included in the final model where three variables are continuous (issue age, premium jump ratio, and premium jump amount), and four are nominal/ordinal variables (gender, risk class, face amount, and premium mode). The interaction terms in the model provide a mechanism to address the nonlinear relationship between variables. The results below show the model can predict the lapse rate well and is consistent with the experience.

It is important to note that extrapolating the model outside the ranges of the variables observed in experience data should be avoided.

Table 50

MODEL PARAMETER

Model Parameter				
Variable	**Type**	**Coefficient**	**Factor**	**P-value**
(Intercept)	Numerical	-1.3200000000		< 2e-16
Issue Age	Numerical	-0.0359200000		2.17E-13
Issue Age^2		0.0011390000		< 2e-16
Issue Age^3		-0.0000078480		2.44E-15
Premium Jump Ratio	Numerical	0.1172000000		9.86E-13
Premium Jump Ratio^2		-0.0088710000		2.22E-09
log(Premium Jump Amount+ 1)	Numerical	0.0912800000		< 2e-16
Gender	Categorical			
F		0.0000000000	1.000	
M		-0.0320800000	0.968	5.38E-08
Risk Class	Categorical			
Pref + NS		0.0000000000	1.000	
SM		0.0697800000	1.072	< 2e-16
Face Amount	Categorical			
<100K		0.0000000000	1.000	
100K-249999		0.0984000000	1.103	2.22E-14
250K-999999		0.1354000000	1.145	< 2e-16
1MIL-1999999		0.1218000000	1.130	1.14E-08
F. 2M+		0.1310000000	1.140	2.59E-05
Premium Mode	Categorical			
Other		0.0000000000	1.000	
Monthly		-0.5809000000	0.559	< 2e-16
Cross term	Mixed			
Premium Mode Monthly : Premium Jump Amount		0.0000269000		8.73E-13
Issue Age: Premium Jump Amount		-0.0000008477		< 2e-16
Premium Mode Monthly : Premium Jump Ratio		0.0470200000		4.50E-14

Table 51

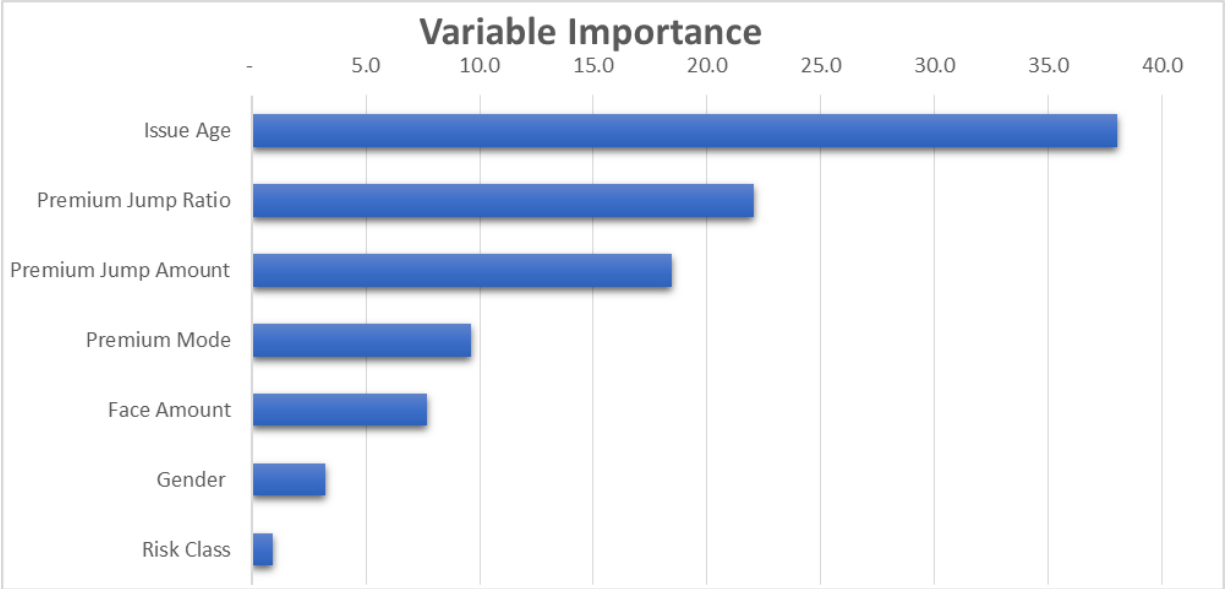
VALIDATION OF RESULTS

Validation of Results				
Variable	**Data Proportion**	**Actual Lapse**	**Predicted Lapse**	**Actual/Predicted**
Gender				
F	43%	51%	51%	100%
M	57%	56%	56%	99%
Risk Class				
Pref + NS	84%	54%	54%	99%
SM	16%	51%	51%	101%
Face Amount				
<100K	6%	49%	48%	101%
100K-249999	39%	52%	52%	100%
250K-999999	49%	55%	55%	99%
1MIL-1999999	5%	60%	60%	100%
2M+	1%	65%	66%	99%
Premium Mode				
Other	15%	71%	72%	99%
Monthly	85%	51%	51%	100%
Premium Jump				
1.01 - 2.00	3%	23%	25%	92%
2.01 - 3.00	11%	32%	32%	98%
3.01 - 4.00	22%	43%	43%	100%
4.01 - 5.00	26%	54%	54%	100%
5.01 - 6.00	23%	64%	64%	100%
6.01 - 7.00	11%	74%	74%	101%
7+	4%	78%	80%	98%

To better understand how each variable impacts the target variable, a statistical analysis was applied to the dataset, and a parameter called variable importance was calculated. The variable importance indicates how much a variable was utilized in a model to make accurate predictions. As its name implies, this parameter can tell how "important" a variable is to explain the variation of the target variable. The plot below shows the variable importance for this analysis.

Figure 93

VARIABLE IMPORTANCE



Even though issue age is the most informative variable, the impact of premium jump is more significant than issue age if the premium jump ratio and amount variables are combined. These two variables describe one single quantity of premium change by looking at two different aspects (the ratio and the monetary amount). This result is consistent with the experience study and actuarial intuition while revealing more insights and understanding of all the variables.

D.5 Premium Jump

As explained previously in the actuarial study, change of premium after the post-level term is a driving factor of lapsation. The premium jump ratio and the premium jump amount are two variables created to describe the change. The Pearson correlation coefficient between the two variables is about 0.6, indicating a strong positive correlation. The premium jump is also a function of issue age and face amount. The strong relationship is evident when examining the correlations between issue age and premium jump ratio (63%) as well as face amount and premium jump amount (45%). The risk class and premium mode would also affect the premium change at the end of the level term.

It is challenging to understand the lapse rate with several highly correlated variables, as we have observed from the actuarial experience study. As a multivariate statistical method, GLMs can disentangle the effects of correlated variables and extract factors to reflect the unbiased impact of a variable on the lapse rate when assuming all other variables are held constant.

For the 7.01+ bucket, most of the policies have a premium jump ratio between 7x and 8x, with only a few reaching a 10x jump. Caution should be taken when applying factors to policies at these higher premium jumps as there was not enough data to separate them out. The US study done a few years ago that was mentioned above could be used as a reference as that study contained many more records with higher premium jumps.

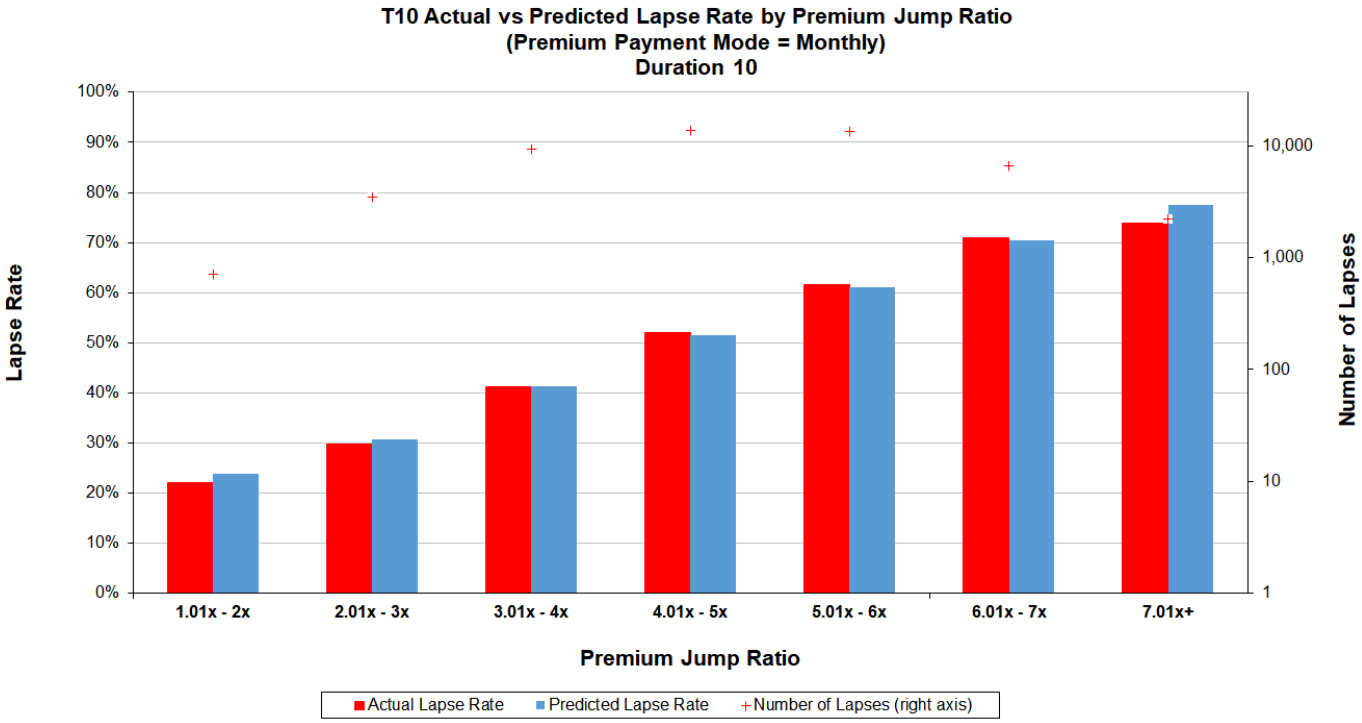
Table 52

T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM JUMP RATIO (PREMIUM PAYMENT MODE = MONTHLY)

Premium Jump Ratio	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
1.01x–2x	715	22.1%	23.9%
2.01x–3x	3,443	29.8%	30.7%
3.01x–4x	9,227	41.3%	41.4%
4.01x–5x	13,651	51.9%	51.5%
5.01x–6x	13,403	61.6%	61.0%
6.01x–7x	6,649	70.9%	70.5%
7.01x+	2,204	74.0%	77.6%
Grand Total	49,292		

Figure 94

T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM JUMP RATIO (PREMIUM PAYMENT MODE = MONTHLY) DURATION 10



The tables and plots show the impact of premium jump ratio and premium jump amount on lapse rate at given levels of issue age and premium mode. Because there are interaction terms in the model between issue age, premium mode, and premium jump amount, the tables and plots are calculated at specific values.

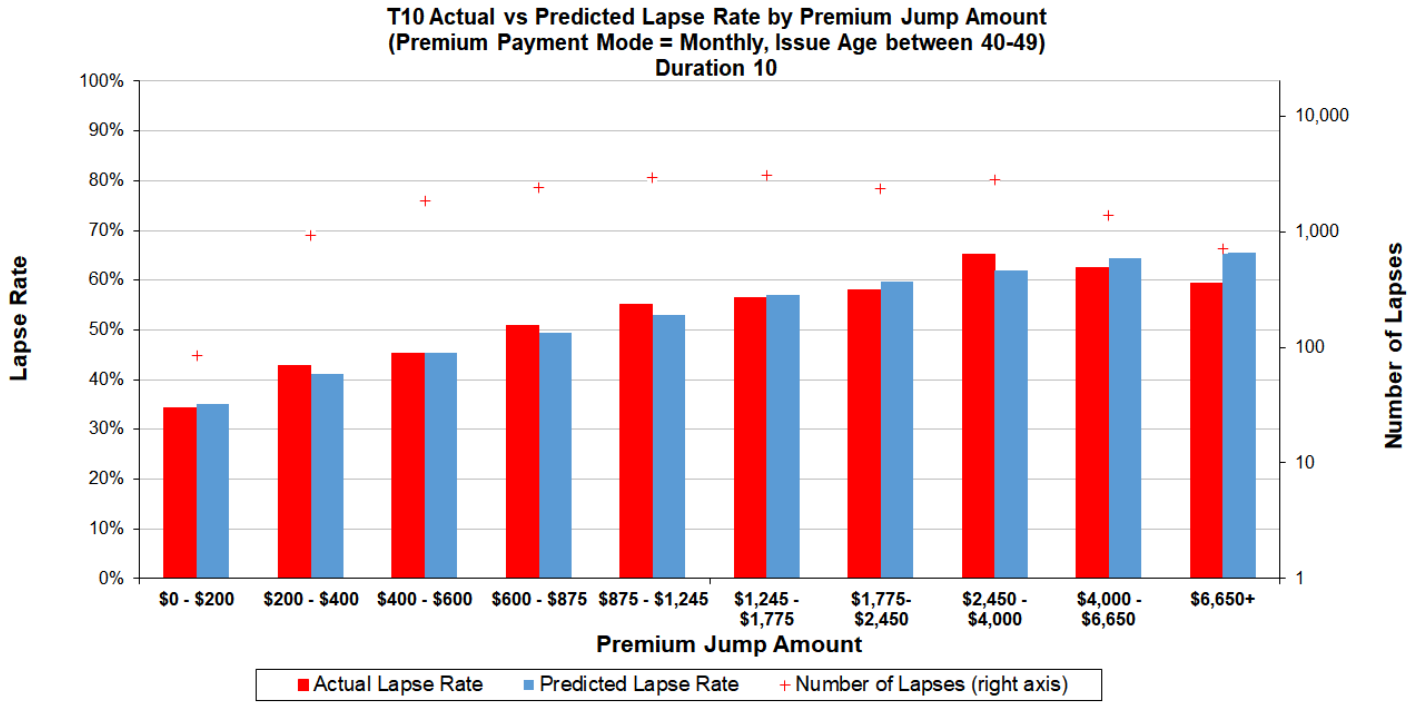
Table 53

T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM JUMP AMOUNT (PREMIUM PAYMENT MODE = MONTHLY, ISSUE AGE BETWEEN 40-49)

Premium Jump Amount	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
$0 - $200	85	34.3%	35.0%
$200 - $400	938	42.8%	41.1%
$400 - $600	1,862	45.4%	45.5%
$600 - $875	2,433	51.0%	49.4%
$875 - $1,245	2,909	55.2%	53.1%
$1,245 - $1,775	3,076	56.5%	56.9%
$1,775- $2,450	2,344	58.0%	59.8%
$2,450 - $4,000	2,814	65.3%	62.0%
$4,000 - $6,650	1,377	62.5%	64.3%
$6,650+	714	59.3%	65.5%
Grand Total	18,552		

Figure 95

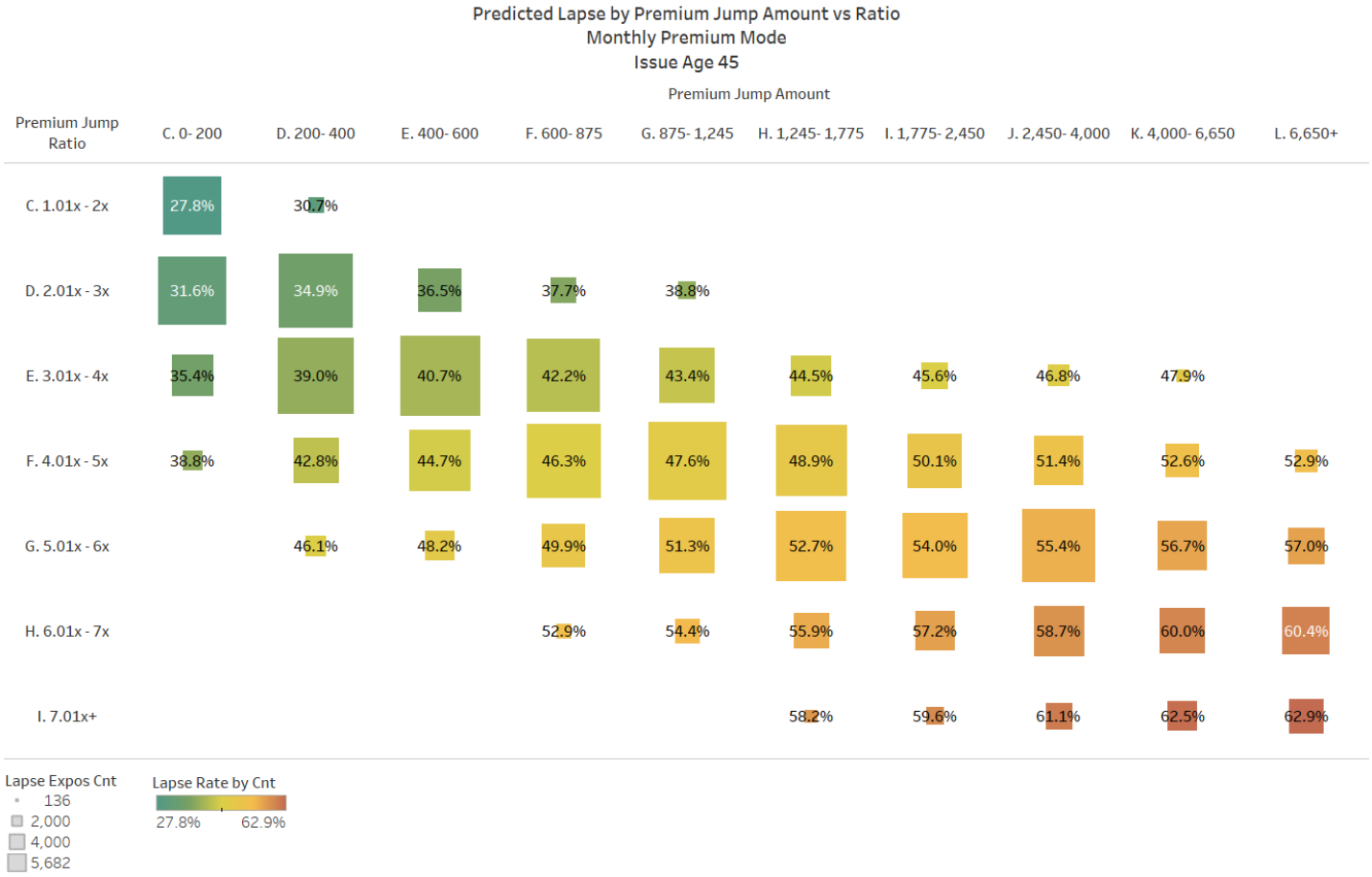
T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM JUMP AMOUNT (PREMIUM PAYMENT MODE = MONTHLY, ISSUE AGE BETWEEN 40-49) DURATION 10



The previous experience study analysis, as well as our examination of the Pearson correlation, have demonstrated that both measures of premium change (premium jump amount and ratio), are highly correlated. We investigate that further below.

Figure 96

PREDICTED LAPSE BY PREMIUM JUMP AMOUNT VS. RATIO MONTHLY PREMIUM MODE, ISSUE AGE 45



In the above chart, the size of the colored square in each cell is proportional to the lapse exposure by count. Unlike the plots in the actuarial study, the numbers are the relative factors on the lapse rate. As a result of multivariate regression, the distribution of these factors can capture the real impact of these two variables when all other variables are the same. In the above chart, premium mode has been isolated to be monthly and issue age is 45 whereas the chart on page 27 of the actuarial study represents all ages and premium modes. Compared to the actuarial chart, it is noticeable that the variation in factors is not the same as the lapse rate variation in the actuarial experience. For example, in the experience study, when the premium jump amount changes from "D.200-400" to "J.2450-4000" with the premium jump ratio in the group "G.5.01-6.00", the lapse rate change goes from 44.4% to 67.5% (an increase of 52.0%). The predictive modeling results show the corresponding factor changing from 46.1% to 55.4%, which is an increase of about 20.8% (see above chart).

For the observed lapse rate in the experience analysis, the change from one cell to the other includes not only the premium jump amount and ratio but also the effects of the other variables. The other variables may not have uniform distributions, especially the variables correlated with the premium change by the end of the level term (e.g., issue age, risk class, face amount, etc.). The predictive model captures the unbiased impact of the premium jump variable by removing the variations among the other variables.

D.6 Issue Age

Besides behavioral differences in policy lapsation as a function of age, the effect of age is also highly correlated with the different levels of premium jump amount. Therefore, an interaction term is included in the model to capture this relationship. The interaction term adjusts for the compound impact of both variables such that it will not overstate or understate their combined effect on the lapse rate. The table and plot below show the impact of issue age at a given premium jump amount and a smooth curve for issue age factors.

Table 54

T10 ACTUAL VS. PREDICTED LAPSE RATE BY ISSUE AGE (PREMIUM JUMP AMOUNT BETWEEN $1,245 – $1,775)

Issue Age	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
20-29	62	46%	43%
30-39	1,761	49%	51%
40-49	3,796	59%	60%
50-59	2,229	66%	68%
60+	143	64%	71%
Grand Total	7,991		

Figure 97

T10 ACTUAL VS. PREDICTED LAPSE RATE BY ISSUE AGE (PREMIUM JUMP AMOUNT BETWEEN $1,245 - $1,775) DURATION 10

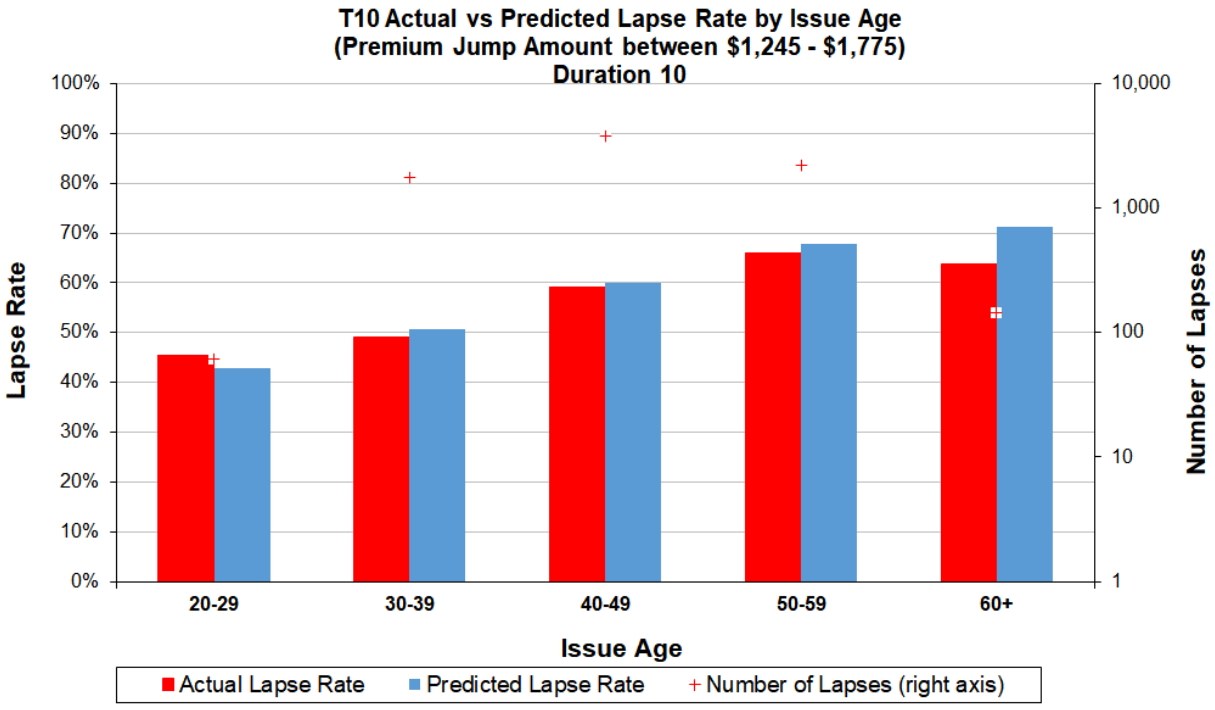
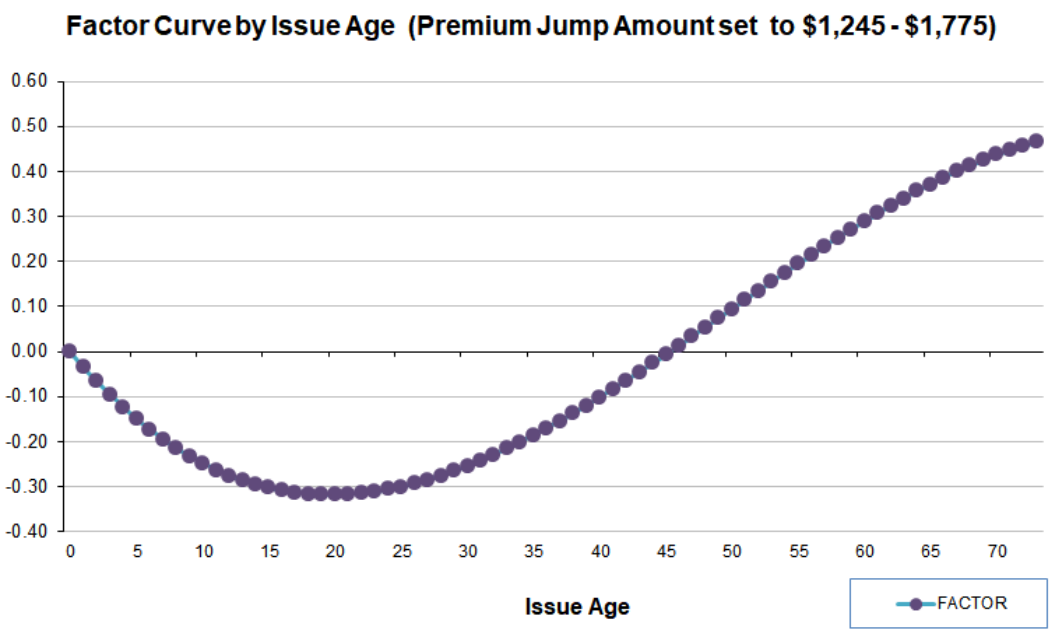


Figure 98

FACTOR CURVE BY ISSUE AGE (PREMIUM JUMP AMOUNT SET TO $1,245 - $1,775)



D.7: Premium Mode

The premium mode variable includes various categories where "monthly" and "annual" contain the most data, while the exposure of the other categories is small. As a result, all of the other categories were combined into the "annual" category. The lapse rate for monthly premium payment mode is at 54.4% of the annual mode, but the reduction in lapse rate decreases as the premium jump amount and ratio increases (as defined by the interaction terms in the model). For a one unit increase of premium jump ratio, the lapse rate increases by about 5% while as the premium amount increases by one unit ($100) the lapse rate increases by 0.3%.

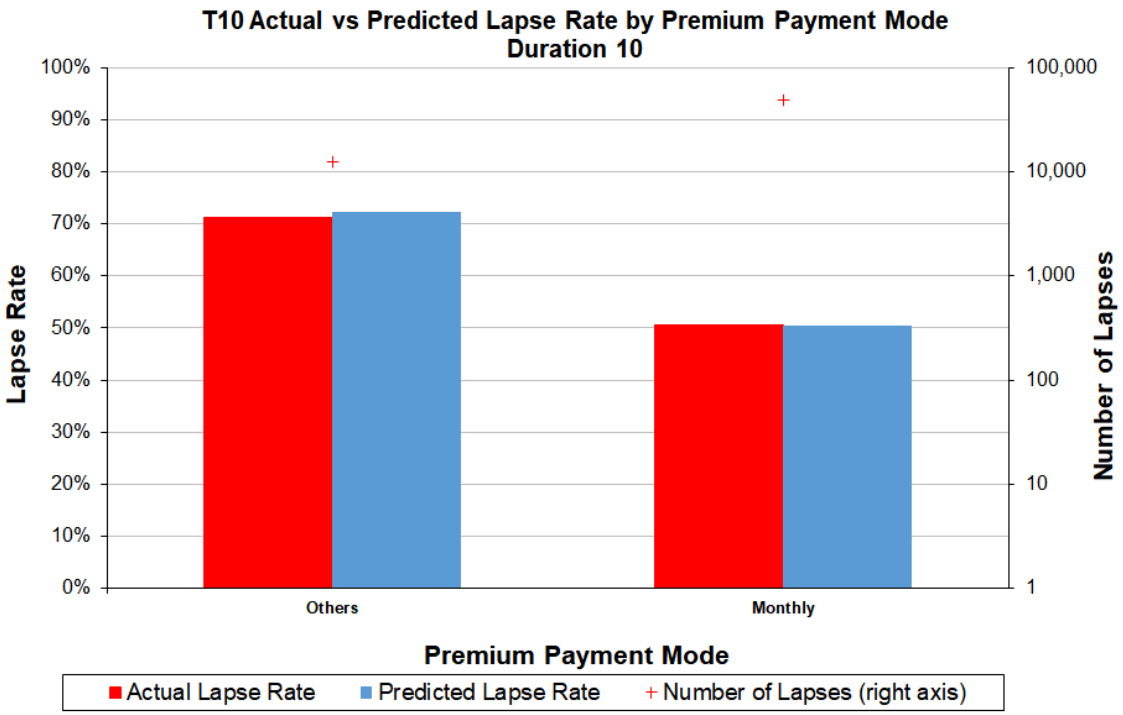
Table 55

T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM PAYMENT MODE

Gender	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
Others	12,331	71%	72%
Monthly	49,292	51%	51%
Grand Total	61,623		

Figure 99

T10 ACTUAL VS. PREDICTED LAPSE RATE BY PREMIUM PAYMENT MODE DURATION 10



D.8 Face Amount

The face amount variable is treated as ordinal in the current model. Typically, it's more effective to retain the granularity inherent in variables such as face amount instead of creating bands by grouping values. Banding continuous variables may result in information loss. However, the experience study analysis required banding for credibility purposes.

The table and plot below show the actual lapse rate vs. predicted lapse rate as a function of the face amount, with overlapping lapse counts.

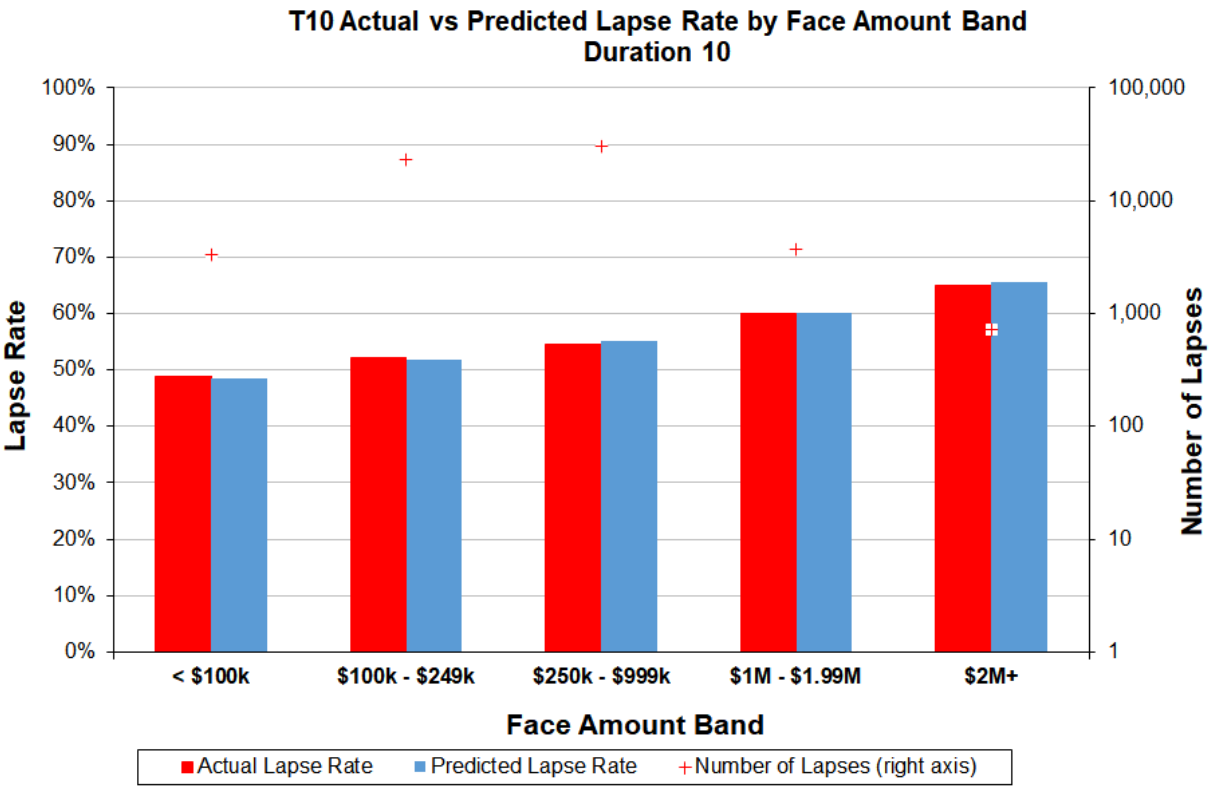
Table 56

T10 ACTUAL VS. PREDICTED LAPSE RATE BY FACE AMOUNT BAND

Face Amount Band	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
< $100k	3,328	48.8%	48.4%
$100k - $249k	23,457	52.1%	51.9%
$250k - $999k	30,418	54.6%	55.0%
$1M - $1.99M	3,694	60.0%	60.1%
$2M+	726	64.9%	65.7%
Grand Total	61,623		

Figure 100

T10 ACTUAL VS. PREDICTED LAPSE RATE BY FACE AMOUNT BAND DURATION 10



D.9 Risk Class

Risk class is intrinsically a nominal variable. The actuarial study defined risk class by grouping across a variety of levels and ultimately retained three. In this study, two levels are maintained for analysis. The table and plot below show model performance as a function of risk class.

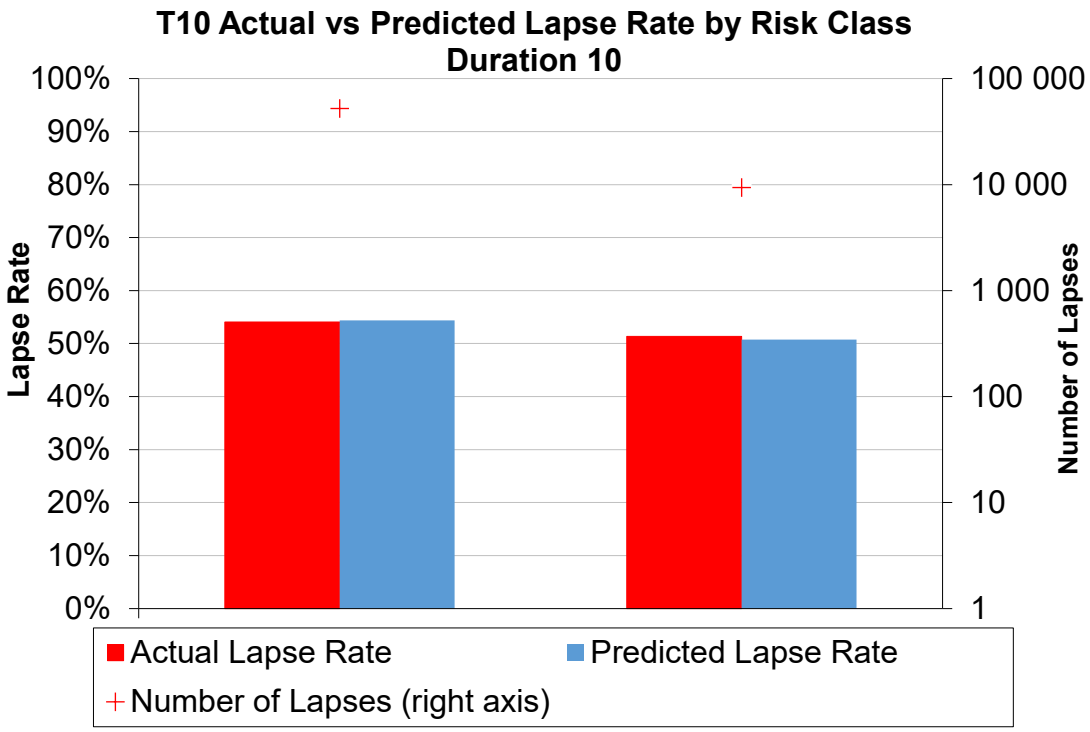
Table 57

T10 ACTUAL VS. PREDICTED LAPSE RATE BY RISK CLASS

Risk Class	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
Non-Smoker	52,269	54.1%	54.4%
Smoker	9,354	51.3%	50.8%
Grand Total	61,623		

Figure 101

T10 ACTUAL VS. PREDICTED LAPSE RATE BY RISK CLASS DURATION 10



The modeling exercise estimated that the difference in relative lapse rates between preferred non-smoking and standard non-smoking is about 0.7%. This estimated quantity is much smaller than the calculated lapse rates differences of 1.9% (53.1% vs. 54.1%) calculated in the actuarial experience study (pg. 53). The contrast of the small quantity of 0.7% obtained from the predictive model is a function of adjusting for all other variables simultaneously. The multivariate adjustment allows for the estimation of the isolated impact between the non-smoking classes directly as everything else is held on an equal basis. Since the 0.7% difference in lapse rates is not statistically significant, the non-smoking categories were combined into one group.

D.10 Gender

The difference between genders is relatively small. After accounting for other variables, the model results indicate that there is a constant factor between different genders, with the female lapse rate at 96.6% of males assuming other variables are the same.

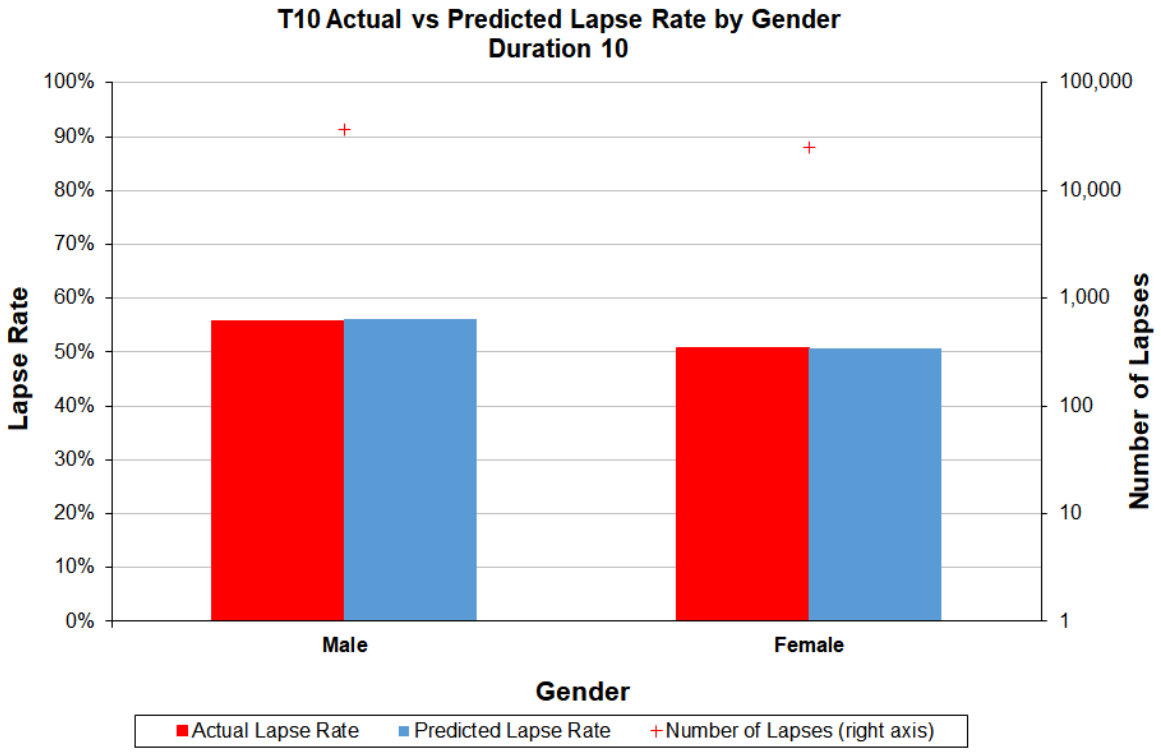
Table 58

T10 ACTUAL VS. PREDICTED LAPSE RATE BY GENDER

Gender	Actual Number of Lapses	Actual Lapse Rate	Predicted Lapse Rate
Male	36,772	56%	56%
Female	24,851	51%	51%
Grand Total	61,623		

Figure 102

T10 ACTUAL VS. PREDICTED LAPSE RATE BY RISK GENDER DURATION 10



D.11 Lapse Model Application

Predictive models can be applied to actuarial work in two ways. First, tables of factors can be generated directly from the model. This approach is consistent with current practice, and no additional changes need to be made to existing actuarial applications. There may be many tables and factors, and continuous variables may need to be grouped or banded in some way to reduce the complexity of the tables generated. The second approach incorporates taking the model formula as input directly into pricing and valuation software. This method is preferred as it allows for increased granularity in the predictions, which increases the accuracy of the assumptions.

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