LONGEVITY RISK TASK FORCE UPDATE

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Presentation to the NAIC's Life Risk Based Capital Working Group

Agenda

- Review charge of Longevity Risk Task Force (LRTF)
- LRTF working positions
- Review mortality improvement experience
- Limitations
- Next steps

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Charge to LRTF

- Guided by work of NAIC Joint LATF/LRBC Subgroup (LRSG)
- Assess approach for longevity risk charge in RBC, initially focusing on annuity products
- Per discussions with LRSG, consensus has been reached that statutory reserves sufficiently cover longevity risk via asset adequacy analysis. LRSG is evaluating whether guidance to the actuary is sufficient.
- Specific request for LRTF to evaluate:
  - An appropriate definition of a tail stress event
  - A potential RBC charge based on the difference between reported statutory reserves and statutory reserves using stressed mortality
  - An RBC charge expressed as a factor(s) applied to statutory reserves
- LRTF focused on methodology; the ultimate statistical safety level for the risk charge (i.e., time horizon and confidence level) will be defined by the regulators

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LRTF Current Views

- RBC charge should reflect the impact of a longevity stress on all future cash flows
- Tentative position is to exclude the potential effects of medical breakthroughs in the initial phase of establishing a risk charge and consider as a second phase
  - Significant public research performed by research professionals on potential medical breakthroughs
  - Differing opinions exist on the effect of medical breakthroughs on mortality improvement
  - Further discussion is needed to determine if potential effects should be included in RBC

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LRTF Current Views

- Statutory reserves are generally held at the 85th percentile level
  - Tabular plus any additional reserves from asset adequacy analysis
  - Capital requirements are established under the assumption that statutory reserves are adequate; RBC is not a balance sheet item and is not intended to make up for shortfalls in reserves
- RBC factors generally cover risks in excess of reserves up to a 95th percentile event
  - The longevity risk stress event is defined at the 1/200 mortality improvement level, using a 5-10 year time period
  - Mortality improvements up to the 85th percentile are assumed to be covered in reserves
- RBC charge will be based on difference between “current” Statutory reserve and Statutory reserve calculated under a longevity stress

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Treatment of Mortality Improvement

- Longevity risk comprised of:
  - Base table mis-estimation risk
  - Trend risk (i.e., mortality improvement)
  - Short-term mortality volatility risk
- LRTF is focusing on trend risk only
  - Base table mis-estimation; very difficult to separate mis-estimation risk from trend risk in historical data
  - Short-term volatility risk will have a small financial impact on longevity products

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Working Quantification of Stress Mortality

- LRTF analyzed historical population data over the period 1900-2013 using Social Security population data
- Calculated 1, 5, 10, 20, and 40 year rates of improvement by age bucket and gender
- Fit historical improvement data to a normal distribution to evaluate use of a normal model
- Developed a 95th %ile improvement event, focused on the 20-year historical period (which is conservative vs current RBC's typical 5-10 year horizon)
- Evaluated difference between 95th %ile and 85th %ile for use in RBC

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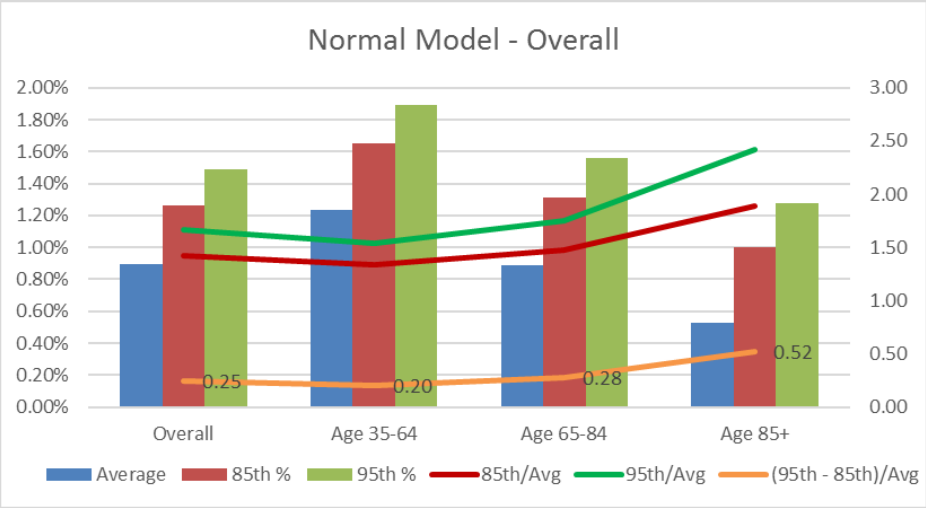
Calibration of Stress Event by Age – Normal Model



Bars show mean, 85th %ile, and 95th %ile annual improvement percentages

Lines show the difference between points on the distribution

- Average improvement (blue bars) has declined with age
- 85th and 95th percentile improvements relative to the average have increased with age. (red and green lines sloped up)
- Net difference between the 85th and 95th%ile outcome (orange line) is our focus for RBC
- Overall calibration using normal model results in a 25% shock (165% - 140%). The corresponding shock at an age group level would range from 20% to 52%

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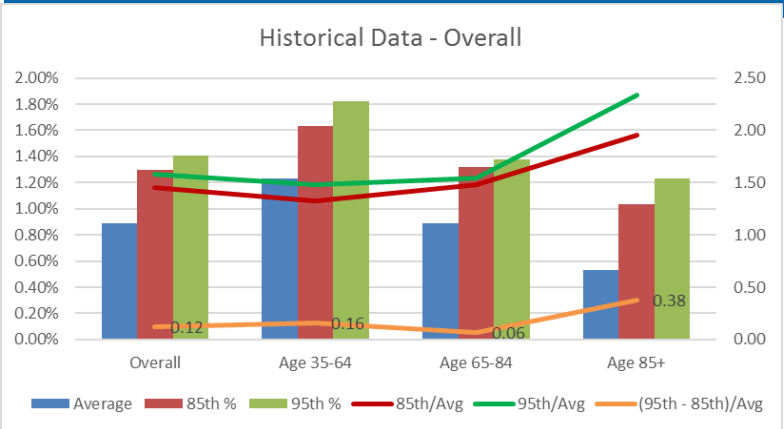
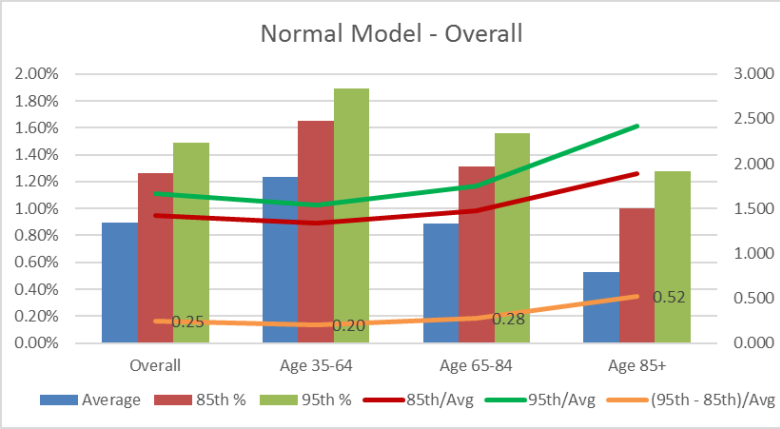
Historical Data vs Normal Model





- LRTF evaluated the average, 85th %ile, and 95th %ile observed directly from the data as well as after fitting the data to a normal model
- Historical implied stress from 85th to 95th percentile is lower than normal model for all age groups
- The normal model may not be a good fit
- But historical data contains only limited number of non-overlapping 20-yr periods making estimates of tail outcomes less reliable
- LRTF now leaning toward direct use of historical data

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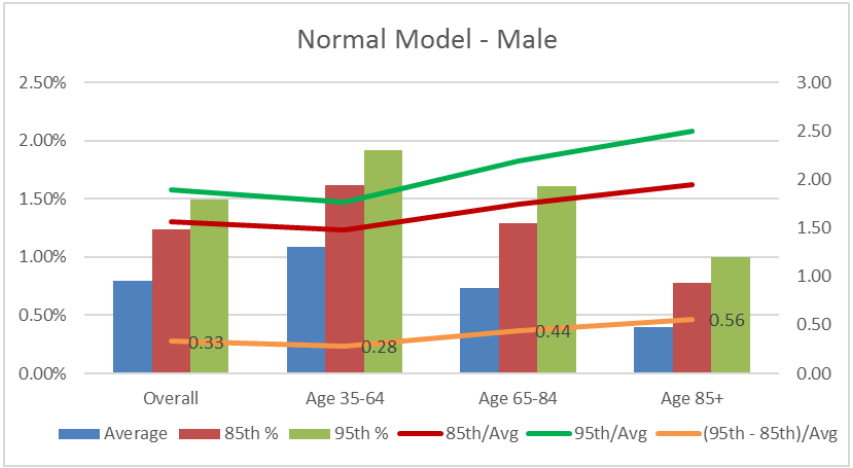
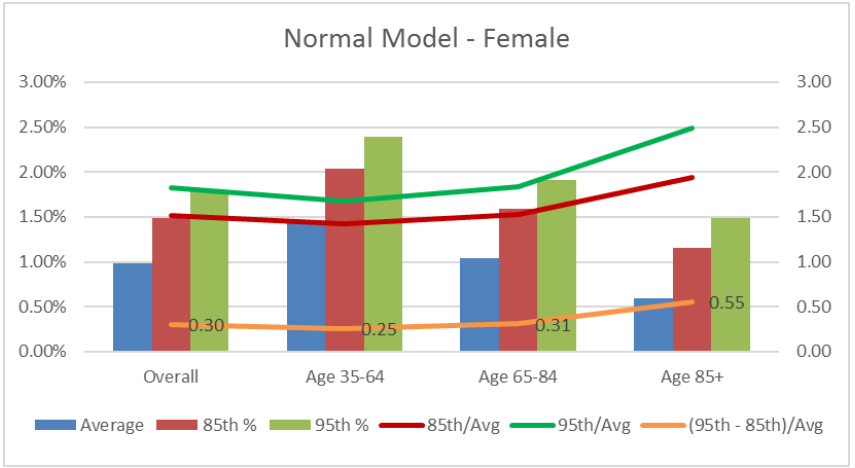
Impact of Gender on Mortality Improvement





Male and Female results are largely consistent based on either historical data or a normal model

Working position is to use the same shock across genders and below age 85, and a higher shock at ages 85+

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Current LRTF View on Stress Mortality Event for RBC

- Use historical data (not fitted to a normal curve) from a 20-year period
- Use the same shock across genders and below age 85, and a higher shock at ages 85+
- Overall calibration (95^{th} %ile - 85^{th} %ile) results in a 15% shock to mortality improvement (160% of base improvement - 145% of base improvement). The corresponding shock at an age group level would range from 6% to 38%.

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Limitations and Considerations

- Underlying data for derivation of stress event has limitations, so that resulting stress varies significantly depending on:
  - Data period used and # years evaluated
  - Direct use versus fitting to a distribution
- There is significant uncertainty in the estimate of an 85th to 95th percentile stress (currently defined as 15% of baseline)
- RBC charge under the proposed approach is dependent on the valuation rate, but that may not be appropriate to reflect in the current RBC construct
- Analysis focused on historical mortality data to define risk, without incorporation of different mortality risk events in the future

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Next Steps

- Presentation to Longevity Risk Subgroup; continue discussions with the LRBC
- Incorporate any regulator feedback
- Refine product definitions to include industry longevity offerings and understand current statutory reporting
- Consider inclusion of lifetime income products, which have not yet been evaluated
- Develop specifications for field testing
- Identify group to conduct company field testing
- Refine methodology

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Appendix

Historical Mortality Improvement Data

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Data Table for 20 Yr Mortality Improvement Calibration

Historical									
Male	Average	Median	85th %	85th/Avg	85th/50th	95th %	95th/Avg	95th/50th	(95th - 85th)/Avg
Overall	0.79%	0.79%	1.31%	1.65	1.66	1.44%	1.82	1.82	0.17
Age 35-64	1.09%	1.03%	1.64%	1.51	1.59	1.85%	1.70	1.80	0.20
Age 65-84	0.74%	0.68%	1.28%	1.74	1.87	1.74%	2.36	2.54	0.63
Age 85+	0.40%	0.39%	0.76%	1.91	1.98	1.00%	2.51	2.59	0.59
Female	Average	Median	85th %	85th/Avg	85th/50th	95th %	95th/Avg	95th/50th	(95th - 85th)/Avg
Overall	0.98%	1.07%	1.53%	1.55	1.42	1.67%	1.70	1.55	0.15
Age 35-64	1.43%	1.28%	2.23%	1.56	1.75	2.54%	1.78	1.99	0.22
Age 65-84	1.04%	1.18%	1.61%	1.55	1.37	1.74%	1.67	1.47	0.12
Age 85+	0.60%	0.65%	1.17%	1.96	1.79	1.50%	2.50	2.29	0.54
Overall	Average	Median	85th %	85th/Avg	85th/50th	95th %	95th/Avg	95th/50th	(95th - 85th)/Avg
Overall	0.89%	0.91%	1.30%	1.46	1.43	1.41%	1.58	1.55	0.12
Age 35-64	1.23%	1.28%	1.63%	1.33	1.28	1.83%	1.48	1.43	0.16
Age 65-84	0.89%	0.96%	1.32%	1.48	1.37	1.37%	1.55	1.43	0.06
Age 85+	0.53%	0.46%	1.03%	1.96	2.26	1.23%	2.33	2.69	0.38
Normal Model									
Male	Average	Median	85th %	85th/Avg		95th %	95th/Avg		(95th - 85th)/Avg
Overall	0.79%	0.79%	1.24%	1.56		1.50%	1.89		0.33
Age 35-64	1.09%	1.09%	1.61%	1.48		1.92%	1.77		0.28
Age 65-84	0.74%	0.74%	1.29%	1.75		1.61%	2.19		0.44
Age 85+	0.40%	0.40%	0.77%	1.95		1.00%	2.50		0.56
Female	Average	Median	85th %	85th/Avg		95th %	95th/Avg		(95th - 85th)/Avg
Overall	0.98%	0.98%	1.49%	1.52		1.79%	1.82		0.30
Age 35-64	1.43%	1.43%	2.04%	1.43		2.40%	1.68		0.25
Age 65-84	1.04%	1.04%	1.59%	1.52		1.91%	1.83		0.31
Age 85+	0.60%	0.60%	1.16%	1.94		1.49%	2.49		0.55
Overall	Average	Median	85th %	85th/Avg		95th %	95th/Avg		(95th - 85th)/Avg
Overall	0.89%	0.89%	1.27%	1.420		1.49%	1.67		0.25
Age 35-64	1.23%	1.23%	1.65%	1.34		1.89%	1.54		0.20
Age 65-84	0.89%	0.89%	1.31%	1.47		1.56%	1.75		0.28
Age 85+	0.53%	0.53%	1.00%	1.89		1.28%	2.41		0.52

Improvement stress of 145% and 160% for 85th and 95th percentiles based on Historical Data (net stress is 15%)

Improvement stress of 140% and 165% for 85th and 95th percentiles based on Overall Normal Model Results (net stress is 25%)

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