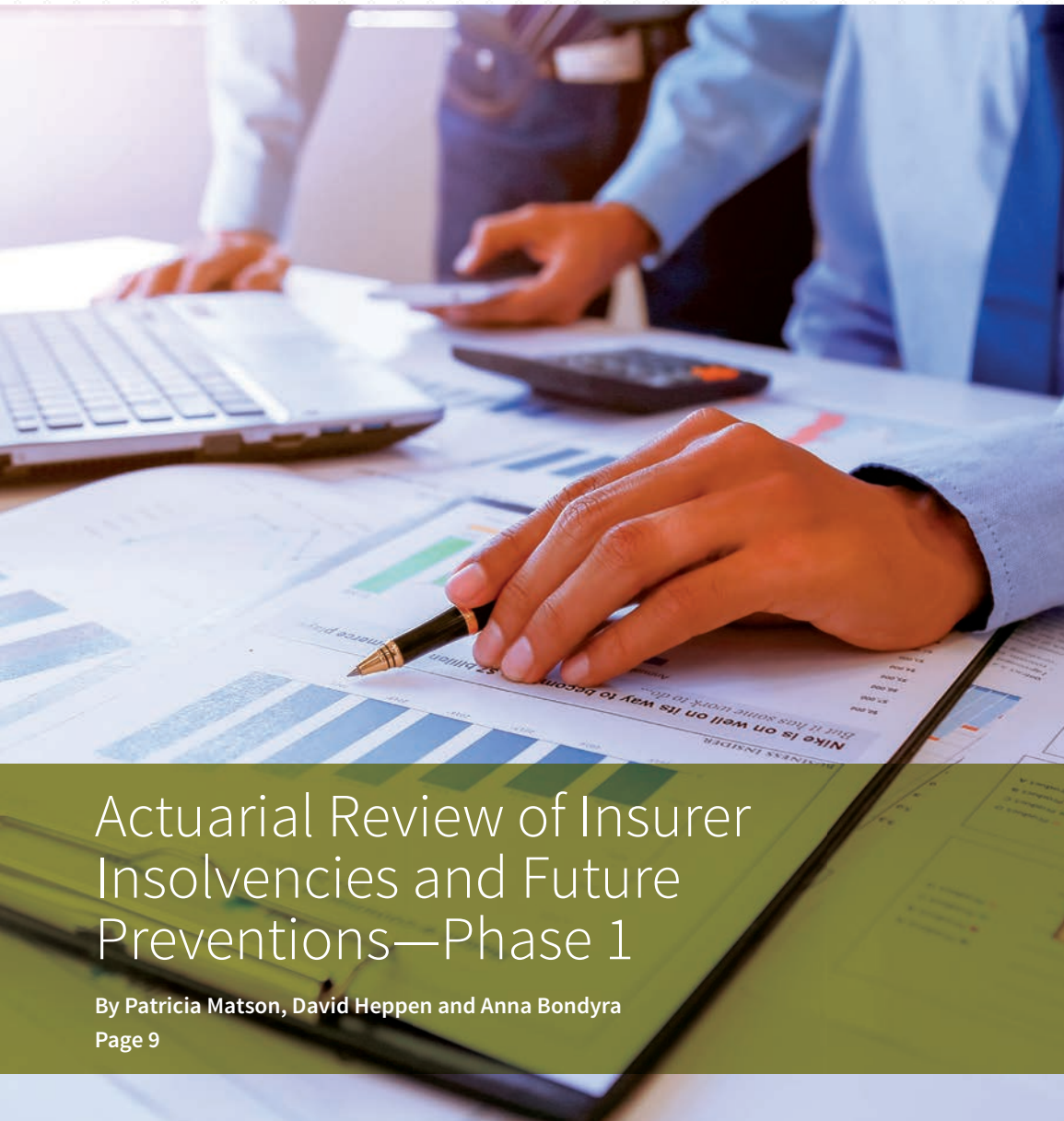


# Risk Management

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MANAGEMENT  
SECTION

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This newsletter is free to section members. Current issues are available on the SOA website ([www.soa.org](http://www.soa.org)).

To join the section, SOA members and non-members can locate a membership form on the Joint Risk Management Section webpage at <https://www.soa.org/sections/joint-risk-mgmt/>.

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### Publication Schedule

Publication Month: August 2019  
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The digital edition of this newsletter can be found at <https://www.soa.org/sections/joint-risk-mgmt/>.

# Chairperson's Corner

By Mario DiCaro

I was recently asked to participate in a survey and specify my opinion on the top five risks from an enterprise risk management (ERM) perspective. I've read the consolidated responses to these surveys many times and contributed to them occasionally. This time the open framing of the question gave me pause. I realized that without context regarding the industry, country or time frame, I was mentally drilling further down into my standard responses to this question.

For example, if the survey had specified "top five risks to property and casualty insurers over the next two years," I would have given a different response than if it had specified "top five risks to the SETI program over the next 30 years." What I came up with was a somewhat sarcastic response that I'll summarize into what I think are the universal risks ERM should monitor:

- The belief that rules keep you safe; and
- The very real possibility of important issues falling through the cracks.

Rules don't keep you safe. Following a rule keeps you safe from the specific danger, or set of dangers, the rule was designed to protect you from. One of the main rules of driving in the U.S. is to drive on the right side of the road. Suppose you are driving on a two-lane twisting mountain highway. The mountain rises to your right. The oncoming lane is to your left. Beyond that is a thousand-foot drop. At times you can see for hundreds of yards ahead and the turns are safer if you straddle the center lane. What do you do? I often straddle the lanes. This leads to screams of terror from my children, who understand the rule that one should drive on the right side of the line but have no experience driving. Maybe I'm wrong, though, and should just slow down. What do you do?

I recently attended a presentation by a power-generating-facilities expert. The subject was cyber risk. He had numerous examples of policies that were in place securing the networks of these companies. The audience raised a couple of real-life examples of breaches that had occurred. He responded by pointing out the specific failures of adherence to rules that had accompanied those breaches, but he maintained his view that the facilities were safe. A few months later I was reading in the



newspaper of a widespread hacking campaign that had breached multiple power-generating facilities by targeting weak points in the networks of various contractors servicing the facilities. No number of rules can stop these sorts of deliberate attacks. Only with very vigilant, creative, engaged employees would you stand a chance. Even then things will still get through the cracks.

Which leads me to the next type of risk: things falling through the cracks. Or, in the case of cyber risk, things being extracted through the cracks. In volleyball sometimes two players will watch as the ball lands between them. From a corporate perspective, the ball is likely invisible if it is falling between two different zones of responsibility. Not only does nobody call it, but nobody can see it. ERM teams should be actively looking for intersecting zones of responsibility to see that risks aren't falling through the cracks. ERM teams are often referred to as the second or third line of defense. If you find yourself on one of these teams, I recommend you take responsibility for the spaces between those positioned on the first and second lines. Some examples of such issues are fungibility of assets, correlation or clash of claims across lines of business and efficient use of reinsurance. You may be the only team in the company in a position to identify and quantify these issues. ■



Mario DiCaro, FCAS, CERA, MAAA, is VP, capital modeling and analytics, at Tokio Marine HCC. He can be reached at [mdicar@tmhcc.com](mailto:mdicar@tmhcc.com).

# Editor's Note

By Cheryl Baoyan Liu

Through various communications, we heard from readers and received their feedback on the newsletter asking for more risk research reports. With support from the Society of Actuaries (SOA) research team, I'm glad to introduce an issue dedicated to research reports in this May 2019 *Risk Management*.

The feature article is a study on root cause in insurer insolvencies and impairments, jointly sponsored by the Canadian Institute of Actuaries, the Casualty Actuarial Society and the Society of Actuaries. This research studies insolvencies and impairments occurring between 1998 and 2015 across property and casualty, life and annuity, and health insurance in the United States and Canada. The study looks at the decisions made by the management team, regulators and policyholders over the life cycle of the insolvency. There are four phases in this research project. The core section of the Phase I study is published in this issue of the newsletter. A full version of the study can be found on the SOA website.

The second article gives the highlights of the most recently published Joint Risk Management Section (JRMS) surveys on policyholder behavior in the tail (PBITT). The JRMS is seeking to develop better estimates of PBITT. A PBITT working group has been established to examine and ultimately give guidance to actuaries on how to set policyholder assumptions in extreme

scenarios. As part of its work, the PBITT working group issues two surveys each year that gather the range of assumptions actuaries use in pricing, reserving and risk management of universal life with secondary guarantees and minimum guarantees on variable annuities. The author has summarized in this article the critical assumptions and findings of the report. Links are provided to the full reports.

The third article is on the topic of the Committee of Sponsoring Organizations of the Treadway Commission's (COSO) guidance on enterprise risk management (ERM) frameworks. The 2017 update to the guidance stresses the importance of considering risk both in the strategy-setting process and in driving performance. Through a real-world COSO implementation example, this article presents an approach that allows organizations to achieve the ERM-strategy link.

"Thoughts on How an Actuarial Control Cycle can Apply to Accelerated Underwriting," by Tim Morant, is on the analytical discussion front of life insurance underwriting. I think this is a nice addition to this research-focused newsletter as it maps out the evolution of underwriting technique and the impact on assumptions that inform pricing. I view this as another form of predictive analytics, which we discussed extensively in the newsletter in 2018.

As usual, a list of recent articles and papers is provided that may be of interest to our members. These pieces can provide further information on a broad range of topics.

Almost every issue of *Risk Management* in the past five years, I ended the Editor's Note by thanking Kathryn Baker and David Schraub for their help in putting the newsletter together. In this issue, we say farewell to Kathryn, our SOA editing partner, who had supported the *Risk Management* newsletter for almost 13 years. She is professional and was great at keeping us on track and managing the newsletter publication. I wish her the best in her new chapter of life.

I would like to give a special thank you to Florian Richard, the JRMS section secretary, who coedited this newsletter. Also, my sincere appreciation to David Schraub, Julia Anderson Bauer and Katherine Pickett for their support in making this research-focused newsletter possible.

Happy reading! ■



Cheryl Baoyan Liu, FSA, CFA, is senior manager, risk management at FWD Life Insurance Company (Bermuda) Limited in Hong Kong. She can be reached at [cheryl.by.liu@fwd.com](mailto:cheryl.by.liu@fwd.com).



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# Staff Corner

By David Schraub

**T**he Society of Actuaries (SOA), the Casualty Actuarial Society (CAS) and the Canadian Institute of Actuaries (CIA) jointly sponsor the Joint Risk Management Section (JRMS). In turn, the JRMS allocates resources to research projects through the Joint Risk Management Research Committee (JRMRC). As the JRMRC is technically part of the SOA research, my staff corner this month focuses on how the JRMRC fits into that framework. You can read how the CIA and CAS do research in the sidebar that accompanies this article.

The Society of Actuaries' mission statement reads: "Through education and research, the SOA advances actuaries as leaders in measuring and managing risk to improve financial outcomes for individuals, organizations and the public." The Joint Risk Management Section newsletter is an example of how the SOA provides practical, high-quality educational material. This is largely done through volunteers, as is the research that the SOA conducts.

Let me provide an overview of how research is conducted and describe the recent introduction of Strategic Research Programs. I hope to also encourage you to become involved in research by either volunteering your time to help oversee a report or doing some research yourself.

Essentially, there are two broad types of SOA research: topical research focused on advancing actuarial practice (practice research) and research that analyzes industry data and usually results in the creation of tables (experience studies).

Practice research can be done either in-house or externally. If conducted in-house, an SOA staff member primarily conducts research guided by a team of volunteers (called a modeling oversight group) by accessing industry databases and other resources. If done externally, normally the SOA hires an outside party through a request for proposal. The process for developing and issuing a request for proposal is overseen by a research committee that is another type of volunteer group with broad knowledge on a specific practice area.

For risk management-related projects that support the JRMS members, the JRMRC vets research proposals on a variety of finance and investment topics. The research is generally



conducted under the supervision of a project oversight group. This group comprises dedicated volunteers with expertise on the specific topic covered by the request for proposal. The group is recruited to provide meaningful comments to the researcher along the way to produce a high-quality report. It is truly a collaborative process that benefits from the partnership of expert volunteers and highly qualified researchers. SOA research staff support the process from the initial idea to the resulting publication.

The SOA conducts experience studies to provide actuaries with robust data that can be used for pricing and reserving. Experience studies have been undertaken for the major product lines of life insurance companies, as well as for more specialized financial products and subsidiary benefits. The SOA also sponsors continuing studies of the experience of public and private sector pension plans. Many of the SOA's studies have been conducted on a recurring basis over an extended period of time. Usually, the process includes study feasibility, study design, data vendor/researcher selection, data collection, data validation and aggregation, data analysis, report development and report publication and closure.

Topics of research undertaken by the SOA are aligned with the practice area expertise and work experience of the individual research committees. These research committees develop ideas and oversee the process leading to publication of reports. Historically, research topics were broadly categorized by the

Fellow of the Society of Actuaries tracks. To further leverage the research work the SOA has traditionally conducted, the SOA Board approved in October 2017 the introduction of five strategic research programs. The advantage of the programs is to take a more holistic approach to select research themes resulting in even more impactful information and enhancement of the reputation of actuaries. Moreover, the programs are intended to raise awareness of the skill set of actuaries to the general public and continue to demonstrate the thought leadership of the SOA. And they will help to make actuaries even more relevant in an evolving society. They include practice research and experience studies, as appropriate. These five strategic research programs, to be launched one at a time, include the following research themes:

- **Aging and retirement.** Reviews the societal impact of aging populations and the solutions for mitigating risks.
- **Actuarial innovation and technology.** Highlights the evolution of technology as it applies to the actuarial profession, industry and population trends.

- **Mortality and longevity.** Examines the factors impacting models and mortality predictions, as well as the analysis of longevity trends.
- **Health care costs.** Focuses on the forces that shape health care cost and utilization and the changes over time.
- **Catastrophe and climate.** Studies climate trends and their impact on extreme and catastrophic events.

In addition to the strategic research programs, there are other ways that research is conducted by the SOA. Going forward, a special pool of funding will be established for research that meets the needs of current events from all areas of practice in which members of the SOA are involved. Examples of current events would include research performed to better understand aspects of principle-based reserves and new developments on the Affordable Care Act (commonly referred to as Obamacare). In addition, SOA sections will continue to sponsor research for the benefit of their members and other audiences. This is what the JRMS has done and will do through the JRMSRC.

### CASUALTY ACTUARIAL SOCIETY

To facilitate research, the Casualty Actuarial Society (CAS) has a number of committees dedicated to the production and oversight of research projects. Some of these committees focus on specific practice areas like ratemaking, reinsurance and reserving. The Theory of Risk Committee (COTOR) and the Dynamic Risk Modeling Committee (DRMC) are tasked with the theoretical and applied analysis of risk. In addition, there are task forces for narrow topics like climate change, cyber risk, automated vehicles and other areas. Finally, the CAS often creates working parties for research that is particularly focused.

The various groups typically oversee work that is outsourced to volunteers, academics or other researchers through a request for proposal process. In addition, the standing research committees support regular call paper programs. Brian Fannin is the CAS's research actuary and assists the committees with the development of project ideas.

The CAS has a dedicated research budget and looks for new and innovative ways to produce and promote research within the industry. The CAS also partners with other actuarial associations, such as the SOA, IFoA and CIA.

Dave Core is director of professional education and research at the Casualty Actuarial Society. He can be reached at [dcore@casact.org](mailto:dcore@casact.org).

### CANADIAN INSTITUTE OF ACTUARIES

The Canadian Institute of Actuaries (CIA) Research Council (REC) manages research projects through the Experience Research Committee, the Academic Research Committee and dedicated project oversight groups (POGs). In most cases, external groups such as universities or independent research firms conduct the actual research, with the relevant committee overseeing the project. Shlomit Jacobson serves as manager of research, providing project management and strategic support to research activities.

The CIA commits significant resources to research, allocated to four project category types: experience, academic, topic-specific and member papers. Aligning with the institute's strategic priorities, funding for each category varies annually, influenced by industry trends and topics of public importance. The CIA welcomes opportunities to partner with other associations, including the SOA, the Institute and Faculty of Actuaries and CAS, and with business and academic organizations.

Shlomit Jacobson, Ph.D., MBA, is manager, Research, at the CIA. She can be reached at [Shlomit.Jacobson@cia-ica.ca](mailto:Shlomit.Jacobson@cia-ica.ca).

Lastly, the SOA supports academic research through a grant program.

Sometimes a particular project will have resource needs too great for an individual research committee or will span several practice areas. In such cases, the work is usually financed through collaboration of several SOA research committees or sections. And often, funding or other support will be provided by external parties such as the Canadian Institute of Actuaries, the Casualty Actuarial Society or others.

Two kind words: The first goes to the research department and particularly to Steve Siegel and Ronora Stryker. Thank you for the great work you do for the section and the SOA in general, and for me by reviewing this Staff Corner. Second goes to you, the reader of the newsletter. Thank you for your

interest. Please consider this an open invitation to raise your hand with an idea or interest in helping on a research committee or a project oversight group. Contact me at [dschraub@soa.org](mailto:dschraub@soa.org), and I will be more than happy to point you in the right direction. ■

#### USEFUL LINK

Joint Risk Management Research Committee, <https://www.soa.org/research/topics/risk-mgmt-topic-landing/>.



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# Actuarial Review of Insurer Insolvencies and Future Preventions—Phase 1

By Patricia Matson, David Heppen and Anna Bondyra

**Editor’s Note:** For the feature article of this issue of Risk Management, we’re pleased to bring you an adapted excerpt from the research report Actuarial Review of Insurer Insolvencies and Future Preventions, jointly sponsored by the Canadian Institute of Actuaries (CIA), the Casualty Actuarial Society (CAS) and the Society of Actuaries (SOA). This research studies insolvencies and impairments occurring between 1998 and 2015 across property and casualty, life and annuity, and health insurance in the United States and Canada. The study looks at the decisions made by the management teams, regulators and policyholders over the life cycle of the insolvency. There are four phases in this research project. The core section of the Phase I study—Section 2: Risk Factor Analysis—is published here. For the research background, all figures and the full report, visit the SOA website: <https://www.soa.org/research-reports/2018/actuarial-review-insurer-insolvencies/>.

## RISK FACTOR ANALYSIS

Some insurer insolvencies point to one primary causal driver, such as fraud. A majority of the insolvencies evolved from multiple risk factors. Further, the underlying causes can be interrelated or unrelated to one another. These dynamics add complexity to any study of insolvency risk drivers.

Many prior studies of insolvency isolate and attempt to quantify the impact of individual risk drivers. When factors are interrelated, this becomes a challenging and potentially highly judgmental exercise. We have reviewed individual risk factors and commented on potential impact from a qualitative perspective, but we have not attempted to quantify the impact on insolvency as a whole.

We focused on risk factors that can be used as leading rather than lagging indicators. This was accomplished by analyzing many of the risk factors over a five-year period prior to the insolvency.

U.S. insolvencies peaked in the early 1990s. Property and casualty (P&C) insolvencies far outnumber life and health. Health insolvencies increased in 2015 (and this has continued in 2016 and 2017). Health cooperatives in particular have had a significant incidence of failure in the U.S.

The Canadian regulatory system is more centralized than the U.S., leading to the question of whether this centralization has potentially contributed to lower insolvency rates. However, though U.S. insurer insolvency rates are higher than Canada’s, the U.S. system has shown decreases in insolvency rates over time (Figures 1 and 2). The U.S. has also developed centralized tools over time, such as risk-based capital (RBC) and the Own Risk and Solvency Assessment, which give regulators additional monitoring opportunities.

Health insolvencies increased in 2015. Health cooperatives in particular have had a significant incidence of failure in the U.S.

Risk factors identified as significant in this research share a number of commonalities with previous Canadian research. Key P&C insolvency drivers identified in Canadian industry research include the following:

- Pricing inadequacy/reserve deficiencies (also noted as significant for the U.S.);
- Number of years in operation; and
- Rapid growth (also noted as significant for the U.S.).

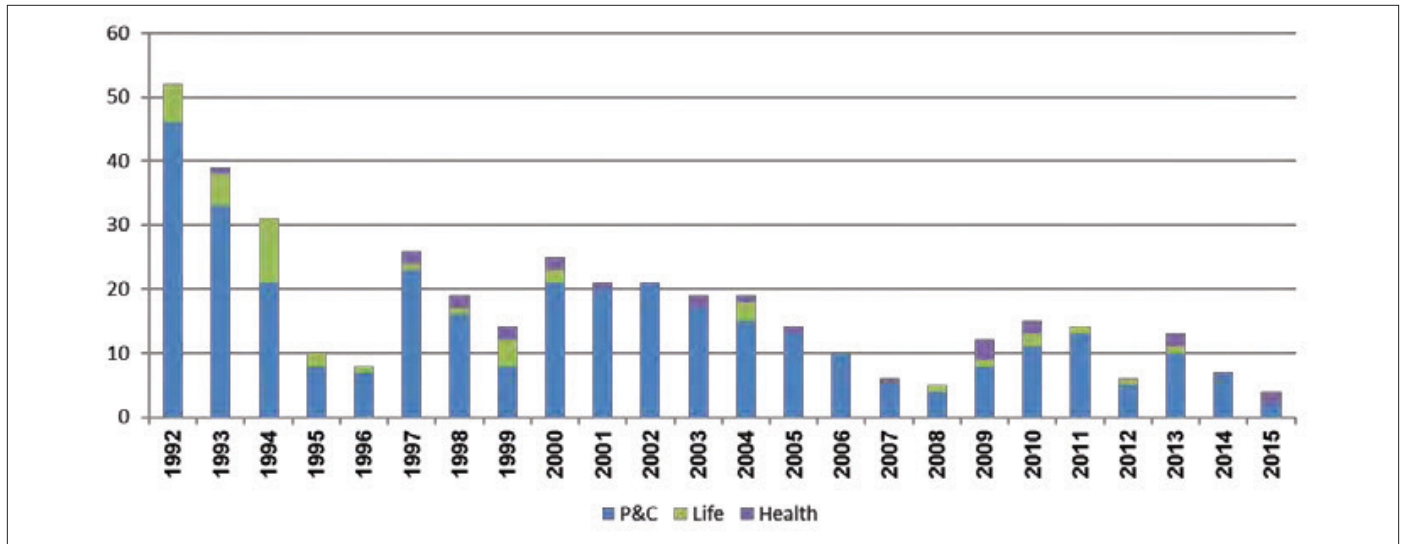
Other key factors noted in this research for the U.S. include the following:

- Liquidity;
- Investment risk; and
- Capital position (measured by risk-based capital (RBC) ratio).

## Research and Literature Review

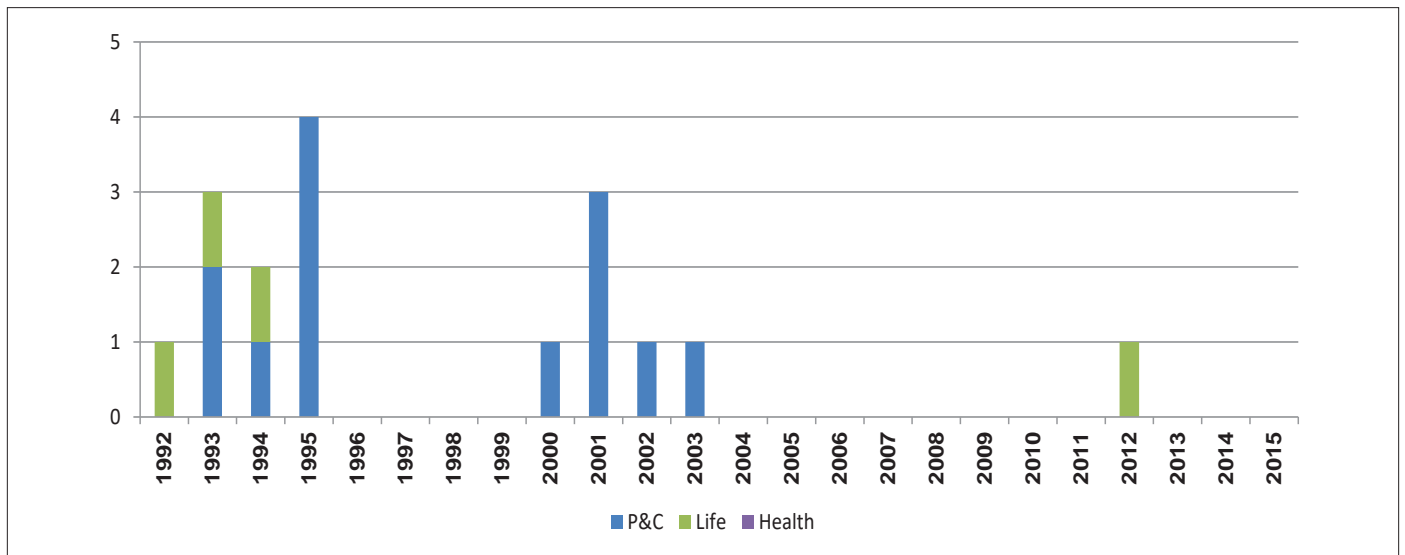
As a foundation for this study, we reviewed numerous prior works published by various U.S. and Canadian organizations and industry experts. A listing of sources considered in this research is included in the References (see full report).

Figure 1  
Historical Number of U.S. Insolvencies by Year by Product Type



Sources: National Conference of Insurance Guaranty Funds (NCIGF) and the National Organization of Life & Health Insurance Guaranty Associations (NOLHGA).

Figure 2  
Historical Number of Canadian Insolvencies by Year by Product Type



Sources: Assuris and Property and Casualty Insurance Compensation Corporation (PACICC).

This research differs from most prior insurance industry studies in that it includes representation from P&C, life and health companies in the analysis of underlying risk drivers.

Many of the risk factors for insolvency that were highlighted in prior works served as a starting point for the risk factors used in this study. However, the researchers made certain judgments in the measurement of particular risk factors, such as liquidity and profitability. These judgments were made in consultation with the Project Oversight Group.

**Risk Factor Analysis: Findings and Observations**

The risk factors we analyzed can be categorized as financial and demographic. Financial risk factors include premium growth, profitability, liquidity, investment mix, leverage and RBC ratio. Demographic risk factors include company size, years in operation, geographic concentration and product concentration.

Overall, our analysis suggested that the financial risk factors were useful indicators for insolvency. The financial risk factors in the insolvent sample analyzed generally show a greater proportion in higher risk brackets when compared to the industry. The demographic risk factors analyzed showed a less significant relationship between risk levels within the insolvent sample and the industry.

We found some commonality across financial risk factor strength by cohort. For example, the P&C personal lines had similar financial indicators. Health cooperatives appeared to show higher risk overall, confirming their unique operating model. Life and annuity proved to be differentiated in both leverage and years in operation risk factors. P&C commercial liability had indications that were more challenging to interpret (Figure 3).

Consistent with our U.S. review, Canadian studies by the Property and Casualty Insurance Compensation Corporation (PACICC) showed growth and profitability (pricing) as leading factors in insolvency. They also highlighted foreign parent as a significant factor, which was less evident in our review of U.S. companies.

**Premium Growth**

Significant premium growth in short time frames may be problematic for any insurer. Industry studies from the PACICC found that rapid growth was a primary cause of 17 percent and a contributing cause to 43 percent of P&C insolvencies in Canada.

Our review of premium growth as a risk factor among cohorts within the insolvent sample shows a varied risk mix (Figure 4).

Figure 3  
Summary of Strongest Risk Factors by Cohort

		P&C Personal Auto	P&C Homeowners	P&C Workers Compensation	P&C Commercial Liability	Life & Annuity	Health incl. LTC	Health Cooperatives
Financial	Premium Growth	X	X	X	X	X	X	X
	Profitability		X	X	X		X	X
	Liquidity	X	X	X		X	X	X
	Investment	X	X	X	X	X		
	Leverage			X		X	X	
	Risk-Based Capital	X	X			X	X	X
Demographic	Company Size (S/M/L)	X				X		
	Number Of Years In Operation		X					X
	Geographic Concentration			X				X
	Product Concentration		X	X	X			

The homeowners and health cooperative cohorts have the largest proportion of high-growth companies within the insolvent companies.

A review of premium growth in the insolvent sample relative to the industry sample shows a higher risk mix in the insolvent sample, with the exception of commercial liability (*Figure 5*). This suggests that growth is a strong indicator of insolvency risk.

**Profitability**

There are specific examples of insolvencies that appear to result primarily from price inadequacy. For purposes of this study, we defined profitability as the cumulative five-year operating loss as a percentage of the initial (positive) adjusted capital (as measured by RBC) during the insurer’s last five complete years of operation.

A review of profitability as a risk factor among cohorts within the insolvent sample shows personal auto and the health-related cohorts as the most susceptible to profitability issues.

A review of profitability in the insolvent sample relative to the industry sample shows a higher risk mix in the insolvent sample, with the exception of personal auto and life/annuity. This suggests that profitability is a strong indicator of insolvency risk (*Figure 6*).

A PACICC study by Suela Dibra and Darrell Leadbetter (“Why Insurers Fail,” 2011) examines profitability using a different metric: reserves as a percentage of premium. This too pointed at price inadequacy as an insolvency driver (*Figure 7*).

**Liquidity**

For purposes of this study, we considered negative operating cash flow as indicative of liquidity risk. We ranked companies by the number of years within the last five during which negative operating cash flow occurred.

A review of liquidity in the insolvent sample to the industry sample shows a higher risk mix in the insolvent sample, with the exception of commercial liability. This suggests that liquidity challenges may be a significant indicator of insolvency risk (*Figure 8*).

The “Why Insurers Fail” Canadian study did not note liquidity as a significant risk factor. It is important to note that this study focused on P&C companies only and did not define liquidity in the same manner as used in this study.

The results suggest that in general for P&C, life and health companies, the occurrence of multiple years of negative operating cash flow is potentially a significant indicator of insolvency risk.



**Investment**

We defined investment risk based on the proportion of invested assets held in bonds and short-term investments (relatively “safe” instruments) as compared to total assets.

A review of investment in the insolvent sample to the industry sample shows a higher risk mix in the insolvent sample, with the exception of the health insurance cohorts. This suggests that investment mix may be a strong risk indicator for insolvency (*Figure 9*).

PACICC Canadian studies have also found higher concentrations of investments in relatively high-risk categories associated with insolvency risk (*Figure 10*).

**Risk-Based Capital Ratio**

The introduction of RBC requirements in the U.S. in 1994 sought to provide added measures to curb insolvency, by providing a metric to help identify weakly capitalized companies. While RBC is not an all-encompassing tool for solvency monitoring, it is notable that the rates of insurer insolvency in the U.S. declined significantly following the adoption of RBC.

A review of RBC ratio in the insolvent sample relative to the industry sample shows a higher risk mix in the insolvent sample. This suggests that RBC continues to be a strong indicator of potential insolvency risk (*Figure 11*).

There are potential challenges to using RBC as a predominant leading indicator for insolvency risk, however. To illustrate this challenge, we note the following with respect to the workers’ compensation insolvencies:

- 31 percent of insolvent workers’ compensation (WC) insurers had RBC ratios greater than 200 percent across a five-year history;
- 50 percent of insolvent WC insurers had a negative RBC ratio in the last year sampled;
- Of those with negative RBC, the years preceding showed a 20 percent–30 percent RBC decrease; and
- Most insolvent WC insurers had significant year-over-year volatility in RBC ratio in at least one annual period.

Further, the range of RBC values varies significantly across products and lines, making the potential risk range considerably wide. (See *Figures 12 and 13* for examples with WC and life and annuity industry RBC ratios.)

**Product Concentration**

We defined product concentration as the percentage of direct premium written in the largest line of business for those companies in the insolvent sample (*Figures 14–17*).

As expected, high product concentration risk is observed for health cooperatives. It can also be observed that product diversification does not appear to stand out as a key risk factor for the other cohorts, suggesting that such diversification is not necessarily correlated to less insolvency risk; other factors such as company management’s experience, economic conditions and other factors may be more important in this context.

We did not compare the insolvent companies to broader industry counterparts for this risk factor, as the industry cohorts were defined on the basis of product concentration.

**Years in Operation**

Industry studies from the PACICC found that

nearly 1/3 of Canadian P&C insurance companies that entered the market since 1980, exited involuntarily. The average age of these failed companies at the time of insolvency was 7.9 years.

Analysis of the age distribution of 164 involuntarily-exited insurance companies incorporated since 1980 in the US and Canada suggests that the greatest risk of insolvency for a P&C insurance company is during the first six years, and 69.5% failed within the first ten years of operation.

A review of years in operation as a risk factor among cohorts within the insolvent sample shows mixed results, suggesting that

years in operation may not be as significant a risk factor for U.S. insolvencies as is the case for Canadian insurers.

**Company Size**

Company size was based on the largest net written premium amount observed in the last five full years of company operations for the insolvent sample. We did not categorize small companies as indicative of higher risk from an insolvency perspective. It can be seen in the comparison to the broader industry results that company size does not appear to clearly indicate relative insolvency risk, as there is no observable pattern of small or large companies predominating the insolvent cohorts relative to their industry counterparts. Company size may therefore be less predictive of future insolvency as compared to other financial risk factors discussed previously.

**Geographic Concentration**

Geographic concentration was defined by the proportion of direct written premium for the insolvent company in its predominant state, as of the latest available point in time from statutory financial filings. It does not appear that geographic concentration distinguishes insolvent companies from the industry as a whole, and therefore this risk factor may be less predictive of insolvency risk.

**Additional Analysis**

Another dynamic of the risk factors that may merit future research is their volatility over time. In the example of leverage, we observed larger year-over-year variation in the insolvent sample relative to the industry samples by cohort. Lack of stability in the financial risk factors previously discussed could present another leading indicator to consider (*Figures 18 and 19*). ■



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# Summary of Risk Management Research on Policyholder Behavior in the Tail Survey

By Jeff Hartman

**Editor’s Note:** *The Joint Risk Management Section (JRMS) is trying to develop better estimates of policyholder behavior in the tail (PBITT). The mission of the PBITT working group is to examine and ultimately give guidance to actuaries on how to set policyholder assumptions in extreme scenarios.*

*As part of its work, the PBITT working group issues two surveys each year that gather the range of assumptions actuaries use in pricing, reserving and risk management of universal life with secondary guarantees and minimum guarantees on variable annuities. This article shares some of the highlights of the most recently published surveys, and links are provided to the full reports.*

## VARIABLE ANNUITY SURVEY

The variable annuity survey explores assumptions in tail scenarios across five categories of benefits. Not all companies have all five types in their portfolio:

- **GMDB.** Guaranteed minimum death benefit with no living benefit
- **GMIB.** Guaranteed minimum income at annuitization; may also include death benefit
- **GMWB.** Guaranteed minimum income over specified (non-lifetime) period; may also include death benefit
- **GLWB.** Guaranteed income stream for life; may also include death benefit
- **GMAB.** Guaranteed minimum account value at a specified time; may also include death benefit

First, the survey explores the “tail” scenario, defined as the first scenario in the stochastic 90 CTE calculation that produces a negative result. For variable annuity guaranteed benefits, the

tail scenario is typically associated with low or negative equity returns in the early projection years. The median of insurers’ responses from 2017 Equity Tail Scenarios (Figure 1) is plotted against the 10th percentile of the equity returns from the American Academy of Actuaries (AAA) prepackaged scenario. The cumulative return is similar to that of the 10th percentile of the AAA prepackaged scenarios, especially in the first 15 years.

A key assumption that varies by scenario is lapses. The average lapse rate for the aggregate block in a tail scenario tends to be lower than that in a base scenario for most guarantee types. However, the degree of differences varies widely by type of guarantee. GMIB and GLWB lapse rates in a tail scenario are significantly less than those in a base scenario. GMDB and GMAB lapses are somewhat lower in a tail scenario. And GMWB lapse rates show little difference between the tail and base scenarios.

The source of assumptions varies between base and tail scenarios. For base scenario assumptions, company experience is the predominant source, followed by best estimate and industry experience. By contrast, for tail scenario assumptions there is a wider range of sources (Figure 2). This is not unexpected, since most actual experience is not in a tail scenario. Lapse assumptions in the tail require more judgment from the actuary.

The survey also asks about sensitivity tests performed related to assumptions that impact policyholder behavior. Sensitivity to the base lapse rate, equity scenario and utilization assumption were the most common types of analyses performed. “Other” responses included sensitivity to mortality, expenses and the dynamic lapse assumption (Figure 3).



Figure 1  
2017 Median Tail Scenarios vs. AAA 10th Percentile, Equity Index (12 companies responding in 2017)

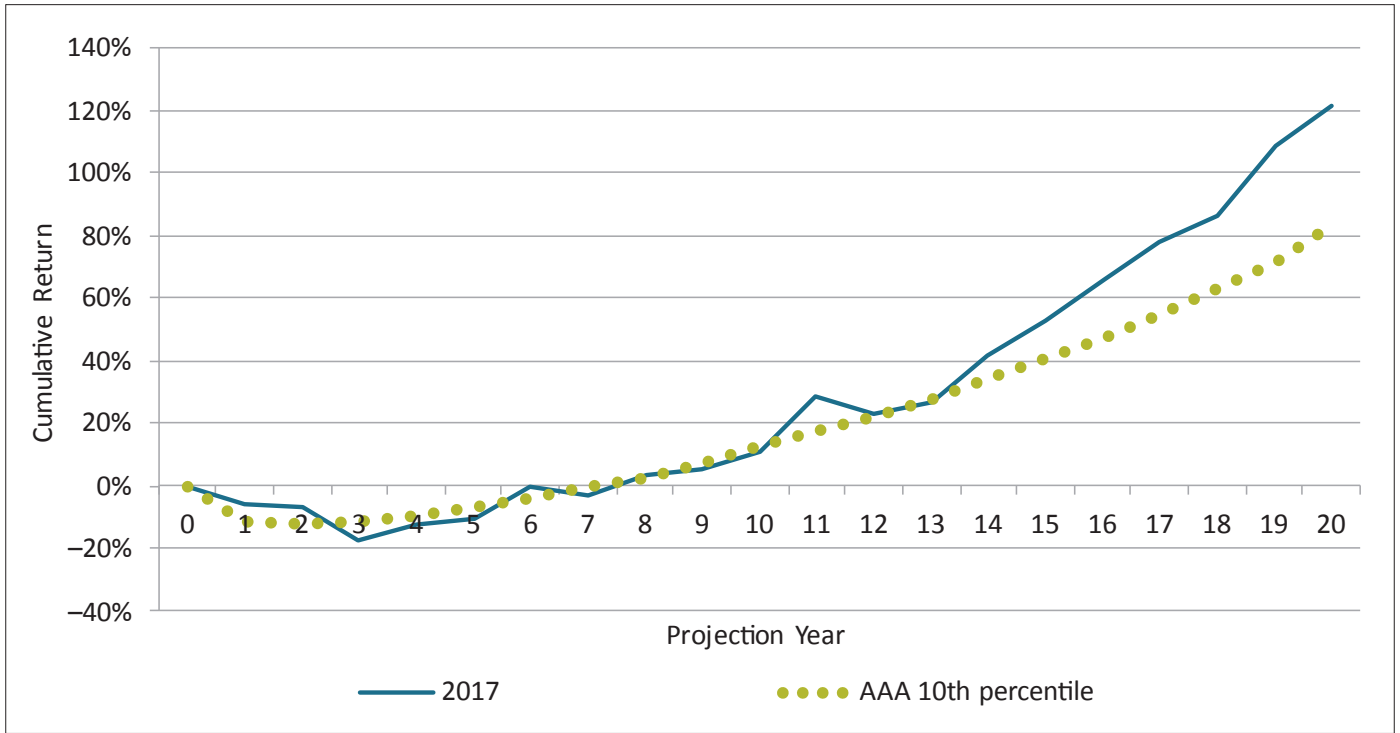


Figure 2  
Expected vs. “In the Tail” Assumptions (Many companies responded with more than one answer)

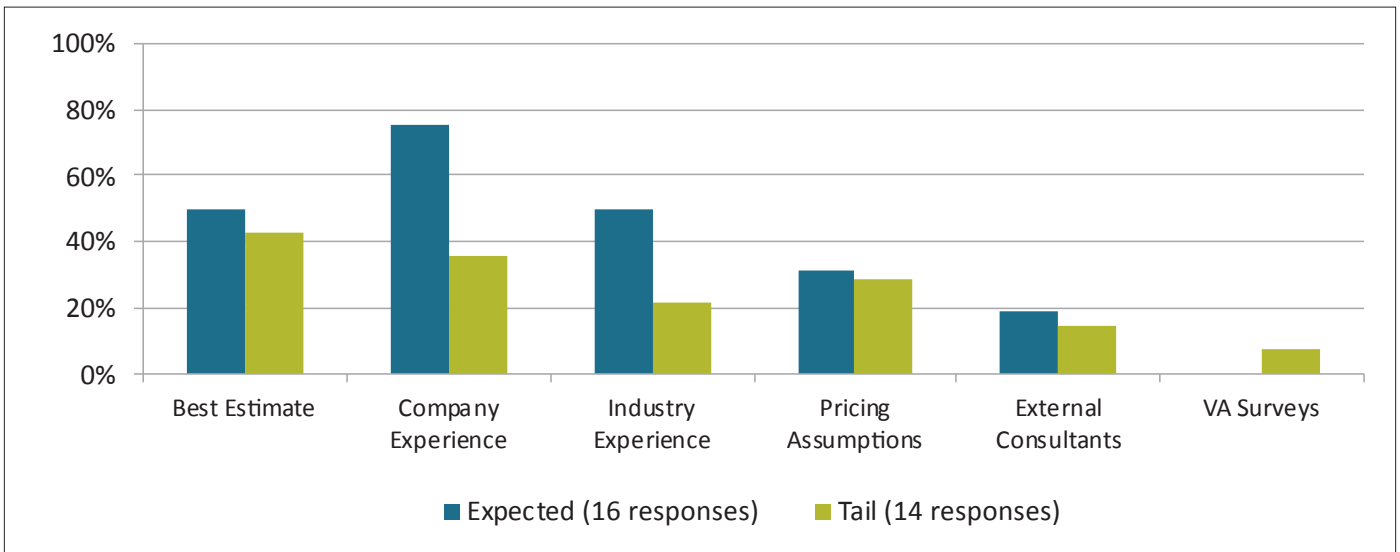
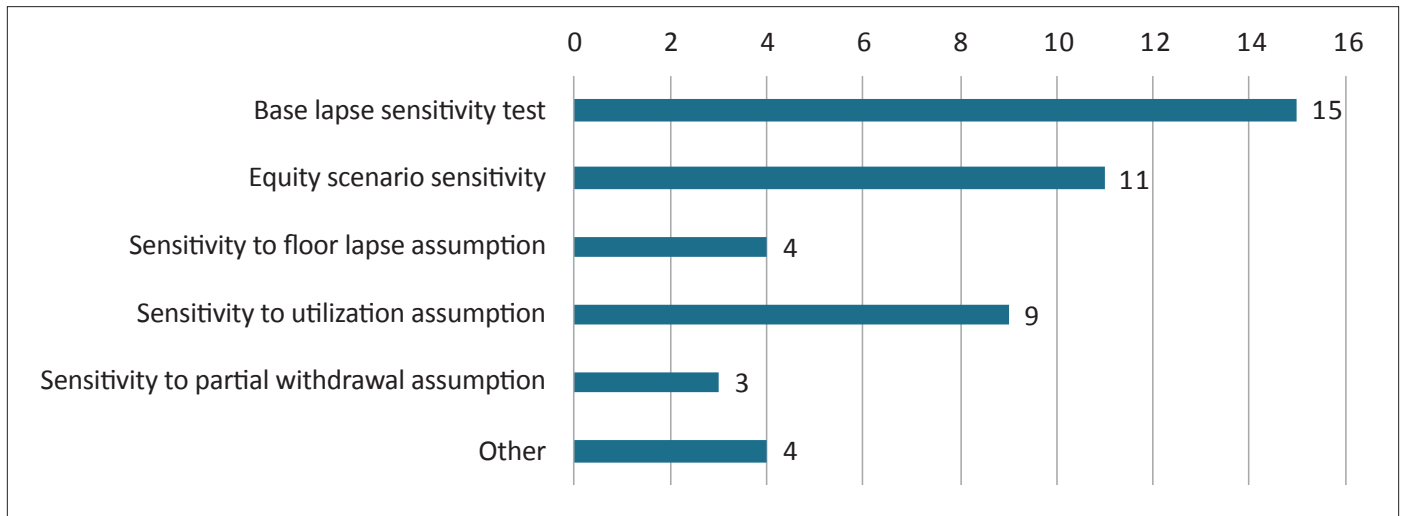


Figure 3  
Sensitivity Analysis Performed (16 responses)



The result of the 2017 survey can be accessed here: <https://www.soa.org/research-reports/2018/variable-annuity-benefits-survey/>.

The result of the 2018 survey can be accessed here: <https://www.soa.org/Files/resources/research-report/2018/2018-variable-annuity-report.pdf>.

### UNIVERSAL LIFE SURVEY

According to the survey results, insurers increasingly use stochastic scenarios to set capital levels for universal life with secondary guarantees. In this year's survey, most companies indicated that they project for over 75 years. For universal life, the tail scenario was defined as the scenario that produces the largest present value loss.

The most critical assumptions for analyzing experience in the tail are investment returns and lapses. Each was cited by a majority of respondents. Tail scenarios vary widely. Typically, the tail scenario is one in which interest rates remain level or decrease (Figure 4). In these cases, the account value is less likely to generate enough investment return to allow the account value to maintain a positive value.

Lapses are the other critical assumption. About half of companies have a lapse rate that varies dynamically, and that percentage has been trending higher. Lapses in the tail vary widely among insurers. Lapse rates in the tail are lower than base lapse rates as the guarantees become more valuable to the policyholder. The majority of companies will vary their lapse assumption by

premium pattern, with single premium policies having a lower lapse rate than level premium policies.

The survey asked companies what would happen to a block of 10,000 newly issued policies that experienced the tail scenario. The median response indicated that 40% would be kept in force by the no-lapse guarantee after 25 years.

Although not as critical as investment performance and lapses, mortality assumptions are important to the modeling of universal life with secondary guarantees. The majority of responding companies include mortality improvement in their model. Mortality improvements commonly vary by gender and age and sometimes vary by smoker status and duration. However, all companies said that their mortality assumptions do not change when the secondary guarantee is in the money and the account value is zero.

The result of the 2017 survey can be accessed here: <https://www.soa.org/Files/Research/Projects/2017-ul-second-guarantee-survey.pdf>.

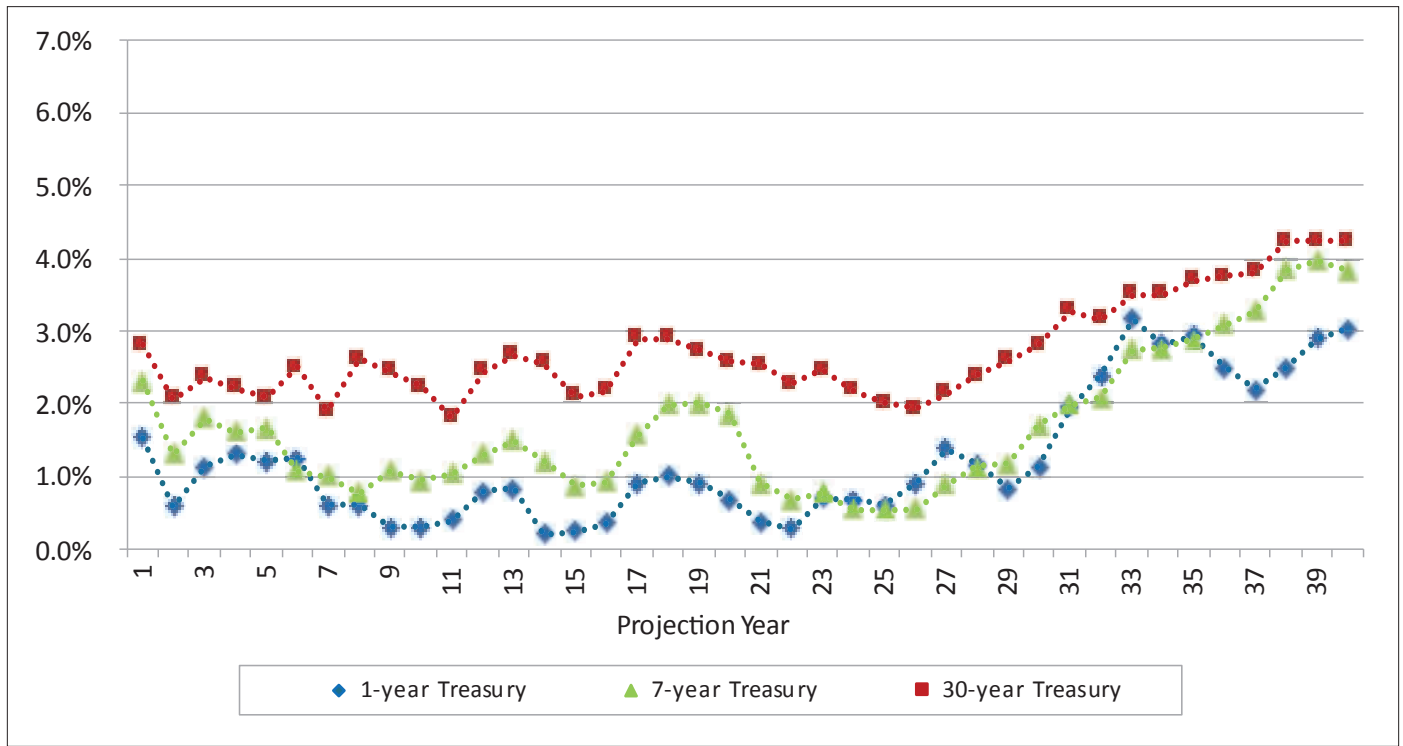
The result of the 2018 survey can be accessed here: <https://www.soa.org/research-reports/2018/2018-ul-second-guarantee-survey/>.

### SUMMARY

All companies that sell these types of variable annuity and universal life products are encouraged to participate in the surveys. Contributions to the surveys are critical for their continued success, and the PBITT committee appreciates those companies



Figure 4  
Median Tail Scenario Across Insurers (9 responses)



that have taken the time to respond. Although many companies choose to be listed as participating, the identities of individual responses are not made available to the PBITT committee.

The committee welcomes feedback and suggestions regarding the surveys and actively seeks any volunteers who may be interested in joining the committee. Please contact either Jim Reiskytl, chair of the Policyholder Behavior in the Tail

committee, at [jimreiskytl@wi.rr.com](mailto:jimreiskytl@wi.rr.com) or Steve Siegel, Society of Actuaries Research Actuary, at [ssiegel@soa.org](mailto:ssiegel@soa.org). ■



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# Real-World COSO Implementation

By Damon Levine

The 2017 update to the Committee of Sponsoring Organizations of the Treadway Commission (COSO) guidance on enterprise risk management (ERM) frameworks (“the Guidance”) stresses the importance of considering risk both in the strategy-setting process and in driving performance.<sup>1</sup> Figure 1, from the updated COSO Framework, describes five key components, each supported by a set of principles. The principles describe various approaches that are applicable to a wide variety of organizations. They provide management and the board with a reasonable expectation for effective risk management that is aligned with its strategy and business objectives.

Realizing COSO’s theme of linking ERM to strategic objectives and execution is challenging in practice. A strength and weakness of COSO is that it is by no means prescriptive. This allows for customization of an ERM framework to company culture, sector, goals and capabilities. However, it does not offer much in the way of concrete suggestions for how an organization may achieve many of its lofty goals.

This article presents an approach that allows organizations to achieve the ERM–strategy link touted by the Guidance. We begin with an example in a real-world business objective, then illustrate how these techniques may be applied to the Guidance itself. After all, reaching an ERM maturity that meets COSO’s goals is certainly a strategic objective fraught with considerable risk and uncertainty. Knowledge of these key challenges and practical countermeasures represents a risk manager’s best chance of implementing a comprehensive and robust framework.

## LOGICAL FRAMEWORK APPROACH

The author has previously described leveraging the Logical Framework Approach (LFA) to create buy-in for and ensure implementation of strategic risk management.<sup>2</sup> The following steps, inspired by LFA, begin with a clear statement of the strategic objective of interest:

1. Carefully describe the strategic objective, OBJ, for the organization (including measurable success criteria, time horizon, etc.).
2. Working with key members of the team responsible for execution, list the critical subgoals or foundational tasks necessary to achieve OBJ. Denote these subgoals as G1, G2, . . . , Gk. For convenience, we name these so we have a time-based sequence where G1 enables G2, and G2 enables G3, and so on, until Gk enables achievement of OBJ. Some find it helpful to begin by thinking of OBJ and work backward to obtain a “causal chain” of subgoals. Many projects contain tasks that are performed in parallel with the others

Figure 1  
The Five Components of COSO’s 2017 Guidance on Enterprise Risk Management



Source: COSO. *Enterprise Risk Management Integrating with Strategy and Performance (Executive Summary)*, June 2017. Copyright © 2017 by COSO. Used by permission. All rights reserved.

and may not have any obvious causal relations. These can simply be included within the relevant  $G_k$  based on their target completion dates.

- Writing the sequence of subgoals from step 2 in a more streamlined format we have

$$G_1 \rightarrow G_2 \rightarrow G_3 \dots \rightarrow G_k \rightarrow OBJ$$

where each arrow suggests that one goal's attainment enables that of the next. The arrows can be viewed as "if-then" assertions because they suggest *if* this task is completed *then* the next task may be completed. These if-then arrows make their own assumptions and come with risks and challenges. The same can be said about each of the goals: Execution comes with uncertainty.

- Based on discussion with those team members from step 2, identify risks to achieving the subgoals  $G_1, G_2, \dots, G_k$  and necessary conditions underlying the if-then arrows from step 3.

The strategic risk analysis coming from this process leads to discussions about current and potential mitigations, with cost-benefit analysis, and risk quantification in relevant metrics (e.g., GAAP earnings impact). We now walk through a *simplified example* of the approach applied to a strategic objective of expanding distribution of a U.S.-based product to Brazil, with the goal of 2020 GAAP net earnings of (at least) 10 million USD. This statement represents our OBJ as mentioned in step 1.

To achieve OBJ the company must accomplish the following:

$G_1$ : Obtain necessary regulatory, legal and compliance approvals;

$G_2$ : Based on applicable laws, regulations, market environment and other factors, outline strategy for distribution, pricing, administration and so on, leveraging knowledge of U.S. operations;

$G_3$ : Develop IT platform for sales, user interface, administration and other considerations based on above, Q3 2019; and

$G_4$ : Train staff in use of IT platform, strategy and so on and create local presence by Q4 2019; begin sales effort in early January 2020.

So, we have the following causal chain as described in step 3:

$$G_1 \rightarrow G_2 \rightarrow G_3 \rightarrow G_4 \rightarrow OBJ$$

Step 4 is about identifying risks, challenges, success factors and other uncertainties that affect attainment of the subgoals  $G_1, G_2, G_3, G_4$  and the required conditions for the if-then arrows to hold true in practice.

Results are summarized in Table 1.

The preceding analysis leads to a strategic risk inventory associated with the strategic objective OBJ. In addition to the risks identified in the Internal and External columns, any challenges

Table 1  
Risk Analysis for Brazil Product Launch (Example)

Risks/Uncertainties				
Subgoal	Internal	External	Causal Link	Necessary Conditions*
$G_1$	Research and filing time constraints; inaccuracy and noncompliance	Uncertainty of application of certain regulations and potential legal changes	$G_1 \rightarrow G_2$	Strategy must conform to legal/regulatory environment
$G_2$	Incorrect assessment of market/economic conditions; product mispricing	Political uncertainties that may impact viability of strategy and consumer demand	$G_2 \rightarrow G_3$	IT platform designers must clearly understand requirements and adapt for local environment
$G_3$	Resource constraints that may delay IT beta and debugging efforts	Internet bandwidth/speed issues and provider pricing	$G_3 \rightarrow G_4$	Training content must be complete and robust; English to Portuguese translation will be required
$G_4$	Lack of effectiveness/timeliness of training	Insufficient pool of talent available; required compensation	$G_4 \rightarrow OBJ$	Sales targets and margins are met; exchange rates remain in expected corridor

\* Conditions regarded as needed for indicated causal link to hold true. Factors that put these conditions in doubt should be included in the strategic risk analysis for the objective.

to or uncertainties around the necessary conditions leads to additional risks to OBJ. Using relevant metrics (e.g., GAAP earnings impact), the risks are then quantified. After consideration of any existing and potential controls and mitigations, a prioritized risk list may then be presented to management and/or the board.

Such analysis might include these factors:

- The internal risk “resource constraints may delay IT beta and debugging efforts” may need additional mitigation in the form of contract workers to assist the permanent team in some of the development and debugging efforts.
- The external risk “internet bandwidth/speed issues and provider pricing” may require very advanced planning, contract negotiation and a higher budget for these services.
- The last causal relationship, that  $G_4$  leads to OBJ, depends in part on an expectation that a certain level of local sales and profits (in Brazilian Real) will be translated into at least 10 million USD at the foreign exchange (FX) rate then in effect. To mitigate the potential for adverse FX rates, the company may consider some type of FX hedging such as currency forwards.

In each case, a risk should be considered in terms of likelihood and its expected impact to key metrics used by management and the business line in question. Arguments for additional mitigation effort and/or investment must include a cost-benefit analysis.

### COSO GETS A TASTE OF ITS OWN MEDICINE

The approach illustrated in this paper, inspired by LFA, is one path toward the strategic integration the Guidance proposes. In addition, the method provides several important insights when it is aimed at the objective of implementing an ERM framework that meets COSO’s aspirations. For the sake of brevity, we use an abbreviated version of the methodology to highlight *some* of the areas of the Guidance outside of strategic risk management that are likely to be challenging.

#### Risk Culture

The Guidance suggests that a company defines its desired culture. Culture in an organization is, at best, a nebulous concept. It is safe to say that *risk culture* is typically less clear. It is also safe to say that the ultimate goal of the communication of risk culture would be to positively impact behavior that will lead to value creation and downside protection. One of the necessary sub-goals for such an objective is that employees clearly understand their expected actions and responsibilities for risk management.

Risks to achieving the objective of a pervasive, healthy risk culture include training or communication that is too broad or diluted, as well as, at the opposite end, including details that apply to only a small group of those being trained. For this reason, targeted training must be developed and might apply to each line of defense separately or can be customized for type of risk, such as operational, financial or hazard. If the notions of risk owner and mitigation owner are used as part of the ERM framework, an owner should know the expected analysis, methods, cadence, metrics and reporting requirements. Additionally, those in the first line of defense who are *not* risk or mitigation owners must have a clear understanding of how they contribute to ERM and are expected to make risk-intelligent decisions.

An additional challenge to establishing an effective risk culture is that some functional areas, departments or locations sometimes seem to get, through design or omission, a “free pass.” If a definition of desired risk culture omits from its purview any specific area—new product “experiments,” mergers and acquisitions, new geographies or specific functional areas such as asset management or business continuity planning—the ERM framework will likely suffer.

Further, ERM comes down to people, of course. To “attract, develop and retain capable individuals” in a risk function, there must be a budget for the department that rivals that of other critical areas. Additionally, a C-suite executive, such as a chief risk officer, should have the same influence (and compensation?) as other C-suite executives. Ideally, resources will be sufficient to have a team of full-time risk management employees. If the days of having one or two full-time risk management employees or risk being accomplished as a “favor” are not yet gone, their departure cannot come soon enough.

The ultimate goal of the communication of risk culture is to positively impact behavior that will lead to value creation and downside protection.

#### Risk Appetite and Strategy Selection

The aspiration to deploy enterprise risk management capabilities as part of selecting and refining a strategy comes with challenges, including (1) ERM processes for strategy design or choice that may not be nimble enough to move at the “speed of business,” (2) ERM that is not viewed as a natural strategic partner and does not have a seat at the table for such discussions and



(3) strategic leaders who feel risk is intrinsic in their decisions and ERM would be redundant in this context.

Those setting strategic direction may not have the luxury or desire to spend much time on what might be called risk analysis. To help address point 1, it is crucial to make use of tools that may be employed with minimal time investment yet clear, tangible benefit. One such concept is a rating of a strategy’s alignment with delineated risk appetite. It measures (numerically or qualitatively) the amount and types of risk that a proposed strategy would create for the company and compares those to the organization’s risk appetite and defined limits. The concept is simply to determine whether the expected exposures are in line with tolerances and preferences for risk amount and type.

The challenges identified in points 2 and 3 can largely be addressed by using the LFA-based approach to strategic risk assessment and stressing subgoal attainment as the foundation of the process, rather than beginning by asking for a “top risk list.” In addition, by quantifying and prioritizing risks using metrics inherent in business line and management decisions, the risk manager can produce intelligence that resonates with key decision makers.

### Portfolio View

From ERM’s humble beginnings, the portfolio or holistic view of risk has been consistently stressed. Because an organization can be well managed only when its risk-reward profile is understood in an accurate and comprehensive manner, the portfolio view is almost universally regarded by practitioners as a critical ERM outcome.

This objective is at risk due to several factors, including (1) failure to include all relevant risk sources, (2) the inability to

aggregate risk properly and (3) a lack of metrics that highlight critical exposures.

We have discussed the importance of capturing all functional areas, locations and departments in the risk assessment process. By ensuring a wide “risk net” and also carefully tracking potentially unseen exposures such as third-party risks, reputational effects and emerging risks, risk factor number one can be avoided.

To address the second factor, it is important to have a clear understanding of correlation and interrelationships across risk types and events. Although not necessary to employ a “full-blown” stochastic model that must be run overnight, it is important to make use of mathematical and statistical notions that capture the practical effects of “intertwined” risks. At the very least, “do no harm” with faulty mathematics.

To ensure that all critical exposures are captured, the ERM framework must employ a suite of metrics that capture all relevant quantities. This means that at insurance companies, one needs some metric relating to capital requirements and usage, and at U.S. public companies we must include GAAP earnings severity estimates in our arsenal. Additionally, because some risks unfold over a number of years, or have an effect only over long time horizons, the framework must have long-term value metrics such as a present value of free cash flows or a risk-intelligent business valuation.

### PARTING THOUGHTS

It (almost) goes without saying that risk environments evolve, organizations change over time and available data and computing methods continue to expand. By incorporating the Guidance’s suggestions for self-learning, review and revision, and targeted use of technology, a company that has attained an advanced ERM maturity can help ensure it continues to stay that way. ■



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### ENDNOTES

- 1 COSO. *Enterprise Risk Management Integrating with Strategy and Performance (Executive Summary)*, June 2017, <https://www.coso.org/Documents/2017-COSO-ERM-Integrating-with-Strategy-and-Performance-Executive-Summary.pdf> (accessed April 22, 2019).
- 2 See, for example, Leonelha Barreto Dillon, *Logical Framework Approach, Sustainable Sanitation and Water Management*, April 27, 2018, <https://sswm.info/planning-and-programming/decision-making/planning-community/logical-framework-approach>.

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# Thoughts on How an Actuarial Control Cycle can Apply to Accelerated Underwriting

By Tim Morant

In the individual life insurance space, accelerated underwriting is the newest iteration of underwriting. In these programs, instead of collecting blood and taking the physical measurements of the applicant, the underwriting relies on self-reported measurements along with information from various databases and scoring tools. This article begins with a brief history of accelerated underwriting, then discusses how it can be applied to risk management.

## HISTORY OF ACCELERATED UNDERWRITING

Accelerated underwriting has evolved since it was first introduced in the early 2000s. As described in this section, these programs have evolved significantly since they were first introduced approximately 10 years ago.

### Accelerated Underwriting 1.0

In early accelerated underwriting programs, companies simply changed their age and amount requirements. For certain ages

and face amounts, paramedical exams and fluid testing were replaced with checks on prescription drug (Rx) and motor vehicle records (MVR) databases. The mortality impact of removing fluids was assessed as a load to the company's fully underwritten mortality assumption, which was partially offset by a discount associated with the protective value of the new underwriting tools and expense savings. In addition, because these changes meant that the underwriting decision would be based on self-reported information rather than tested information (e.g., build and smoker status), loads were introduced to account for asymmetry of information and additional adverse selection.

These early programs often passed on the net increase in expected mortality to the end consumer. Also, the first adopters of these programs usually did not allow for preferred risk classes. Thus, these programs were not priced competitively and were prone to additional adverse selection. Few, if any, of these programs achieved their sales targets, and the mortality experience often performed poorly.

### Accelerated Underwriting 2.0

To make these products more attractive in the market and with the intent of attracting better risks, companies started to introduce various changes. Figure 1 outlines the general evolution of these products over time.

Significantly, companies started to offer preferred classes at competitive rates. They also introduced more underwriting tools and various forms of underwriting triage systems to select better risks or introduce a sentinel effect. These underwriting tools continue to evolve. Some tools under consideration in the market are electronic health records, health insurance claims records and activity information from wearable devices. We do not know how the mortality experience of these products will

Figure 1  
Evolution of Accelerated Underwriting Products, 2010–2019

Industrywide	2010	2014	Today
Number and type of programs	The first programs were introduced around this time	Fewer than 10 programs available in the market	Over 30 programs in the market and many more under development
Underwriting tools	MIB, MVR, Rx	MIB, MVR, Rx, other vendor tools, first-generation predictive models, interviews, reflexive questions	MIB, MVR, Rx, credit-based scores, more sophisticated predictive models, interviews, reflexive questions, triage
Rules engines	Rare	Half	Most
Nonsmoker risk classes	1	2 or more	Same as fully underwritten
Pricing	Table 4-8	10%–15% loads	Fully underwritten premiums
Maximum face amounts	\$100,000	\$250,000	\$500,000 or higher

Abbreviations: MIB, Medical Information Bureau; MVR, motor vehicle records; Rx, prescription drug databases.





emerge over time or how wide the range of mortality experience based on differences in underwriting will be.

### ACTUARIAL CONTROL CYCLE AND RISK MANAGEMENT

When setting a price and assessing the profitability of a new product, an initial set of best-estimate assumptions must be determined. Once the product is launched, experience needs to be monitored, and as experience deviates from expected, assumptions need to be updated to reflect the actual experience. This process is iterative and as credibility builds, assumptions should converge to a long-term average.

When applied to insurance products, this process has been termed *the actuarial control cycle*. Much like the scientific method, successful actuarial implementation of the control cycle requires data that is collected over time. The data in this case comes from monitoring the experience. To be successful, the monitoring process needs to be designed at the beginning of the product development process. That way the necessary data collection can be put in place from day one.

With accelerated underwriting, rates are often set at the same premium level as traditionally underwritten products, but because of how new they are, there is no credible mortality experience of accelerated underwriting programs. Thus, the mortality level has a high degree of uncertainty for these programs. Mortality experience will take some time to emerge. As such, monitoring should initially focus on the leading indicators such as straight-through processing rates; distribution by age, gender, face amount and product type; and lapse experience. These could be compared to the pricing assumptions to help validate the original pricing ahead of actual claims experience. Other items to monitor include misrepresentation rates on application questions, such as build and smoking status. In a triage system, it would also be important to track and measure these variables by underwriting path. The next section discusses some of the ways to implement this monitoring.

### CREATING A SENTINEL EFFECT AND INFORMING THE ACTUARIAL CONTROL CYCLE

Actuaries and underwriters have a number of tools at their disposal for evaluating their exposure to risk presented by

accelerated underwriting programs. These tools have strengths and weaknesses that must be understood in order to correctly interpret results.

**Retrospective Studies**

To set initial assumptions for accelerated underwriting programs, a company will often perform a retrospective study. In such a study, a pool of applications that were previously underwritten under a traditional program will be evaluated using the new, accelerated underwriting rules. The actuary can then use the misclassification by class, smoker status and decline cases to calculate an implied load from the traditional underwriting to the accelerated underwriting program.

One item to consider is that if the retrospective study is based on a pool of applicants that originally underwent traditional underwriting, the conclusions of the study would be incomplete. Since the applicants were aware at the time they applied that they would need to undergo paramedical exams and submit to fluid requirements, it is assumed they were more motivated to honestly disclose information on the application than they otherwise would be. This effect is called the sentinel effect. In accelerated underwriting programs, the risk is that applicants become aware that they may not need to submit to such exams and thus disclosure rates will decrease and misrepresentation

rates will increase. A load for the loss of sentinel effect must then be added on top of the loads derived from the retrospective study. The mortality impact of the loss of sentinel effect is a very difficult assumption to derive.

**Random Holdouts**

Many accelerated underwriting programs perform random holdouts. A random holdout is an application that has fully qualified for accelerated underwriting yet has been randomly chosen to also undergo full underwriting. Random holdouts serve two main purposes: to introduce a sentinel effect and to provide information that would aid in the actuarial control cycle. Both are intended to refine the underwriting rules and/or update or refine the pricing and valuation assumptions. Since the selection of the holdout applications is random, once the sample size is large enough, the results should be distributed evenly about the mean. This is illustrated in Figure 2 with a 10 percent random holdout rate.

One problem encountered with random holdouts is that applicants withdraw their applications when they are requested to submit to invasive underwriting requirements. This could be because they view the underwriting request as bait and switch, or it may be because these applicants are misrepresenting their health status and thus it's in their best interest to withdraw the

Figure 2  
Distribution of Random Holdouts

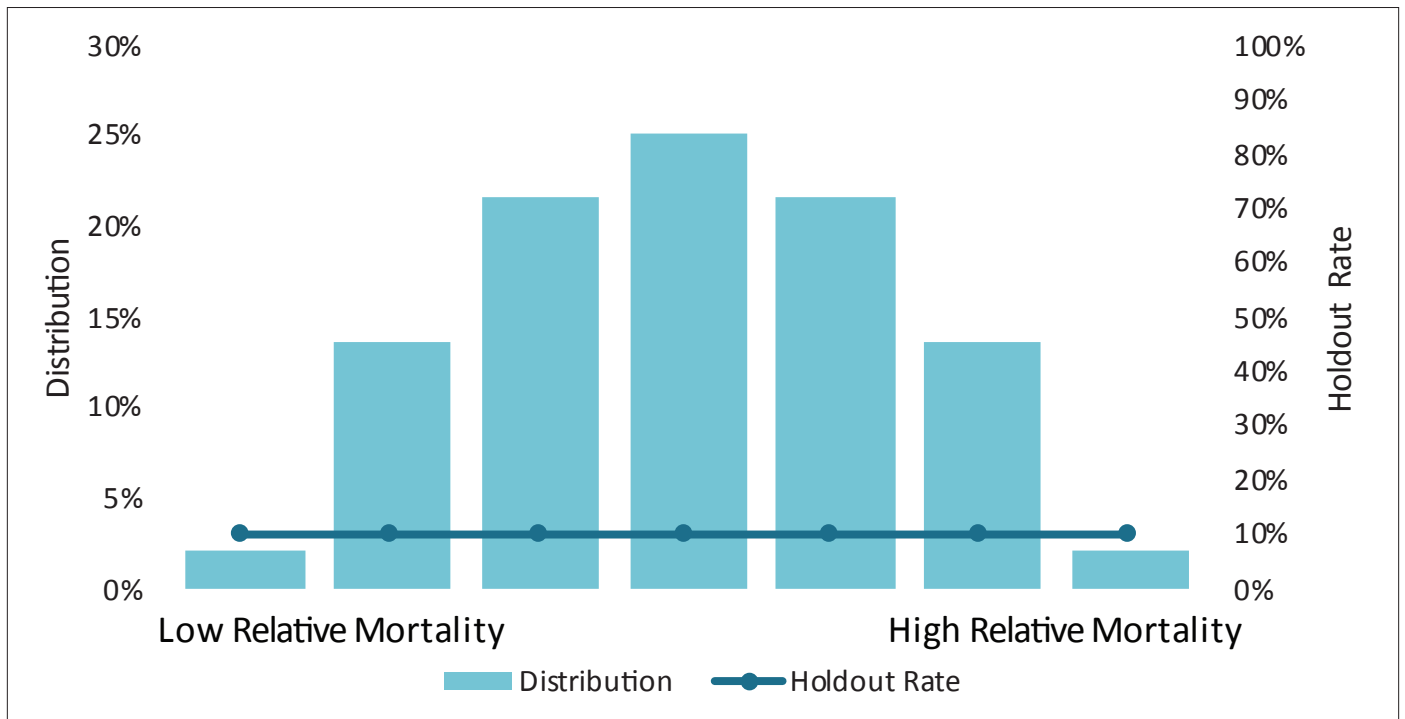
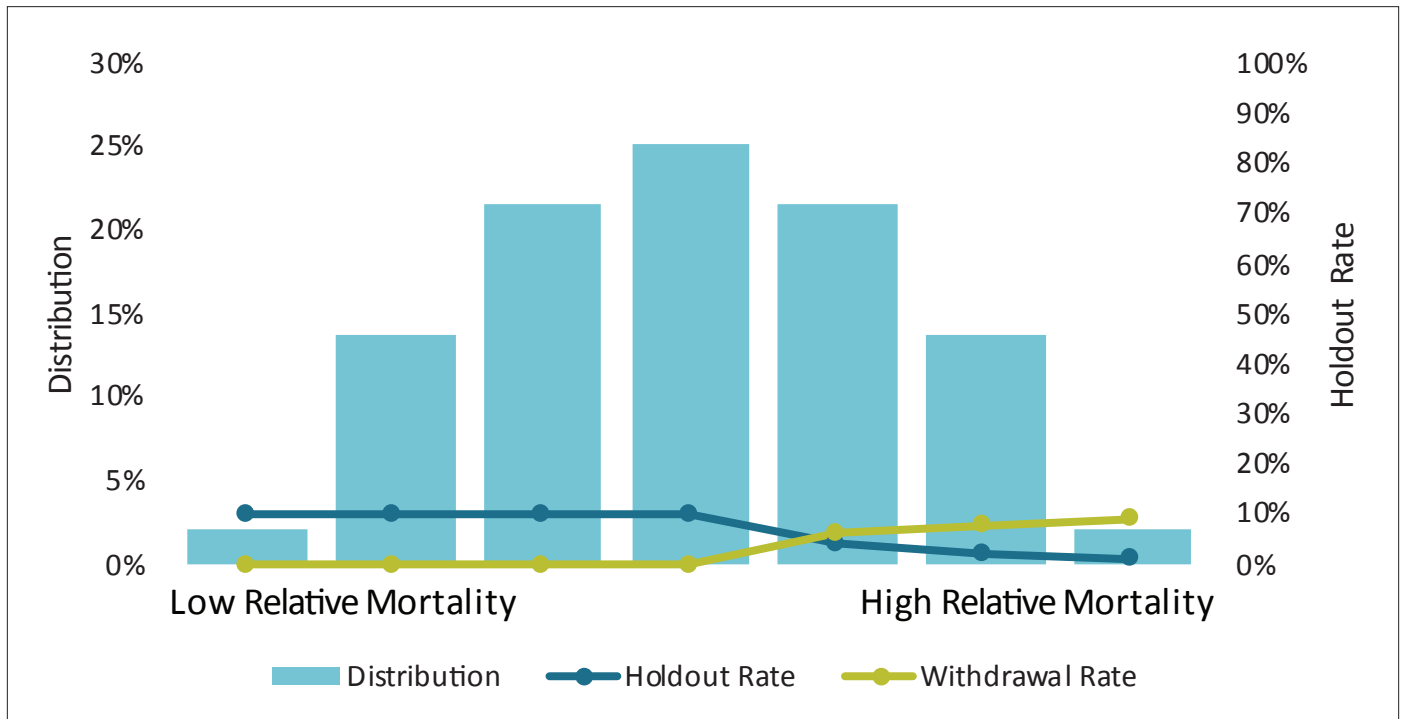


Figure 3  
Distribution of Random Holdouts With Withdrawals



application and try applying elsewhere. If the latter is the case, Figure 2 becomes skewed, as shown in Figure 3.

The higher the withdrawal rate of the holdout applications, the more skewed the results could be. This would reduce the accuracy of the information being used in the actuarial control cycle to reset underwriting rules or updated pricing assumptions.

### Targeted Holdouts

Some companies perform targeted holdouts. Like random holdouts, targeted holdouts select a subset of otherwise accelerated-underwriting-eligible applications and send them to traditional underwriting. However, the selection of these applications is not random. Instead, some type of predictive analysis is performed to target applications that are more likely to be misrepresenting their health status. One form of predictive analysis that is being used to choose the targeted holdout set is a smoker propensity model intended to catch smokers who are misrepresenting their smoker status. Similar propensity models can be built for build misrepresentation, agent behavior or other risk factors. One advantage of targeted holdouts over random holdouts is that, since the selection of holdouts is skewed toward the worst risks, withdrawals are more likely to provide protective value to the program, whereas, with random holdouts,

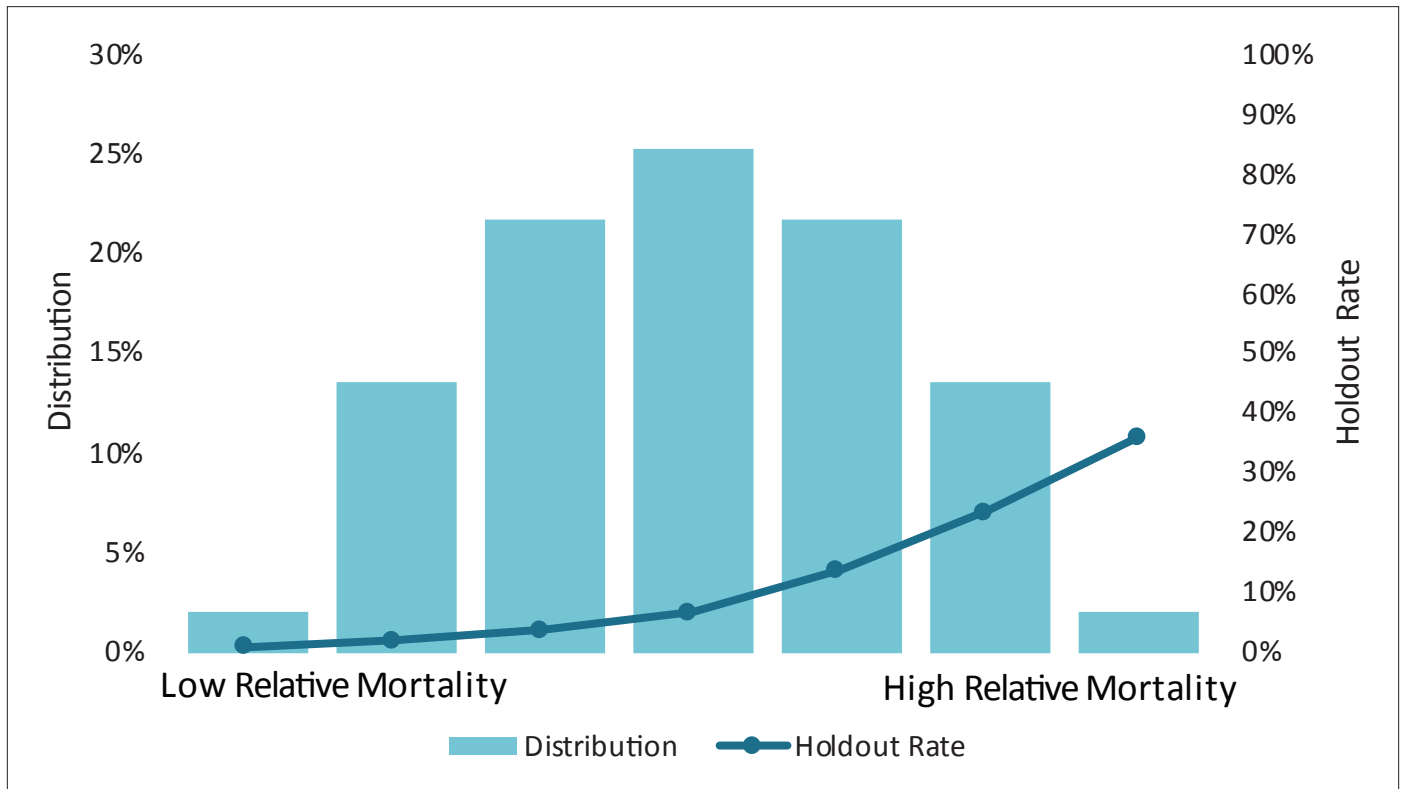
those withdrawals may very well be missed sales that were good underwriting risks (Figure 4).

### Post-issue Analysis

Another alternative is to perform post-issue analysis. *Post-issue analysis* is where a subset of policies issued under accelerated underwriting are selected to go through additional review. Various tools are used in post-issue analysis. Most often, an attending physician’s statement (APS) is requested, and an underwriter will use the APS to evaluate the risk from a traditional underwriting viewpoint. The assessment of the underwriter can then be compared to the assessment of the accelerated underwriting program. This can inform both the pricing assumptions and the underwriting rules as part of the actuarial control cycle. Action can be taken in cases of material misrepresentation or fraud.

An additional benefit of post-issue analysis is that the policies are already in force, so the withdrawal rate will be zero. One drawback is that for the target demographic of most accelerated underwriting programs, APS hit rates might be low. Younger applicants may not regularly visit the doctor or even have one. Another drawback is that information on an APS is not exactly the same as the information a traditional underwriting

Figure 4  
Distribution of Targeted Holdouts



assessment would have from paramedical exams and fluid tests, which creates some basis risk between APS and fluid testing.

### MISCLASSIFICATION ANALYSIS

With any of the tools just described, a misclassification matrix could be created. This misclassification matrix can then be used to approximate the shift in risk class distribution (prevalence) and relative mortality (relative risk) under the proposed accelerated underwriting rules, thus approximating the impact on profitability of the new program.<sup>1</sup> There is no unique solution for what the implied loads should be when using a misclassification matrix method. We will illustrate one method here.

Let's assume the following misclassification matrix between full underwriting and accelerated underwriting is observed for a specific program (Figure 5). We will assume a very small sample size for the ease of illustration. The conclusions can be generalized to larger sample sizes. We will also assume that the accelerated underwriting program issues policies only to lives that are assessed standard or better through accelerated underwriting rules; otherwise they are referred to an underwriter and drop out of our analysis.

Figure 5  
Misclassification Matrix

		Accelerated Underwriting Class			
		Preferred	Standard	Smoker	Refer to UW
Full UW Class	Preferred	40	0*	0	0
	Standard	6	26	0	0
	Smoker	1	1	6	0
	Substandard	1	1	1	0
	Decline	1	1	1	1

\* Misclassification can occur in the cells above the main diagonal, but we will assume the applicant has perfect information and thus would not accept an offer in the accelerated underwriting program that is less than optimal.

We will also assume that the relative risk based on the fully underwritten experience is as presented in Figure 6. Relative risk here can be thought of as the factor needed to be multiplied to a standard mortality table to get to the mortality level of the respective risk class.

Figure 6  
Relative Mortality and Prevalence  
(Traditional Underwriting Class)

	Relative Mortality	Prevalence
Preferred	80%	47%
Standard	125%	37%
Smoker	200%	9%
Substandard	250%	3%
Decline	500%	3%

Figure 7  
Distribution Within Each Accelerated  
Underwriting Preferred Class

		Accelerated Underwriting Class		
		Preferred	Standard	Smoker
Full UW Class	Preferred	82.0%	0.0%	0.0%
	Standard	12.0%	90.0%	0.0%
	Smoker	2.0%	3.3%	75.0%
	Substandard	2.0%	3.3%	12.5%
	Decline	2.0%	3.3%	12.5%

Next we calculate the distribution within each accelerated underwriting preferred class that corresponds to each fully underwritten class (Figure 7).

Now, if we calculate the sum-product between this normalized matrix and the vector of relative risk in the fully underwritten program, we will get a vector of implied relative mortality in the accelerated underwriting program. The results are shown in Figure 8.

The few cases that exhibit extreme mortality deviations, such as a case that would have been declined under traditional underwriting but was classified as preferred under accelerated underwriting, would imply a material load to the mortality. For example, if the 2 percent declines had not been misclassified into the preferred class, the implied relative mortality of that class would have been 91 percent rather than 100 percent.

Figure 8  
Implied Relative Mortality and Prevalence  
(Accelerated Underwriting Class)

Risk Class	Implied Relative Mortality	Prevalence*
Preferred	100%	57%
Standard	144%	34%
Smoker	244%	9%

\* Prevalence should be measured on expected claims so that total actual-to-expected ratio is preserved. Here we are using case count since that is the way misclassification matrices are usually presented.

Thus, it would be beneficial to investigate those cases to identify any common areas of misrepresentation and then take steps to improve the insurance application or the underwriting process to mitigate those risks in the future.

## CONCLUSIONS

Although mortality experience is not generally available for accelerated underwriting programs, monitoring leading indicators can provide valuable insights into emerging experience. The different types of holdouts or post-issue analysis can provide valuable monitoring and allow for the establishment of a control cycle to measure implied mortality deviations. This information can be used to gain comfort with assumptions or can be used to inform pricing and underwriting updates before the development of actual experience. ■



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## ENDNOTE

- 1 Blind retrospective studies do not account for change in population or the effect of adverse selection due to the loss of the sentinel effect. Additional adjustments would need to be included. Random holdout studies or post-issue studies on accelerated underwriting programs would include these effects to varying degrees.

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