Velogica® Analytics Minimize the Risks in Non-Medical Underwriting

Many life insurers are considering entering or expanding their presence in the middle market where the time and costs associated with traditional underwriting methods are difficult to justify. A primary concern that carriers face is how their sales force will act when the rigors of a fully underwritten program are removed and whether they have the ability to effectively monitor and influence producer behavior. Yet if a company has the right set of tools backing up a simplified issue program, it can minimize these issues and take advantage of enormous opportunities in the middle market.

Adverse selection – the attraction of a disproportionate number of high-risk lives to a product offering – is a concern for all life insurers, especially for companies in the non-medically underwritten market. While the risk of adverse selection can be factored into the pricing of these products, it is still one of the main challenges facing carriers in the simplified issue market.

When analyzing the results of simplified-issue programs, it is common to see a small subset of producers who attempt to take advantage of weaknesses in the system and submit anti-selective business. Companies most often discover this years after the behavior occurred when analyzing paid claims data to discover why their actual-to-expected ratios on a product are not working out as desired. Insurers are then left to contemplate how much additional business the producer has placed in the interim and the impact this could have on future results.

Velogica®, our automated underwriting engine for small face amount life products, has a unique capability that aids in identifying potential anti-selective behavior. This allows companies to deal with issues and correct problems early when the costs can be minimized. While Velogica clients are usually drawn by the speed and sophistication of our underwriting decision algorithm, many come to believe that the producer analysis capability is one of Velogica’s most valuable features.

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Identifying anti-selective behavior is extremely difficult to accomplish by looking at individual applications. Velogica instead captures and analyzes data using a statistically driven warning system that flags unusual patterns in a producer’s portfolio of cases. The analysis draws on several factors: number of applications submitted, age distribution, level of admitted information on applications and the amount of times non-admitted information has been discovered elsewhere.

The process compares the performance of individual producers against the portfolio as a whole and highlights producers who are extreme outliers of normal metrics. The actuarial math behind this approach capitalizes on our years of experience underwriting business using Velogica and as a reinsurer. Our understanding of simplified business allows us to establish accurate probabilities specific to a client portfolio and successfully indicate which producers exhibit behavior well outside what would be expected.

There will always be applicant misrepresentation in this business. However, when the math says that the business from a particular producer has only a 0.2 percent likelihood to have been achieved randomly, a carrier needs to consider what is happening to remove the randomness from the process.

Warning Flags

Two categories of warning flags alert us to possible anti-selective behavior: The Smoking Gun and the Inferred Misrepresentation. Smoking Guns occur when subsequent investigation by tools such as electronic databases definitively tells us that information was omitted or incorrect on an application.

Inferred instances of possible misrepresentation can be identified by analyzing the pattern of answers on applications from a particular producer. While this may not seem as convincing as the Smoking Gun proof, our sophisticated algorithm provides the statistical probability that the pattern of information on applications occurred randomly. Our experience shows that all of our clients have at least a few producers with a probability rating approaching zero percent, meaning that the pattern of responses on their submitted applications has close to no chance of occurring randomly. And many producers achieve concerning scores on multiple flags.

The Sentinel Effect

While more difficult to quantify, we also believe that carriers gain significant benefits from the sentinel effect produced by this tool. Just having a tool to identify application misrepresentation can stop some level of anti-selection before it even begins.

In addition to being useful for individual producers, the tool can also be used for any identifiable sub-group that a Velogica client can identify within their portfolio. This allows analysis of the business from a particular office, region, wholesaling group, etc.

Anyone who writes simplified issue business is interested in controlling anti-selection and likely has a program in place to monitor their distribution force. Our process allows clients to focus those efforts where they will do the most good – on the few individuals whose business can be statistically measured as anti-selective. By helping companies manage behavior down to the individual level, our Velogica solution can influence better adherence to practices and contribute to an improved quality of business.

Statistically Driven Producer Analysis

Binomial distribution, a common test for determining statistical significance, deals with the likelihood of an event happening as expected. Velogica relies on binomial distribution to identify patterns of behavior that could lead to adverse mortality implications.

Binomial distribution is applied to determine a score for various warning metrics. This score represents how unlikely it would be to randomly achieve a given number of occurrences of unusual results within a producer’s portfolio of business. The less probable a score is to occur randomly, the more likely it is that an external factor has encouraged anti-selective behavior.

When a large number of producers submit applications with relevant information, their scores will likely distribute as shown in the chart above. A producer will be flagged for a warning if their score on a particular metric falls in the green bar region of the chart.
The Society of Actuaries (SOA) and several other associations commissioned a study last year to examine alternative medical markers for their potential use in mortality assessment. The report, prepared by Milliman with the assistance of the major medical labs, compared the usefulness of various laboratory tests against total cost (Figure 1). The study’s findings suggest that a number of tests in use today can provide companies with net mortality savings.

Many carriers understand the value of the NT-proBNP test as a possible indicator of coronary-artery disease, especially among older-age applicants. Companies have also identified hemoglobin A1c as a promising marker for adult-onset diabetes. Adding these and other medical markers to existing blood panels may provide additional protective value.

The SOA report itemizes the potential total cost of administering a test, including not only the cost of the test itself but also costs associated with necessary underwriter training and interpretation after factoring an assumed not-taken rate. These costs range from $11-$37 per application.

The authors do not discuss any price efficiencies gained by combining tests, nor do they provide recommendations. In some situations a direct correlation to mortality was not available, and in these cases the authors used estimations or reasonable proxies. More research will be necessary to develop more precise mortality correlation coefficients.

Certain medical tests may be more useful to some carriers than others, based on management strategies and target market. NT-proBNP is associated with reduced left ventricular function and possible cardiovascular disease. In recent years carriers have been interested in using the test in underwriting, especially for older-age cases. Yet older tests like TNF-alpha have yet to win acceptance despite their initial promise. Some markers have only been tested against a general population such as the Social Security Administration’s Death Master File (DMF) or the third National Health and Nutrition Examination Survey (NAHANES III). Further study is needed to see if the markers retain their value against an insured population.

The major labs are already working with direct writers to assess the protective value of some of these tests in an insured population. Several labs have begun marketing proprietary risk assessment “scorecards” based on these and other blood panel factors to help underwriters reach a decision more quickly.

As risk partners, reinsurers have a vested interest in supporting direct writers’ underwriting decisions. We recommend that direct writers consult with their reinsurers before using such risk assessment tools to place business on which they seek reinsurance coverage. SCOR Global Life Americas looks forward to collaborating with clients to gauge how these and other future underwriting developments can improve bottom-line claims experience.


### Figure 1: Medical Markers - Net Mortality Savings

<table>
<thead>
<tr>
<th>Marker</th>
<th>Ages labs recommend for testing</th>
<th>Net mortality savings (male age 70, $100,000 face)</th>
<th>Total cost for marker test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apo A-1 and B</td>
<td>40+</td>
<td>$33.70</td>
<td>$21</td>
</tr>
<tr>
<td>RDW</td>
<td>60+</td>
<td>$193.44</td>
<td>$17</td>
</tr>
<tr>
<td>Cystatin C</td>
<td>55+</td>
<td>$272.29</td>
<td>$19</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>65+</td>
<td>$558.76</td>
<td>$20</td>
</tr>
<tr>
<td>Hemoglobin A1c</td>
<td>35+</td>
<td>$151.95</td>
<td>$19</td>
</tr>
<tr>
<td>Microalbumin</td>
<td>35+</td>
<td>$148.60</td>
<td>$23</td>
</tr>
<tr>
<td>NT-proBNP</td>
<td>60+</td>
<td>$407.64</td>
<td>$37</td>
</tr>
<tr>
<td>Oxidized LDL</td>
<td>45+ (male) 55+ (female)</td>
<td>$104.65</td>
<td>$27</td>
</tr>
<tr>
<td>Lp-PLA2</td>
<td>45+</td>
<td>$45.77</td>
<td>$25</td>
</tr>
<tr>
<td>TNF-alpha</td>
<td>50+</td>
<td>$199.09</td>
<td>$11</td>
</tr>
<tr>
<td>Troponins I and T</td>
<td>55+ (Male) 65+ (female)</td>
<td>I: $114.13  T: $186.54</td>
<td>$31</td>
</tr>
</tbody>
</table>

Underwriting time per test is a significant portion of the estimated savings. NT-proBNP is seeing more use by carriers. One reason could be that the test is relatively quick to assess (average two minutes, 15 minutes for abnormal cases).
For life insurers, pandemic risk has been part of the risk management conversation for nearly two decades. It’s a tough risk to nail down, but the industry is making headway in understanding the changing nature of the pandemic threat and developing methods to quantify and make provisions for the risk. SCOR is committed to furthering industry knowledge/management of pandemic risk. (SCOR hosted a two-day conference in Paris on this important topic in early July.)

**Stakeholders Demand More Detailed Analysis**

Some drivers of the recent uptick in activity around pandemic risk include Solvency II and the NAIC’s Own Risk and Solvency Assessment (ORSA) requirement. Additionally, economic capital initiatives, principles-based concepts and modeling of mortality catastrophe bonds have each played a role. For example, under Solvency II and ORSA requirements, entities must quantify their risk appetite and risk tolerances. They must also provide monitoring mechanisms and prepare risk management and mitigation plans in case of extreme loss scenarios.

Solvency II also requires entities to maintain capital to meet the Solvency Capital Requirement (SCR). The SCR provides a standard formula for assessing its various component risks. Since the standard formula is meant to cover a variety of entities, it defines a single scenario at a conservative 1-in-200 year level. Many companies may choose instead to use internal models to define, measure and manage their particular pandemic risk, using tools and concepts appropriate for their business.

Internal models can also create a more robust picture of a company’s risks. Instead of a single scenario, one can design an internal model that provides a full probability distribution of its pandemic risk and not just a particular scenario at a given level. In addition, a company could use various methods of measuring tail risk such as Value at Risk (VaR) and Conditional Tail Expectation (CTE, also known as TailVaR) for different aspects of the analysis. All internal models should include assumptions about correlations across various geographical regions and risk types. Specific attention should be given to correlation of risks in the tail.

Insurers and reinsurers have issued mortality catastrophe bonds to help mitigate their tail risks. Bond underwriters require extensive analyses and stochastic modeling of all the various mortality risks involved, including pandemic risk. Industry analysts and credit rating agencies similarly want to see this type of detailed information. This increase in regulatory and external interest in the pandemic risk issue has prompted expanded research and development of tools that allow more robust analysis of pandemic risk.

**Pandemic Risk Today versus Yesterday: More Outbreaks, Faster Containment**

While most attention focuses on influenza as the cause of pandemics, other infectious diseases also cause pandemics. Non-influenza pandemics have occurred less frequently through history but can result in more severe mortality.

A pandemic of any kind would affect the world differently today than in the past. Over the past 100 years, global travel has become much faster and affordable, allowing infectious disease to spread more rapidly. The emergence of superbugs and drug-resistant bacteria would serve to increase morbidity and mortality due to a pandemic.

Some changes are good: modern communications such as radio, television, internet and mobile

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Figure 1: Risk of Influenza Pandemic Emergence, 2012

In recent decades most pandemic threats have been influenza or influenza-related outbreaks originating from East Asia. Population density and economic development likely contributed to this risk.
telephone can save lives. These media provide fast means of sharing information, which can aid the speedy implementation of public health measures and help scientists develop and produce vaccines.

Other advances over the past century have improved society’s resilience as well. The rise of the field of virology has led to better diagnostics for detecting the sources of diseases. Improved sanitation and hygiene have lowered the probability of transmission. The development of vaccines and antibiotics has enabled monumental strides in reduction of mortality due to infectious diseases.

**Deeper, More Detailed Insight**

An epidemic could affect an insured portfolio quite differently from the general population. Likewise, various countries are likely to experience an outbreak differently due to local geographical conditions, ease of travel and socioeconomic conditions.

Modern research on pandemics provides insight on the impact of outbreak on subsets of the population. To aid in risk management, insurers are particularly interested in research on the impact of pandemics on:

- **Age** – insured portfolios tend to have age profiles distinct from the general population
- **Socioeconomic status** – depending on the target market, insured portfolios tend to have different socioeconomic profiles than the general population
- **Underlying health conditions** – preferred risks are likely to exclude many impairments (i.e., cardiovascular and respiratory disease) that are additional risks in pandemic scenarios.

**Be Prepared**

A pandemic risk model should reflect all characteristics of an insurance portfolio. It should provide managers with a means to understand, measure and manage pandemic risk and thereby help provide an optimal risk-return profile. Detailed level of analysis, down to the product level, could someday become the state of the art in the life insurance industry. Regulators and capital markets entities are already starting to ask for this type of information. Even if they were not asking for it, life insurers have many business reasons to develop this level of analysis on their own – and their competitors may already be doing so.

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Since the early 1990s, the life insurance industry has embraced the concept of preferred underwriting classification. Insureds with favorable health factors such as low cholesterol, low blood pressure, good build and no tobacco usage pay lower premiums, while those at the other end of the health spectrum pay higher rates. In theory, assigning insureds into a preferred underwriting class should result in a group of individuals with similar risk profiles. In reality, however, this process is far from perfect. Rather than creating a clean demarcation of who is preferred and who is not, the insurance industry’s typical classification scheme produces a very fuzzy boundary that misplaces many insureds into the wrong underwriting class.

A Model for Preferred Life Mortality

To illustrate the true nature of preferred underwriting classification, I applied a Cox Proportional Hazards mortality model to a database of approximately 220,600 recently underwritten male nontobacco lives. Each database record contained indicators for age, gender and smoking status, as well as values for blood pressure, total cholesterol and HDL ratio. Details of the Cox model are beyond the scope of this article. However, the model is frequently applied in clinical research studies to analyze relative mortality among groups having different medical conditions. My model was tested and validated using data from SCOR’s proprietary mortality experience database.

I created a simple three class underwriting structure for male nontobacco users. Each life in the database is assigned to a class according to the criteria shown in the table below:

<table>
<thead>
<tr>
<th>Super Preferred</th>
<th>Preferred</th>
<th>Residual Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index ≤ 26</td>
<td>Body Mass Index ≤ 29</td>
<td>Body Mass Index ≤ 37</td>
</tr>
<tr>
<td>Total Cholesterol ≤ 240</td>
<td>Total Cholesterol ≤ 280</td>
<td>Total Cholesterol ≤ 320</td>
</tr>
<tr>
<td>HDL Ratio ≤ 5.0</td>
<td>HDL Ratio ≤ 6.5</td>
<td>HDL Ratio ≤ 9.9</td>
</tr>
<tr>
<td>Blood Pressure ≤ 135/85</td>
<td>Blood Pressure ≤ 140/90</td>
<td>Blood Pressure ≤ 160/95</td>
</tr>
</tbody>
</table>

Similar to most of today’s preferred classification methodologies, failure to meet any single criterion knocks a life out of that class. I have ignored secondary factors such as motor vehicle record, family history, personal history and avocation/vocation for the sake of simplicity. Lives not qualifying for Super Preferred or Preferred are placed into a Residual Standard class.

Distribution of Relative Mortality

The model’s predicted mortality for each life in the database is represented as a relative percentage, with 100 percent being the average mortality for all lives combined. Figure 1 shows the distribution of these percentages. Values range from around 45 percent for...
lives with the lowest mortality to well over 175 percent for lives with the highest mortality. It is encouraging to see that mortality is approximately normally distributed about the mean value of 100 percent. For those familiar with the pattern of mortality in a diverse population, this is not an entirely unexpected result.

The Reality of Preferred Classification

Since it is known which lives are Super Preferred, Preferred and Residual Standard, it is easy to plot the distribution of mortality in each underwriting class separately. As shown in Figure 2, each distribution approximates a normal curve, just like the distribution for all lives combined. Notice how much overlap exists in mortality among the three classes.

Compare the theoretically ideal distribution of mortality by class shown in Figure 3 with the model results in Figure 4. This shows in a very dramatic fashion the reality of preferred underwriting classification.

While my illustrative underwriting system is a little simplistic, the knock-out methodology it represents is a good proxy for how most life insurance companies categorize preferred lives. Figure 4 shows that the use of a limited number of cardiovascular mortality markers is insufficient to segregate lives in anything but the crudest manner. To be fair, the majority of today’s knock-out classification methods vary criteria values by age groups and include motor vehicle and personal/family history indicators. I am also seeing more companies use debit/credit classification systems that try to fairly balance positive and negative risk factors. These enhancements tend to lessen the mortality overlaps shown in Figure 4 but certainly not eliminate them entirely.

From a pricing perspective, the average mortalities for the Super Preferred, Preferred and Residual Standard classes, based on the theoretical distributions in Figure 3, are not too far from the averages using the actual distributions from Figure 4. Super Preferred actual mortality is about five percent higher than theoretical Preferred actual is nearly equal to theoretical. Residual actual is less than 10 percent lower than theoretical. Realize, however, that the theoretical average mortalities would have been used as an expectation only in the absence of any other knowledge. Company and industry experience studies reflect actual distributions and are the sources of mortality assumptions for current premium calculations.

Conclusion

So how has the life insurance industry gotten away with (so to speak) the use of such a crude classification technique? Well, everyone is pretty much doing the same thing. Therefore, anti-selection among companies competing for the same lives is minimized. Any change in the industry’s classification scheme could produce a dramatic shift in sales distributions as well as generate market confusion on the part of agents and consumers. So, no company wants to be the first to make a move – the status quo remains.

In the ideal use of a credit/debit knockout system, actual mortality exactly matches expected mortality.

In reality, Super Preferred mortality is about five percent worse than the theoretical ideal. Preferred mortality is about even with the ideal and residual Standard lives are 10 percent better than ideal.
Dodd-Frank Gives Home States Sole Authority for Solvency Regulation

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The Dodd-Frank Act significantly changed the regulation of all financial services, including life insurance. Title V of the Act introduces important reforms affecting relationships between regulators, life insurers and reinsurers. Title V limits some but not all forms of extraterritoriality - instances where a state attempts to compel companies incorporated in other states to abide by its rules.

Title V addresses regulation of reporting requirements and solvency. Under the new law, a company’s home state has sole authority for solvency regulation – reserving, reporting, investments, etc. Dodd-Frank does not affect issues such as compensation structures, market conduct, product authorizations and remedies for distressed companies.

A well-known example of extraterritoriality is New York’s Regulation 147, enacted in 1994 to set reserving guidelines for products with long-term guarantees. Included in the regulation were rules guiding credit for reinsurance. For a New York insurer to obtain credit for reinsurance, that company’s reinsurance partners had to abide by New York regulations as well. Many companies set up New York-only subsidiaries to do business there to minimize the impact of the state’s strict reinsurance and reporting guidelines.

Section 531(a) of Title V of Dodd-Frank specifies that if the home state of the ceding insurer “recognizes credit for reinsurance for the insurer’s ceded risk, no other state can deny such credit for reinsurance.” It is a possible scenario that New York-specific subsidiaries will go away.

New York so far has not resisted these changes; however, the Empire State maintains that it can continue to require foreign admitted reinsurers to hold reserve levels that mirror the credit for reinsurance given to domestic carriers. New York is among the states that have already updated their insurance laws to align with Title V/Dodd-Frank. Other states include New Jersey, Indiana, Connecticut and Virginia. California and Georgia have legislation pending as well.

Dodd-Frank defines the power of setting reserving, solvency and reporting requirements to each insurer’s home state. On the other hand, those same regulators will have to abide by the decisions of other supervisors for foreign companies doing business within their borders. SGLA will continue to follow developments and provide updates.∞