Report

of the

Society of Actuaries

Predictive Modeling

Survey Subcommittee

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Introduction

This report presents the results of the Predictive Modeling Survey conducted by the Society of Actuaries (SOA) Committee on Life Insurance Mortality and Underwriting Surveys. The Survey was conducted in April 2011 and sent to chief actuaries and chief underwriters of direct and reinsurance companies writing business in the U.S. Fifty-four companies responded to all or part of the survey questions.

The objective of the Survey was to gather information on behalf of the life insurance industry about the degree of the use of predictive modeling and the tools and methods used by life insurance companies to optimize results. It should be noted that while predictive modeling has been utilized by the casualty industry for many years, it is currently in the initial phases of development and use in the life insurance industry. This Survey took a snapshot of how predictive modeling was being used by the insurance industry. For the purpose of this Survey, we provided a definition of what comprised Predictive Modeling.

Predictive modeling is:

> A process used in predictive analytics to create a statistical model of future behavior. Predictive analytics is the area of data mining concerned with forecasting probabilities and trends. A predictive model is made up of a number of predictors, variable factors that are likely to influence or predict future behavior. The end result is both a set of factors that predict, to a relatively high degree, the outcome of an event, as well as what that outcome will be. In marketing, for example, a customer's gender, age and purchase history might predict the likelihood of a future sale. To create a predictive model, data is collected for the relevant factors, a statistical model is formulated, predictions are made and the model is validated. The model may employ a simple linear equation or can be a complex neural network or genetic algorithm.

The Survey included sections on:

- Demographic Information
- Marketing
- Underwriting
- Reinsurance
- Claims
- Risk Mitigation
- Regulatory Issues
- Market Conduct

The Survey Subcommittee would like to thank all of the companies who participated in the Survey. We also thank those who helped us review this document and offered helpful suggestions and thoughtful comments. Finally, the Survey Subcommittee thanks the Society of

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Comments about this report and suggestions for future surveys are welcome and can be addressed to the Committee on Life Insurance Mortality and Underwriting Surveys c/o The Society of Actuaries.

Executive Summary

Fifty-four companies completed this Survey. Not all companies answered all questions; therefore, the number of respondents may vary by question. Where the numbers were relatively small, the results are expressed as numbers only.

The following summary highlights some of the more significant observations in this report.

Marketing:

- Upwards of 40% of respondents indicated they were currently using or considering using predictive modeling to enhance sales and marketing practices or strategies.
- Of those who responded, age, gender and financial data were by far the most frequently considered data points in developing the predictive model.
- The most prominent plans currently utilizing predictive modeling for marketing strategies were fully underwritten life insurance plans (term and permanent).

Underwriting:

- Half of the companies responding were <u>considering</u> using predictive modeling for life insurance products, with a higher percentage indicating an interest for fully underwritten as compared to simplified issue products.

Reinsurance:

- Fourteen companies sought reinsurance support for underwriting requirements or practices with respect to predictive modeling.

Claims:

- Four companies are <u>considering</u> using predictive modeling for claims.

Risk Mitigation:

- More than 80% of the respondents indicated that they were not using predictive modeling for any purpose.
- Of those who responded that they were using predictive modeling, more than 50% considered the risk associated with the use of predictive modeling.

Regulatory Issues:

- The area considered most important as it related to potential regulatory issues involved underwriting assessment and classification.

Market Conduct:

- Ninety percent of the companies responding to this section had not identified any market conduct issues related to predictive modeling.

Predictive Modeling Survey Report

Section I: Demographics

This section of the Survey asked companies to provide certain information regarding their company. Fifty-four companies responded to some or all of the survey questions.

1.1   The Survey asked about company size based upon new life insurance face amounts issued in 2009.

Table 1.1 - Company Size

Small (less than $1B)	Medium ($1B-$50B)	Large (over $50B)	Total # of Respondents
12 (22%)	30 (56%)	12 (22%)	**54**

1.2   The Survey asked what type of life insurance company the respondents worked for. The results are summarized below.

Table 1.2 - Type of Life Insurance Company

Stock	Mutual	Fraternal	Other*	Total # of Respondents
33 (61%)	17 (31%)	2 (4%)	2 (4%)	**54**

*Other (verbatim): One company reported being a stock subsidiary of a mutual holding company. The other company reported being privately owned.

1.3   The Survey asked if companies were the life affiliate of a multi-line insurance group. Of the 54 respondents, 23 (43%) answered "Yes" and 31 (57%) answered "No."

1.4   The Survey asked if the company was a direct writer or a reinsurer. Forty-nine (91%) reported being a direct writer, and five (9%) reported being a reinsurer.

Section II: Marketing

The purpose of this section was to address the predictive modeling techniques used in various distribution channels for marketing life and annuity products.

2.1.a   The Survey asked if companies were currently using or considering using predictive modeling to enhance sales and marketing practices or strategies. The number of respondents varied depending on the practice.

Table 2.1.a – Companies Responding to Various Sales and Marketing Practices

Practices	Currently Using	Considering Using	Not Considering	Total # of Respondents
Cross-selling to Current Customers	9 (18%)	13 (35%)	29 (57%)	**51**
Up-selling to Current Customers	9 (18%)	12 (24%)	30 (59%)	**51**
Lead Generation	7 (14%)	13 (26%)	30 (60%)	**50**
Target Marketing	10 (20%)	17 (34%)	23 (46%)	**50**
Level of Future Sales	4 (8%)	15 (31%)	30 (61%)	**49**
Other*	3 (13%)	2 (9%)	18 (78%)	**23**

> ***Other (verbatim):**
> - *Models are under development and currently in progress. Thus, our answer falls somewhere between currently using and considering using.*
> - *No plans yet, but very interested in educating ourselves on its potential.*
> - *Not currently using because of high cost of the options we have explored and the difficulty of determining the expected return on the investment. We are not far enough along in the "considering" process to answer the rest of the questions in this section of the survey. (2)*
> - *Our current initiative involves building a website that could gather more data.*
> - *Vulnerability and attrition models*
> - *We had used existing customer data to market our multi-line products including direct marketing efforts.*
> - *Agent recruiting (2)*
> - *Estimate future claim liability*
> - *Also have "defector" models*

In most cases, more than half of the respondents were not considering using predictive modeling in any of the various sales and marketing practices.

2.1.b   The Survey asked companies if they were **not** using predictive modeling to **enhance** sales and marketing practices or strategies. Thirty companies (72%) indicated they were not.

2.2   If the respondent indicated their company was currently using or considering using predictive modeling in sales and marketing, the Survey asked if their system was internally developed or purchased from an outside vendor. Thirteen companies responded to this question.

Table 2.2 - Development of System

Type of Development	Total # of Respondents
Internally Developed	4
Purchased/Leased*	3
Purchased but Significantly Modified	3
Other**	3
Total Responses	**13**

*"Purchased/Leased" Comments (verbatim):
- *SAS (2)*
- *DMRA* (Database Management Research Analytics)
- *Don't Know*
- *Don't recall--I'm not in marketing so I don't use it.*

**Other (verbatim):
- *Not sure*
- *Consulting*
- *TBD*

Additional Comments (verbatim):
- *Current system was internally developed. May or may not switch to a vendor solution as enhancements are considered.*
- *SAS enterprise minor*

2.3   The Survey asked companies to indicate what data was considered in developing the model and to check all that applied. Twelve companies responded to this question.

Table 2.3 - Data Considered in Developing the Model Used in Sales & Marketing

Data Considered	Currently Using	Considering Using
Age	10	2
Gender	10	0
Financial Data	9	0
Lifestyle Data (e.g. shopping data)	5	4
Competitiveness of Premium	5	2
Commercial Applications (e.g. LexisNexis)	4	2
Credit Reports	4	0
Motor Vehicle Record (MVR)	3	1
Other*	3	0

*Other (verbatim):
- *Census track data*
- *Internal customer data*
- *Not involved in project*

Of those who responded, age, gender and financial data were by far the most frequently considered data points.

2.4   The Survey asked companies in which distribution channel(s) those practices had been used or considered. Ten companies responded to this question.

Table 2.4 – Distribution Channels

Distribution Channels	Currently Using	Considering Using	Not Considering
Direct Mail	8	0	1
Affiliated Agents	5	2	3
Individual Agent/Broker	3	2	2
Internet	2	3	3
Telemarketing	2	2	3
Banks/Financial Institutions	2	1	5
Credit Unions	2	0	5
TV/General Print Media	0	3	4
Specialized Print Media	0	2	4

Of the distribution channels available, predictive modeling was utilized most often with direct mail and affiliated agents. The Survey did not ask which distribution channel each company specifically uses.

2.5 The Survey asked companies which of the following plans they were currently using or considering using predictive modeling for sales and marketing practices. Twelve companies responded to this question.

Table 2.5 – Life Insurance Plans

Plans	Currently Using	Considering Using	Not Considering
Fully Underwritten Life - Permanent	5	3	0
Fully Underwritten Life - Term	5	3	0
Simplified Issue Life	4	7	1
Annuities - Deferred	3	2	1
Final Expense	2	4	2
Annuities/Immediate/Payout	2	3	1
Guaranteed Issue Life	2	2	5
Other*	0	0	1

***Other (verbatim)**: *We do not* [have] *sufficient historical data for Guaranteed Issue Life or Simplified Issue Life.*

It is difficult to draw specific conclusions regarding which life plans utilized predictive modeling for sales and marketing. The most prominent plans noted were fully underwritten life insurance plans. It is interesting to note that the largest cohort currently using or considering using predictive modeling is for simplified issue plans.

Section III: Underwriting

This section of the Survey examined how companies are using predictive modeling in underwriting assessment and classification.

3.1   The Survey asked companies for information on their use of predictive modeling in underwriting different types of fully underwritten, blood-tested life insurance products.   The number of responses varied from 36 to 44 depending on the product.

Table 3.1 – Use of Predictive Modeling in Underwriting
Fully Underwritten, Blood Tested Life Insurance Products

Product	Currently / Considering Using	Not Considering	Total # of Responses
Term Life	22 (50%)	22 (50%)	**44**
Whole Life	20 (45%)	24 (55%)	**44**
Universal Life	20 (49%)	21 (51%)	**41**
Variable Life	8 (22%)	28 (78%)	**36**
Other	3 (17%)	15 (83%)	**18**

Nearly half of all respondents indicated they are considering using predictive modeling in underwriting term life, universal life and whole life products.   Only 22% of respondents are considering using predictive modeling to underwrite variable life products.

3.2   For those respondents who indicated they are currently using or considering using predictive modeling in underwriting, the Survey requested further detail regarding the manner in which it is utilized to categorize risks. The number of responses again varied by product and ranged from 5 to 11 responses.

Table 3.2 – Utilization of Predictive Modeling to
Classify Risks for Fully Underwritten Products

Product	Preferred Risks Only	All Non-Rated (Standard or Better) Risks	All Risks (Standard and Sub-Standard)	Other (please describe)	Total # of Responses
Term Life	0	8 (73%)	3 (27%)	0	**11**
Universal Life	0	7 (78%)	2 (22%)	0	**9**
Whole Life	0	4 (57%)	3 (43%)	0	**7**
Variable Life	0	3 (60%)	1 (20%)	1 (20%)	**5**
Other	0	1 (100%)	0	0	**1**

For all products, more than half the respondents indicated they are considering predictive modeling to underwrite all non-rated risks. A smaller number of respondents indicated they would utilize predictive modeling when underwriting sub-standard risks.

3.3   The Survey then asked those respondents who are currently using or considering using predictive modeling in underwriting for information regarding the development of the system used. Fifteen respondents answered this question.

**Table 3.3 – Development of System Used in
Predictive Modeling for Fully Underwritten Products**

Development of System	Currently / Considering Using
Internally Developed	6 (40%)
Externally Purchased/Leased	5 (33%)
Purchased but Significantly Modified	3 (20%)
Other*	1 (7%)
Total # of Respondents	**15**

***Other (verbatim)**: *considering only -- not this far in the consideration process. Likely not internally developed.*

Only one respondent indicated they were currently using any system and they indicated that the system was internally developed.   The results were split fairly evenly between externally developed and internally developed systems. Thirty-three percent of respondents indicated they were considering an externally purchased or leased system in order to implement predictive modeling in underwriting; 40% indicated they were using or considering using an internally developed system. Twenty percent of respondents indicated they were considering purchasing a system, but anticipated that the system would be modified significantly.

If respondents indicated the system was externally purchased, the Survey also asked for the name of the vendor or software package. The only response received was the following:

Have not yet determined which system we will use. Considering systems developed by labs or other vendors such as Biosignia.

3.4.a   The Survey asked those respondents who indicated they were using or considering using predictive modeling in underwriting to specify how they were using or planning to use predictive modeling in underwriting. Eleven companies responded to this question.

**Table 3.4.a – How Predictive Modeling is Used in
Underwriting for Fully Underwritten Products**

Technique	Using / Considering Using	No	Total # of Responses
Risk Class Selection	8	1	**9**
Significant Data forwarded to Underwriter for Additional Action	6	2	**8**
Trigger Additional Underwriting Information	6	2	**8**
Rating Determination	6	1	**7**
Other*	1	0	**1**

***Other (verbatim)**: *don't know yet how we will use it in underwriting*

The majority of respondents indicated they were using or considering using predictive modeling in several ways in underwriting.

3.4.b   The Survey asked those respondents who indicated utilizing predictive modeling in underwriting to indicate if a score or decision is generated for any of the uses listed in question 3.4.a. Five respondents answered this question and these responses are shown below.

- *Yes*
- *System recommends a mortality assumption for each underwriting cl*ass
- *Not at this time*
- *We are considering this type of process (2)*

3.5   The Survey asked companies to indicate what data was considered in developing the predictive model and were asked to check all that applied. Eleven companies responded and the number varied by type of data.

Table 3.5 – Data Considered in Developing Predictive
Model Utilized in Underwriting Fully Underwritten Products

Data	Currently / Considering Using
Motor Vehicle Report (MVR)	11
Pharmaceutical Records	11
Build	9
Demographics (e.g., age, gender, etc.)	9
Medical Information Bureau (MIB)	9
Family History	8
Company Mortality Experience	7
Industry Underwriting Data (e.g., laboratory studies)	7
Lab Test Results for Individual Applicants	7
Company Underwriting Data	6
Financial Data	6
Insurance Activity Index (IAI) from MIB	5
Credit Reports	4
Industry Mortality Experience	4
Commercial Applications (e.g., LexisNexis)	3
Lifestyle Data	3
Medical Studies (e.g., NHANES, Framingham, Internet research, etc.)	3
Reinsurance Manual	2

The types of data with the highest number of respondents indicating using or considering using were MVR and pharmaceutical records (11 each) followed by build, demographics and MIB (9 each).

3.6   The Survey asked companies for information on their use of predictive modeling in underwriting different types of simplified issue life insurance products. Forty-one companies responded and the number varied by product.

**Table 3.6 – Use of Predictive Modeling in
Underwriting Simplified Issue Life Insurance Products**

Product	Currently / Considering Using	Not Considering	Total # of Responses
Term Life	20 (48%)	21 (51%)	**41**
Universal Life	15 (39%)	23 (61%)	**38**
Whole Life	18 (47%)	20 (53%)	**38**
Final Expense	6 (16%)	31 (84%)	**37**
Other*	1 (9%)	10 (91%)	**11**

***Other (verbatim)**: *YRT reinsurance of perm products*

Only 16% (6 of the 37 respondents) indicated they were considering using predictive modeling for final expense products. A higher percentage indicated they were considering using it for simplified issue term life, universal life and whole life products. However, more than half of the respondents indicated they were not considering using predictive modeling in underwriting any simplified issue products.

3.7   For those respondents who indicated they were currently using or considering using predictive modeling in underwriting simplified issue products, the Survey requested further detail on how predictive modeling was utilized to categorize risks. The number of responses again varied by product and ranged from 5 to 10 responses.

**Table 3.7 – Utilization of Predictive Modeling
to Classify Risks for Simplified Issue Products**

Simplified Issue Product	Preferred Risks Only	All Non-Rated (Standard or Better) Risks	All Risks (Standard and Sub-Standard)	Other (please describe)	Total # of Responses
Term Life	1	7	2	0	**10**
Universal Life	1	4	1	0	**6**
Whole Life	1	3	1	0	**5**
Final Expense	0	0	0	0	**0**

For all products, more than half the respondents indicated they were considering predictive modeling to underwrite all non-rated risks. A smaller number of respondents indicated they would utilize predictive modeling when underwriting sub-standard risks.

3.8   The Survey asked those respondents who were currently using or considering using predictive modeling in underwriting simplified issue products for information regarding the development of the system used. Thirteen companies responded to this question.

Table 3.8 – Development of System Used in
Predictive Modeling for Simplified Issue Products

System	Currently / Considering Using
Internally Developed	6
Externally Purchased/Leased	5
Purchased but Significantly Modified	2
Total # of Respondents	**13**

Comment: One of the respondents indicated they are considering working with a reinsurer to develop a system.

3.9   Next, the Survey asked respondents to indicate what data was considered in developing the predictive model for simplified issue products. The number of responses varied by type of data and ranged from two to eight. The total number of respondents was nine.

Table 3.9 – Data Considered in Developing
Predictive Model Utilized in Underwriting Simplified Issue Products

Data	Currently / Considering Using
Pharmaceutical Records	8
Build	7
Demographics (e.g., age, gender, etc.)	7
Financial Data	7
Motor Vehicle Record (MVR)	7
Family History	6
Medical Information Bureau (MIB)	6
Company Mortality Experience	5
Company Underwriting Data	5
Credit Reports	5
Insurance Activity Index (IAI) from MIB	5
Reinsurance Manual	5
Commercial Applications (e.g., LexisNexis)	4
Industry Mortality Experience	4
Lab Test Results for Individual Applicants	4
Lifestyle Data	4
Industry Underwriting Data (e.g., laboratory studies)	3
Medical Studies (e.g., NHANES, Framingham, Internet research, etc.)	2
Other*	1

***Other**: Respondent did not indicate what other data was utilized.

Eight respondents indicated they either currently use or are considering using pharmaceutical records. Seven respondents indicated using or considering using the following data in a predictive model developed for simplified issue underwriting: build, demographics, financial data and MVR.

Section IV: Reinsurance

This section of the Survey gathered information about potential inputs from reinsurers regarding the use of predictive modeling. There are sections for direct writers and for reinsurers.

Direct Writers

4.1.a   The Survey asked direct writers if their company had sought or considered some form of reinsurance support for predictive modeling. Forty-four companies responded; 14 had sought reinsurance support, while 30 had not.

4.1.b   The Survey asked why those companies had not sought reinsurance support. Twenty-one companies responded with comments.

> **Comments (verbatim):**
> - *We are not this far into the project on the life product side*
> - *Don't know*
> - *Value not seen*
> - *Not ready to begin integrating changes*
> - *We have relatively low benefit level and need very little reinsurance*
> - *too early in the process.*
> - *Don't have the resources for proper analysis*
> - *Our company is too small for us to trust the benefits would outweigh the costs.*
> - *Have not yet reached a point to start discussing opportunities.*
> - *Higher priorities given the time commitment*
> - *We are only investigating the concept at this time.*
> - *Could do internally, if pursued.*
> - *Not interested at this time.*
> - *Currently do not have enough direction to know what information we need from reinsurers.*
> - *We've valuate Predictive Modeling and don't feel that it make sense for us at this time.*
> - *Not that far along, expect to contact reinsurers for support from a reinsurance perspective*
> - *Predictive modelling is not something we're even considering at this time.*
> - *We reinsure very little at this time.*
> - *Far more pressing priorities.*
> - *our reinsurance program is currently under review*
> - *We need to identify and evaluate the benefits and risks associated with using predictive modeling first before seeking reinsurance support.*

4.2   The Survey asked those respondents who indicated they had sought reinsurance input to specify in which areas they had requested it. Forty-four companies responded to this question.

Table 4.2 – Reinsurance Support Areas

Specific Area	Yes	No	Considering	No Response
Claims	1	4	3	3
IBNR	0	5	0	5
Marketing (i.e., target market)	1	5	1	4
Pricing	4	1	5	1
Underwriting requirement(s) or supplement to risk selection practices	7	0	7	0
Other	0	0	1	3

Companies sought or considered seeking reinsurance support for claims (4 companies), marketing (2 companies), pricing (9 companies), and underwriting requirements or practices (14 companies). It appears that all 14 companies that responded "Yes" to seeking reinsurance support in question 4.1.a sought it for underwriting requirements or practices.

Comments (verbatim):
- *Not sure excactly. I know if's been discussed.*
- *admin engine*

4.3.a   The Survey asked those direct company respondents who indicated they had sought reinsurance input whether the reinsurers had been receptive to the application or use of predictive modeling techniques. Thirteen companies responded. Ten reported the reinsurers had been receptive and three reported the reinsurers had not been supportive of the predictive model application.

4.3.b   The Survey asked respondents who answered "No" to provide the reasons given by their reinsurer for their reluctance to embrace their predictive model strategy. Two companies responded.

Comments (verbatim):
- *No actuarial justification for conclusions of predictive modeling.*
- *reluctance expressed to not using APS, blood and urine*

Reinsurance Providers

4.4 The Survey asked reinsurance company respondents if their company applied predictive modeling to any of the following functions. Companies were encouraged to check all situations that applied to them and five companies responded.

Table 4.4 – Reinsurance Use of Predictive Modeling

Specific Areas	Yes	No
Claims	1	4
Facultative placement models	0	4
IBNR	1	4
Marketing (i.e. target market)	0	4
Pricing assumptions	1	4
Underwriting requirements or supplements to risk selection practices	1	4

Section V: Claims
This section of the Survey gathered information about the responding companies' use of predictive modeling regarding claims' procedures and evaluations.

5.1   The Survey asked companies to identify situations where they used or might use predictive modeling to assist with claims practices. Companies were encouraged to check all situations that applied to them. Forty-one companies responded to this section.

Table 5.1 – Predictive Modeling Situations

Situation	Currently / Considering Using	Not Considering
Calculating/estimating incurred but not reported claims	4	37
Adjustments to expected rescission rates	3	38
Triggering different levels of life claims investigation	3	38
Triggering a rescission action	2	39
Other (Please describe)	1	15

The greatest number of companies that considered using predictive modeling in claims handling at the time of the Survey was four. Only one company responded that they were currently using predictive modeling for claims practices.

> **Comments (verbatim):**
> - *Sales>inforce>claims reports or / age>location>IMO>Agent*
> - *current focus has been underwriting and marketing, expect to explore other uses such as claims management and fraud investigations*

There were no responses for the following questions. **All 42 respondents clicked to bypass the remainder of the claims questions.**

5.2   If companies were currently using or considering using predictive modeling for determining claim investigation requirements, the Survey asked what factors they had identified. Companies were encouraged to check all situations that applied to them.

5.3   The Survey asked companies if they were currently using or considering using predictive modeling to automatically trigger a fraud investigation. Companies were encouraged to check all situations that applied to them.

5.4   The Survey asked companies if they were currently using or considering using predictive modeling to identify factors which might expedite a claim approval automatically. Companies were encouraged to check all situations that applied to them.

Section VI: Risk Mitigation

The purpose of this section was to obtain information regarding risk mitigation strategies that were in place or being considered to reduce the risk associated with the use of predictive modeling.

6.1.a   The Survey asked companies to indicate whether they had considered the risks associated with the use of predictive modeling and to check all that applied. Forty-one companies answered this question.

Table 6.1.a - Predictive Modeling Risk

Area	Yes	No	Not Using	Total # of Responses
Underwriting Assessment and Classification	9 (22%)	3 (7%)	29 (71%)	**41**
Claims Forecasting	3 (8%)	2 (5%)	34 (87%)	**39**
IBNR	1 (3%)	4 (10%)	34 (87%)	**39**
Pricing Assumptions	7 (18%)	2 (5%)	30 (77%)	**39**
Future Sales	4 (11%)	3 (8%)	30 (81%)	**37**

Of those who said "Yes," 40% of the respondents indicated they considered the risk associated with underwriting assessment and classification and pricing assumptions as most important.

6.1.b   The companies who responded " Yes" to question 6.1.a were asked if they had been able to mitigate the risks. Not all of the companies who responded "Yes" to 6.1.a responded to this question.

Table 6.1.b - Mitigating Risk

Area	Yes	No	Total # of Responses
Underwriting Assessment and Classification	4	3	**7**
Pricing Assumptions	3	3	**6**
Future Sales	1	3	**4**
Claims Forecasting	0	3	**3**
IBNR	1	0	**1**

Comments (verbatim):
- *WE are at the very front end of using predictive modeling but will certainly consider the risks carefully.*
- *We're still in the early stages of evaluating these risks.*
- *Not sure*
- *Have considered risks associated with underwriting as we consider whether to use a model (accuracy of model; agent acceptance; regulatory concerns)*
- *Adjusting pricing assumptions and monitoring experience would mitigate risks*

6.2 The Survey asked companies to indicate the strategies used to limit the exposure to the risks that modeling may not do a good job of predicting and to check all that applied. Nineteen companies responded.

Table 6.2 - Strategies to Limit Modeling Risk

Strategy	Total # of Responses
Limit face amount	17
Limit maximum issue age	17
Perform post-issue analysis of emerging experience	16
Limit products utilizing predictive modeling	12
Include risk premium	10
Limit marketing channel	10
Operate in clearly defined markets for products using predictive modeling	9
Use multiple predictive modeling techniques	5
Limit coverage period	4
Implement stringent claim administrative procedure	3
Vary compensation if a product uses predictive modeling	1

The most common responses regarding strategies limiting modeling risk were to limit face amount, limit maximum issue age, and perform post-issue analysis of emerging experience.

Comments (verbatim):
- *While we may expand in the future, we would limit to term products at the start*
- *Not using predictive modelling in any fashion at this time.*
- *We are not using these currently, but as we consider predictive modeling, these are some of the strategies that could be considered - in addition to others.*
- *Not currently using predictive modeling for any scenario.*

6.3 The Survey asked those respondents who indicated that they limit face amount in question 6.2 to specify the maximum face amount limit. There were 19 respondents to this question.

Table 6.3 - Maximum Face Amount Limit

Age	<$50K	$50-<100K	$100-<250K	$250-<500K	$500K and >	Total # of Responses
Under 40	0	1	4	3	2	**10**
40-59	1	0	4	0	2	**7**
60-70	1	2	2	1	0	**6**
Over 70	2	1	2	0	0	**5**

Most companies limit maximum face amount to $250K. A few companies allow face amounts of at least $500K, but these face amounts are only for issue ages under age 60.

> **Comments (verbatim)**:
> - *I assume we would limit the amount of coverage but we are not yet using this process*
> - *Haven't analyzed to this level, yet.*
> - *500K would likely be the max face initially*
> - *Not using at this time, but would consider. Amount to be determined.*

6.4 The Survey asked those respondents who indicated that they limit the coverage period in question 6.2 to specify the maximum term. Six companies responded.

Most of the respondents did not provide any additional information. Two companies limited or considered limiting the maximum term.

> **Comments (verbatim)**:
> - *We would limit the age at time of issue, the amount issued and the time period*
> - *Have not analyzed to this level, yet.*
> - *consider max age of 45*
> - *based on term product limitations*
> - *Not using at this time, but would consider. Amount to be determined.*

6.5.a The Survey asked the companies if they modified, changed or created any internal procedures based on analysis of predictive modeling results. Forty-three companies responded. Of those companies, only five (12%) said "Yes" and the remaining 38 (88%) said "No."

6.5.b The Survey asked those companies who responded "Yes" to question 6.5.a as to which areas they had made procedural changes and to check all that applied. Five companies responded to this question.

Table 6.5.b - Areas Where Procedure Changes Made

Area	Yes	No	Considering	Total # of Responses
Underwriting	1	2	1	**4**
Marketing	2	1	0	**3**
Pricing	2	1	0	**3**
Risk Management	2	1	0	**3**
Valuation	2	1	0	**3**
Asset Liability	1	1	0	**2**
Claims	1	1	0	**2**
Legal	0	2	0	**2**

Most of the companies that responded said they made procedural changes in the areas of marketing, pricing, risk management and valuation.

> **Comment (verbatim)**: *not in production yet but these processes will need to be evaluated for change*

Section VII: Regulatory Issues

Statutes and the interpretations of insurance regulations must always be weighed when a company is considering the use of a new tool or process that could impact pricing or valuation. The purpose of this section was to elicit information about those new tools and processes as they related to regulatory issues.

7.1   The Survey asked respondents if their company had explored any existing or potential regulatory issues related to the use of predictive modeling in any of the following areas of their company. Respondents were asked to select all that applied. Twenty-one companies responded.

Table 7.1 – Areas of Existing or Potential Regulatory Issues Explored

Areas	Total # of Responses
Underwriting Assessment & Classification	15
Marketing (i.e., target market)	5
Pricing Assumptions	5
Claims Forecasting	1
IBNR	0
Other*	2

The area considered most important as it related to potential regulatory issues involved underwriting assessment and classification.

*Other (verbatim):
- *Not yet*
- *Not sure*

Comments (verbatim):
- *Not formally*
- *N/A*
- *No*
- *As we consider predictive modeling, we monitor potential regulatory issues. Our understanding at this time the regulatory returns are not necessarily about the use of predictive modeling, but the use of certain data in models.*

Section VIII: Market Conduct

The purpose of this section was to elicit information from companies related to the use of predictive modeling for market conduct issues.

8.1   The Survey asked if companies had identified any market conduct issues related to predictive modeling. Of the 42 companies responding, four (10%) answered "Yes" and 38 (90%) answered "No."

8.2   The four respondents answering "Yes" in question 8.1 were asked to identify the areas in which they found issues.

Table 8.2 - Areas with Market Conduct Issues

Issues	Yes
Underwriting Assessment and Classification	3
Marketing	2
Claims Adjudication	1
Pricing Assumptions	1
Compliance	0
Legal	0
Sales	0

The most important market conduct issues were underwriting assessment and classification and marketing.

> **Comment (verbatim)**: *Any 'issues' we have with the model have been addressed such that we feel we are in compliance.*

8.3   The respondents from question 8.1 were asked what market conduct issues were considered for the models chosen above. There were three responses: 1) *legal, FCRA*; 2) *legal and compliance*; and 3) *ability to disclose reasons for underwriting assessments and classification to applicant and company employees.*

Additional Comments about the Survey (verbatim):

- *Our average size face amount is over $650,000 and we have had extremely favorable mortality over the past ten years. Also, our % of risk classifications have been very consistent with pricing assumptions for some time. In view of our successful business practices, we have no plans to explore predictive modeling at this time.*
- *We are very early in the "considering" stage, so answered the questions to reflect that.*
- *We have seen the impact PM has had in the P&C sector of the insurance industry and believe there can be application to the life sector, but haven't seen it effectively being used yet. We are in the education process right now and will let our findings dictate the extent to which we will apply PM to our business models.*

Appendix A - List of Participating Companies

Alfa Life Corp.
Allstate Financial
American General Life & Accident
American-Amicable of TX Group
Americo
Ameritas
Amica Life Insurance Co
Assurant Solutions
Auto-Owners Insurance
Combined Insurance
COUNTRY Life
CUNA Mutual Group
Empire Life
Erie Family Life
Farm Bureau Life Insurance Company of Michigan
Federal Life Insurance Company (Mutual)
Generali USA Life Re
Grange Life Insurance
Guarantee Trust Life
ING
John Hancock Financial
Knights of Columbus
Lincoln Financial Group
MassMutual
MetLife
Midland National Life
NACOLAH
Nationwide Financial
Northwestern Mutual
Ohio National
OneAmerica
Optimum Re Insurance
Oxford Life Insurance Co
Pacific Life Insurance Company
Phoenix Life
Principal International, Inc
Prudential
Royal Neighbors of America
SCOR Global Life
Scott & White Health Plan
Securian Financial Group
State Farm Life Insurance Company
Sun Life Financial

Symetra
TARe
The Cincinnati Life Insurance Co.
The Hartford
The Lafayette Life Insurance Co.
TIAA-CREF
Transamerica Life Canada
Transamerica Reinsurance
Trustmark Insurance Company
Ullico
USAA Life Insurance Co.

Appendix B – Predictive Modeling Survey

Introduction

The Committee on Life Insurance Mortality and Underwriting Surveys of the Society of Actuaries is undertaking a survey regarding predictive modeling in the life insurance industry.

The objective of the survey is to gather information on behalf of the industry about the degree of the use of predictive modeling and the tools and methods used by life insurance companies to optimize results. It should be noted that while predictive modeling has been utilized by the casualty industry for many years, it is now only in the initial phases of development and use in the life insurance industry. This survey intends to take a snapshot of the current status of this development. This survey includes sections on:

- Demographic Information
- Marketing
- Underwriting
- Reinsurance
- Claims
- Risk Mitigation
- Regulatory Issues
- Market Conduct

Please complete the survey for your company's US individual life and annuity business. Life insurance and annuity amounts should be on a gross basis, before reinsurance ceded.

Please note that survey responses are submitted to the Society of Actuaries and individual responses will be kept confidential.

Definition of Predictive Modeling

Predictive modeling is a process used in predictive analytics to create a statistical model of future behavior. Predictive analytics is the area of data mining concerned with forecasting probabilities and trends. A predictive model is based on a number of predictors, factors that are likely to influence or predict future behavior. The model output is a set of factors that predict, at some confidence level, the outcome of an event. In marketing, for example, a customer's gender, age and purchase history might predict the likelihood of a future sale.

To create a predictive model, data is collected for the relevant factors, a statistical model is formulated. The model is then fitted or trained and validated on out-of-sample data. At that point, predictions can be made. The model may employ a simple linear or a more complex nonlinear relationship.

I. Demographic Information

The purpose of this section is to collect some information about your company and its market(s). Please do not complete this survey if you represent a consulting firm.

1. What is your company size, based upon new life insurance face amount issued in 2009?

Small (less than $1 billion)
Medium (between $1 billion and $50 billion)
Large (more than $50 billion)

2. What type of life insurance company do you work for?

Stock
Mutual
Fraternal
Other (please describe)

3. Is your company the life affiliate of a multi-line insurance group?

Yes
No

4. Is your company a direct writer or a reinsurer?

Direct writer
Reinsurer

II. Marketing
The purpose of this section is to address the predictive modeling techniques used in various distribution channels for marketing life and annuity products.

1a. Is your company currently using or considering using predictive modeling to enhance sales and marketing practices or strategies? (Check appropriate boxes)

	Currently Using	Considering Using	Not Considering
Cross-selling to current customers			
Lead Generation			
Level of Future Sales			
Target Marketing			
Up-selling to current customers			
Other (please describe)			

Comments:

1b. If your company is not using predictive modeling to enhance sales and marketing practices or strategies, please click here.

2. If currently using or considering using in sales and marketing, was (or will) the system (be) internally developed or purchased from outside vendor?

Internally developed
Purchased / Leased*
Purchased, but significantly modified
Other (please describe)

*From whom did you purchase/lease and what is the name of the software package?

Comments:

3. If currently using or considering using a predictive model in sales and marketing, please indicate what data was considered in developing the model: (Check all that apply)

	Currently Using	Considering Using
Age		
Commercial Applications (e.g., LexisNexis)		
Competitiveness of Premium		
Credit Reports		
Financial Data		
Gender		
Lifestyle Data (e.g., shopping habits)		
Motor Vehicle Record (MVR)		
Other (please describe)		

Comments:

4. In which distribution channels have these practices been used or considered?

	Currently Using	Considering Using	Not Considering
Affiliated Agents			
Banks / Financial Institutions			
Credit Unions			
Direct Mail			
Individual Agent / Broker			
Internet			
Specialized Print Media			
Telemarketing			
TV / General Print Media			
Other (please describe)			

Comments:

5. Is your company currently using or considering using predictive modeling in the sale and marketing of the following plans?

	Currently Using	Considering Using	Not Considering
Annuities – Deferred			
Annuities – Immediate / Payout			
Final Expense			
Fully Underwritten Life – Permanent			
Fully Underwritten Life – Term			
Guaranteed Issue Life			
Simplified Issue Life			
Other (please describe)			

Comments:

III. Underwriting

The purpose of this section is to gather information on how companies are using predictive modeling in underwriting assessment and classification.

1a. Is your company currently using or considering using predictive modeling in underwriting the following products (fully underwritten, blood tested)?

	Currently Using	Considering Using	Not Considering
Term Life			
Universal Life			
Variable Life			
Whole Life			
Other (please describe)			

Comments:

1b. If your company is not using predictive modeling in underwriting the above products, please click here.

2. If currently using or considering using predictive modeling in underwriting, please indicate the appropriate products and risk categories: (Check all that apply)

	Preferred Risks Only	All Non-Rated (Standard or Better) Risks	All Risks (Standard and Sub-Standard	Other (please describe*)
Term Life				
Universal Life				
Variable Life				
Whole Life				
Other (please describe)				

*Please describe Other:

Comments:

3. If currently using or considering using predictive modeling in underwriting, please indicate how the system was developed:

	Currently Using	Considering Using
Externally Purchased / Leased*		
Internally Developed		
Purchased, but significantly modified		
Other (please describe)		

*From whom did you purchase/lease and what is the name of the software package?

Comments:

4a. How is predictive modeling used in underwriting? (Check all that apply)

	Yes	No	Considering
Rating determination			
Trigger additional underwriting information			
Risk class selection			
Significant data forwarded to underwriter for additional action			
Other (please describe)			

4b. For any of the uses chosen above, is a "score" or decision generated automatically?

Comments:

5. If currently using or considering using a predictive model in underwriting, please indicate what data was considered in developing the model: (Check all that apply)

	Currently Using	Considering Using
Build		
Commercial applications (e.g., LexisNexis)		
Company mortality experience		
Company underwriting data		
Credit reports		
Demographics (e.g., age, gender, etc.)		
Family history		
Financial data		
Industry mortality experience		
Industry underwriting data (e.g., laboratory studies)		
Insurance Activity Index (IAI) from MIB		
Lab test results for individual applicants		
Lifestyle data		
Medical studies (e.g., NHANES, Framingham, Internet research, etc.)		
MIB		
MVR		
Pharmaceutical records		
Reinsurance manual		
Other (please describe)		

Comments:

Please use the following definition of Simplified Issue when answering questions 6 through 9.

Simplified Issue

"Simplified Issue" can mean different things to different people. To provide the most meaningful and consistent results, we ask respondents not to provide information on products with any of the following characteristics:

Not:
- Nonmedical band of a fully underwritten product
- Routinely required paramedical examinations
- Routinely collected bodily fluids
- Agent-collected oral fluid or urine
- Guaranteed issue products
- COLI/BOLI products
- Credit insurance products
- "Group" products other than affinity groups solicited by mass marketing
- Juvenile-only products (e.g., under age 16)
- Annuity products
- Accidental death

6a. Is your company currently using or considering using predictive modeling in underwriting assessment and classification of simplified issue products?

	Currently Using	Considering Using	Not Considering
Final Expense			
Term Life			
Universal Life			
Whole Life			
Other (please describe)			

Comments:

6b. If your company is not using predictive modeling in underwriting assessment and classification of simplified issue products, please click here.

7. If currently using or considering using predictive modeling in underwriting simplified issue products, please indicate the appropriate products and risk categories: (Check all that apply)

	Preferred Risks Only	All Non-Rated (Standard or Better) Risks	All Risks (Standard and Sub-Standard	Other (please describe*)
Final Expense				
Term Life				
Universal Life				
Whole Life				
Other (please describe)				

*Please describe Other:

Comments:

8. If currently using or considering using predictive modeling in underwriting simplified issue products, please indicate how the system was developed:

	Currently Using	Considering Using
Externally Purchased / Leased*		
Internally Developed		
Purchased, but significantly modified		
Other (please describe)		

*From whom did you purchase/lease and what is the name of the software package?

Comments:

9. If currently using or considering using a predictive model in underwriting simplified issue products, please indicate what data was considered in developing the model: (Check all that apply)

	Currently Using	Considering Using
Build		
Commercial applications (e.g., LexisNexis)		
Company mortality experience		
Company underwriting data		
Credit reports		
Demographics (e.g., age, gender, etc.)		
Family history		
Financial data		
Industry mortality experience		
Industry underwriting data (e.g., laboratory studies)		
Insurance Activity Index (IAI) from MIB		
Lab test results for individual applicants		
Lifestyle data		
Medical studies (e.g., NHANES, Framingham, Internet research, etc.)		
MIB		
MVR		
Pharmaceutical records		
Reinsurance manual		
Other (please describe)		

Comments:

IV. Reinsurance

The purpose of this section is to gather information about potential inputs from reinsurers regarding the use of predictive modeling. Please note there is a section for direct writers and for reinsurers.

Direct writers only

1. Has your company sought or considered reinsurance support / advice for predictive modeling?

Yes
No

If no, why not?

2. If yes, in which areas has your company sought or considered reinsurance support / advice for predictive modeling?

	Yes	No	Considering	N / A
Claims forecasting				
IBNR				
Marketing (i.e., target market)				
Pricing assumptions				
Underwriting assessment and classification				
Other (please describe)				

Comments:

3. Have the reinsurers been receptive to the application or use of predictive modeling techniques?

Yes
No

If no, what reason(s), if any, were given for the reluctance of the reinsurer(s) to embrace predictive modeling?

Comments:

Reinsurance providers only

4. As a reinsurer, has your company applied predictive modeling for any of the following functions? (Check all that apply)

	Yes	No	Considering	N / A
Claims forecasting				
Facultative placement models				
IBNR				
Marketing (i.e., target market)				
Pricing assumptions				
Underwriting assessment and classification				
Other (please describe)				

Comments:

V. Claims
The purpose of this section is to elicit information regarding claims' procedures and evaluations as a result of predictive modeling.

1a. Is your company currently using or considering using predictive modeling in any of the following situations? (Check all that apply)

	Currently Using	Considering Using	Not Considering
Adjustments to expected rescission rates			
Calculating/estimating incurred but not reported claims			
Triggering a rescission action			
Triggering different levels of life claims investigation			
Other (please describe)			

Comments:

1b. If your company is not using predictive modeling in any of the above situations, please click here.

2. If currently using or considering using predictive modeling for determining claim investigation requirements, what relevant factors have you identified which have been incorporated into your model? (Check all that apply)

	Currently Using	Considering Using	Not Considering
Age of the insured at claim time			
Age of the insured at issue			
Agency submitting the claim			
Cause of death			
Date from expiration of contestable period			
Date from policy issue			
Documentation submitted with original claim			
Face amount			
Gender			
Post contestable issue claims to identify true fraud as opposed to material misrepresentation			
Other (please describe)			

Comments:

3. Has your company identified factors through the use of predictive modeling which automatically trigger a fraud investigation?

	Currently Using	Considering Using	Not Considering
Age of the insured at claim time			
Age of the insured at issue			
Agency submitting the claim			
Cause of death			
Date from expiration of contestable period			
Date from policy issue			
Distribution channel			
Documentation submitted with original claim			
Face amount			
Gender			
Post contestable issue claims to identify true fraud as opposed to material misrepresentation			
Other (please describe)			

Comments:

4. Has your company identified factors through the use of predictive modeling which might expedite a claim approval?

	Currently Using	Considering Using	Not Considering
Age of the insured at claim time			
Age of the insured at issue			
Agency submitting the claim			
Cause of death			
Date from expiration of contestable period			
Date from policy issue			
Distribution channel			
Documentation submitted with original claim			
Face amount			
Gender			
Post contestable issue claims to identify true fraud as opposed to material misrepresentation			
Other (please describe)			

Comments:

VI. Risk Mitigation

The purpose of this section is to obtain information regarding risk mitigation strategies that are in place or being considered to reduce the risk associated with the use of predictive modeling.

1. For your various predictive models, please indicate whether you have considered the risks associated with the use of the model and whether these risks can be mitigated. (Check all that apply)

	Have you considered the risks?			If yes, have you been able to mitigate the risks?	
	Yes	No	Not Using	Yes	No
Claims forecasting					
Future sales					
IBNR					
Pricing assumptions					
Underwriting assessment and classification					
Other (please describe)					

Comments:

2. The primary risk associated with any predictive model is that the model doesn't do a good job of prediction. This may or may not have a material impact on the company, depending upon what is being modeled. Please indicate below strategies you may be using to limit your exposure to this risk. (Check all that apply)

Implement stringent claim administrative procedure
Include risk premium
Limit coverage period
Limit face amount
Limit maximum issue age
Perform post-issue analysis of emerging experience
Use multiple predictive modeling techniques
Limit products utilizing predictive modeling
Limit marketing channel
Operate in clearly defined markets for products using predictive modeling
Vary compensation if a product uses predictive modeling
Other (please describe)

Comments:

3. If your company limits the face amount, please indicate the maximum face amount.

	< $50K	$50 - < $100K	$100 - $250K	$250 - < $500K	$500K and >
Under 40					
40 – 59					
60 – 70					
Over 70					

Comments:

4. If your company limits the coverage period, please indicate the maximum term.

	Yes	No	Considering
5 – 10 years			
11 – 15 years			
16 – 20 years			
To age 65			
To age 70			
To age 75			
To age 80			
To age 95			
Other (please describe)			

Comments:

5a. Has your company modified, changed or created any internal procedures based on analysis of predictive modeling results?

Yes
No

5b. If yes, in what areas of your company have procedural changes been made? (Check all that apply)

	Yes	No	Considering
Asset Liability Management			
Claims			
Legal			
Marketing			
Pricing			
Risk Management			
Underwriting			
Valuation			
Other (please describe)			

Comments:

VII. Regulatory Issues
Statutes and the interpretations of insurance regulations must always be weighed when a company is considering the use of a new tool or process that could impact pricing or valuation. The purpose of this section is to elicit information about these new tools and processes as it relates to regulatory issues.

1. Has your company explored any existing or potential regulatory issues related to the use of predictive modeling in the following areas within your company? (Check all that apply)

Claims forecasting
IBNR
Marketing (i.e., target market)
Pricing assumptions
Underwriting assessment and classification
Other (please describe)

Comments:

VIII. Market Conduct

The purpose of this section is to elicit information from companies regarding market conduct issues arising from the use of predictive modeling.

1. Has your company identified any market conduct issues related to the use of predictive modeling?

Yes
No

2. If yes, which models have you identified that have issues: (Check all that apply)

Claims adjudication
Marketing
Pricing assumptions
Underwriting assessment and classification
Other (please describe)

Comments:

3. For the models chosen above, what market conduct issues have you considered? (e.g., legal, compliance)

4. Additional comments: