

A banner for the 2017 SOA Annual Meeting & Exhibit. It features a central image of a person in a suit standing on a city skyline at night. The background is a light blue and white geometric pattern. Text is overlaid on the left and right sides.

2017 SOA
**Annual Meeting
& Exhibit**

Oct. 15-18, 2017
Boston, MA

Session 049 PD - Predictive Analytics ASOPs: Modeling and Setting Assumptions

Moderator:

David N. Karo, ASA, MAAA

Presenters:

Jason Jeffrey Altieri, ASA, MAAA

Eileen Sheila Burns, FSA, MAAA

Christine Hofbeck, FSA, MAAA

2017 SOA Annual Meeting & Exhibit

Session 049 PD - Predictive Analytics ASOPs: Modeling and Setting Assumptions

Eileen S. Burns, FSA, MAAA

Jason Altieri, ASA, MAAA

Christine Hofbeck, FSA, MAAA

David Karo, ASA, MAAA

October 16, 2017



SOCIETY OF ACTUARIES

Antitrust Compliance Guidelines

Active participation in the Society of Actuaries is an important aspect of membership. While the positive contributions of professional societies and associations are well-recognized and encouraged, association activities are vulnerable to close antitrust scrutiny. By their very nature, associations bring together industry competitors and other market participants.

The United States antitrust laws aim to protect consumers by preserving the free economy and prohibiting anti-competitive business practices; they promote competition. There are both state and federal antitrust laws, although state antitrust laws closely follow federal law. The Sherman Act, is the primary U.S. antitrust law pertaining to association activities. The Sherman Act prohibits every contract, combination or conspiracy that places an unreasonable restraint on trade. There are, however, some activities that are illegal under all circumstances, such as price fixing, market allocation and collusive bidding.

There is no safe harbor under the antitrust law for professional association activities. Therefore, association meeting participants should refrain from discussing any activity that could potentially be construed as having an anti-competitive effect. Discussions relating to product or service pricing, market allocations, membership restrictions, product standardization or other conditions on trade could arguably be perceived as a restraint on trade and may expose the SOA and its members to antitrust enforcement procedures.

While participating in all SOA in person meetings, webinars, teleconferences or side discussions, you should avoid discussing competitively sensitive information with competitors and follow these guidelines:

- **Do not** discuss prices for services or products or anything else that might affect prices
- **Do not** discuss what you or other entities plan to do in a particular geographic or product markets or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

Adherence to these guidelines involves not only avoidance of antitrust violations, but avoidance of behavior which might be so construed. These guidelines only provide an overview of prohibited activities. SOA legal counsel reviews meeting agenda and materials as deemed appropriate and any discussion that departs from the formal agenda should be scrutinized carefully. Antitrust compliance is everyone's responsibility; however, please seek legal counsel if you have any questions or concerns.

Presentation Disclaimer

Presentations are intended for educational purposes only and do not replace independent professional judgment. Statements of fact and opinions expressed are those of the participants individually and, unless expressly stated to the contrary, are not the opinion or position of the Society of Actuaries, its cosponsors or its committees. The Society of Actuaries does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information presented. Attendees should note that the sessions are audio-recorded and may be published in various media, including print, audio and video formats without further notice.

2017 SOA Annual Meeting & Exhibit

EILEEN BURNS, FSA, MAAA

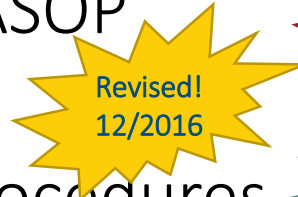
Session 49, Predictive Analytics ASOPs: Modeling and Setting Assumptions

October 16, 2017



ASOPs Relevant to Predictive Analytics

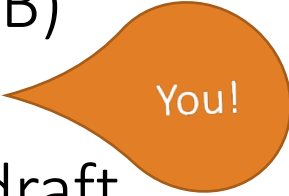
- ASOP 1 – Introductory ASOP
- ASOP 23 – Data Quality
- ASOP 25 – Credibility Procedures
- ASOP 41 – Actuarial Communications
- Draft ASOP – Setting Assumptions
- Draft ASOP – Modeling
- Others...



ASOP 1: Introductory ASOP

- Emphasizes scope of guidance from ASOPs:
 - Must vs. should
 - Materiality, practicality, professional judgment
 - Deviation
- Compliance
 - ASOPs are binding per the Actuarial Code of Conduct
- How new ASOPs come to be

How does a bill become a law?

- Discussion draft (task force)
- Exposure draft (parent ASB committee)
- Exposure draft (ASB)
- Comment period  You!
- Second exposure draft
- ...
- Approval (ASB)



The nitty gritty



Past Exposure Draft: Setting Assumptions

3.1 Setting or assessing the reasonableness of assumptions

3.2 Alternative assumptions and sensitivity

3.3 Prescribed assumptions set by law

3.4 Reliance on others

3.5 Assumptions set by others

- Links to ASOPs: Credibility Procedures and Data Quality
- Overall intention to emphasize actuarial judgment

3.1 Setting or assessing the reasonableness of assumptions

“The actuary should use professional judgment when setting assumptions or assessing whether assumptions set by the principal or another party are reasonable.”

Goals of the next several slides

- Highlight key areas that may be relevant to actuaries in predictive analytics functions
- Discuss content with respect to intention of achieving reasonable actions and proper use of professional actuarial judgment
- Encourage you to get involved
- Not intended to be comprehensive!

3.1 Setting or assessing the reasonableness of assumptions

3.1.1 General considerations

b. *“available and relevant data, including, where appropriate, the credibility of any such data as discussed in [ASOP No. 25, Credibility Procedures](#)*

d. *“whether there are reasons to expect that future experience will differ significantly from past experience.”*

3.1 Setting or assessing the reasonableness of assumptions

3.1.2 Adjustments for data deficiencies

“The actuary should consider to what extent it is appropriate to adjust assumptions to compensate for known deficiencies in the available data. The actuary should document any such adjustments made and should consider making disclosures, as appropriate, of any such adjustments.”

3.1 Setting or assessing the reasonableness of assumptions

3.1.3 Reasonableness of assumptions

- a. *“Consider the reasonableness of the material assumptions underlying each component of the methodology used. Where applicable, as described in section 1.2, this includes consideration of the reasonableness of the methodology selected”*

- Specific model forms should be assessed

3.1 Setting or assessing the reasonableness of assumptions

3.1.3 Reasonableness of assumptions

b. *“assess whether a set of assumptions is reasonable in the aggregate.”*

- Generally related to prescribed or padded assumptions
- Therefore may not be relevant to standard applications of predictive analytics, which tend to avoid using pads during model selection

3.1 Setting or assessing the reasonableness of assumptions

3.1.3 Reasonableness of assumptions

c. “ensure that assumptions are not set for the purpose of counteracting the effect of prescribed assumptions set by law.”



Duh.

3.1 Setting or assessing the reasonableness of assumptions

3.1.3 Reasonableness of assumptions

d. *“determine whether material assumptions, other than prescribed assumptions set by law, are reasonably consistent.”*

- Do your exposure basis match the model form chosen and experience data?

3.1 Setting or assessing the reasonableness of assumptions

3.1.3 Reasonableness of assumptions

e. “to the extent known to the actuary, consider consistency of assumptions with similar assumptions used for other assignments within the entity.”

- Do other product areas use GLMs? Is exposure defined consistently? These considerations may aid others throughout the organization in understanding and accepting methods selected.

3.1 Setting or assessing the reasonableness of assumptions

3.1.4 Margins for adverse deviations

“Where the purpose of the measurement allows for margins for adverse deviation, the actuary should consider whether it is appropriate to adjust the assumptions by including such margins, or choose assumptions that have already been adjusted. For example, such margins may be included to allow for uncertainty in the underlying data or assumptions.”

- Somewhat of a red flag for predictive analytics, this may be addressed in the upcoming Modeling ASOP

3.1 Setting or assessing the reasonableness of assumptions

3.1.5 Changes in condition

“The actuary should consider any material changes in conditions or experience that were known to the actuary by the information date and that might cause assumptions that reflect prior conditions or experience to no longer be appropriate. Examples of changes in conditions include the following:

- a. *“internal circumstances regarding the entity such as changes in claims processing or changes in the mix of business; or*
- b. *“external circumstances affecting the entity such as changes in the economic, legislative, regulatory, demographic, technological, and social environments.”*

3.2 Alternative assumptions and sensitivity

“If appropriate to the intended purpose, the actuary should consider using sensitivity analysis to evaluate the potential effects of reasonable alternative assumptions on the findings.”

3.4 Reliance on others

“The various elements of an assignment may require expertise in different actuarial practice areas. In recognition of the complexities involved, two or more actuaries with complementary qualifications in different practice areas may collaborate on an assignment, with each responsible for certain assumptions.”

Get your friends
involved!

3.5 Assumptions set by others

Precept 8 of the Code of Profession Conduct states

“An Actuary who performs Actuarial Services shall take reasonable steps to ensure that such services are not used to mislead other parties.”



Duh.

4.1 Actuarial Communications

If practical and relevant, the actuary should disclose

- Material assumptions (input)
- Material changes in assumptions (output)

Other relevant ASOPs



ASOP 23: Data Quality

- *“In 2014, the ASB concluded that this ASOP should be revised to update language to keep pace with practice changes (for example, increasing use of non-traditional data sources for predictive models, and legislatively mandated data submissions).”*
- Exposure draft open for comments (11/2015-2/2016)
 - Summarized key changes
 - Asked for specific questions to be addressed in comments
 - 23 comments received
- New version in effect 12/2016

ASOP 25: Credibility Procedures

- The original standard (1996) applied to only a few disciplines
- First exposure draft (9-12/2012)
- Second exposure draft (6-9/2013)
- Appendix I – Background and Current Practices
 - Emerging practice involving statistical models
- Practice note 2008

ASOP 41: Actuarial Communications

- Linked to every ASOP via *Section 4. Communications and Disclosures*



www.actuarialstandardsboard.org

The screenshot shows the website's interface. At the top is a navigation bar with links: HOME, ASB MEMBERS, STANDARDS OF PRACTICE, DRAFTS, GUIDELINES, COMMITTEES, ABOUT ASB, and CONTACT. Below this is a dark blue banner with the ASB logo and the text "ACTUARIAL STANDARDS BOARD". Underneath the banner is a secondary navigation bar with links: ALL STANDARDS, PENSION, LIFE, HEALTH, GENERAL, ERM, and CASUALTY. The main content area features three ASOP cards:

- ASOP 1**: Introductory Actuarial Standard of Practice. Category: General. Date: March 2013. Status: Adopted. View | Download PDF.
- ASOP 2**: Nonguaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts. Category: Life. Date: March 2004. Status: Adopted.
- ASOP 3**: Continuing Care Retirement Communities. Category: Health. Date: May 2011. Status: Adopted. View | Download PDF.

To the right of these cards is a text block: "For instructions on adding an icon to your handheld device that directly links to the ASB's mobile responsive website, click here." Below this text is the ASB logo.

2017 SOA Annual Meeting & Exhibit

JASON ALTIERI, ASA, MAAA

Session 49, Predictive Analytics ASOPs: Modeling and Setting Assumptions

October 16, 2017



Past Exposure Draft: Modeling

3.1 Applicability

3.2 Models Developed by Others

3.4 Model Meeting the Intended Purpose

3.5 Validation

3.1 Applicability

- Applies to models with either:
 - Material financial impact
 - Heavy reliance by user
 - Examples: ratemaking, reserving, and financial planning
- Exception for “simple models”
 - Simple models meet one of two criteria:
 - Results are transparent and can be predicted without a run
 - Results can be readily obtained from external source (not another model)
- Professional judgement applies

Discussion of Scope

- Intentionally broad scope of “modeling”
 - Provides a basis for narrower future standards
- Intended to cover all forms of modeling
 - Including predictive modeling
- Only formally applies to actuarial services (as defined in ASOP 1)
 - Intent is for broader applicability to all practice areas

3.2 Models Developed by Others

- Actuary should understand:
 - Intended purpose
 - General operation
 - Sensitivities and dependencies
 - Strengths and weaknesses

3.4 Model Meeting the Intended Purpose

“The actuary should select, design, build, modify, develop, or use a model that reasonably meets the intended purpose. An actuary who is reviewing or evaluating a model should evaluate whether the model reasonably meets the intended purpose”

- All the subsections in section 3.4 are expressed relative to the model’s intended purpose

3.4.1 Designing, Building, or Developing the Model for the Intended Purpose

- Consistency with intended purpose:
 - Granularity
 - Relationships recognized
 - Volatility/uncertainty
 - Ease of updates

3.4.5 Model Structure

- Structural considerations:
 - Inclusion of specific risks or provisions (i.e. plan with a geographic concentration)
 - Impact of the level of detail in inputs (i.e. is grouping okay)
 - Type of results (stochastic/deterministic)
 - Reflection of available options (i.e. financial options)

3.4.7 Assumptions and Parameters

- Based on actual experience, industry experience, and professional judgement
- Consider the use of margins
- Ranges of assumptions/parameters
- Internal consistency
- Re-evaluate appropriateness for each run (are the assumptions/parameters stale?)

3.5 Mitigation of Model Risk

- 3.5.1: Validation
 - Model Integrity
 - Analyzing the Output
 - Peer Review
- 3.5.2: Appropriate Governance and Controls

3.5.1 Validation—Model Integrity

- Reconciling inputs
- Checking logic and references
- Testing against historical results

3.5.1 Validation—Analyzing Results

- Assess reasonableness
- Comparison to prior model runs
- Sensitivity testing on changing inputs
- Comparing to alternative models

3.6 Presentation of Results

- Explain:
 - Methodology
 - Key assumptions/parameters
 - Limitations
 - Material changes (if applicable)
 - Intended purpose
- Choose language to reflect conservatism or optimism

Other relevant ASOPs

- ASOP 23 – Data Quality
- ASOP 41 – Actuarial Communications
- Setting Assumptions Exposure Draft

Applicability to Predictive Modeling

- Many of the concepts covered in the proposed ASOP are applicable to predictive modeling
- There are still some gaps:
 - No discussion of bias-variance tradeoff
 - Does not directly address generalization
- These gaps may be addressed in future drafts given past comments that it should apply to predictive modeling

2017 SOA Annual Meeting & Exhibit

Session 49, Predictive Analytics ASOPs: Modeling and Setting Assumptions

October 16, 2017

Presentation prepared by Mary H. Simmons, FSA, MAAA

Presentation given by Christine Hofbeck, FSA, MAAA

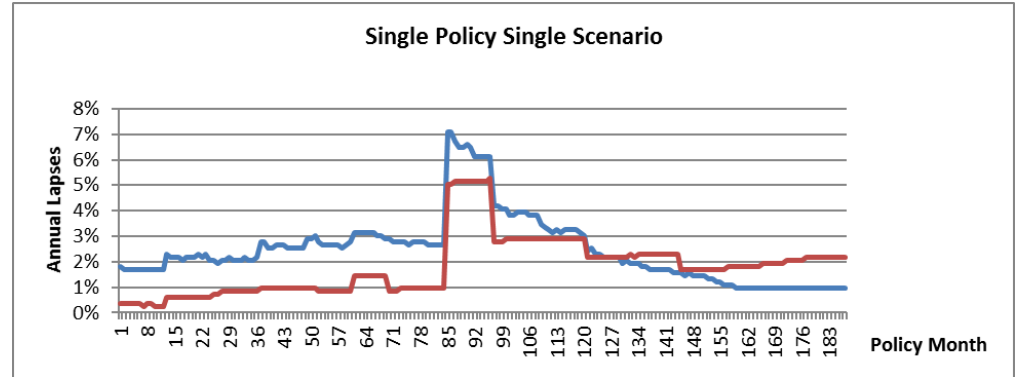


Scenario

- Chief actuary for Aesop's Life Insurance Company
- Considering Term post level lapse model and VA surrender model predictive models
 - Pricing
 - Cash flow testing

A Very Common Concern

- Can model results be relied upon to support decisions?
- Source of unexpected results
- Exposure drafts can help us

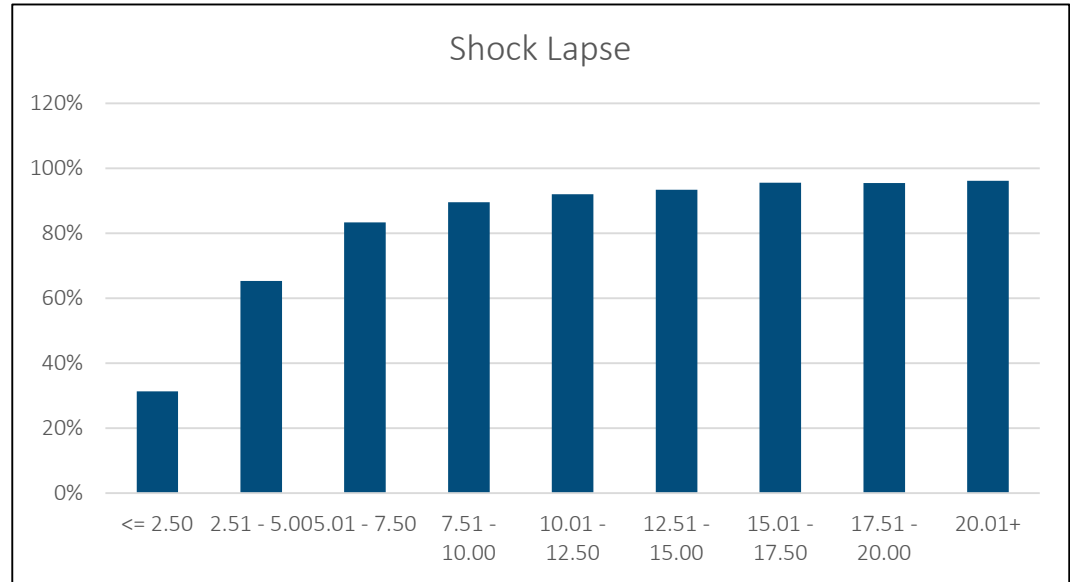


Where Do You Start?

- The data
- Setting Assumptions Exposure Draft guidance
- Modeling Exposure Draft guidance
- Example: VA surrenders correlation with unemployment rates

A Similar Point

- Model structure
- Granularity of the model
- Example: 10 year term shock lapses



General Data Concerns

- Credibility of data
- Lack of company data
- Relevance of industry data
 - Credibility ASOP

What If Your Data Is Not Fully Credible?

- Use a consultant to build the model
- Can I use a model someone else built?
 - Modeling Exposure Draft guidance
 - Understanding the model
 - Strengths
 - Limits

Can You Build a Model With Sparse Data?

- Maybe / Maybe not
- Assumptions Exposure Draft guidance
- Example: VA data is very credible for at the money guarantees

Can You Modify a Predictive Model?

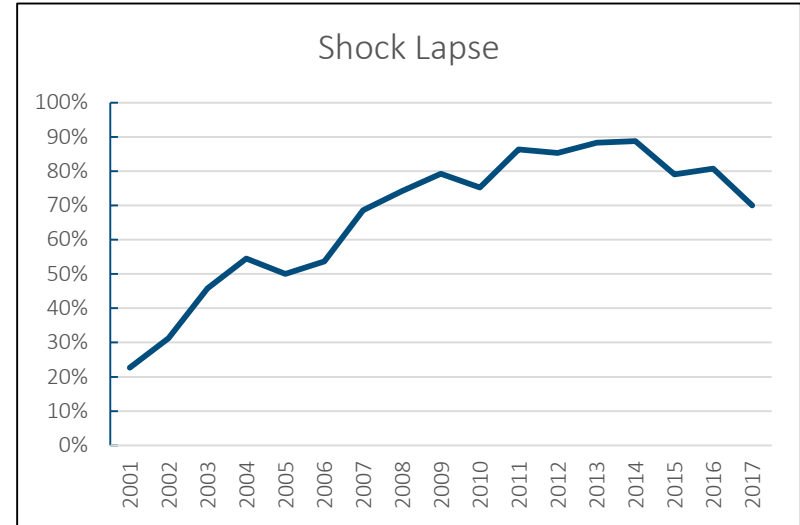
- Setting Assumptions Exposure Draft - use professional judgment when setting assumptions
 - Not allowed to NOT use professional judgment
- If waiting for fully credible data; then may wait a long time for some assumptions
 - Predictive model or not

How Do You Modify a Predictive Model?

- Modeling Exposure Draft - Same steps and concerns as when building a model
- That is - may be easy to justify changing a single factor if data is sparse
- May be inappropriate to try to change the structure of the model

Will the Future Always Resemble the Past?

- No
- Predictive models identify
 - Drivers of an observed behavior
 - Not just levels of an observed behavior
- Predictive models can help address this question.



“Only” Evaluating a Model?

- Auditing, peer review, or governance
- The Assumption Setting Exposure Draft still applies

Documentation Guidance

- ASOP 23 - Data quality
- ASOP 25 – Credibility
- ASOP 41 - Communication
- Setting Assumptions
- Modeling

QUESTIONS



Provide Your Feedback and Win!

Complete meeting and session evaluations on the mobile app or meeting website and be entered to win one of these three great prizes:

- One (1) complimentary registration to the 2018 Annual Meeting
- One (1) complimentary room reservation (max. 3 nights) at the Omni Nashville Hotel for the 2018 Annual Meeting
- One (1) complimentary registration a SOA webcast

Responses will be kept anonymous.

*See Official Rules at

<http://soa.org/2017annualinfo>



**SOCIETY OF
ACTUARIES®**



**SOCIETY OF
ACTUARIES®**



**SOCIETY OF
ACTUARIES®**