

Accelerated Underwriting and the Control Cycle

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Agenda

- The Actuarial Control Cycle
- Define the Accelerated Underwriting ("AUW") Problem
- Design the Solution: Implementing an AUW Model
 - \circ Data Sources
 - \circ Predictive Models
- Design the Solution: Product Design and Pricing
- Monitor the Results: Risk and Experience Monitoring





The Actuarial Control Cycle



The Actuarial Control Cycle

What is it?

Society of Actuaries' problem-solving framework Created in 2001, last revised 2010

What are the steps in it?

- 1. Define the problem
- 2. Design the solution
- 3. Monitor the results

What makes it distinctly actuarial?

"The nature of the work:

- > The problem will usually (though not always) involve uncertain future cash flows.
- > The design of a solution will almost always involve modeling.
- The actuary may have ongoing responsibility for monitoring the experience as it develops and advising on the response, or may seek to build flexibility into the solution."

Klugman, S. et al. 2012. Understanding Actuarial Practice. Society of Actuaries



Define the Problem



The Accelerated Underwriting Problem

Considerations to keep in mind:

- > No consistent industry definition of "accelerated underwriting"!
- > We see common goals or objectives across carriers:
 - a) Need to reduce underwriting time
 - b) Achieve fully-underwritten outcomes
 - c) Decrease acquisition costs
 - d) Improve the customer experience
 - e) Increase placement ratios

Define the Problem:

How do we reduce underwriting time while achieving fully-underwritten outcomes?

Why is it an Actuarial Problem?

The AUW problem is not just actuarial! It is imperative to collaborate with underwriters, data scientists and other stakeholders throughout the process.



Define the Problem: How do we reduce UW time while achieving fully-UW outcomes?

Control Cycle Step		What Makes It Actuarial	The AUW Problem		
1	Define the Problem	Involves uncertain future cash flows	Impacts to mortality and persistency from changes to the underwriting paradigm		
2	Design the Solution	Involves modeling	 Implement an AUW model Incorporate AUW into product design and pricing 		
3	Monitor the Results	Actuary responsible for monitoring emerging experience and advising on the response	Monitor AUW actuarial metrics, such as implied mortality loads		



Design the Solution Implementing an AUW model



Define the Problem: How do we reduce UW

time while achieving fully-UW outcomes?

Reducing Underwriting Time



Design the Solution:

Implement an accelerated underwriting model to replace medical exams with <u>data and models</u>.



What Data Sources Are Available?



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Part I application

What is it?

General or personal data filled out by the applicant seeking insurance.

Examples include:

- Insurance information (plan type, beneficiary, owner, etc.)
- Address
- Date of birth
- Occupation
- Activities and lifestyle history
- Financial history
- Other insurance applications or benefits
- Tobacco usage

How is it used?

- For triage
- For manual, full underwriting
- Input into risk class prediction or smoker predictor model

What are the actuarial implications?

Risk of misrepresentation and fraud.



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Part II application

What is it?

Medical questions filled out by the applicant seeking insurance.

Examples include:

- Medical information
- Personal history
- Family history

In traditional UW, this was filled out by the paramed taking fluids.

In AUW, this can be filled out through a tele-interview or through an e-Application.

How is it used?

- For triageFor manual, full underwriting
- Input into risk class prediction

What are the actuarial implications?

Risk of misrepresentation and fraud.





Motor vehicle records (MVR)

What is it?

Publically-available driving records.

🛲 MVR Online	

MVR Pricing (price per MVR)			<u>?)</u>

State / Territory	Years	Turnaround Time	Required Info.	Price
New York	3 YRS	Instant	DL#, Name, DOB	\$17.00
			* Contact us for volur	ne discour

Driver License Information Included in MVR

Org. Issue Date Issue Date		Exp. Date	License Class	Status	Endorsement
		\checkmark	\checkmark	\checkmark	\checkmark

New York CDL Medical Certificate Included in MVR

Issue Date	Exp. Date	Status	Self Certif.	Added Date	Restrictions	Examiner
\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark

Click Here to Order

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Availability: Employers & Insurance providers Requirements: Driver's signed consent

How is it used?

- ➢ For triage
- To define AUW kickouts
- For manual, full underwriting
- Input into risk class prediction
- What are the actuarial implications?

Provides insight into risk-seeking behavior.





MIB Checking

What is it?

Information that alerts underwriters to undisclosed risk factors that impact an applicant's health and longevity. Its products \succ For manual, full underwriting are commonly used in AUW:

- ➢ MIB Plan-F
- MIB Insurance Activity Index

Also known as Medical Information Bureau Inc., MIB is a company with service and product offerings for underwriting, actuarial, and compliance.

How is it used?

- To define AUW kickouts
- Trigger further UW investigation

What are the actuarial implications?

Provides protective value against high-risk applicants.



Prescription (Rx) history

What is it?

A report containing prescription history data. \succ For triage Details include drug name, dosage, fill date, \succ Input into risk class prediction pharmacy and physician information.

ExamOne and Milliman are the leading providers.



How is it used?

- > For manual, full underwriting
- For post-issue reviews

What are the actuarial implications?

Provides medical profile of an applicant without fluids, can help achieve fully underwritten outcomes.





Non-medical mortality scores

What is it?

A predictive model or set of models taking publicly available information as inputs and providing a mortality ranking as output.

More commonly known as credit-based scores.

LexisNexis Risk Classifier (LNRC) and TransUnion's TrueRisk Life Score are the most widely used.

How is it used?

- For triage
- To define AUW kickouts
- For manual, full underwriting

What are the actuarial implications?

Provide additional mortality segmentation, in addition to fully underwritten risk classes.



Medical mortality scores

What is it?

A relative mortality score that incorporates medical data, such as prescription data and medical records.

Milliman's Irix is a prescription-based predictive model that quantifies the relative mortality risk.

MassMutal's MyLifeScore360 incorporates both medical and non-medical self-reported data.

How is it used?

- For triageFor manual, full underwriting
- Input into risk class prediction

What are the actuarial implications?

Provides mortality risk in relation to medical information, without fluids. Can help achieve fully underwritten risk classes and, potentially, additional mortality segmentation.





Attending physician statements (APS)

What is it?

An APS is a testament by a hospital, physician, or medical facility who has treated an applicant seeking insurance.

It is ordered by the insurer and is on the insurer's dime.

(3) Did this sickness or injury arise out of patient's employment	ont? Yes
# "Yes", explain	
Is disability due to pregnancy? Yes No	X
If "Yes", what was approximate date of commencement	of pregnancy
(4) Nature of surgical or observical procedure, if any (Deuci of right leg \$150,00, 12-5-64, Debri 12-0-64, Bebriddement and sylit thick 12-12-64, Dressing change, partial, 2 Directing \$50,00, 12-2-64 Bin graf Date performed. Charge for this procedure \$ Charge for this procedure \$ Where performed. St. Vincent Hosp. 17 Where performed. St. Vincent Hosp. 17 ar (5) Give dates of treatments	se (My) 12-2-64. Inderidement of necrotic tissue from burn dement of necrotic tissue of burned rich leg \$150.00, ness skin grafting of third depres hunn; Vight leg \$250.00, \$0.00, 12-21-6-64. Breasing change (50.00, 12-21-64
Office 1-26-65, 1-29-65, 2-5-6	5, 2-19-65, 2-26-65, 3-9-65. No Charge
Home	S
Hospital	ss.
(6) Remarks:Patient.is.still.under. Da	-, 's cars
	Rogen vou Heinburg, M.D.
Date	Signed

How is it used?

- > For manual, full underwriting
- For post-issue audit reviews

What are the actuarial implications?

Post-issue APS audits provide early indications of expected mortality slippage in the AUW policyholders.





Electronic medical records (EMR)

What is it?

Digital version of the paper charts in a clinician's office.

They contain medical and treatment history of patients from **one practice**.

Providers are already incorporating EMRs into their product offerings such as ExamOne and Milliman.

How is it used?

For triageFor manual, full underwriting

What are the actuarial implications?

Provides medical profile of an applicant without fluids, can help achieve fully underwritten outcomes.



Electronic health records (EHR)

What is it?

Digital version of a patient's paper chart.

They include medical and treatment histories across **all health care providers** involved in a patient's care.

No market leader has been identified in the industry. Vendors in the race include: MIB, ExamOne, Milliman, Clareto, ...

How is it used?

- > Pilot programs to test EHRs.
- Not widely used by carriers yet.

What are the actuarial implications?

Provides comprehensive medical profile of an applicant without fluids. High potential to achieve fully underwritten outcomes.

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Lifestyle data

What is it?

To an extent, this has already been incorporated in FUW and AUW through Part I application questions.

Examples of emerging sources include:

- Consumer behavior
- Social media
- Wearable technology

How is it used?

- > Not used yet in underwriting
- Used in production for:
 - Propensity to buy models
 - $\circ~$ To provide discounts

What are the actuarial implications?

Can shift target markets and tap into healthy applicants that would not be identified otherwise.







Summary of data sources available

Medical data

Currently used...

- Part II application
 - Tele-interview
 - e-Application
- Attending physician statements (APS)
- MIB Checking
- Prescription (Rx) history
- Electronic medical records (EMR)
- Medical mortality scores

Not in use but widely considered...

- Electronic health records (EHR)
- Lifestyle data

Non-medical data

Currently used...

- Part I application
- Motor vehicle records (MVR)
- Non-medical mortality scores
 - (a.k.a., credit-based scoring)
 - LexisNexis Risk Classifier
 - TransUnion TrueRisk

"Third-party data"

Define the Problem: How do we reduce UW time while achieving fully-UW outcomes?

Design the Solution: Implement an AUW model to replace medical exams with data and models.



Modeling Lifecycle





Data-driven Approach

Dataset is a collection of samples from a probabilistic process, where ith sample is represented by:

 $Output_i = true_function(Input_i) + uncertainty(i)$

- Each data point is a manifestation of the true relationship and the sample's associated uncertainty.
- Idea: Learn the relationship between underwriting evidence and risk class.





Supervised Learning: Regression vs Classification





Model 1: Logistic Regression

- Assume that the AUW program is trying to accelerate individuals in Super Preferred Class.
- True function: linear relationship between the probability of True and inputs.
- Probabilities are generated by transforming the linear relationship into a sigmoid curve in range (0,1).
- Classification is done by selecting a threshold and classifying all cases with logits above threshold as true.





Model 2: Random Forest Classification

- Assume that the AUW program is trying to accelerate as many individuals as possible across all risk classes.
- Sequence of yes/no questions asked about data leading to predicted class
- Model built by constructing many linear boundaries







Model 2: Random Forest Classification

- Assume that the AUW program is trying to accelerate as many individuals as possible across all risk classes.
- Random forest is made up of many decision trees
- Uses random sampling of training data points when building trees and random subset of features when splitting nodes
- Final prediction does not rely on one individual tree, relies on a pool of votes from all decision trees.





Model Evaluation

Hold-out

Randomly divide the data set into 3 subsets

- Training Set : The subset of data used to build the model
- Validation Set : used to assess the performance the model. Use this set to fine tune model parameters and select the best-performing model.
- Test set : or unseen examples to assess the likely future performance of a model.



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Cross-Validation

- Divide the data into K subsets of equal size
- Build models each time using K-1 data sets and testing on the left out subset.
- Helps reduce bias and overfitting.





Evaluation Metrics

- To get the best performing model need to look more metrics than just accuracy and precision.
- Need to fully understand strengths and weaknesses of the selected model.
- Metrics to consider:
 - Trade off between straight-through processing and mortality cost.





Evaluation Metrics

- To get the best performing model need to look more metrics than just accuracy and precision.
- Need to fully understand strengths and weaknesses of the selected model.
- Metrics to consider:
 - Trade off between straightthrough processing and mortality cost.
 - Bias and fairness

