SOCIETY OF ACTUARIES

Health Spring Meeting
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Session # 25: Evaluating Inforce Blocks of Disability Business

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Evaluating Inforce Blocks Of Disability Business With Predictive Modeling

SOA Spring Health Meeting

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CLAIMANALYTICS

Agenda

- Intro to Predictive Modeling
- Modeling Diagnoses
- Evaluation of Inforce Blocks
  - Valuation of Open Claims
  - Claims Management Opportunities
- Summary

Introduction to Predictive Modeling

A Part of Everyday Life

Have you used a predictive model today?

- Mail sorting
- Credit card processing
- Credit scores
- Weather forecasting
- Grocery shopping

What is Predictive Modeling

- Harnesses power of modern computers to find hidden patterns in data
- Used extensively in industry
- Many possible uses in insurance:
  - Claim management
  - Pricing
  - Reserving
  - Fraud detection

About Predictive Models

May be parametric…

- apply numerical methods to optimize parameters
- E.g., gradient descent, competitive learning

Or non-parametric

- often have a decision tree form
- typically optimized using exhaustive search

Predictive Modeling Tools

Some common techniques

- Generalized linear models
- Neural networks
- Genetic algorithms
- Random forests
- Stochastic gradient boosted trees
- Support vector machines

Modeling Diagnoses

Why Model Diagnoses?

There's more to diagnosis than category

- within categories, severity varies
- similarities can exist between diagnoses of different categories
- how do we extract more information?

Scoring Diagnoses

Create a series of metrics for each diagnosis

- relative values from 0 - 10
- for example:
  - **terminal** **- curable**
  - **fine motor skills** **- pharmaceuticals**
- allows every diagnosis to be compared to every other diagnosis

Scoring Diagnoses - Example

	335.20 ALS	715.04 OA/Hand	722.6 DDD
DX Cat	Nervous System	Musculo-Skeletal	Musculo-Skeletal
Terminal	10	0	0
Curable	0	3	7
Fine Motor	10	8	0

Benefits

- Modeling allows each diagnosis to be compared to every other diagnosis
- Similarities and differences can be found and quantified – both within categories and between categories
- Better information ➔ better predictions

Evaluation of Inforce Blocks With Predictive Modeling

Inforce Blocks of Business

Two predictive modeling applications:

- Valuation of open claims with claimant-specific termination rate assumptions
- Identifying claim management opportunities

Claimant-specific Termination Rate Assumptions

Current Termination Rates

- Table-based
- Use small subset of known information:
  - **Age**
  - **EP**
  - **Gender**
  - **Maybe occ or diag**
- Tables work well in low dimensions
- In high dimensions, tables are often sparsely populated

Better Termination Rates

- Predictive modeling allows several additional factors to be accounted for:
  - Primary, secondary and tertiary diagnosis
  - Industry / SIC Code
  - Pre-disability income
  - Monthly benefit
  - Own occ period
  - Reporting lag
  - And more…

Modeling Termination Rates

- Build models to predict likelihood of termination between several horizons, eg:
  - **0-3 months**
  - **3-6 months**
  - **6-12 months…**
- Interpolate between key points
- Beyond 36 or 48 months, blend into table
  - Too few terminations to model

Building the Model

It starts with a data extract:

- Age
- Gender
- 2nd diagnosis
- Benefit
- Region
- Industry
- EP
- Diagnosis
- Income
- Occupation
- Own occ period
- and more

Building the Model

1. Model presented with your historic claim data, including known outcomes.
2. Model begins making predictions on cases in the sample…
3. …compares predictions to real outcomes, and begins to detect patterns…

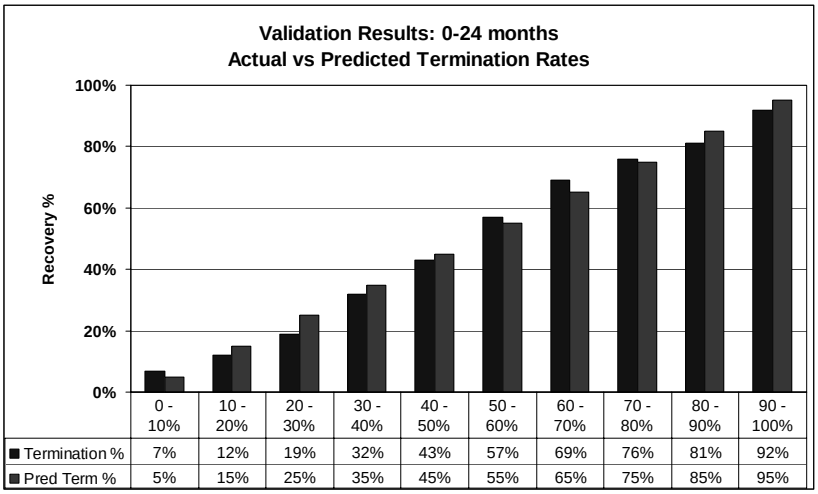
Initial predictions are rough…

- But… model continues to learn
- With each iteration the model's accuracy improves
- And converges to a complex algorithm that **fits the experience**

Model Validation

- Critical test of model's accuracy
- For 10% of data, withhold from modeling
- For this data, compare model predictions to actual outcomes

Validation Results



	0 - 10%	10 - 20%	20 - 30%	30 - 40%	40 - 50%	50 - 60%	60 - 70%	70 - 80%	80 - 90%	90 - 100%
Termination %	7%	12%	19%	32%	43%	57%	69%	76%	81%	92%
Pred Term %	5%	15%	25%	35%	45%	55%	65%	75%	85%	95%

Benefits

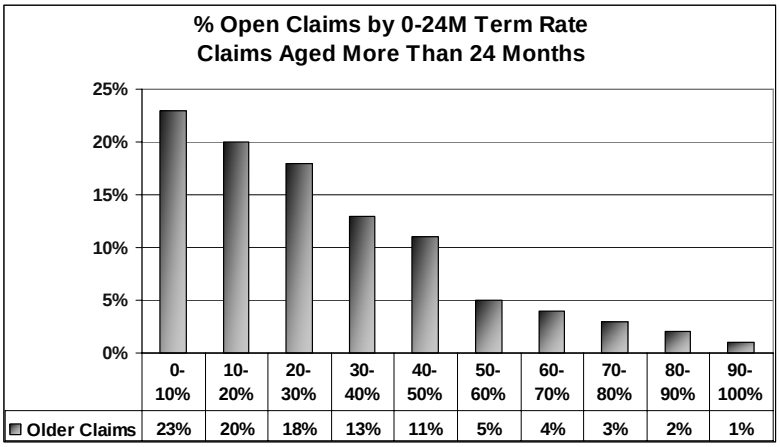
- Reserves are not averages – they are appropriate for each claim
  - Important if open claims differ from historical
- Model can train using data from either target company or acquiring company
  - To reflect claims management practices that will be used going forward

Identifying Claims Management Opportunities

Claims Management Practices

- Can vary greatly between companies
- In an acquisition scenario, claims area may need to quickly review inforce claims
- Predictive modeling can provide guidance about opportunities for inforce claims

Profile of Older Claims



Claims Open More than 2 Yrs

- About 5% of older claims had high probability of termination when new
  - It may be possible to revisit and help many of these claimants to return to work
- Most older claims had low probability of termination at benefit commencement date
  - Probability of termination likely even lower now
  - It may be possible to review and reduce allocation of resources to these claims (e.g., rehab)

Benefits

- Predictive model accurately accounts for the unique characteristics of each claim
- Predictive modeling isolates opportunities to realize significant value within the open claims block

Summary

Summary

- Claimant-specific termination rates can be modeled for inforce blocks of DI business
  - More accurate valuation of open claims
  - Identification of opportunities to realize value via claims management

Questions?