2018 Predictive Analytics Symposium

Session 34: Predictive Analytics (PA) – A Disruptive Force in Life Insurance Underwriting

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Disruptive Technologies and Life Underwriting: A Longitudinal Study

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SOA Predictive Analytics Symposium

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A Decade in the Life of a Disruptor

- Prologue – 2007-08
- Early Enlightenment – 2010
- Initial Predictive Model Implementation – 2013
- Iteration 2 – 2015
- A Period of Questioning – 2016-17
- New Directions – 2018

Perspectives

- Actuaries
- IT professionals
- Underwriters
- Clinicians
- Management
- Customers

Prologue – 2007-08

- Additive Model
- Bare bones comorbidity
- Arbitrary Caps

Prologue – 2007-08

Actuarial Perspective

- Focus on seniors – over 65
- Underwriting engine based on additive debits/credits
  - Developed by a clinician with little or no actuarial input or supporting data
- Unique underwritten lives crossed 50,000
  - Over half were in duration 1
  - 85,000 total underwritings
- Annual outsourced A/E studies provided little insight with no direction

Prologue – 2007-08

IT Perspective

- Poor manual workflow with enormous wastes of time and resources
- Inadequate Data Security
- Product Deliverables
  - Inconsistent, Not very informative
  - Exceptions were produced in Excel

Prologue – 2007-08

Underwriting Perspective

- Familiar paper environment
- Records emailed electronically were immediately printed

Clinical Perspective

- Rare disease
- Completely separate process with no crossover to standard UW

Management Perspective

- Difficulty finding enough bodies to fill labor intensive process
- High cost of resources (5 different positions from start to finish)
- A/E outsourcing expensive and difficult to prepare/understand

Prologue – 2007-08

Customer Perspective

- Wanted more information & transparency into the decisions
- Equal risk in liability of data breach
- Long turn-around-times

Prologue - 2008

2007/08 - Prologue Traditional Debit/Credits

- Additive Model
- Bare bones comorbidity
- Arbitrary Caps

2008 - Adjusting Mortality Multipliers (MM)

- Add Anti-Selection
- Future Mortality Improvement
- Adjustment Factors based on MM range

Prologue - 2008

Primary measure of success was Actual-to-Expected

- A/E bounced around – above and below 1 for years
  - Nose dive in 2007
- Actuarial solution
  - A/E by age/gender/smoking status/mortality multiplier (MM)
    - Quinquennial ages
    - MM: <1, 1-3, 3-5, 5+
  - Interpolate between those ages to develop adjustment factors for each MM bucket and apply them to future underwritings
  - Durational adjustment factors for anti-selection
  - US population mortality improvement introduced for the future

Prologue - 2008

Actuarial Perspective

- Not enough data
  - Half was less than a year in the study
- A/E is a retrospective analysis
  - Dealt with a small portion of the overall survival curve
- MM does not reflect differences in impairment profiles
  - Does cancer behave like heart disease?

Prologue - 2008

IT Perspective - Creation of Paperless Environment

- Resistance to change
- Resolved Data Security Issues
  - Clients uploaded records
  - Clients retrieved certificates through secure portal
- Product deliverables
  - Professional Presentation
  - Automated and consistent (Except for clinical reviews)
  - Anti-Fraud measures included

Prologue – 2008

Underwriting Perspective

- Scary New Frontier – “Where’s my paper and highlighter?”

Management Perspective

- Reallocating/Reducing Employees
- Increased Training
- Increased Hardware Requirements

Customer Perspective

- Full curve included
- Highlighted top impairments that impact mortality
- Reduced risk in liability of data breach
- Shorter Turn-Around-Times

Early Enlightenment - 2010

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2010 - Early Enlightenment

- In-house A/E Engine
- Medical Advisory Board
- Engagement with Chronic Disease Research Group
- Begin utilizing SAS for stepwise regressions

Early Enlightenment - 2010

- Built in house A/E to stratify performance by disease group – ***This did not paint a pretty picture!***
- Engaged a research group with access to Medicare data (Chronic Disease Research Group)
- Not a perfect fit with our population, but statistically significant
- Introduced us to their predictive models for mortality
- Used SAS to perform similar analysis of our data

Early Enlightenment - 2010

- Based on Cox Proportional Hazards Model and Kaplan-Meier
  - Immediately identified with Cox output
    - Gompertz similarity
- Bad News
  - Populations were not homogeneous

Early Enlightenment - 2010

- Good news
  - Some useful conclusions could be drawn from data stratified by zip code
  - We understood enough to take the next step
    - Develop predictive models based on CPH for our data exclusively
- Struggles with SAS
  - Extremely expensive
  - Slow to process large datasets
  - Poor code structure made learning curve harder

Early Enlightenment - 2010

Clinical Reviews – *"Why can't we learn from these too?"*

- Clinical Reviews now coded the same way to track variables for future analysis
- Clinical Review output consistent with standard product

Initial Predictive Model Implemented – 2013

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2010 - Early Enlightenment

- Medical Advisory Board
- Sub-committee to analyze individual conditions
- Engagement with Chronic Disease Research Group
- Begin utilizing SAS for stepwise regressions

2013 - Initial PM Implemented - First Exponential Based Model

- Multi-pass Cox Proportional Hazard Ratios on full model

Initial Predictive Model Implemented – 2013

Programming Tools – R

- Open source software – it's free
- Comprehensive governance
- Extensive validation
- 5,000 packages – including detailed graphics
- Well-suited for data applications
- Large support network - Worldwide use by statisticians, investment bankers, commercial bankers, academics

Initial Predictive Model Implemented – 2013

- Cox Proportional Hazard Ratios with hundreds of discrete and continuous variables
  - Multi-pass approach (All variables , p-value <=.2 , p-value <=.1 , p-value <=.05)

Initial Predictive Model Implemented – 2013

Actuarial Perspective

With every new answer came 20 new questions

- Conditions we thought would have an impact proved irrelevant (diastolic dysfunction) – *"So what… do we throw these conditions out?"*
- Conditions we thought were hazardous turned out protective (hyperlipidemia, family history) – *"How can that be? Does that make sense?"*
- Why when regressing on a single condition are the results so drastically different than when included in the full model – *"Something isn't right here… what are we missing?"*

Initial Predictive Model Implemented – 2013

Management Perspective

"This is much better than what we have now… Put it in production!"

Actuarial & IT Perspective

"We need to take more time to understand!"

Underwriting Perspective

"Some of these new debits/credits don't make sense!"

Initial Predictive Model Implemented – 2013

Client Perspective

"What happened… these results are totally different! And some of these things are ridiculous!"

Actuarial & IT Perspective

"How did we get to this point?"

Second Iteration –Deep Dive - 2015

2010 - Early Enlightenment

- Medical Advisory Board
- Sub-committee to analyze individual conditions
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- Begin utilizing SAS for stepwise regressions

2013 - Initial PM Implemented - First Pass at Co-morbidity

- Multi-pass Cox Proportional Hazard Ratios on full model

2014 - Second Iteration - Deep dive into Comorbidity

- Compare Cox Model to Regression of Individual Conditions
- Correlation Matrices
- Combining and ranking correlated conditions
- Combining other data sources to inform research

Second Iteration –Deep Dive - 2015

- Differences when running independent variables together in the regression vs. standalone
- Correlation matrices to analyze collinear explanatory variables
- New variables that measured effects of comorbidity
  - High level
  - Proving someone has a bad heart 6 different ways does not mean it's 6x worse

Second Iteration –Deep Dive - 2015

- Analysis by cohort
  - Age Banding
  - Gender
  - Lifestyle
- Use of other data to inform
  - Health data predicts impairments from Rx/Medical spend

A Period of Questioning – 2016-17

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A Period of Questioning – 2016-17

- New variables that combined collinear conditions
  - Where there's one… you'll see the other… so why not combine them?
    - Stenosed heart vessels
- Implications of removing variables from the model or ignoring statistically significant results

A Period of Questioning – 2016-17

- Vignette – ADL loss
  - Status Quo – individual debits for each ADL
  - UW perspective: there is a cutoff at 3+ ADLs where mortality spikes
  - Actuarial/IT response: create new variables to test this theory
  - Result: the data suggests that there are two cuts – at 4 and 6
  - Conclusion: Underwriters were directionally correct, but the analytics allowed further refinement

Today – Where We're Heading- 2018

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Today - Where we're heading

- Tracking onset of conditions
- Electronic Health Records
- Machine Learning

Today – Where We're Heading- 2018

- Collecting more information to look at additional perspectives (e.g. track onset and progression of conditions)
- Include other Big Data sources
- Exploring the power of Machine Learning
- Working on the next iteration
  - Comorbidity within and among disease families

Our Advice

- The world does not stand still so a commitment to PA is a long term decision
- Use all your resources in concert with one another. The perspectives you gained by bringing the right parties to the table are priceless!
- Involvement begets buy in
- Buy in begets success

Our Advice

- Creative processes take time… Don't force it!
- Meaningful improvement often requires breaking new ground
- Balance incremental growth and major change
  - Dependent on resource availability

Thank You!

For complete copy of this presentation, email

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Give it time…

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