Big Data and Advanced Analytics: Are You Behind the Competition?

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Deloitte.

Questioning our Traditional Detection of Morbidity/Mortality Risks

Which of these handsome gentlemen exhibit the best health risks?

Big Data on Consumers: what kind of information is available?

Third party companies, aggregate data from a variety of sources to create robust data profiles of consumers

Jane

- Reads two e-books per month
- Subscribes to multiple health magazines
- Attends yoga class twice a week
- Frequently purchases fruits and vegetables from grocery store
- Collects collectible plates
- Likes country music
- Listens to books on tape

Joe

- Subscribes to Diabetes Monthly magazine
- Frequently purchases discounted gift certificates for fast food from deal-of-the-day websites
- Orders plus-size clothing
- Gambles at casinos
- Reads about astrology
- Owns a video game system

Data is being collected on a daily basis through regular actions such as using a credit card, magazine subscriptions, prescription drug history, lifestyle habits

Big Data: Who collects it?

Data Vendors

Acxiom
AM Best
AMA
American Housing Survey
American Tort Reform Foundation
Burueau of Labor Statistics
Carfax
Census Point
Directory of US Hospitals
Dun & Bradstreet
EASI Analytics
EEOC
Equifax
ESRI
Experian
Fastcase Legal Research System
Florida Tax Assessment Records
Fulbright Lititgation Trends Survey
Insurance Information Institute
Internal Renvue Service
Knowlege Based Marketing (KBM)
LexisNexis
MRI Purchasing Propensities
NFIRS – National Fire Reporting
NHTSA
OSHA
US Census

Data vendors are…

Constantly collecting data

- Some companies process more than 50 trillion data transactions a year

Collecting & consumers may not know

- Consumers may be unaware their data is being collected, stored and aggregated

Selling the data to other companies

- Customers may include just about any company looking for insights into its customers

Experiencing success

- Acxiom had $1.13 billion dollars in revenue during the last fiscal year

The largest data vendors have 500 million active consumers worldwide with about 1,500 data points per person

Data Compliance: Impacts of the Fair Credit Reporting Act (FCRA)

FCRA and is subsequent amendments promote the accuracy, fairness and privacy of information in the files of consumer reporting agencies.

Impacts

- **Places limits on how data can be shared**- Consumer reporting agencies may not share data with a party that lacks permissible purpose
- **Disclose credit file upon request**- Credit reporting agencies must provide the consumer their credit report upon request and proper identification
- **Challenge disputed information**- Consumers may challenge what they believe to be inaccurate information, and the credit reporting agency must investigate
- **Delete outdated information** – Negative information that is more than 7 years old must be removed from the consumers file

FCRA Compliant Data
Motor Vehicle Report
Medical Information Bureau
Rx drug database
Credit score

FCRA non – Compliant Data
Transactional data
Census data
Event registration data
Big Data

How predictive analytics is being used today

How Analytics is used in other industries

Banking

- Cross-sell and up-sell financial services to maximize Customer Lifetime Value
- Identify fraudulent customers and transactions using neural networks, heuristic models and business rules
- Predict risk of delinquency and guide an integrated approach to collections and recoveries

Retail

- Retailers utilize predictive analytics to predict life events and send its customers customized marketing
- Analyze consumer buying behavior to inform direct marketing, in-store promotions, cross-selling
- Market basket analysis and in-store analytics

Technology

- Video streaming website used analytics to determine what actor, director and plot should be utilized to improve the chances of creating a popular television show (the company accomplished this goal)
- Dating websites analyze stated preferences, behavioral patterns on their website, and triangulation methods to find compatible matches
- Companies like Amazon and Netflix use historical preferences and buying patterns to make personalized product recommendations to their customers

How Analytics changed the P&C industry

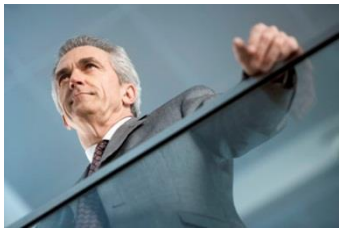
The P&C industry has recently been at the forefront of Analytics

- The use of predictive analytics in P&C Industry began with the use of credit scoring in the 1990s - an early bellwether of the disruptive power of data in insurance
- Today many property and casualty (P&C) insurers have analytics capabilities. Analytics is now considered essential to remain competitive
- The leading P&C companies typically apply analytics across the entire insurance lifecycle:
  - Distribution
  - Rating and pricing – Rate Plans
  - Underwriting –Loss Ratio Models
  - Claims management - Fraud, Adjuster Assignments, Duration and Severity of claims
  - Customer Lifetime Value – Retention, Cross-sell, Up-sell and overall risk management

Progressive *disrupted* the market with strategic use of data and telematics

1997: First insurer to sell policies online
2000: First insurance company to introduce a WAP
2002: First auto insurance group to receive a wireless payment
2000: Initiates driving habit research
2007: Introduces customized rates based on actual driving
2010: First insurer to offer Name your Price

Today there is increased awareness around analytics



- Farsighted leaders in a variety of domains are increasingly aware of the competitive and operational advantages that analytics can bring

- IBM recently reported that nearly three-quarters of insurance companies believe that big data and analytics will give them a competitive edge[1]

- The Chartered Institute of Loss Adjusters showed that 82% of industry professionals believe that organizations which do not utilize big data will become uncompetitive[2]

1 http://www-935.ibm.com/services/us/gbs/thoughtleadership/big-data/insurance/
2 http://www.computerweekly.com/feature/Ordnance-Survey--insurance-industry-can-harness-big-data-analytics

Can analytics be used in the health insurance, life insurance and retirement industries?

Current state of analytics: life insurance, health insurance and retirement industries

Insurers are incorporating applications of advanced analytics across the entire value chain and are using advanced analytics to better understand their business, learn more about their customers and to refine their business strategies.

Insurance Value Chain

Health Insurance

- Consumer Acquisition
- Member Retention
- Impairment and Cost Prediction
- Early Disease Identification
- Wellness and Change Behavior

Life Insurance

- Agent Recruitment
- Target Marketing
- Application Triage
- Proactive Retention Management
- Cross-Sell / Up-Sell

Retirement Providers

- Proactive targeting of rollover activities
- Identifying Plan participants for worksite marketing / cross-sell opportunities
- Driving effective segmentation in the “Communication and Education” approach

Current applications in the health insurance industry

Healthcare Reform is Bringing About Many New and Difficult Questions

Analytics and alternative data sources can be used to better understand the prospect and member populations.

Retention:
- Which members of a relatively unknown population are likely to leave?
- Which members do we want to invest our time and talent to keep?

Managing Individual's Health Risk:
- Which members will likely be afflicted with a specific disease?
- Which members show interest in change behavior?

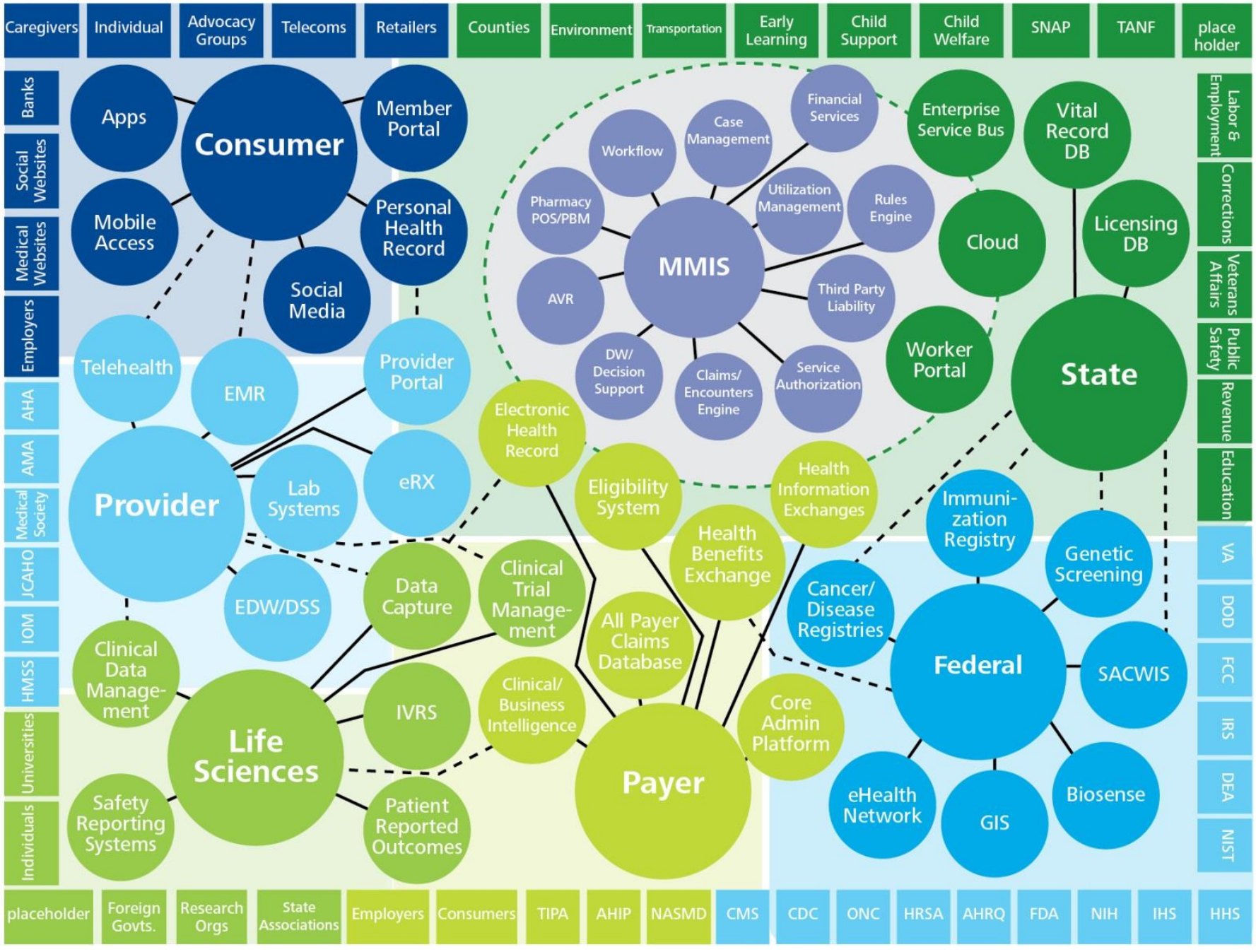
Acquisition:
- Which consumers are most likely to buy?
- Who are the best candidates to target with a specific product?
- What are upsell or cross sell opportunities?
- What is this customers Lifetime Value?

Wellness/Health Management:
- Which members are most likely to comply with health engagement programs?
- Which members have a higher probability of having positive outcomes from medical management programs?
- Which groups would it make sense to offer wellness initiatives to?

Future Medical Claims:
- What are the future health risks for members with unknown or limited claims data?

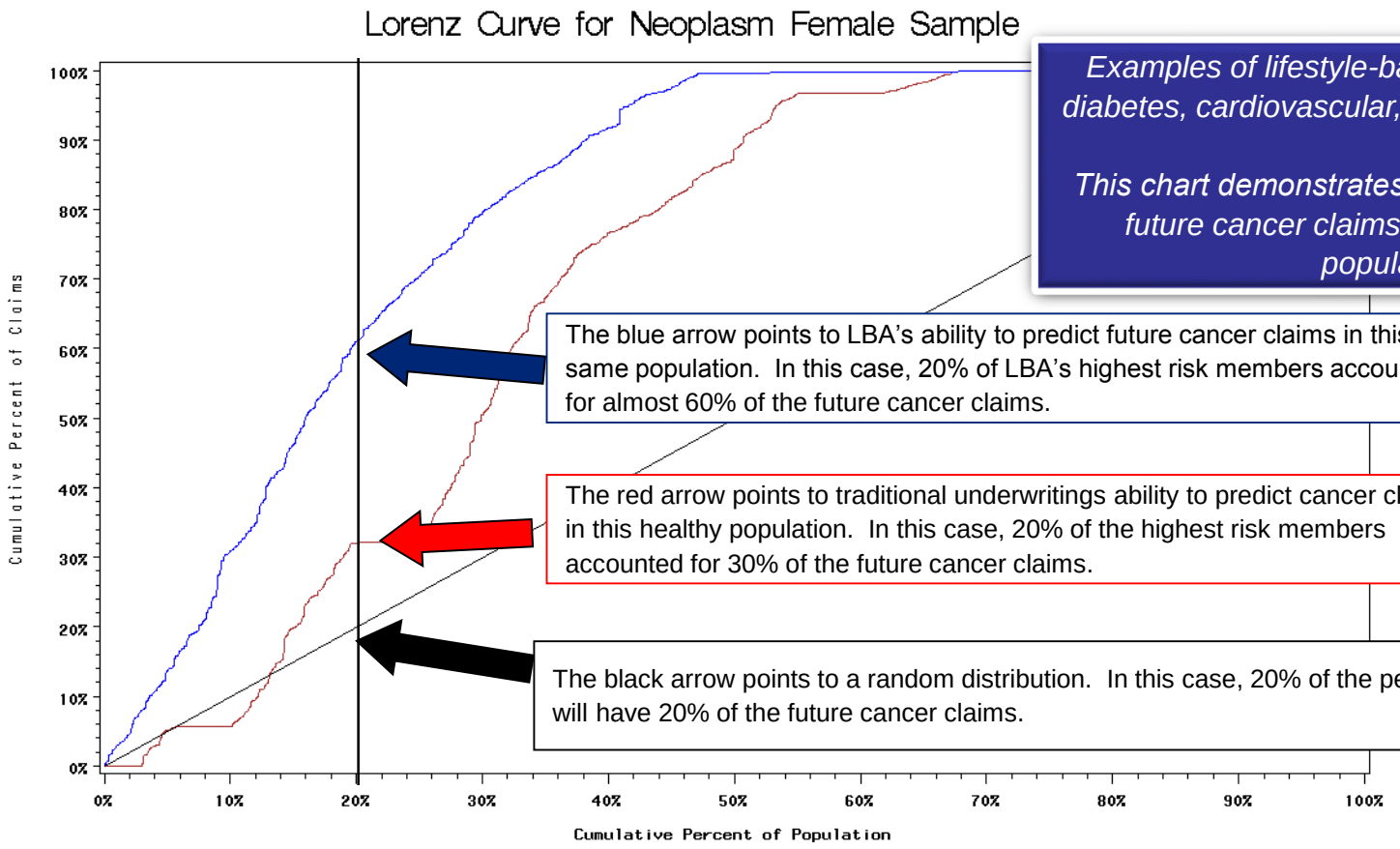
Health Plans, using a new generation of lifestyle-based analytical models, may be able to predict the likelihood of significant life events with more accuracy than ever before, and it starts with something as simple as a name and an associated address

Health Stakeholder & Technology Ecosystem



Wellness Application: Specific Disease State Risk Models

Lifestyle Based Analytics (LBA) focuses on identifying increased health risks using “lifestyle” based data. According to the US Surgeon General, lifestyle based diseases account for over 70% of US of healthcare expenses and subsequent deaths.



Examples of lifestyle-based diseases include: diabetes, cardiovascular, cancer, and respiratory.

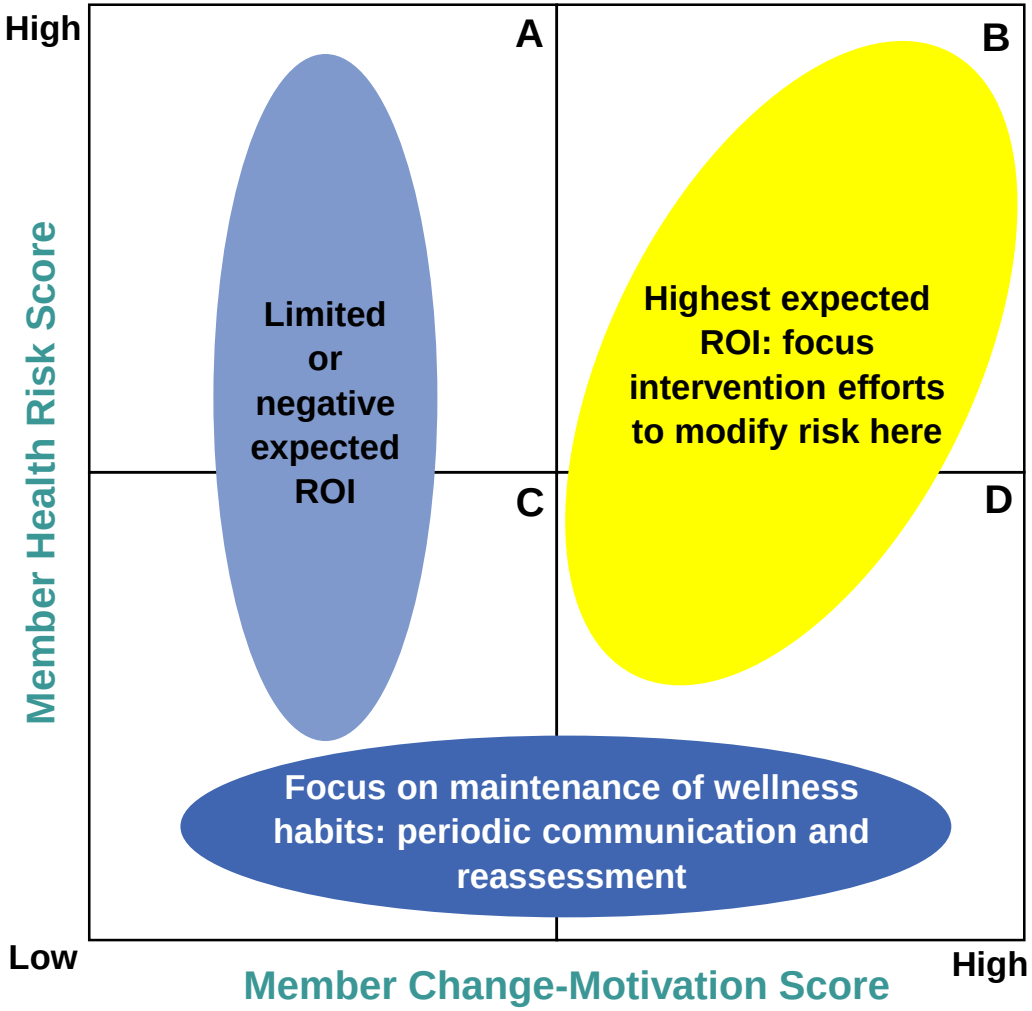
This chart demonstrates LBA’s ability to identify future cancer claims in a healthy female population.

The blue arrow points to LBA’s ability to predict future cancer claims in this same population. In this case, 20% of LBA’s highest risk members accounted for almost 60% of the future cancer claims.

The red arrow points to traditional underwritings ability to predict cancer claims in this healthy population. In this case, 20% of the highest risk members accounted for 30% of the future cancer claims.

The black arrow points to a random distribution. In this case, 20% of the people will have 20% of the future cancer claims.

Member Health Risk / Change-Motivation Matrix

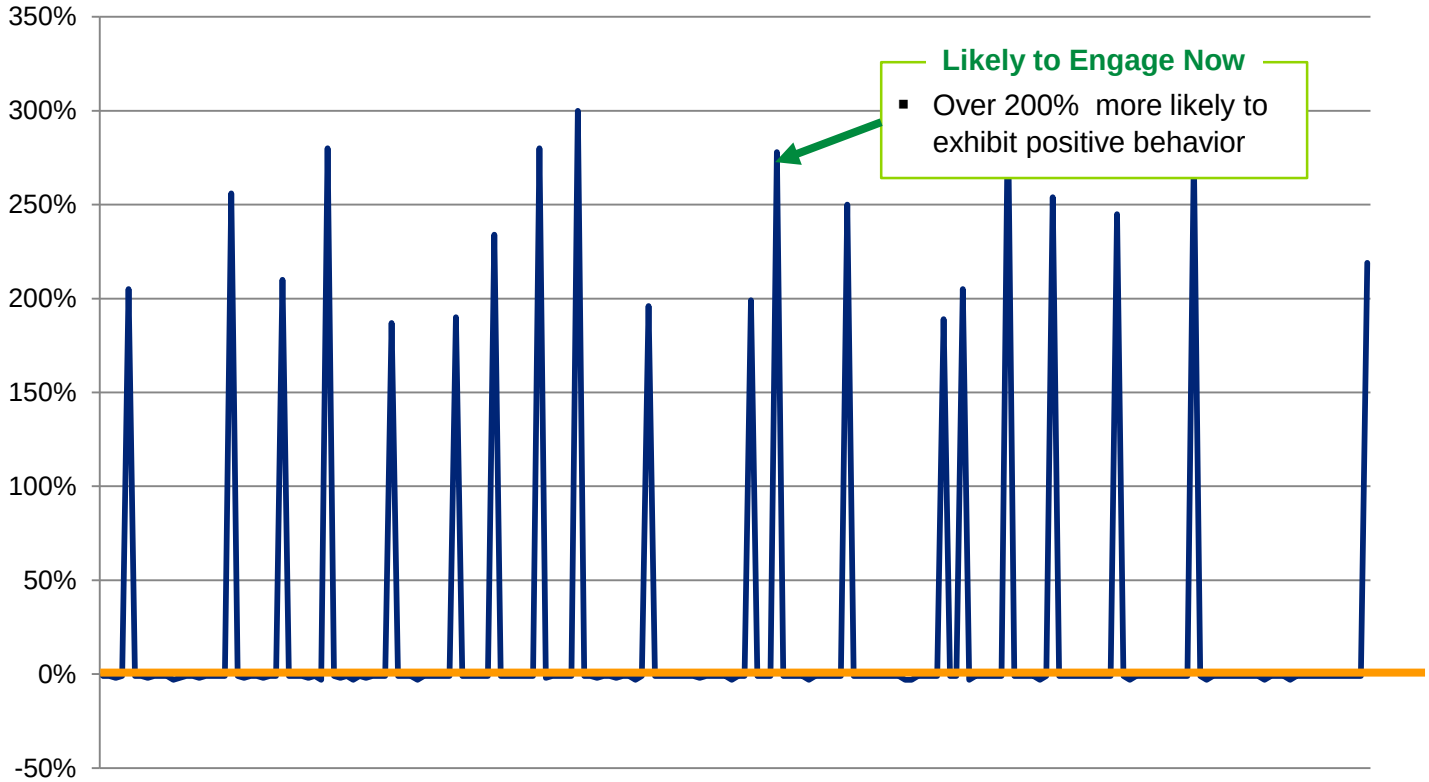


Focused wellness interventions start with associates and dependents that fall into Quadrant B – those members that are designated as high-risk **and** with a predicted willingness to change healthcare habits

Example of Timing Results for Engagement

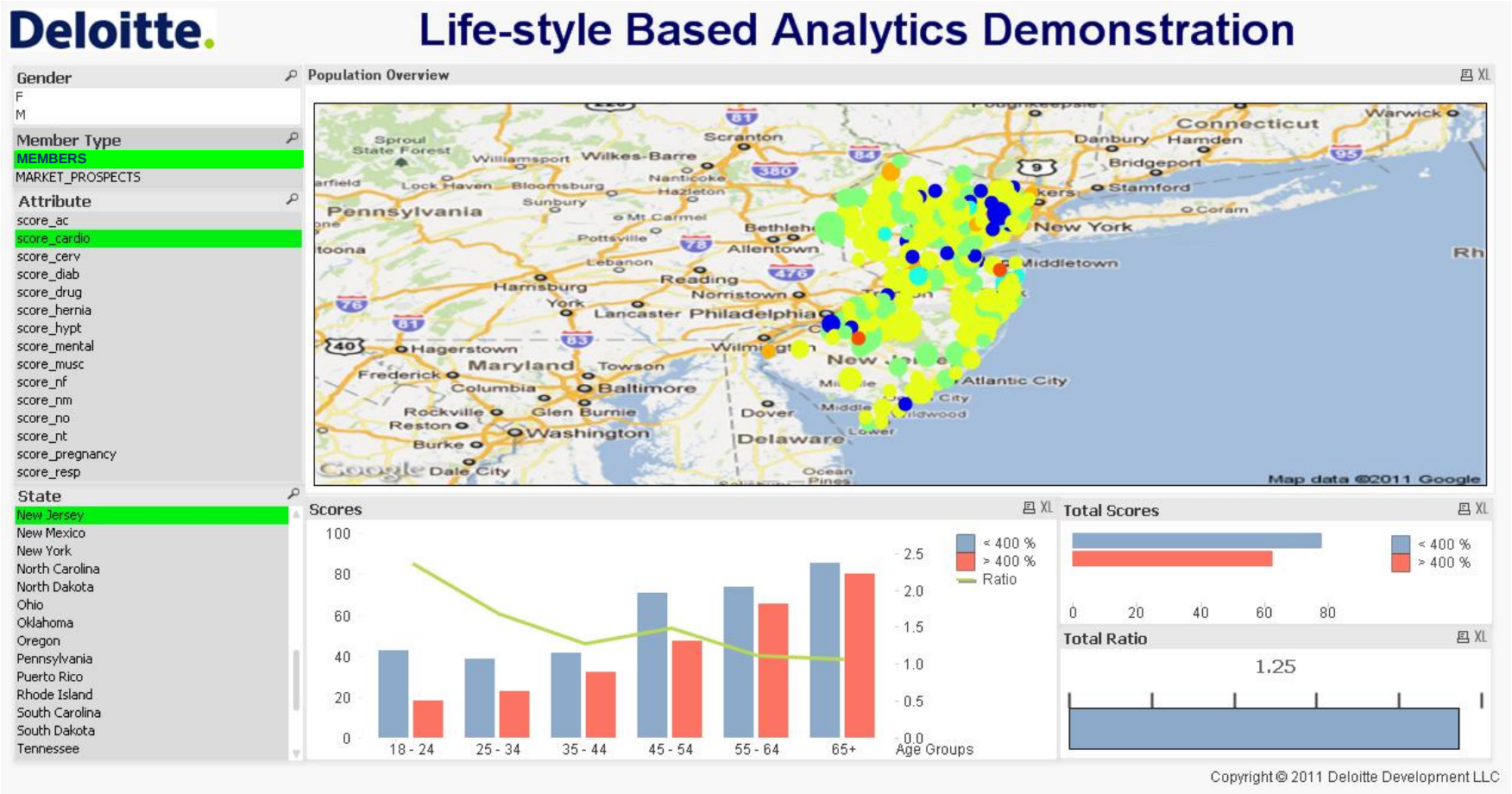
Historically attempts to focus on timing have been limited to single life events such as marriage or birth of a new child. Although these life events do increase the likelihood, they are often over marketed to events and your message can easily get lost in the others. However, using advanced statistical techniques like CART analysis we can find 100's of points where propensities to engage are heightened.

Example A Timing Lift Curve



Undiagnosed Conditions Represent Billions in Lost Reimbursement

We have the ability to display modeling results in graphic, front-end tools that allow users to select different dimensions for additional analyses. The exhibit below depicts member risk levels for Cardiovascular Disease for a sample of individuals in the greater New Jersey area.

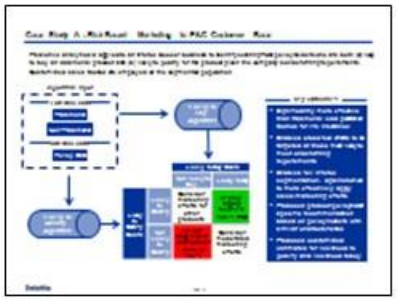


Current applications of analytics in the life insurance industry

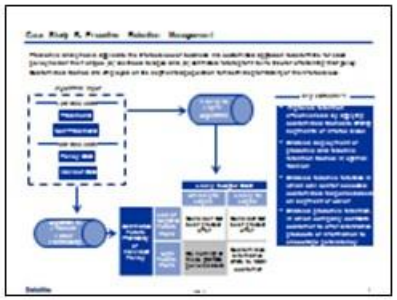
Current scenario in the life insurance industry

A variety of point solutions designed to improve a particular function by utilizing “big data” are being implemented in the industry today.

Growth

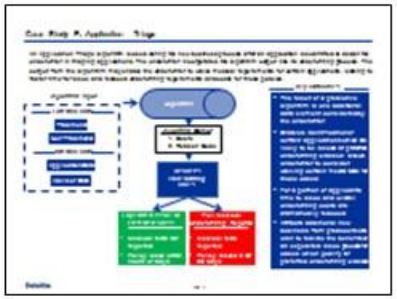


Risk-Based Marketing

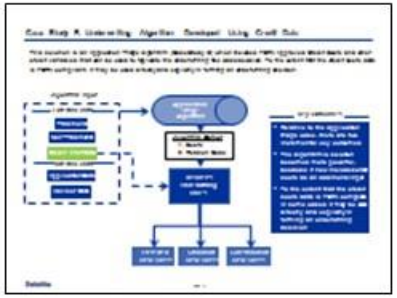


Proactive Retention Management

Operations

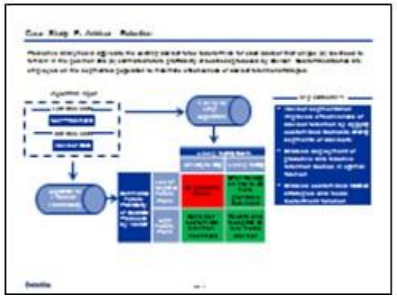


Application Triage

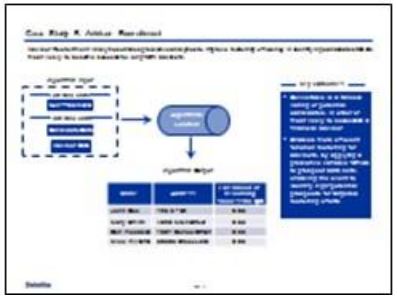


Underwriting Algorithm developed using Credit Data

Distribution



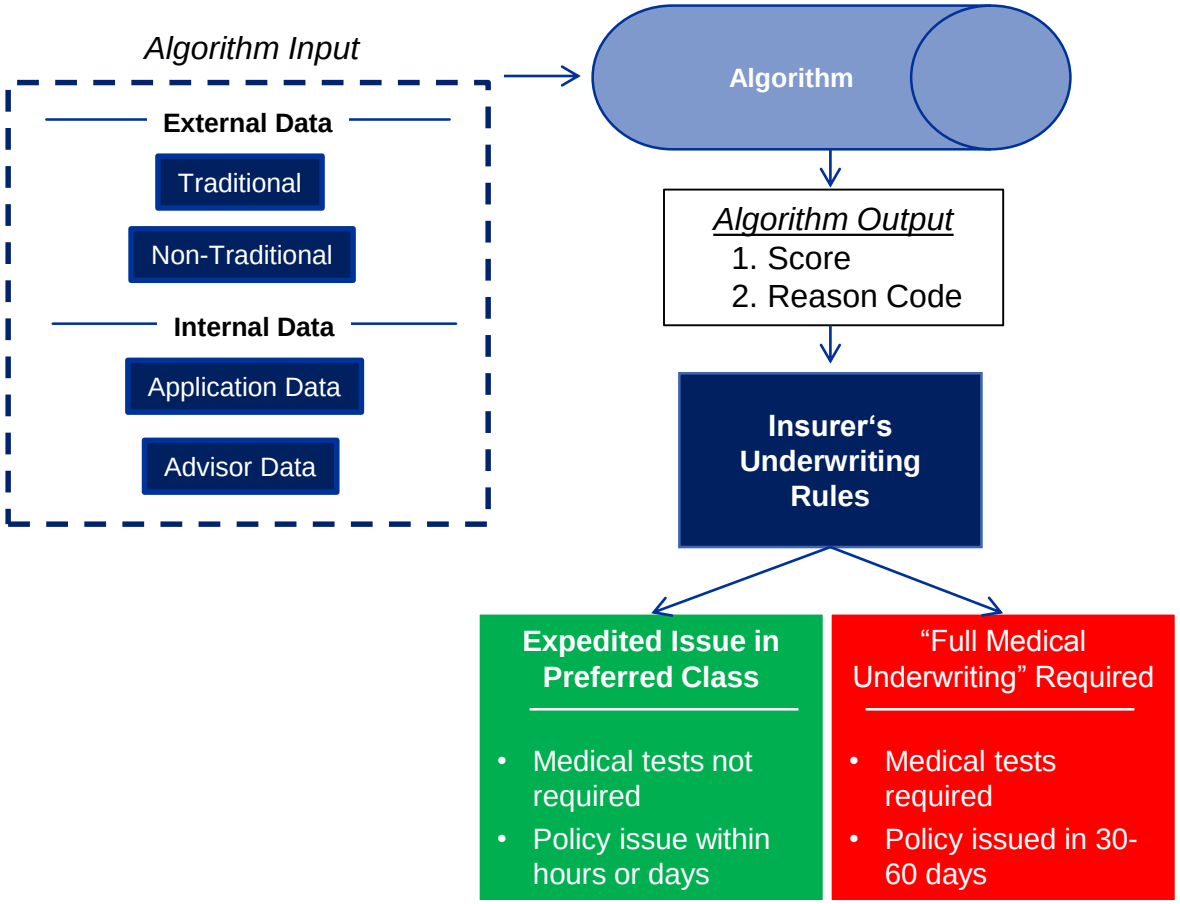
Advisor Retention



Advisor Recruitment

Example: Application Triage

An Application Triage algorithm is used during the new business process after an application is submitted to assist the underwriter in triaging applications. The underwriter incorporates the algorithm output into its underwriting process. The output from the algorithm may enable the underwriter to waive medical requirements for certain applications, leading to faster time-to-issue and reduced underwriting requirements and costs for those policies.



Key Outcomes

- The result of a predictive algorithm is one additional data element considered by the underwriter
- Enables identification of certain applications which are likely to be issued at preferred underwriting classes; allows underwriter to consider waiving certain medial tests for those cases
- For a portion of applicants, time to issue and overall underwriting costs are dramatically reduced
- Attracts additional new business from producers who wish to realize the benefits of an expedited issue process for cases which qualify for preferred underwriting classes

Application Triage: Key Considerations

- **Algorithm Development**

  The objective of the algorithm alone is to independently replicate the underwriting decision on risk class. The intended use of the algorithm output is to provide the underwriter with additional data to consider in assigning the risk class.

- **Incremental Data Requirements:**

  In addition to external third party data, this solution uses application data provided to the insurance company

External Data		Internal Data	
Traditional	**Non-Traditional**	**Application Data**	**Advisor Data**
▪ MIB (# of codes, unique codes – some positive and some negative factors) ▪ Motor Vehicle Record [MVR] (categorized by severity) ▪ Prescription Drug History	▪ Disease State Models ▪ Occupation and Net Worth ▪ Type of vehicle owned ▪ Housing ▪ Hobbies ▪ Exercise habits	▪ Name / Address / Age / Gender ▪ Face Amount ▪ Adverse medical history ▪ Adverse family heath history ▪ Tele-interview results	▪ Agent Production ▪ Agent Tenure ▪ Commission structure ▪ Total household premium placed with company

Note the specific data fields listed here are illustrative.

- **Technical and Business Implementation Considerations**

  Due to the objective of the algorithm and large quantity of data inputs used by this application, the technical and business implementation initiatives and associated considerations are typically relatively high for this application of predictive analytics.

Risk-Based Marketing

Predictive analytics is applied to an inforce block of business to identify potential target customers who are both (a) likely to buy an additional product and (b) likely to qualify for the product given the company's underwriting requirements. Customized sales tactics are employed on the segmented population.

Algorithm Input

External Data

- Traditional
- Non-Traditional

Internal Data

- Policy Data

'Likely to Buy' Algorithm

'Likely to Qualify' Algorithm

		Likely to Buy' Score	
		Not likely to Buy	Likely to Buy
Likely to Qualify' Score	Likely to Qualify	Consider marketing efforts for other products	**Deploy highly focused sales effort**
	Not Likely to Qualify	**Do not target these individuals for new sales**	Consider moderated marketing efforts

Key Outcomes

- Significantly more effective than traditional lead generation tactics for life insurance;
- Enables cross-sell efforts to be targeted at those most likely to meet underwriting requirements
- Enables full inforce segmentation, against which to more effectively apply sales/marketing efforts
- Produces product/policyholder specific recommendation based on policyholders with similar characteristics
- Produces customized estimates for likelihood to qualify and likelihood to buy

Risk-Based Marketing: Key Considerations

- **Algorithm Development**

  The algorithm is designed to identify potential target customers who are both (a) likely to buy an additional product and (b) likely to qualify for the product given the company's underwriting requirements

- **Data Requirements:**

  This application is developed using external third party data from traditional and non-traditional data sources

External Data		Internal Data	
Traditional	**Non-Traditional**	**Policy Data**	**Advisor Data**
▪ MIB (# of codes, unique codes – some positive and some negative factors) ▪ Motor Vehicle Record [MVR] (categorized by severity) ▪ Prescription Drug History	▪ Disease State Models ▪ Occupation and Net Worth ▪ Type of vehicle owned ▪ Housing ▪ Hobbies ▪ Exercise habits ▪ Insurance-based financial stability indicator	▪ Name & Address	None

Note the specific data fields listed here are illustrative.

- **Technical and Business Implementation Considerations**

  Due to the nature of the model output, the extent of the technical and business implementation initiatives and associated considerations are relatively few when compared to some other applications predictive analytics.

Current applications in the retirement industry

Example: Driving More Proactive and Effective Targeting of Rollover Opportunities

Provider Challenge	Role of Predictive Analytics	Business Value / Outcomes
Pressure to Target More Rollovers to Increase Retention of Assets	Identification and modeling of the key variables that help signal a rollover out of the plan	Revenue opportunities and efficiencies from more proactive, timely identification of potential value

Illustration

Algorithm Input

External Data

- Traditional
- Non Traditional

Internal Data

- Policy Data

Analysis

Analytics to find key indicators and potential buyers

Output

Likely to Rollover Score	
Likely to Rollover	Unlikely to Lapse
Send out communication	Take no action

Example: Driving Effective Segmentation in the Communication and Education Approach

Provider Challenge	Role of Predictive Analytics	Business Value / Outcomes
Plan Sponsor Demand for Improved Plan and Participant Outcomes	Correlations between various Communication and Education tactics and delivery channels to driving lift in plan participation	More targeted, effective Communication and Education strategies driving Increased Plan effectiveness, greater satisfaction and increased revenue

Illustration

Algorithm Input

External Data

- Traditional
- Non Traditional

Internal Data

- Policy Data

Analysis

Analytics to find correlations between campaign type, delivery channel and success

Output

Group Participants	
Group A	Group B
Prefers electronic information in small pieces	Prefers mailings with thorough descriptions

Sam

- 28 years old
- Reads e-books
- Owns a tablet

Meredith

- 65 years old
- Book club member
- Collects stamps

Imagine the Future

Imagine the Future: Quantified Self

Insurers will engage customers in a whole new manner using lifestyle, performance and health data to lower the cost of insurance and make better underwriting and marketing decisions.

Financial Advice Lifecycle

Financial Rep. Recruitment / Retention	Design & Develop Products/ Services	Marketing Campaigns	Assess Client Needs/ Illustrate	Submit & Process Application	New Customers/ Applications	In-Force Management

Potential Disruptive Factors

- May simplify underwriting with individualized data
- May allow insurance companies to more accurately predict loss trends

Devices and software such as Fitbit and various smartphone applications allow customers to monitor and share lifestyle/health data such as:

- Weight and Body Measurements
- Heart Rate
- Blood Glucose
- Blood Pressure
- Quantity and frequency of physical activity

In particular, new smartphone applications allow patients to automatically share data from their blood pressure app with their doctors

What if customers voluntarily allowed such data to be transmitted directly to a life insurance company to impact:

- Cost of insurance
- Underwriting decisions
- Customized offers for additional products

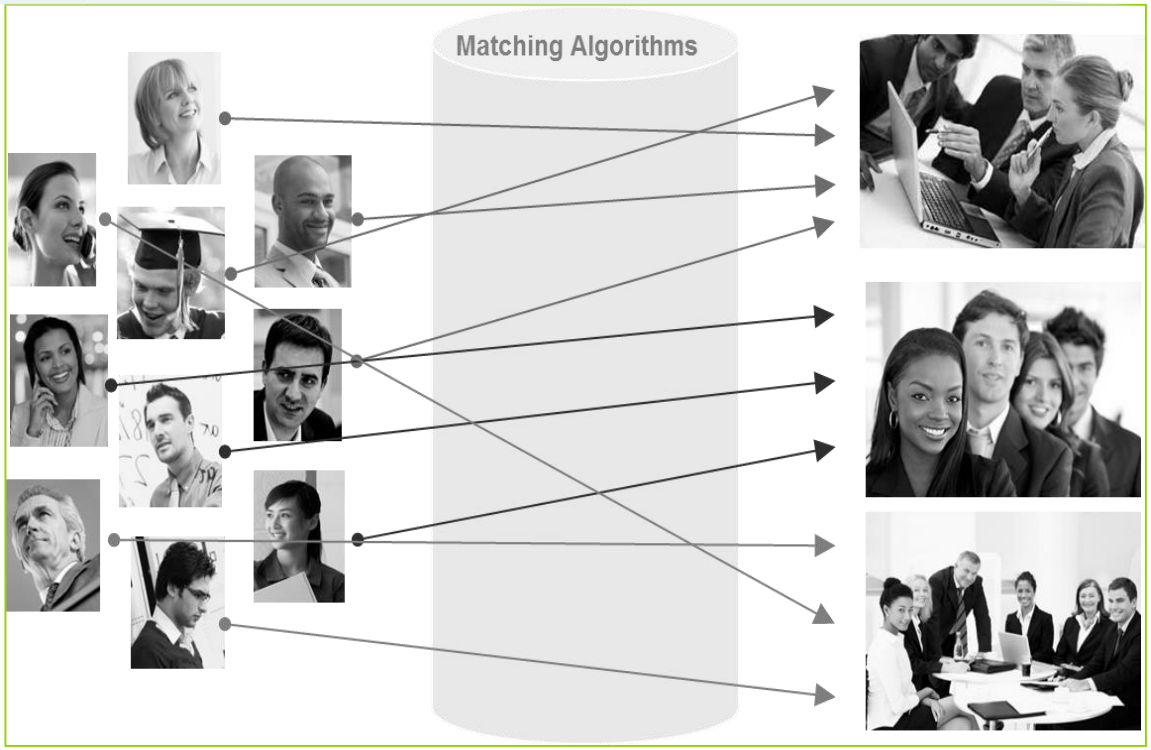
Who will disrupt the life insurance market with similar technology?

Imagine the Future: Advisor Matching

Companies like Match.com and eHarmony.com use sophisticated algorithms factoring in stated preferences, behavioral patterns on their website and triangulation methods to find compatible matches. Similar methods might be used to match individuals to the most suitable Financial Advisor.

Financial Advice Lifecycle

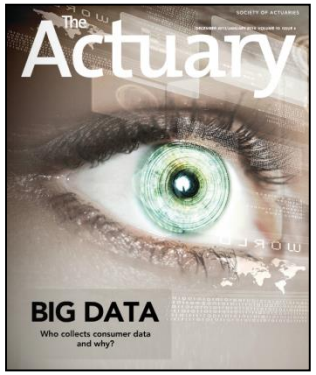
- Financial Rep. Recruitment / Retention
- Design & Develop Products/ Services
- Marketing Campaigns
- Assess Client Needs/ Illustrate
- Submit & Process Application
- New Customers/ Applications
- In-Force Management



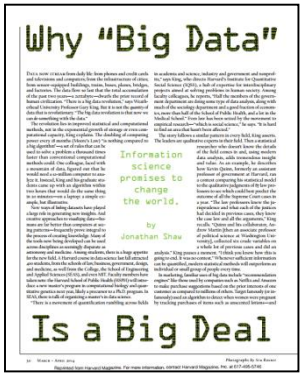
Potential Disruptive Factors

- System based rules can potentially match compatible advisors with potential clients
- Geography constraints may be lowered by online presence of competitors

Additional resources on Big Data



Big Data: Who Collects Consumer Data and Why?



Why "Big Data" Is a Big Deal

Mapping, and Sharing the Consumer Genome

How 'Big Data' Is Different

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Big Data and Advanced Analytics: Are You Behind the Competition?

David Moore, FSA, MAAA

November 5, 2014

Nationwide®
is on your side

Why is “Big Data” important to the insurance industry?

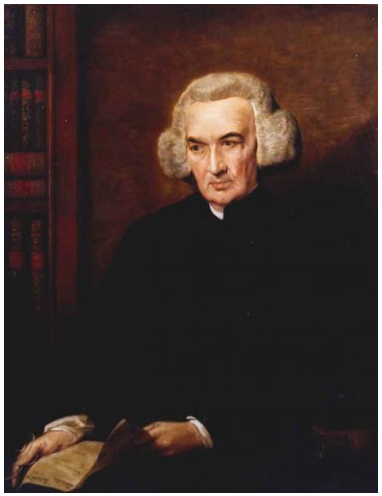
Defining “Big Data”

- There is no consensus in the marketplace as to how to define “big data”
- Big Data exceeds the capability of commonly used hardware environments and software tools to capture, manage, and process it within a tolerable elapsed time for its user population
- 4 V’s of Big Data
  - Volume
  - Variety
  - Velocity
  - Veracity

Sources: “Taming the Big Data Tidal Wave”, Bill Franks, 2012

A Brief History of Big Data and Analytics in Insurance

- 1774 – Richard Price ran the first experience study for the ‘Society for Equitable Assurances on Lives and Survivorship’



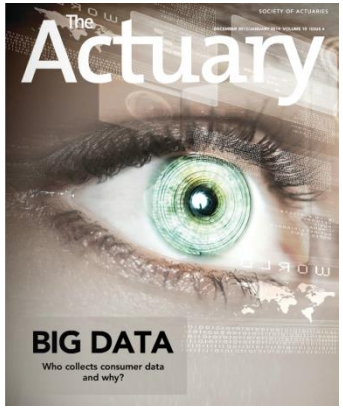
A Very Brief History of Big Data and Analytics in Insurance

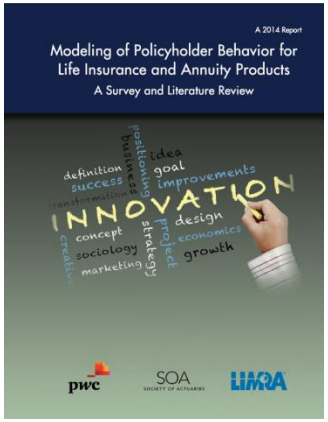
- 1774 – Richard Price ran the first experience study for the 'Society for Equitable Assurances on Lives and Survivorship'
- 1990's – P&C insurers adopt credit score in pricing personal lines
- 2000's – P&C models incorporate additional data sources to segment risks in personal and commercial lines
- 2010's – Use of telematics becomes prevalent in P&C
  - According to 2013 survey by Earnix, 82% of P&C companies use predictive modeling; only 17% of large P&C companies and 7% of small companies are currently using Big Data
  - Life Insurance companies are behind, but looking to catch up
  - In a 2012 SoA survey of Life Insurance companies, upwards of 40% of respondents indicated they were currently using or considering using predictive modeling to enhance sales and marketing practices or strategies

Sources: "2013 Insurance Predictive Modeling Survey", Earnix Inc. and Insurance Services Office, Inc , 2013
"Report of the Society of Actuaries Predictive Modeling Survey Subcommittee", Society of Actuaries, 2012

Adoption of Predictive Modeling in Life & Annuity

- Predictive Modeling has developed in the wake of the success in P&C insurance, looking to additional data sources to help do a better job selecting risks as well as understand customer behavior
- In 2000's, the introduction of automated underwriting engines enable the use of the increasing number of data sources and helped expedite the underwriting process
- The initial pilot projects in Predictive Modeling leveraged these 'rules engines' but added on a 'predictive' score based on a GLM developed from data not traditionally used in Life Insurance
- In 2010, the SoA awarded prizes for a call for papers on the topic "Predictive Modeling for Life Insurers"
- Today, there is increased awareness and numerous articles being published, but the discipline is still maturing





Advanced analytics for life and annuities

Predictive analytics across the insurance lifecycle

- **Sales and Marketing**
  - Customer response modeling – propensity to buy or renew
  - Agent recruiting
- **Pricing / Product Development**
  - Price optimization
- **Risk Selection / Scoring**
  - Predictive underwriting
  - UW triage
  - Risk segmentation
- **Experience Analysis**
  - True multivariate approach
  - Efficient use of data
- **In-force Policy Management**
  - Customer retention / lifetime value models
  - Reserving
- **Claims Management**
  - Improve fraud detection
  - Improve exposure analysis
- **Financial Forecasting**

Predictive modeling techniques used in insurance

	Supervised Learning (The target is known)	Unsupervised Learning (The target is unknown)
Parametric (Statistical)	• Linear Regression • Time Series • **Generalized Linear Models** • Hazard Models • Mixed Effect Models	• Cluster Analysis (i.e. K-means) • Principal Components Analysis
Non-parametric	• Neural Networks • CART (Classification and Regression Trees) • Random Forests • MARS (Multivariate Adaptive Regression Splines)	• Neural Networks

Generalized linear models

GLMs have become the most common tool for model development in life insurance as a result of their ability to accommodate forms other than normal, and for being relatively easy to explain

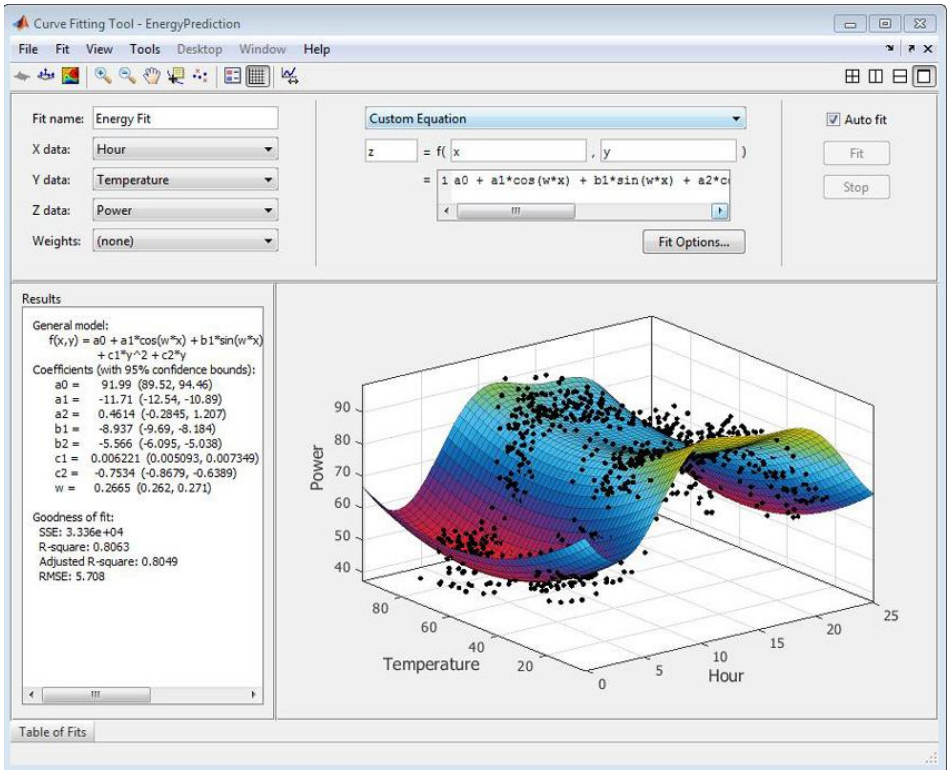
Common GLM Applications

Technique	Link Function	Distribution	**Application**
Classical Regression (Ordinary Least Squares)	Identity: $g(\mu)=\mu$	Normal	**General Scoring Models**
Logistical Regression	Logit: $g(\mu)= \log[\mu/(1-\mu)]$	Binomial	**Binary Target Applications (i.e. Retention)**
Frequency Modeling	Log: $g(\mu)=\log(\mu)$	Poisson Negative Binomial	**Count Target Variable Frequency Modelnig**
Severity Modeling	Inverse: $g(\mu)=(-1/\mu)$	Gamma	**Size of claim modeling**
Severity Modeling	Inverse Squared: $g(\mu)=(-1/\mu^2))$	Inverse Gaussian	**Size of claim modeling**

Predictive analytics software

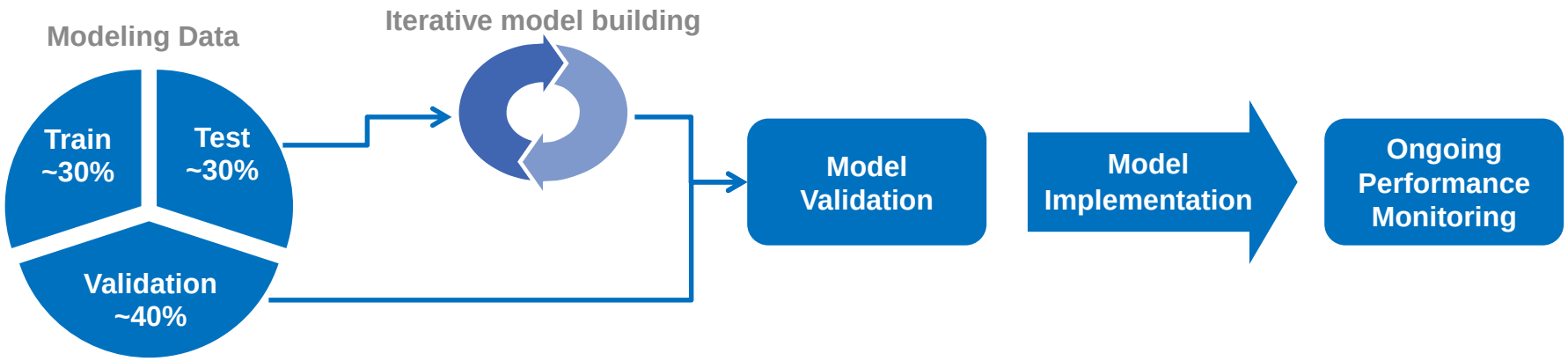
- Many packages for different aplications, platform and modeling skills

- **Some packages used in insurance:**
  - Angoss KnowledgeStudio
  - Excel
  - IBM SPSS Modeler
  - Mathematica
  - MATLAB
  - Oracle Data Mining
  - R
  - SAS Predictive Analytics



Predictive modeling development and validation

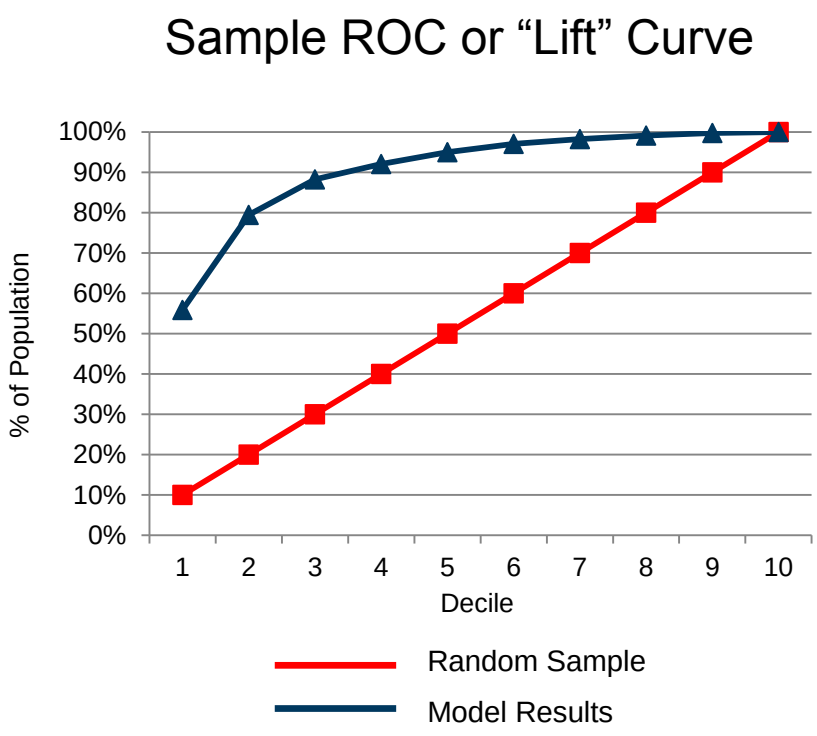
- When developing a model, it is important to use an accepted validation methodology to evaluate the model. This improves the likelihood the model will produce accurate feedback going forward



Train Data	• Algorithm development is an iterative process – “train data” is run through numerous modeling techniques and potentially hundreds of algorithms to determine the optimal model
Test Data	• This dataset is an unbiased sample to help select the best predictive model
Validation Data	• This represents a hold out sample which is not used to either develop or test the model. Once the final model is selected, this data is used to validate the results on a blind sample and to confirm that there is no over fitting

Visualizing and interpreting results

- **Receiver Operating Characteristic (ROC) or "Lift"** is a measure of the performance of a model at predicting or classifying cases as having an enhanced response (with respect to the population as a whole), measured against a random choice targeting model.



The future of “Big Data” in insurance

How will Big Data change the industry?

- More Data
  - More brokers of structured data
  - Increased ability to capture and use unstructured data
    - Geospatial
    - Clickstream
    - Social Media

- More tools
  - Today companies are embracing R and SAS to develop predictive models
  - Enterprise Data Warehouses need to grow and adapt to new data sources and technology
  - Simulation software is growing in use
  - Companies need to have proficiency in MapReduce programs
  - Tomorrow's Big Data software solution has not been designed yet

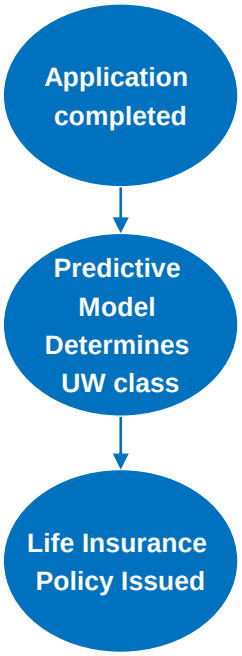
How do you view the value of a customer?

- What is the net worth of an individual customer? Their lifetime value? Their propensity to buy?

- Instead, what if business decisions are based on the “value” of individual’s network?

The future of Life Insurance Products?

Future applications may not be bound by the traditional limits of life insurance and annuity products, and disruptions may occur from outside the industry.



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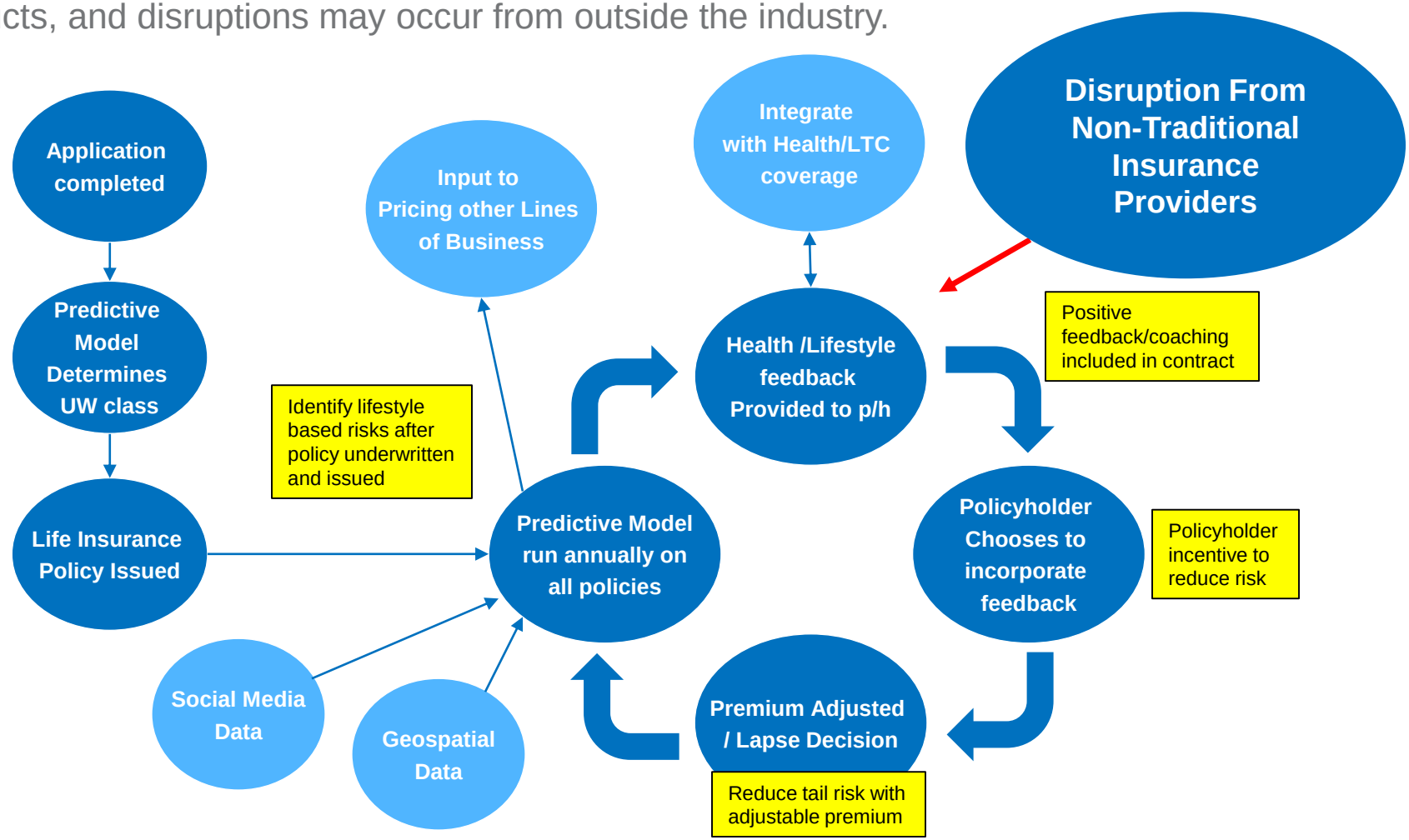

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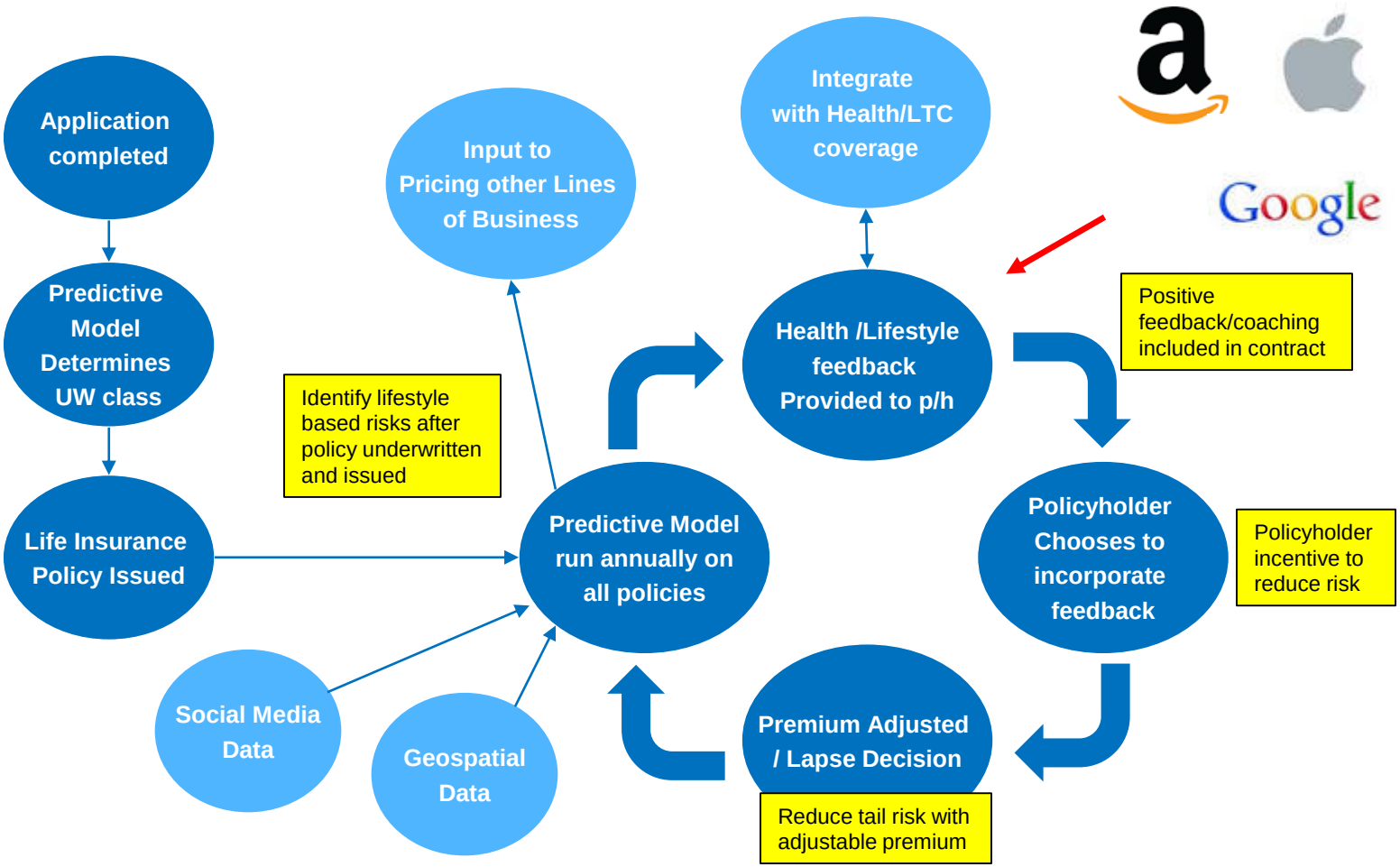


Are you behind the competition?

Considerations for developing an analytics program

Tools

- Does your organization have the tools in place to capture, store, and analyze the expanding universe of data?

Human Resources

- Do you have people with appropriate business and technical skills to design, build, and implement advanced analytical solutions?

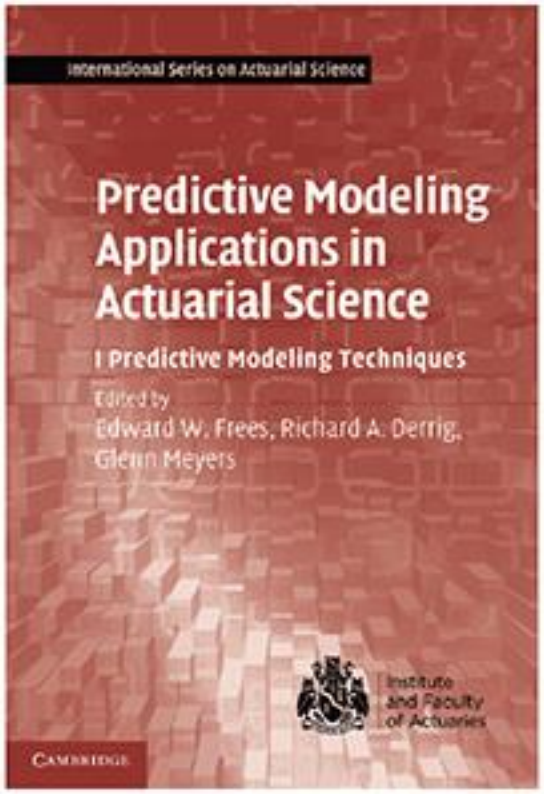
“Big” Data

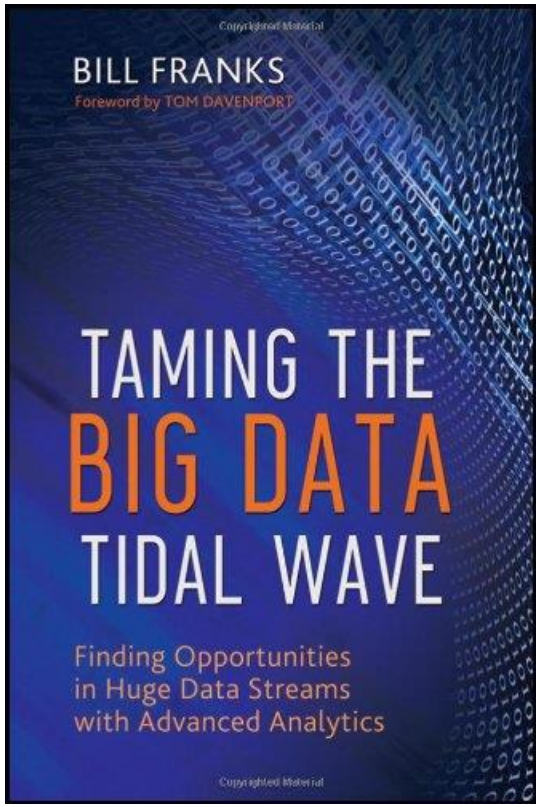
- Do you have a plan in place to deal with “Big Data”?

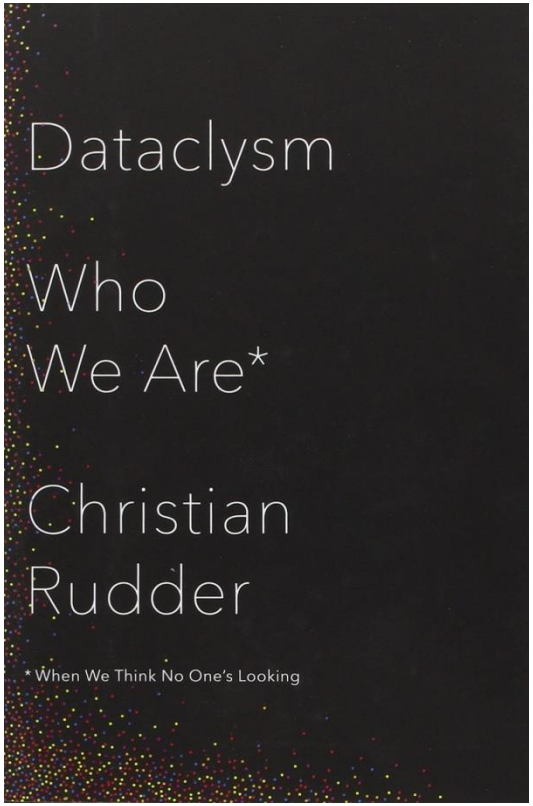
Patience

- Developing predictive analytics and modeling capabilities within an organization can take time and requires a long term vision and plan

#ReadingList







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Franks, Bill (2012). Taming the Big Data Tidal Wave : Finding Opportunities in Huge Data Streams with Advanced Analytics
Rudder, Christian (2014). Dataclysm: Who We Are (When We Think No One's Looking)

Takeaways

- Predictive Modeling and the use of Big Data is still in the early stages of maturity in the Life and Annuity space, although the level of interest in developing and using predictive modeling continues to grow rapidly…act now or fall behind!

- To harness the power of “Big Data”, more storage and computing power are not enough. Developing an analytics team requires people with both a knowledge of your business and of statistical modeling techniques in order to apply their knowledge to the increasing volumes of data