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THE 62nd ANNUAL CANADIAN REINSURANCE CONFERENCE

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Future of Underwriting - A Medical Perspective

ReImagine insurance

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Future of Underwriting

- New
  - Medical advances that may likely affect underwriting
- Old
  - What things are not likely to change in the near future
- Unknown
  - What is unpredictable

Medical Advances

- Hybrid closed loop insulin delivery system
- Potential for “true” cure of hepatitis B
- Improved therapies for elevated cholesterol
- Advances in cancer diagnosis and therapy
  - Adoptive cell transfer
    - Chimeric antigen receptors (CAR-T)
  - Liquid biopsy
  - Expanded targeted therapy for tumors
    - Example – breast cancer

Hybrid Closed Loop Insulin Delivery

- Getting close to the artificial pancreas – currently available
- Links an implanted glucose sensor with an insulin pump
  - Continuous glucose monitoring
  - Insulin delivery via a pump
  - Automated control using algorithms
- “Smart” system in that, with experience it adjusts algorithms over time
- Hybrid in that it still requires input on carbohydrate load from meals by the patient
  - Users still have to “sign off” on recommended boluses of insulin

Hybrid Closed Loop Insulin Delivery

- Can be used safely by adolescents and adults
- Consistently improves HbA1c levels
- Reduces risk of hypoglycemia
- Window to the eventual lowering of morbidity and mortality with type 1 diabetes

Hepatitis B

- Estimated 2 billion individuals have been infected worldwide
  - 257 million chronically infected
  - 10-30 million new infections per year
  - 887,000 deaths in 2015
- Prevalence in Canada is 0.4% in the general population
  - 1.6% in the foreign born
  - Estimated at 111,800 overall

Hepatitis B
“Functional” Cure

- Current therapy can achieve a “functional” cure
  - Clearance of the hepatitis B surface antigen
  - Normalization of liver function tests
  - Circulating viral DNA becomes undetectable
- However, viral genetic material (cccDNA) remains in liver cells
  - Risk of cirrhosis and hepatocellular cancer is low but not zero
  - Virus can be reactivated at times of immunosuppression
- “True” cure eliminates the viral DNA and risk of recurrence
  - Not achieved with current therapies

Hepatitis B
"True" Cure

- Goal is to eliminate the viral genetic material
  - Achieve the type of results seen with hepatitis C
- Now looks possible with a combination new therapies
  - Drugs to reduce the hepatitis B surface antigen levels (fight immune fatigue)
  - Drugs that block entry into hepatocytes
  - Capsid inhibitors – impair viral particle assembly
  - Molecular therapies
    - CRISPR/Cas9 – search out and destroy cccDNA in liver cells
    - RNA inhibitors – silence the viral genome
- Some interesting examples of genetic therapy
  - However, target is the *viral* NOT the host genetics

Improved Therapy for Elevated Lipids

- Lowering cholesterol levels has been a major advance in cardiology
  - Statin drugs have had a significant effect on lowering cardiac event rates
- However, statins do not work for everyone
  - Levels not controlled - some develop disease despite their use
  - Many do not tolerate the drugs
- New era of lipid lowering with a new class of drugs – PCSK9 inhibitors
  - Block the enzyme **P**roprotein **C**onvertase **S**ubtisin**k**exin type **9**
  - Inhibits the destruction of LDL receptors
  - Results in clearance of LDL (“bad”) cholesterol from the blood
  - Two drugs are currently approved in the US and Canada
    - Alirocumab – Praluent
    - Evolocumab – Repatha

PCSK9 Inhibitors

- Lowers LDL cholesterol by 60% to 70% compared with placebo
- Lowers LDL cholesterol 20% to 50% compared to those on statins
- Works best in those with familial hypercholesterolemia
- May be critical now that coronary disease and cardiovascular mortality has begun to plateau
- Still questions about how effective they will be
  - No studies yet on how effective they will be on improving mortality
    - Substantial data on the value of statins
  - Drugs must be given by injection
  - Expensive

Adoptive Cell Transfer Therapy (ACT)

- Form of immunotherapy for cancer
- In effect giving the patient a “living drug” – CAR T
- Involves collecting and using the person’s own immune cells to treat cancer
- T cells are genetically engineered using a viral vector
  - Express chimeric antigen receptors (CARs) on the surface
- Allow the T cells to recognize and attach to antigens on the tumor cells (C19)
- Altered immune cells are then re-infused into the patient
  - Preceded by a lymphodepleting chemotherapy regimen
- Altered immune cells persist in the body
  - Can help fight recurrences

Adoptive Cell Transfer Therapy (ACT)

- Treatment has been most effective for hematologic malignancies
  - Relapsed acute lymphocytic leukemia (ALL) in children –few other options
  - Aggressive lymphomas in adults
  - Multiple myeloma
- High response rates with long-term remissions
- Two drugs currently FDA approved
  - Tisagenlecleucel – Kymriah
  - Axicabtagene ciloleucel - Yescarta
- May be more difficult to do ACT with solid tumors
  - Less likely to have antigens on the surface of the tumor cell
- Other forms of ACT and targets for CAR T (C22) are currently in development
- Overall has the potential to be a real game changer for some tumors
- Another example of “atypical”, non-hereditary genetics applied in clinical medicine

Liquid Biopsy

- Tumor cells or small amounts of tumor related material may be found in the blood
  - DNA, RNA, proteins, tiny vesicles called exosomes
- Several different potential applications
  - Screening for and diagnosis of tumors at an early, curable stage
  - Monitoring of response to therapy (decreasing or disappearing levels)
  - Surveillance of those who have already been treated and are in remission – detection of recurrence
- A recent study from Johns Hopkins was promising for an assay called CancerSEEK
  - Used a combination of tumor genetic markers and proteins
    - Sensitivity 70% overall for 8 common cancers (43% stage I, 73% stage II, 78% stage III)
    - False positive rate 1%
  - Cautions
    - Not a true screened sample – diseased individuals had known cancer
    - Healthy population had no conditions that might have caused false positives

Liquid Biopsy

- Potential advantages of the approach
  - Tumor specific
  - Cheaper and less invasive than a tissue biopsy
  - Could be adapted to the insurance environment
- Limitations/caution
  - Results have been inconsistent using different assays
  - Have to know what mutations you are looking for in the tumor
  - Different mutations may have variable prognostic significance
  - Results can vary depending on timing relative to therapy
- Big question – is what you find clinically significant?
  - Does not seem yet ready for prime time – but getting closer

Targeted Cancer Therapy

- Therapy based on specific genetic or protein markers
  - Different than chemotherapy that non-specifically attacks dividing cells
  - Acts on specific molecular targets (“smart bombs”)
  - Use “rational” drug design
    - Deliberately chosen or designed based on tumor characteristics or functions
  - Considered part of *precision medicine*
- Two different types
  - Small molecules
    - Chemicals that do not elicit an immune response from the host
    - Attack targets within cells
  - Monoclonal antibodies – larger molecules
    - Inject tumor antigens into animals (usually mice) and harvest antibodies that are formed
    - Humanize the antibodies by substituting human for mouse components
    - Introduce them into the patient
    - Work on the cell surface or outside cell

Different Types of Targeted Therapies

- Hormone therapy
  - Stop or limit growth of hormone sensitive tumors (breast, prostate)
- Signal transduction inhibitors
  - Block signals from factors that induce growth in tumor cells
- Gene expression modulators
  - Modify proteins that modulate tumor genes
- Apoptosis inducers
  - Induce cancer cells to lose their immortality and undergo programmed cell death
- Angiogenesis inhibitors
  - Block the growth of new blood vessels that are needed by growing tumors
- Monoclonal antibodies that deliver toxic molecules or chemotherapeutic agents
  - Antibody finds the target cancer cell
  - Attached agent, molecule or radioactive material kills it

Targeted Therapy
Breast Cancer

- Everolimus (Afinitor) – mTOR inhibitor
  - Limits cancer growth and helps overcome hormone resistance
- Bevacizumab (Avastin)
  - Blocks the growth of new blood vessels
- Trastuzumab (Herceptin)
  - Blocks signaling pathways in HER2 positive breast cancer cells and limits growth
- Ado-trastuzumab emtansine (Kadcycla)
  - Combination of Herceptin and a chemotherapeutic agent
  - Binds to HER2 positive cells, limits signaling and delivers killing chemical agent (emtansine)
- Palbiciclib (Ibrance)
  - Blocks a kinase needed for cell division
- Olaparib (Lynparza)
  - Blocks the enzyme PARP that is needed to repair DNA damage in tumor cells
  - Reduces ability to continue growth

Targeted Cancer Therapy
Limitations

- Resistance commonly occurs
  - Target may mutate making the designed drug ineffective
  - Tumors can find a new pathway around the blocked one
    - Nature finds a way
- Result – duration of clinical response may be limited
  - Common problem seen with a number of initially promising drugs
- Combination therapy may work best
  - Block multiple pathways or modes for tumor growth simultaneously
- Despite tumor specific design significant side effects may still occur

Old
It’s Still About the Basics

- Q waves/poor R wave progression – when to rate?
- Is it really a TIA?
- COPD – significant?
- Mild mitral regurgitation
- Sleep apnea without testing
- Athletic heart vs LVH
- “False positive” stress test
- Reflex CDT
- Elevated creatinine

Underwriting Like Medicine is Often Evaluating the Common and Mundane

- Value judgments are frequently the critical piece of the puzzle
  - Things are seldom black and white
  - Information is often conflicting and variable over time
- Decisions often need to be made with incomplete data
- There is no match for understanding the disease process
  - Often winning good business is determined by a table or two
- Not likely to change in the near future in many cases
  - Individuals who fail acceleration
  - Complicated cases
  - Large dollar amount cases
  - Elderly

Competent, Well Trained Underwriters will be Critical

- Their cases will be fewer but more complex
- Rush to automated/automatic approach may lead many to let UW departments languish
- Expertise and knowledge will concentrate in centers of excellence
  - Large companies
  - Reinsurers
  - Consultants may fill the void
- Someone needs to monitor the automated systems
- Who answers when a decision is challenged?
- Someone needs to slot the new into the established paradigm
  - Objectively critique new ideas
  - Learn and adapt on the fly

Unknown
Stuff Happens

- Predictive analytics and historical data have their limits
- New things happen that change the world
  - HIV disease
  - Opioid epidemic
  - SARS
  - Ebola
  - Zika
- In some we dodged the bullet – in others not so much
- To think we can totally predict the future is flying in the face of reality
  - Hubris of those who don’t know what they don’t know

Example
HIV Disease

- A “Future of UW” presentation in 1980 would not have mentioned HIV
  - Yet it was a thunderclap that dramatically changed the industry and underwriting *within 5 years*
    - Universal blood testing
    - Advent of preferred underwriting
- All of the current computing power, all of the big data we currently have, all of the third party or wearable information now available would not have;
  - Predicted the onset of the disease
  - Provided any help on what it was or what it meant
  - Provided any help on how to deal with it
- Underwriters and medical directors had to learn, educate and adapt
  - There is no reason to think that capability will not be needed at some point going forward
- Chance favors the prepared mind

Think Holistically
No One Approach is the Total Answer

- Simplify the process for the easy cases
  - Get nuisance work off the plate
    - Automated programs
    - Accelerated underwriting
- Cultivate a professional UW staff with cutting edge ability
  - Knowledge and ability to deal with the complex or unusual
  - Ability to, informed by the complex, evaluate and adapt the automatic processes
- As for external clients manage the internal underwriter experience
  - Don’t let the basics deteriorate
  - An overworked staff can’t think clearly and be creative
- Never stop learning and looking forward
  - Investigate, adapt, educate

Kevin Oldani SVP & Chief Underwriter

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The Future of Underwriting

- The Underwing profession is alive and well
- Predictive analytics and the impact to underwriting
- New underwriting tools that could improve underwriting
- Automation

Underwriting Profession

- Underwriters will still be needed, the future is bright
  - Risk assessment is our profession
  - Rules sets and underwriting criteria still need validation
- Skill sets are changing
  - Analytics
  - Forensic underwriting
  - Underwriting Tools evaluations
  - Data valuation
- Focus will be on the complex cases
  - Medical advancements

Predictive Analytics

Big Data, Data Mining, and Predictive Modeling

VANTAGE POINT

'Moneyball' Lessons for Insurance Pricing Strategy

What can insurers learn from a film about a successful baseball team built through a disruptive analytical technique?

By Aviv Cohen

Oakland Athletics' general manager Billy Beane rocked Major League Baseball by applying a sabermetrics-based analytical technique that identified success factors that other teams failed to appreciate. It wasn't that competitors didn't use analytical techniques or lacked the relevant data; it was that they started from inadequate assumptions and asked the wrong questions. Insurers have a similar opportunity today to leap ahead of competitors by applying prescriptive analytics, a technique that optimizes pricing through sophisticated analysis of customer demand. But like Beane, champions of prescriptive analytics must overcome internal cultural resistance.

In the 2011 film "Moneyball," Beane has a fateful encounter with Peter Brand, a Yale economics graduate student. The Brand character insists that scouts and coaches are applying the wrong criteria of success, focusing on prospects with signs of potential greatness. His insight was that cumulative team criteria such as the aggregated propensity for getting on base – known as the on-base percentage (OBP) – were more important than traditional gauges of excellence in individual players. The conventional thinking of team managers was to think in terms of buying players, Brand notes. "Your goal shouldn't be to buy players, your goal should be to buy wins," he counsels Beane. "And in order to buy wins, you need to buy runs."

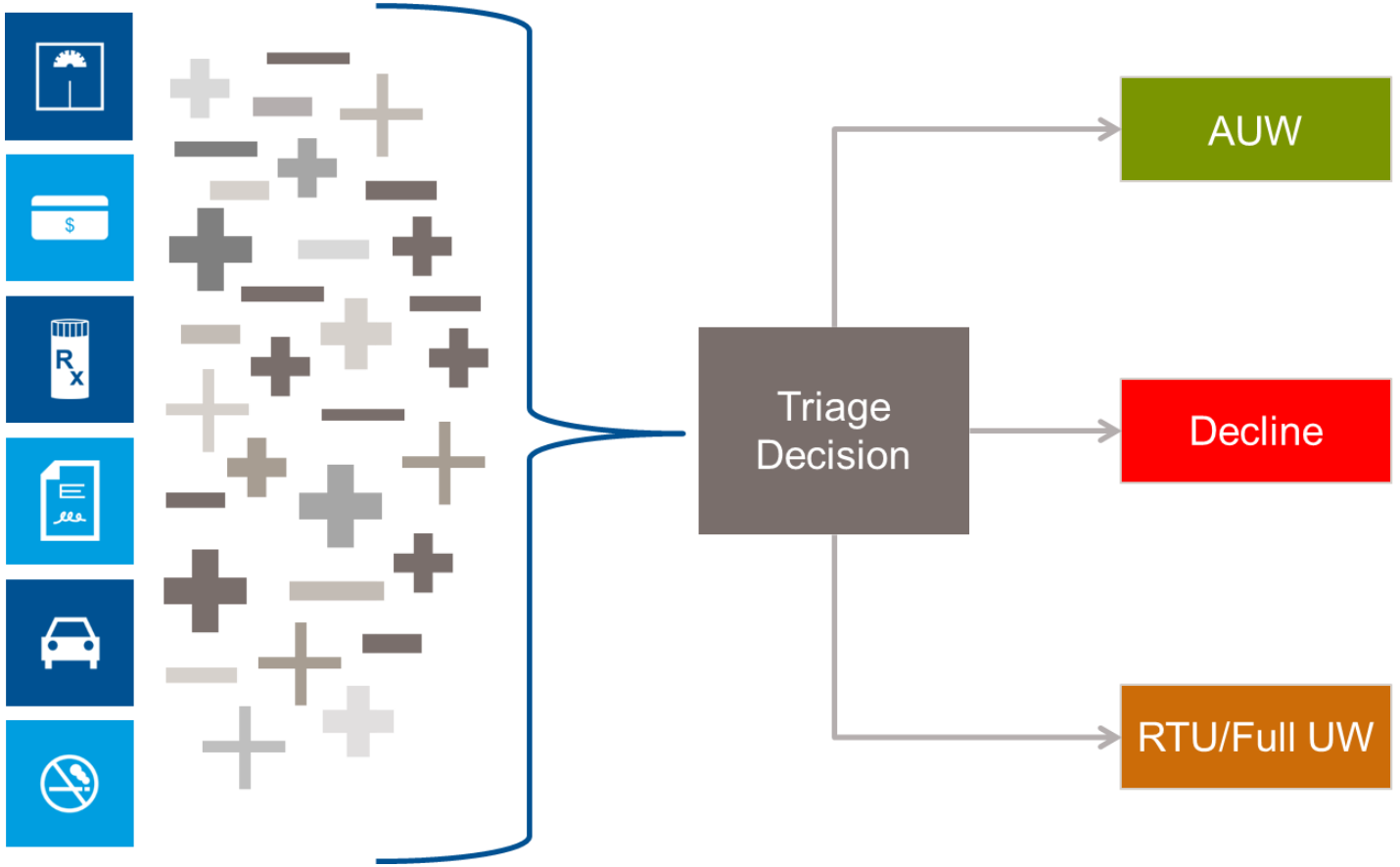
When attempting to act on Brand's advice, Beane runs into determined resistance from A's scouts and leadership. Champions of pre-

Insurers have an opportunity to leap ahead of competitors by applying prescriptive analytics, a technique that optimizes pricing through analysis of customer demand.

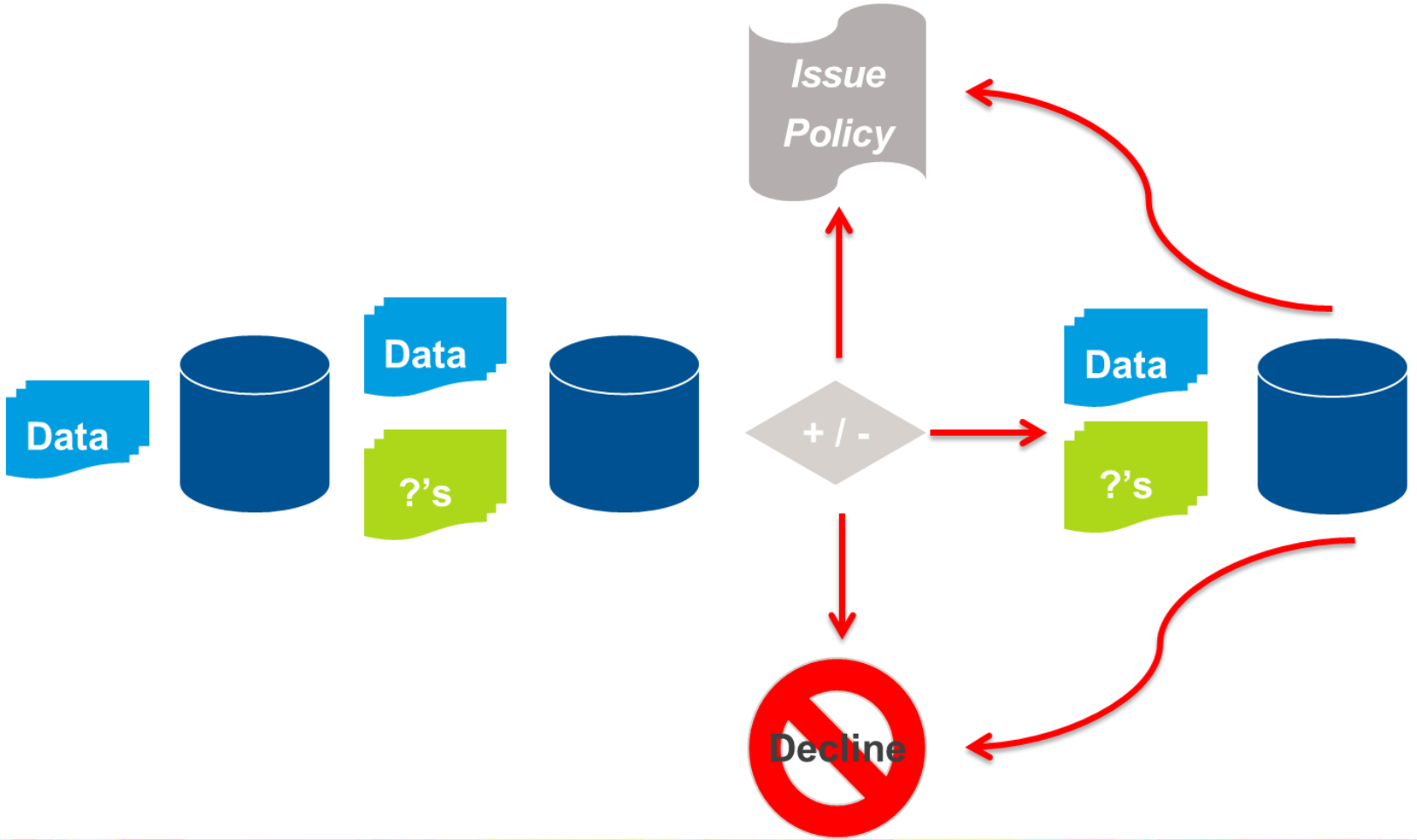
Typically, insurers apply experience-driven "rules of thumb" about customer demand and price elasticity to determine effective pricing. For example, a carrier might apply the assumption that a 10-percent increase in premium will result in a 2-percent relative drop in retention. While the enforcers of such rules can provide statistical support for them, the rules are nevertheless insufficiently granular. They fail to acknowledge change in consumer price elasticity over time and, more significantly, they assume all customers react in the same way. In reality, customers in different segments react differently. Internet shoppers are more price-sensitive than customers who buy through an agent, multi-policy customers are more likely than single-policy customers to renew after an increase, and prospects are more sensitive to price than existing customers.

The first question that arises when considering a more sophisticated analytical technique is "What data will be needed?" The answer in most cases is that the insurer, even a small insurer, already possesses the right data in its internal systems. The data required is about which of the insurer's customers and prospects buy or renew at a given price point, and which don't. Important variables include absolute premium, change in premium, multi-policy-holder status, driver age, credit score and distribution channel.

Using information today



AUW...Moving Toward "Agile Underwriting"



Predictive Analytics

- Data Science and underwriting
- Company data
- Commercially available data underwriting tools

Data Science and Underwriting

- Underwriters must provide input into the models
- Underwriters must develop analytical skill sets outside of the medical knowledge
- Predictive models can not be developed in a vacuum
  - Underwriting must determine “does it make sense”

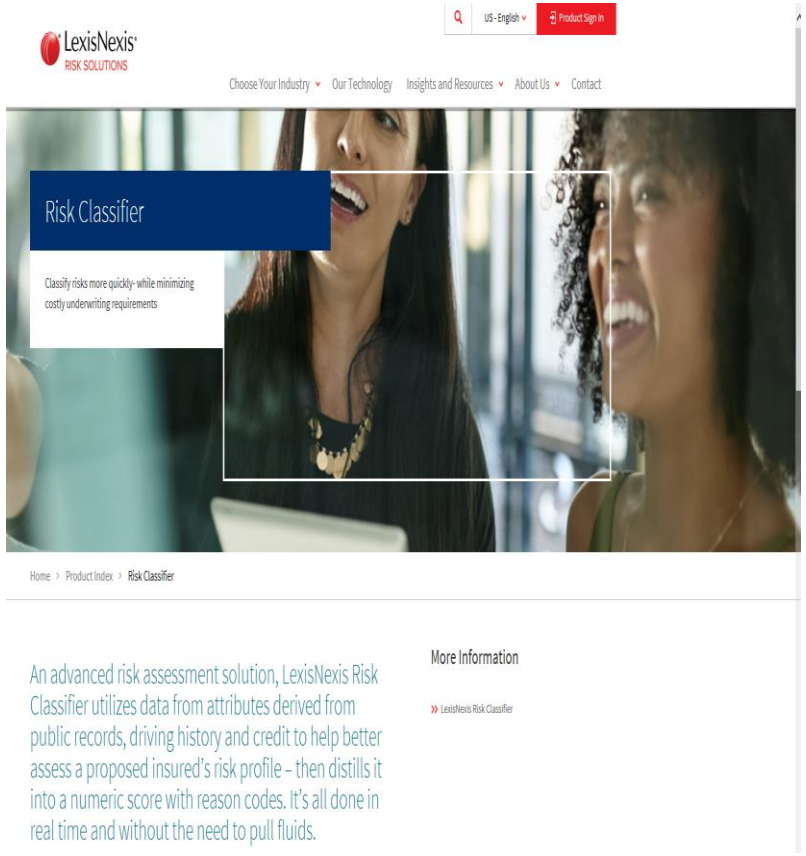
Developing predictive models

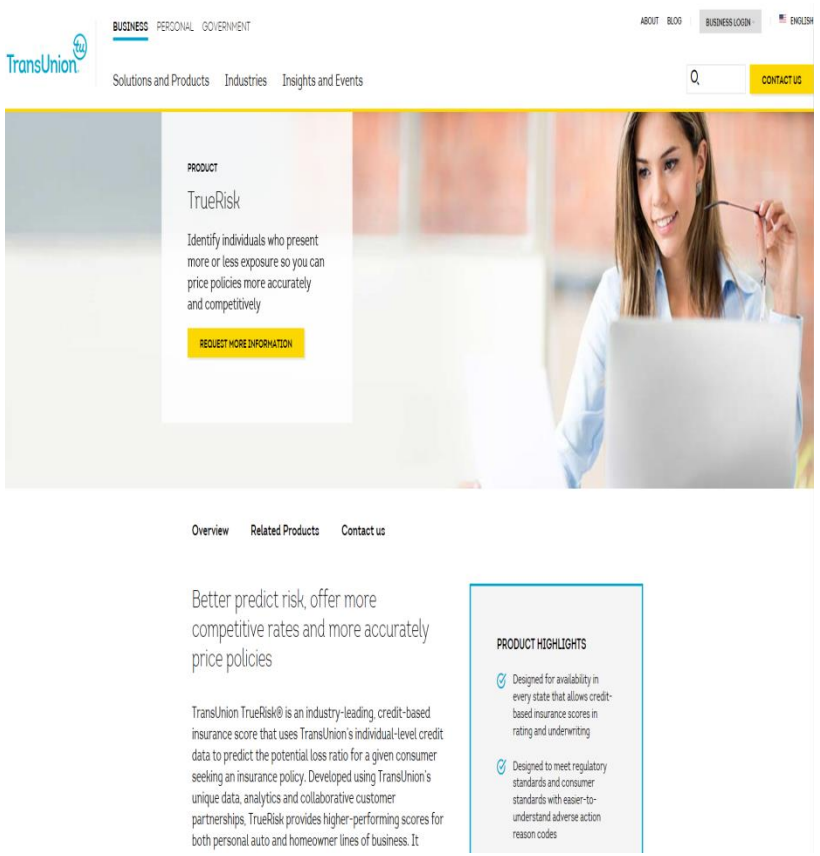
- You must start with developing a system to collect your data
  - Applicant data (sales)
  - Application data
  - Third party data
    - Mib, Credit, MVR, other sources
  - Agent data
  - Inforce data
    - Lapse, claims

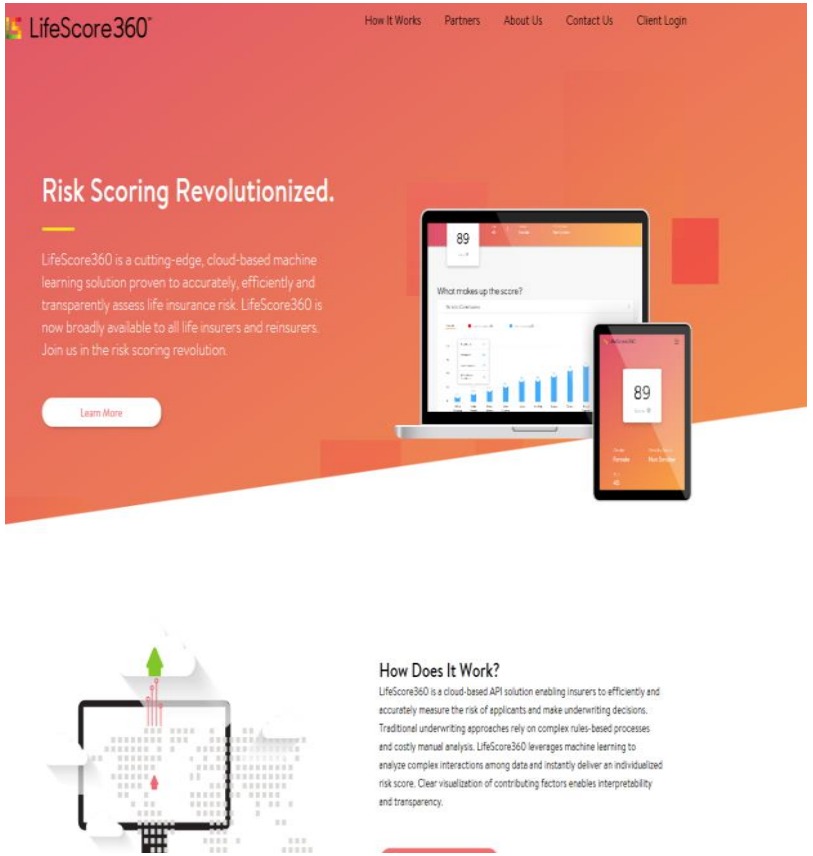
Commercially available Predictive models

- Limited currently in Canada
- In the US more availability because of information
  - LexisNexis, Trans Union, Deloitte, Others
- Consultants/Reinsurance support

Predictive Models







Automation/Automation/Automation

- The 5 minute policy for core ages and amounts
- Electronic application with dynamic questions based on responses
- Electronic Health Records (may not replace the full aps on limited number of cases)
- Validation of a number of points that lead to the same conclusion. Large picture underwriting

Underwriting tools and new technology

- Wearable devices/how much information can we get for risk assessment?
  - Sleep Habits
  - Fitness
  - Stress level
  - Blood pressure
  - Weight
  - Electrocardiogram
- *Dr. Bertalan Mesko, PhD is The Medical Futurist, keynote speaker and is the author of The Guide to the Future of Medicine and My Health: Upgraded.*

Risk Assessment and Underwriting

Increasing Underwriting Agility

- Not the same process for everyone
- Will need to deal with having different types of information for each applicants
- Demands some degree of automation
- Dynamic or Personalized Underwriting
- New underwriting Tools, EHR implications, Genetic testing?

Data Elements Will Change – Not Just How We Access Them

- Some historical Underwriting data elements will continue
- But - some will stop being utilized
- New data elements and metrics will replace them
- Will require a great deal of R&D and analysis

No One Company Can "Do it All"

- Partnerships and alliances will increase in importance
- Data is a valuable currency

Products and Ratings Will Evolve

- Movement from discrete rate classes to a continuum
- Not locked into initial assessment based upon a point in time
- Health and lifestyle over time will drive product performance

My Crystal Ball

- Age and amount requirements go away, underwrite the individual (some cases will still need full underwriting requirements)
- Rates will be individualized
- Confidence models, move away from preferred knock out
- Distribution will work with us on risk selection
- Partnerships are key
- Underwriters will still underwrite but expend into different skill sets

Questions?

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