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Predictive Analytics in Life Insurance

ACLI Annual Conference

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Predictive Analytics and Big Data

Actuaries have been analyzing data and making predictions for centuries…. so what's new?
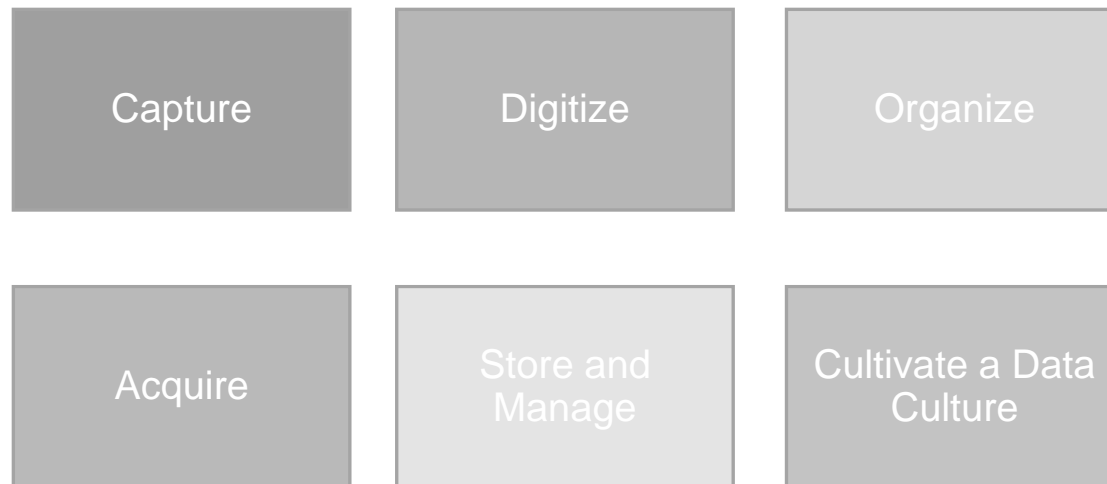
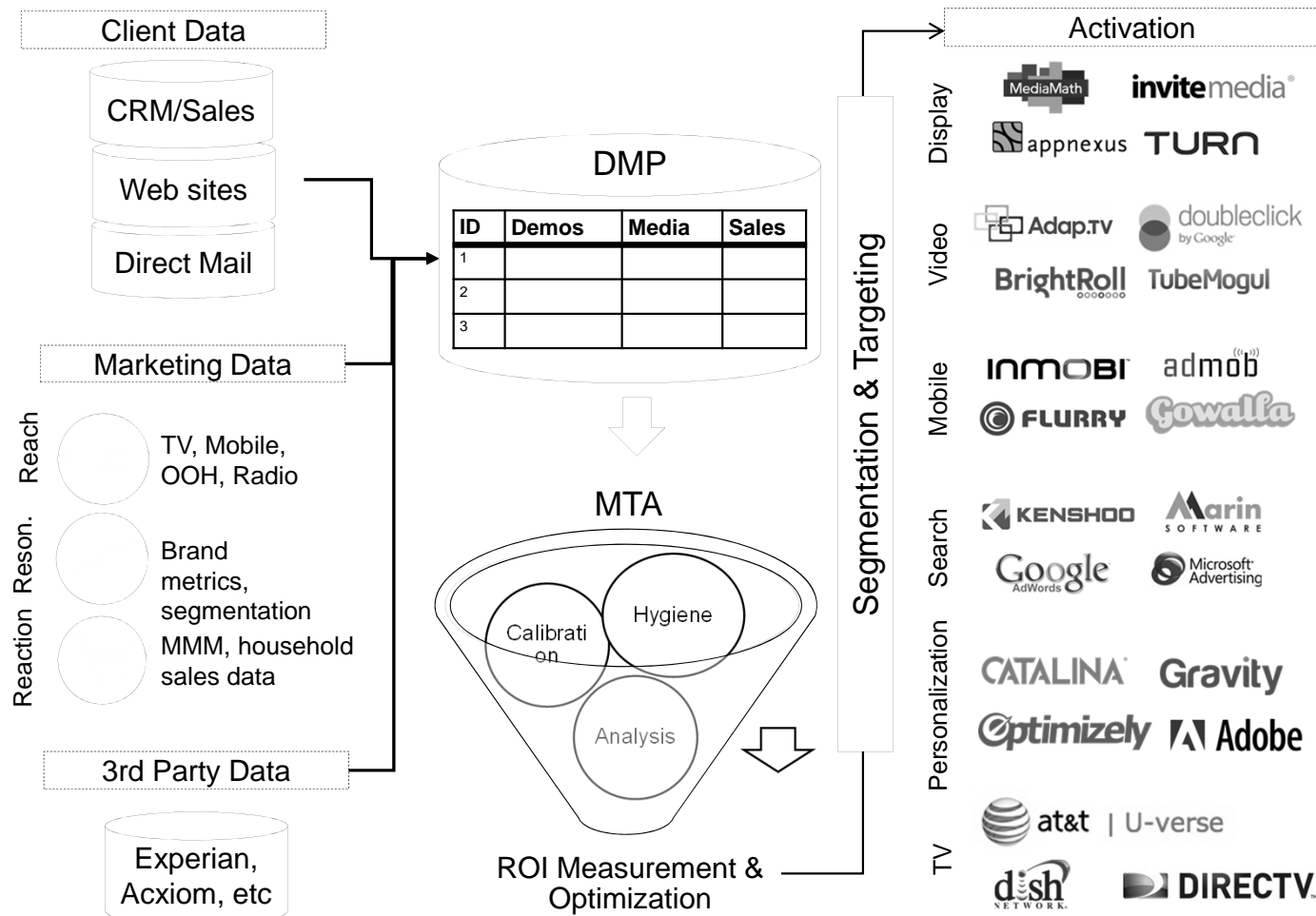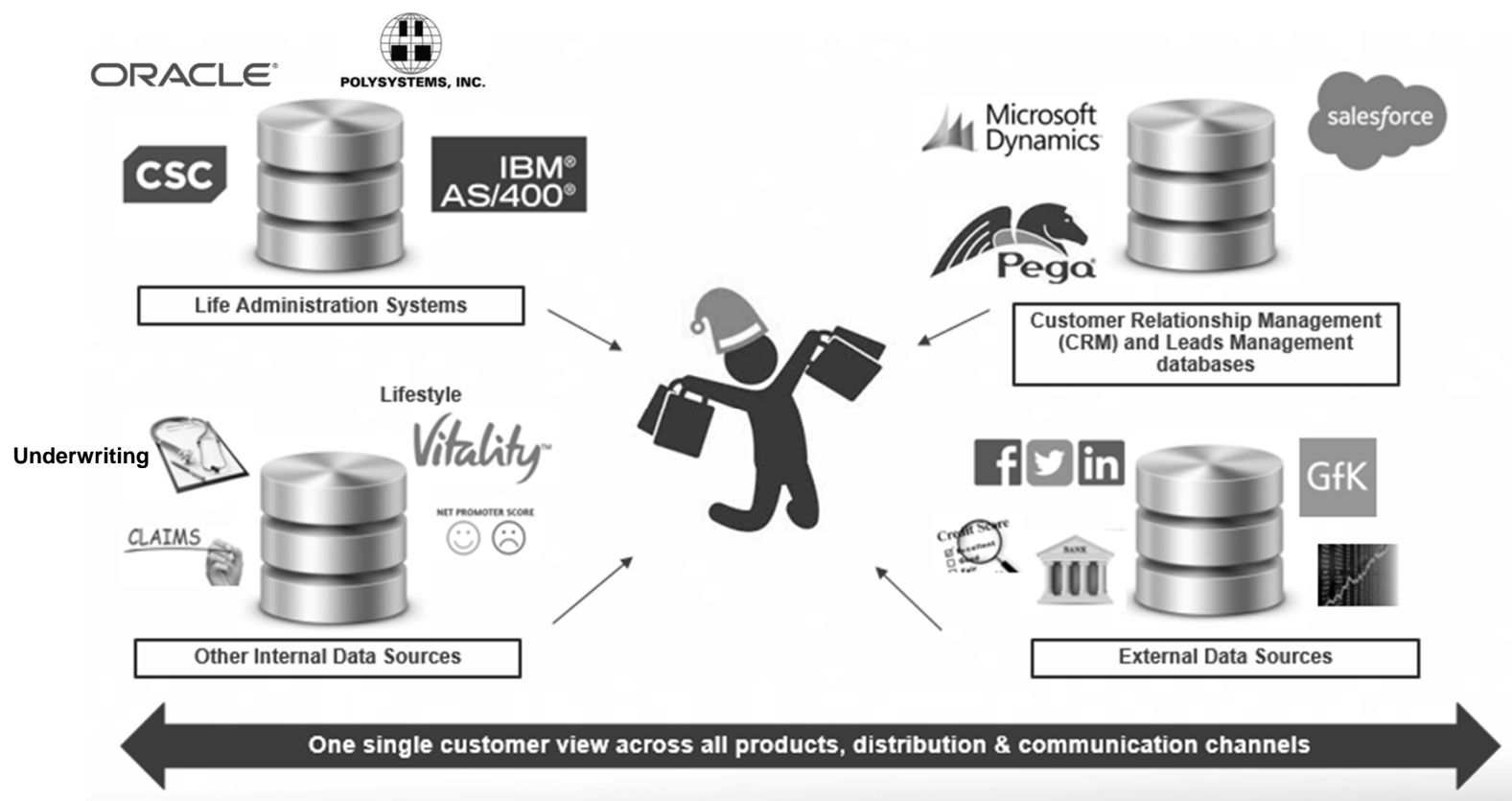| Availability of Data	Computational Power	New Approaches to Analyzing Data	Technology to Automate Processes	Cultural Shifts

DATA!

- Without data, nothing is possible!
- Companies need to:

Capture	Digitize	Organize
Acquire	Store and Manage	Cultivate a Data Culture

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Data management platforms used across different industries

Client Data

CRM/Sales

Web sites

Direct Mail

Marketing Data

Reach — TV, Mobile, OOH, Radio

Reson. — Brand metrics, segmentation

Reaction — MMM, household sales data

3rd Party Data

Experian, Acxiom, etc

DMP

ID	Demos	Media	Sales
1			
2			
3			

MTA

Calibration

Hygiene

Analysis

ROI Measurement & Optimization

Segmentation & Targeting

Activation

Display — MediaMath, invitemedia, appnexus, TURN

Video — Adap.TV, doubleclick by Google, BrightRoll, TubeMogul

Mobile — INMOBI, admob, FLURRY, Gowalla

Search — KENSHOO, Marin SOFTWARE, Google AdWords, Microsoft Advertising

Personalization — CATALINA, Gravity, Optimizely, Adobe

TV — at&t | U-verse, dish NETWORK, DIRECTV

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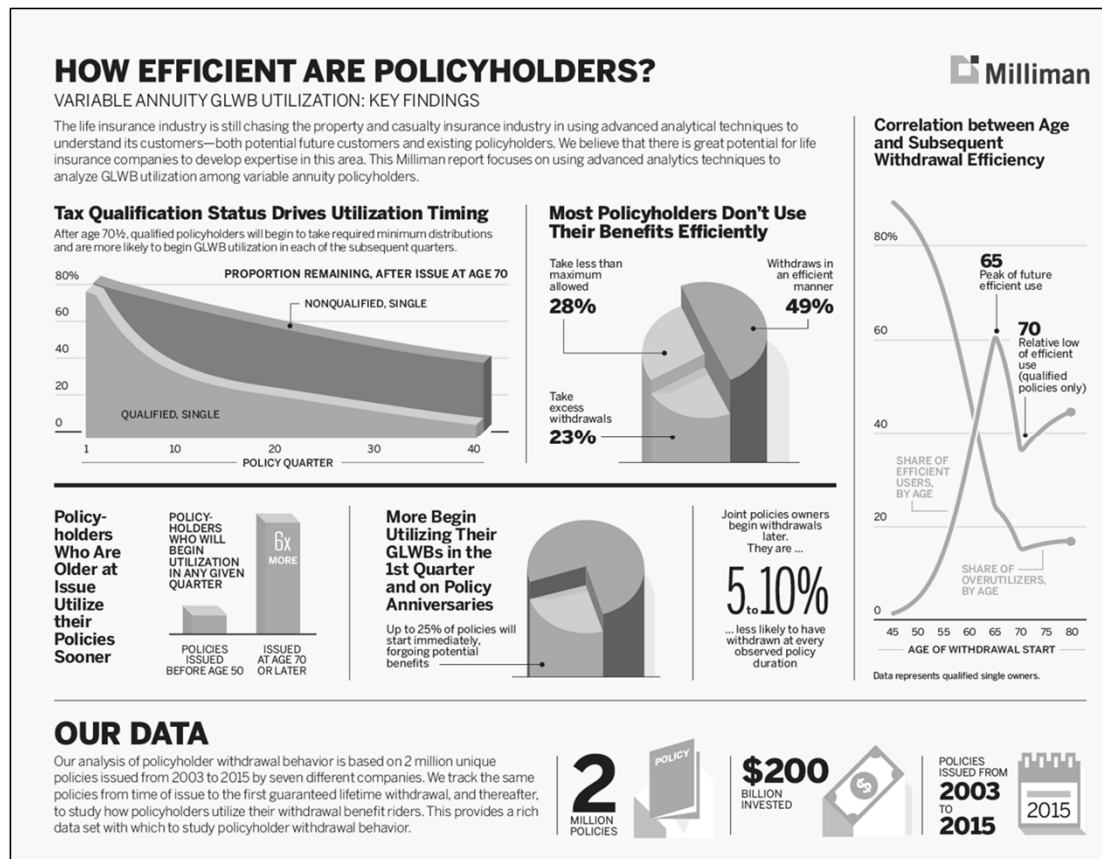# Life Insurance Data Enrichment and Organization Framework

Life Insurance Applications

- We have observed companies use Predictive Analytics for the following:

  - Predictive Underwriting
  - Sales/Marketing
    - Customer segmentation
    - Cross and up-selling
    - Propensity to buy
    - Lead generation
  - Retention/Proactive Lapse Management

  - Fraud Detection
  - Distribution Management
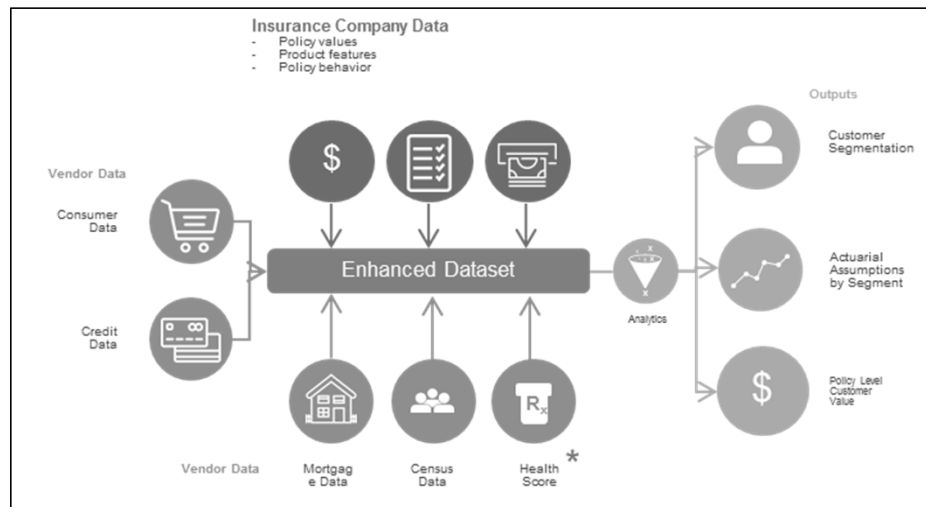 - Assumption Setting
  - Customer Value Analysis

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Assumption Setting Example: VALUES Industry Utilization Study 2016

- Study covered 7 companies, 2 million policies, $200bn AV

- Studied both timing of first WB withdrawal and amount of withdrawals relative to MAWA using experience data from 2007 to 2015

- Impact of drivers and predicted behavior are analyzed by applying advanced statistical modeling.

- Study showed that policyholders who are older at issue tend to utilize their policies sooner

- Policyholders with rollup feature wait longer to utilize the GLWB.

- Less than half of all policyholders currently taking GLWB withdrawals utilize their GLWB benefit with 100% efficiency.
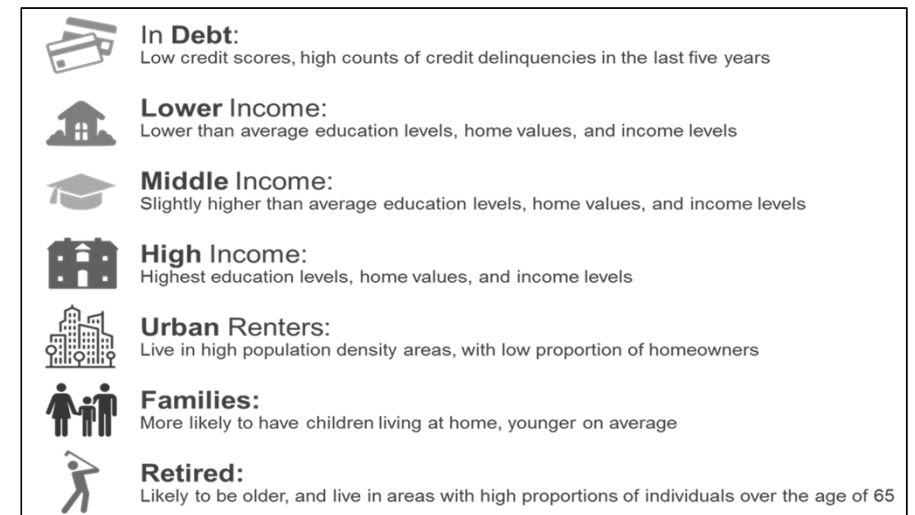
VA Data Enrichment Study (1)
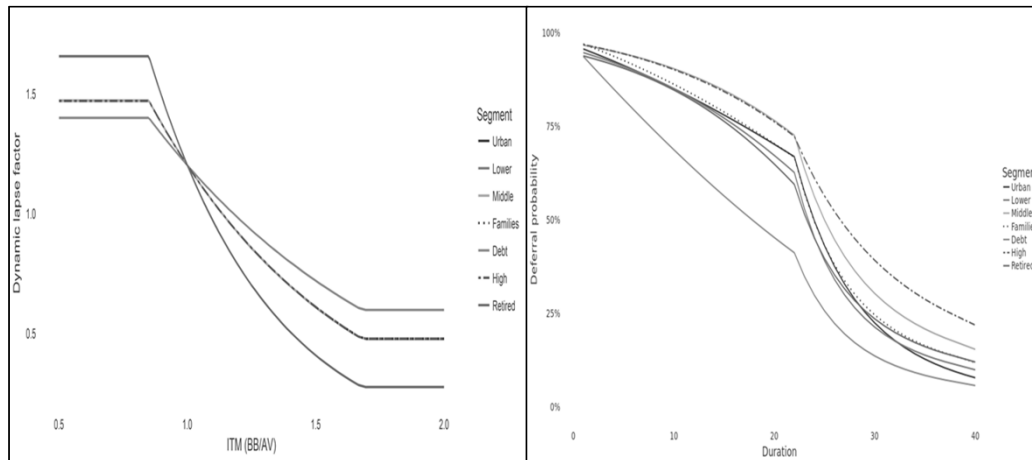
1. Enrich with external data

Insurance Company Data
- Policy values
- Product features
- Policy behavior

Vendor Data

Consumer Data

Credit Data

Enhanced Dataset

Analytics

Vendor Data

Mortgage Data

Census Data

Health Score *

Outputs

Customer Segmentation

Actuarial Assumptions by Segment

Policy Level Customer Value

2. Use analytical tools to develop customer segmentation

In Debt: Low credit scores, high counts of credit delinquencies in the last five years

Lower Income: Lower than average education levels, home values, and income levels

Middle Income: Slightly higher than average education levels, home values, and income levels

High Income: Highest education levels, home values, and income levels

Urban Renters: Live in high population density areas, with low proportion of homeowners

Families: More likely to have children living at home, younger on average

Retired: Likely to be older, and live in areas with high proportions of individuals over the age of 65
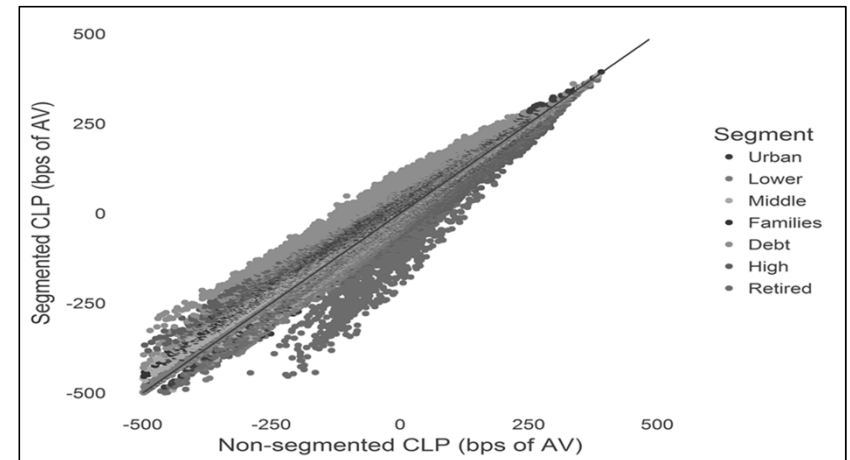
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VA Data Enrichment Study (2)

3. Use Predictive Modeling to develop distinct behavioral profiles

4. Visualize results of customer profitability individually and by segment

VA Data Enrichment Study (3)

Potential applications

- Retrospective pricing review

- Distribution strategy

- Targeted retention and buyout

- Targeted M&A

- Product strategy

- Improvement of assumptions for reserving, capital, hedging

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Product Development Example: Vitality

- Vitality is a leading company in integrating wellness benefits in life insurance products, and has partnered to launch life insurance products in different countries

- John Hancock has launched a UL product in partnership with Vitality

- Customers accumulate points and rewards for maintaining a healthy lifestyle (diet, exercise, health screenings)

- Points status is used to determine discounts for each year's premium

- The product proposition is empowered by Predictive Analytics and new data
  - Steady stream of data is captured from customer
  - Historical dataset used to analyze impact of various lifestyle indicators on mortality rates
  - Presented as a win-win proposition to customer
  - Data from customer can be used for other purposes (cross-sell/up-sell)

INTRODUCING A NEW KIND OF LIFE INSURANCE

Agenda

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Big Data and Underwriting

Big Data from an Rx Perspective

Predictive Modeling using Rx

Case Studies

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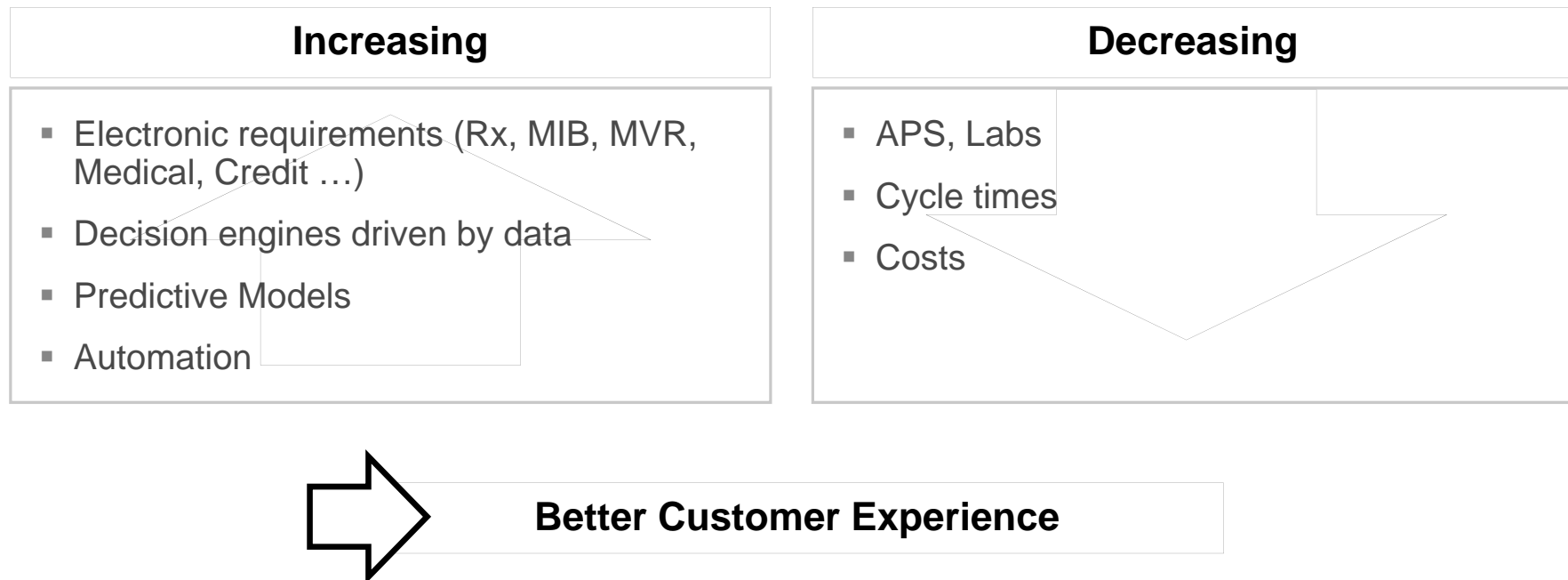
IntelliScript History

2005
Acquired by Milliman
3 clients / 3 employees

2009
RxRules launched

2017
200 clients / 70 employees
Medical Data launched

2014
PopulationRx
launched

2001
Founded as IntelRx

2008
1 million
transactions
processed

2010
GRx launched

2016
8 million
transactions
processed
Risk Score launched

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14
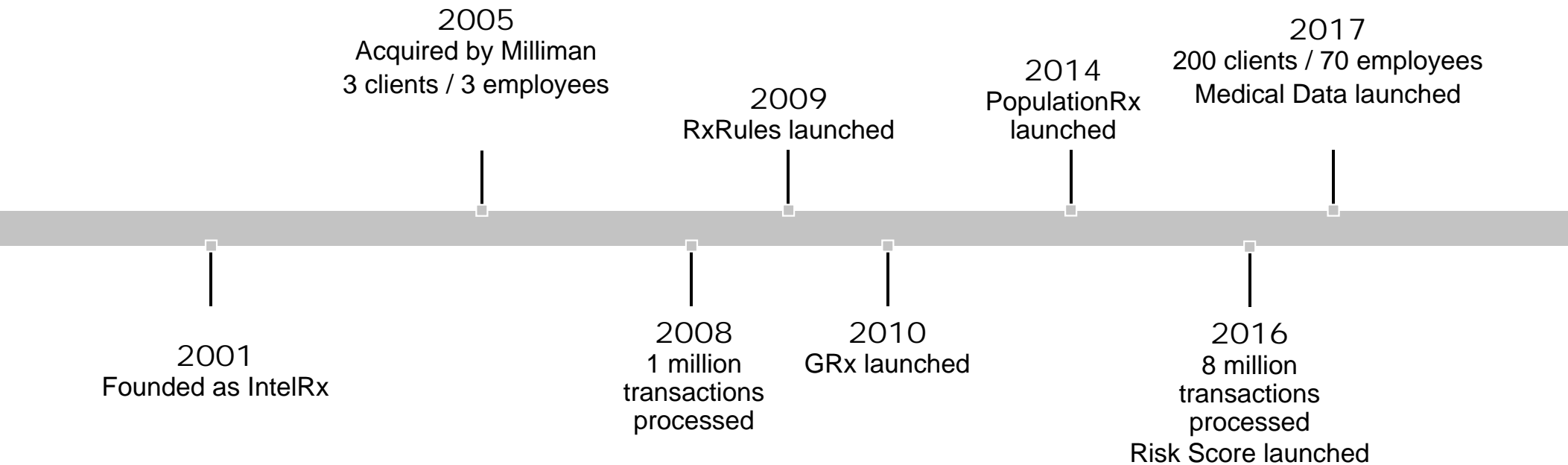
Why is Big Data important?

The Future of Underwriting…

Increasing	Decreasing
- Electronic requirements (Rx, MIB, MVR, Medical, Credit …) - Decision engines driven by data - Predictive Models - Automation	- APS, Labs - Cycle times - Costs

Better Customer Experience

Big Data – Milliman Perspective

Access (with authorization) to Rx Histories on more than 200 million Americans.

Health Plan	Clearing House
PBM	Retail Pharmacy
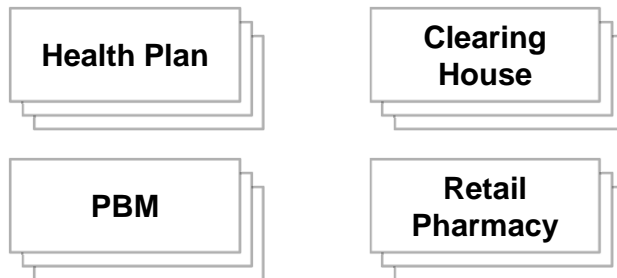
Milliman has accumulated a large Rx and mortality data set.

2015

Milliman mortality study

- 53M exposure years
- 13M lives
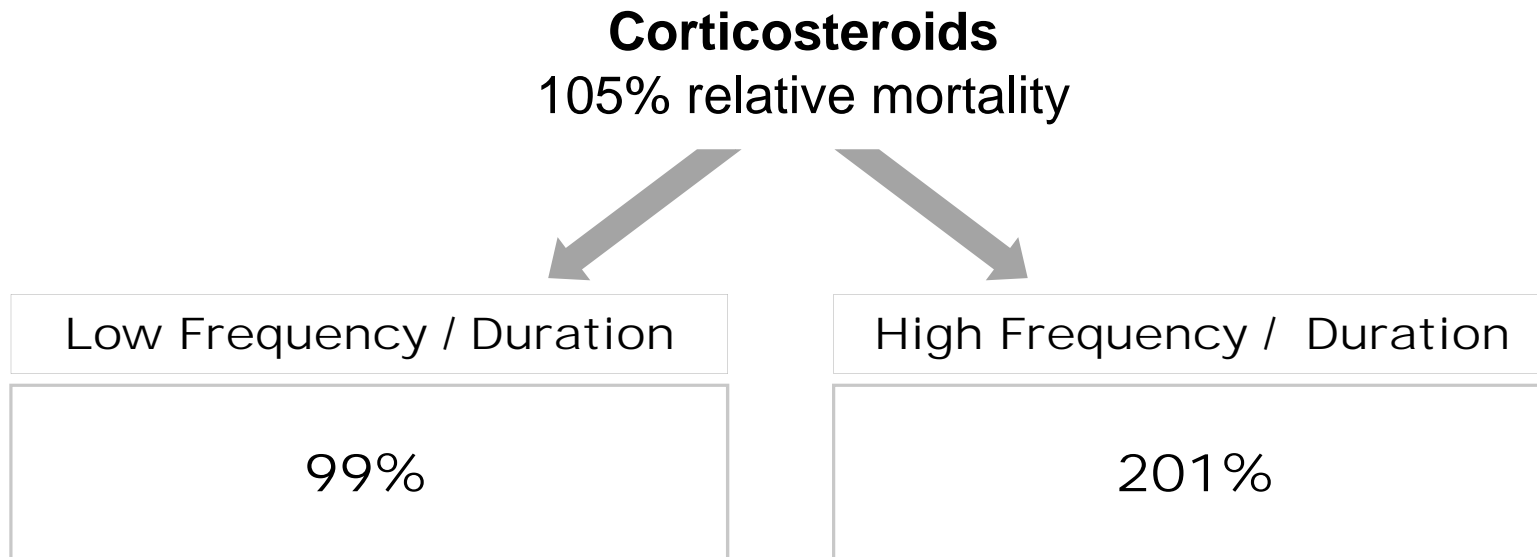- 231,000 deaths
- Created Milliman Risk Score

Rx Histories

1	**Prescription** Brand and generic name | Dosage and quantity | Date of fill	

2	**Physician** Specialty | Contact information
3	**Pharmacy** Contact information
4	**Dates of eligibility** With or without prescriptions
5	**Underwriting significance indicator** Red, yellow, green

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RxRules interprets big data.

Data Input
- Rx data
- Application data
- MIB / MVR
- Medical data

RxRules

UW Guidance
- Conditions
- Severity
- Decisions

Rule Variables
- Indication / Therapeutic class
- Drug combinations
- Fill timing(date or duration ranges)
- Fill counts / patterns
- Dosage / quantity
- Physician specialty / count
- Gender / Age
- Other variables
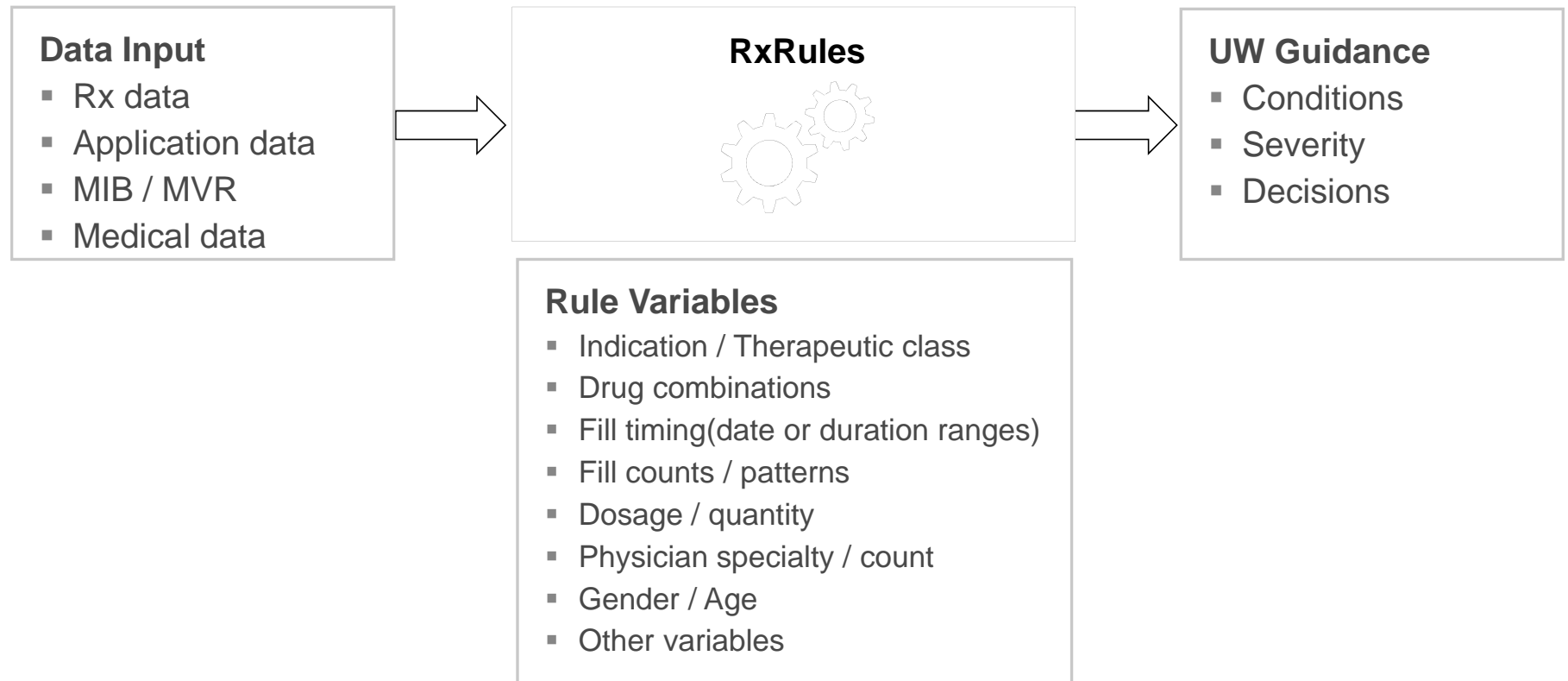
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RxRules – Timing and Duration Matter

Corticosteroids
105% relative mortality

Low Frequency / Duration	High Frequency / Duration
99%	**201%**

Corticosteroids are very common among insurance applicants

RxRules – Dosage Matters

Trazodone
147% relative mortality

Low Dose	High Dose
132%	**224%**
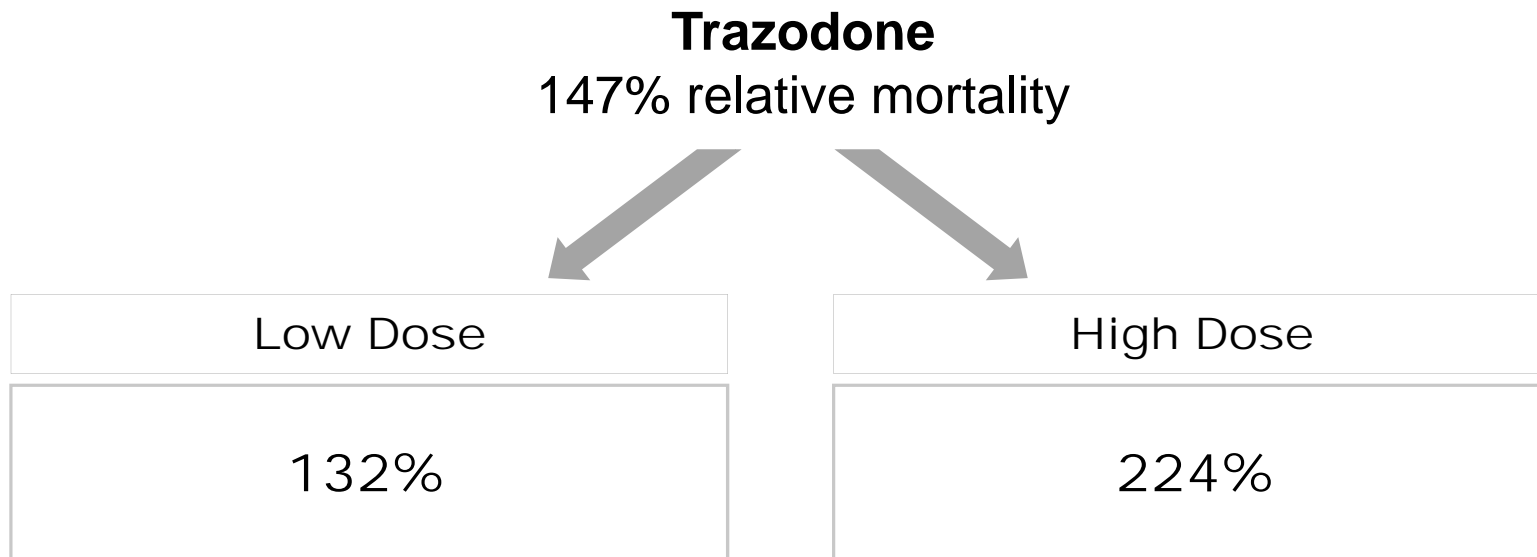
RxRules – Drug Combinations Matter

Spironolactone
209% relative mortality

With 2 out of 3 of:	**Without** 2 out of 3 of:
▪ Thiazide Diuretics (102%)	▪ Thiazide Diuretics (102%)
▪ Ace / Angio II (ARBS) (116%)	▪ Ace / Angio II (ARBS) (116%)
▪ Beta Blocker (122%)	▪ Beta Blocker (122%)
328%	**166%**
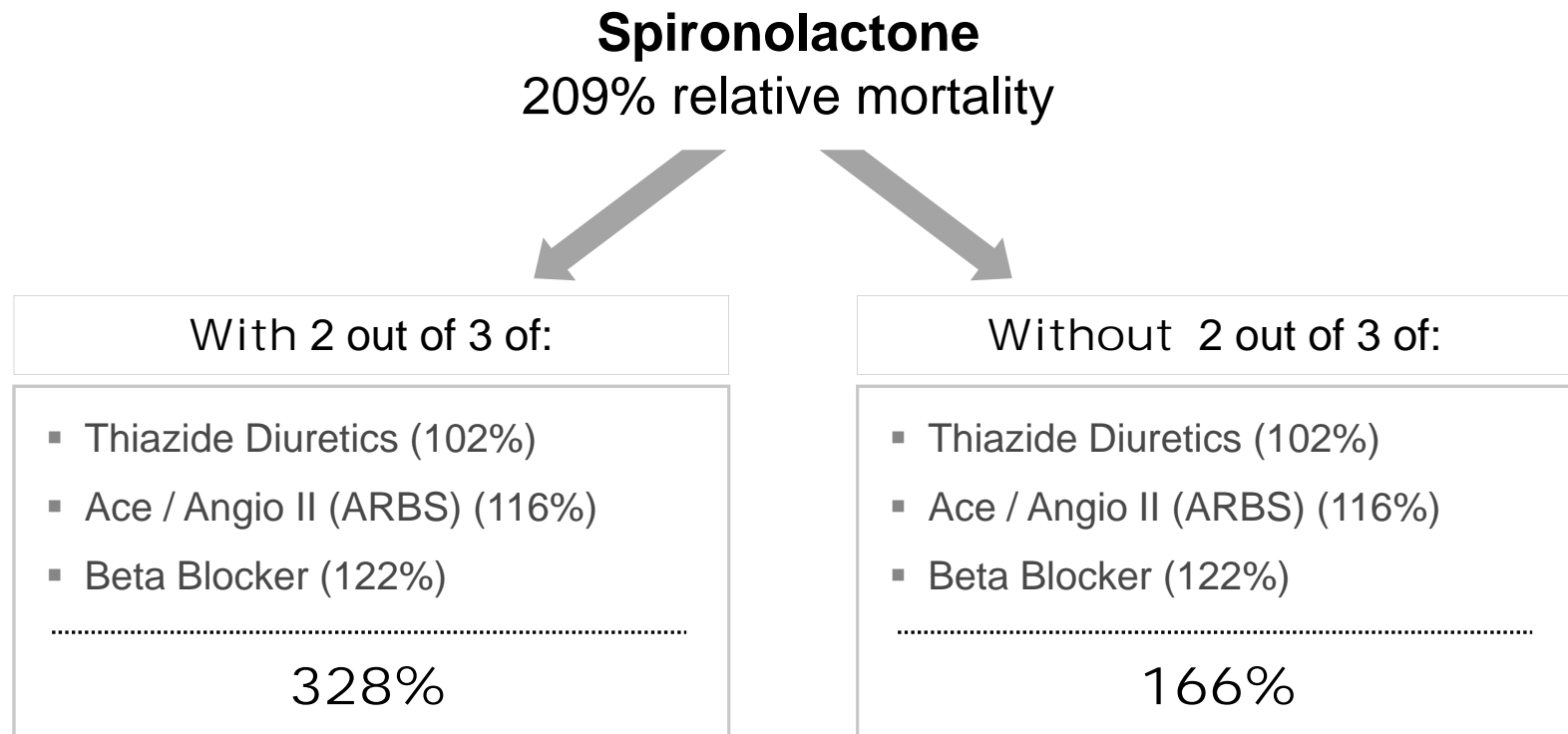
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RxRules – Morphine Equivalence Matters

Opioids
156% relative mortality

Low MED*	High MED*
135%	**322%**
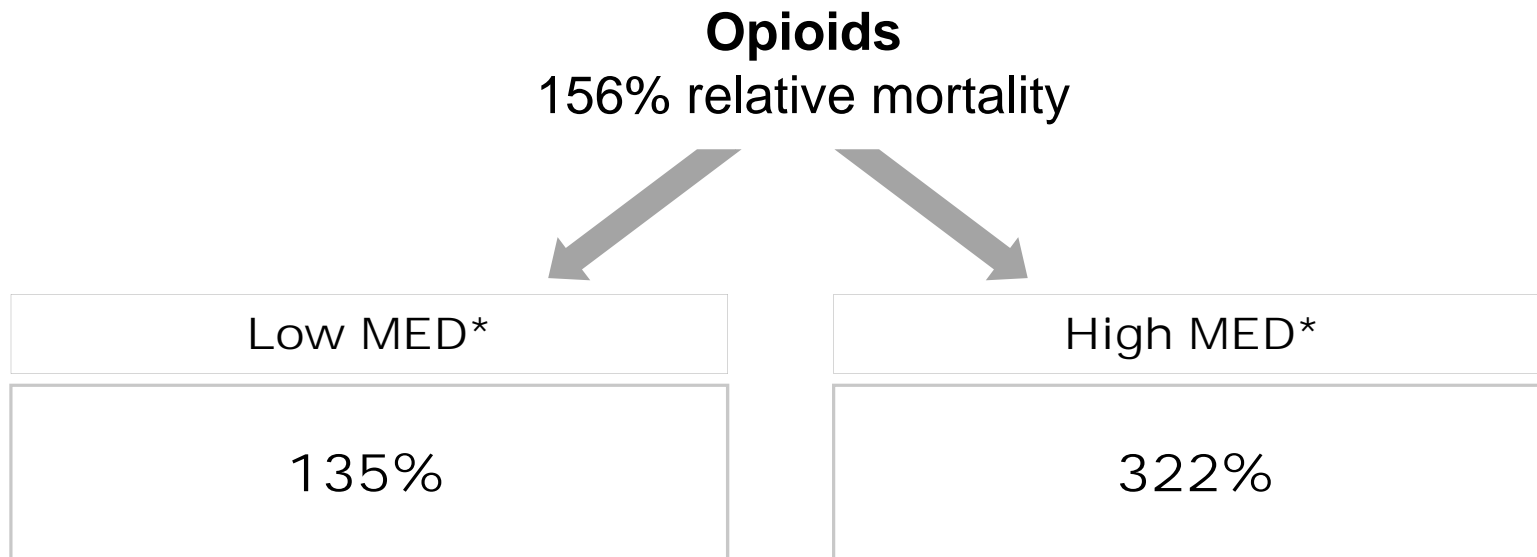
* MED = Morphine equivalent dosage

Predictive Modeling: Milliman Risk Score

RxRules-driven Predictive Model

Predicts relative mortality of a life or group of lives

Multi-variate Rx based score

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The Milliman Risk Score is built on RxRules.

**250,000
NDC codes**

**7,500
GPI codes**

**Hundreds of
RxRules**

1.27

**Milliman
Risk Score**
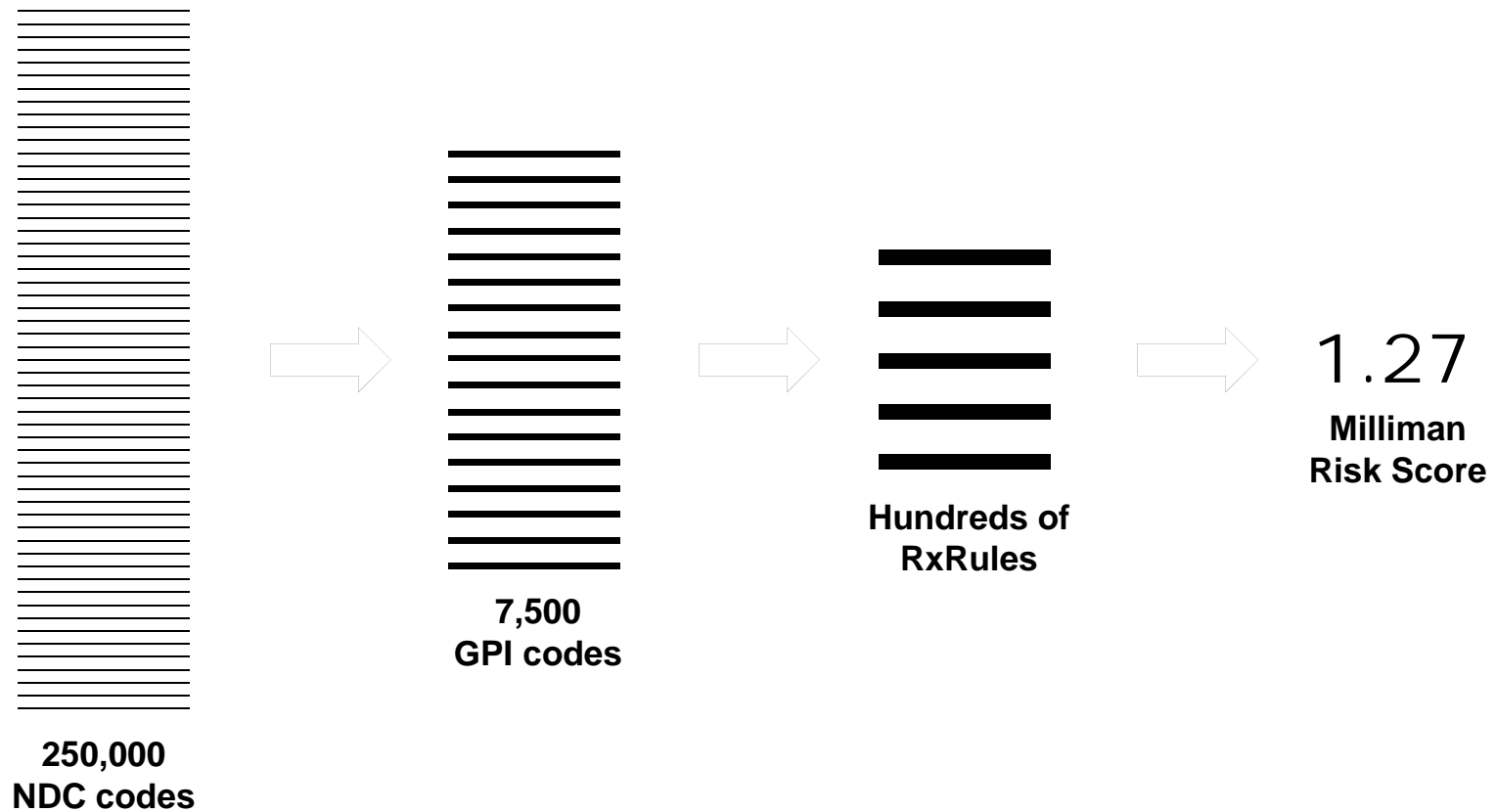
Milliman's Risk Score effectively predicts mortality.

Relative Mortality and Lives by Milliman Risk Score
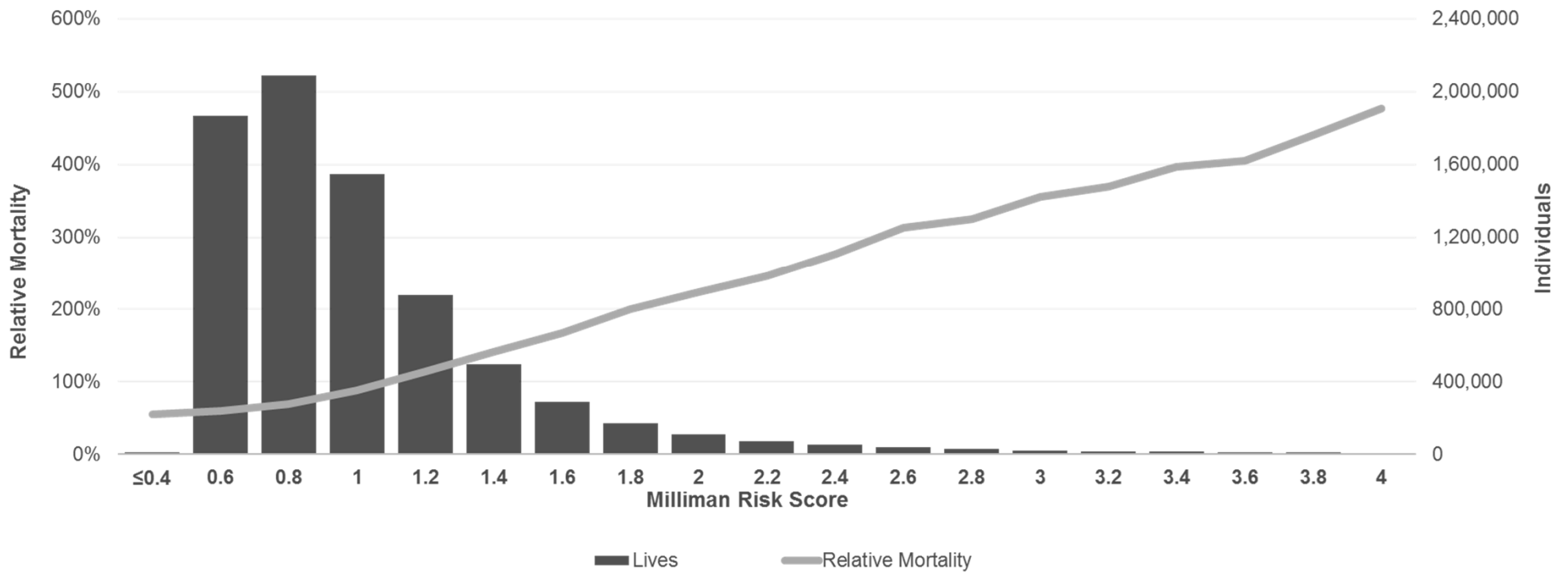
What's so great about this predictive model?

- Evidence based and data driven

- Stratify risk within a given medical condition

- Detect unintuitive patterns

- Quickly and consistently interpret large amounts of data

- Relatively easy to test, implement, use, and update

Risk Score stratifies platelet inhibitor risk.
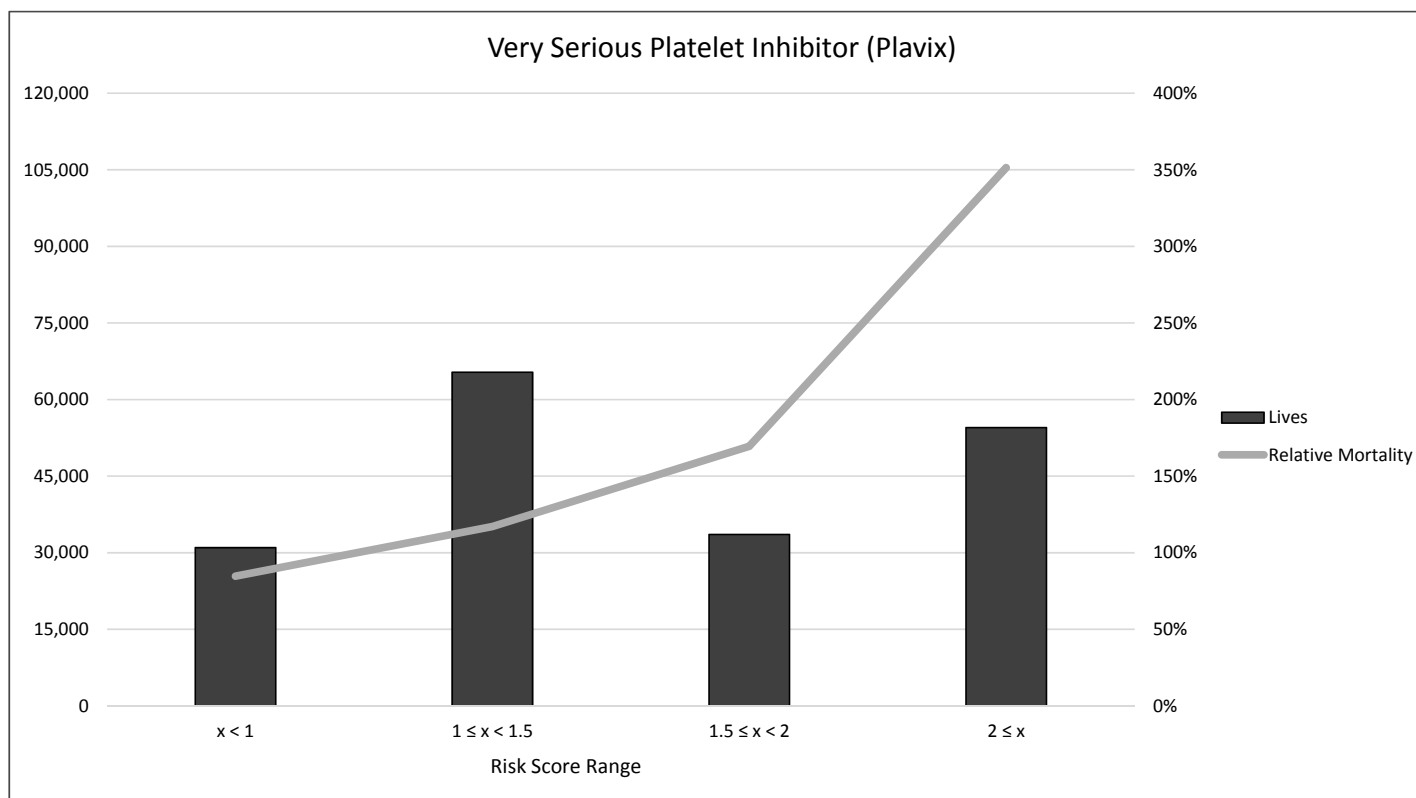
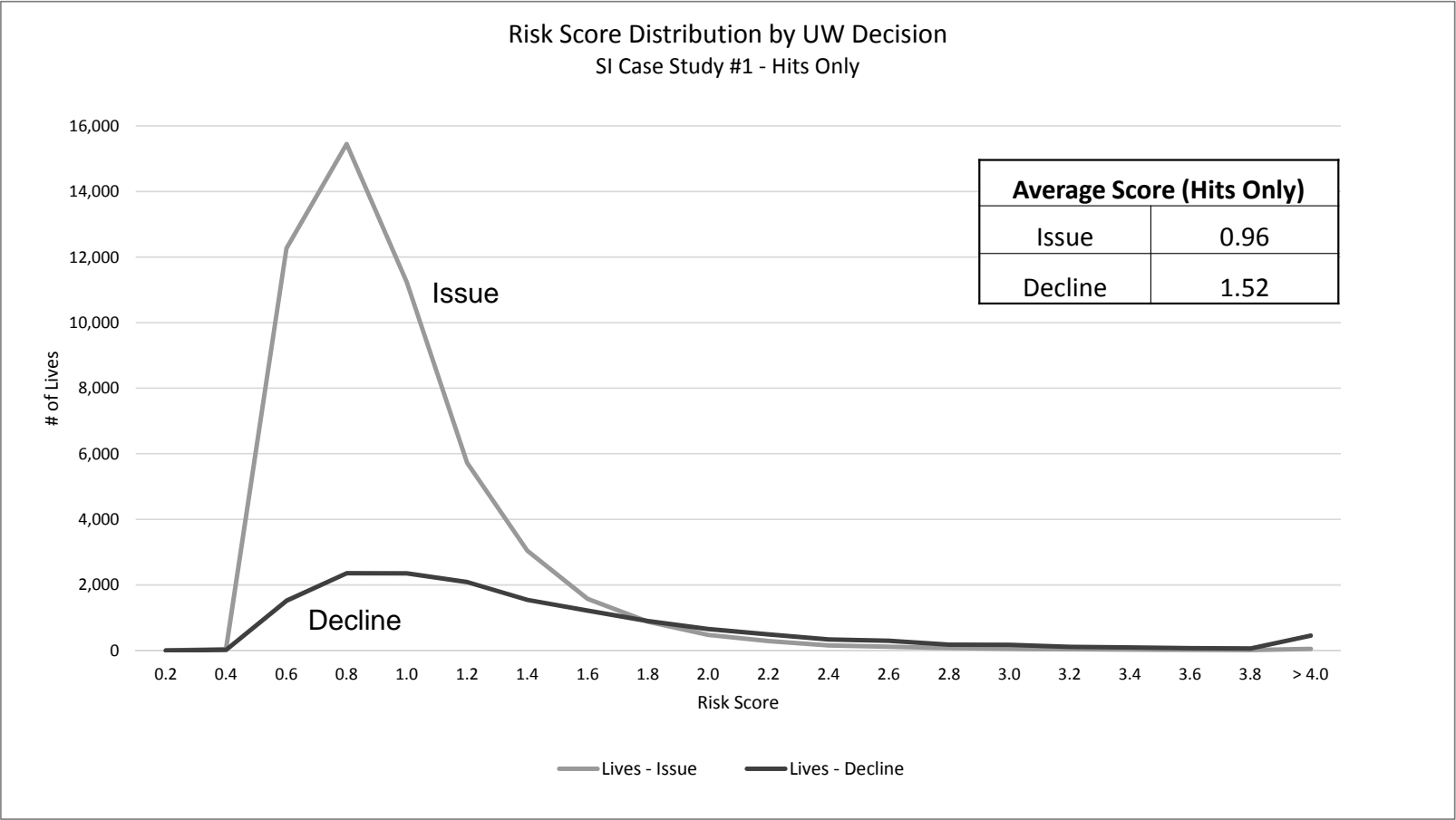# Risk Score stratifies insulin risk.

Diabetes Third Line with Insulin
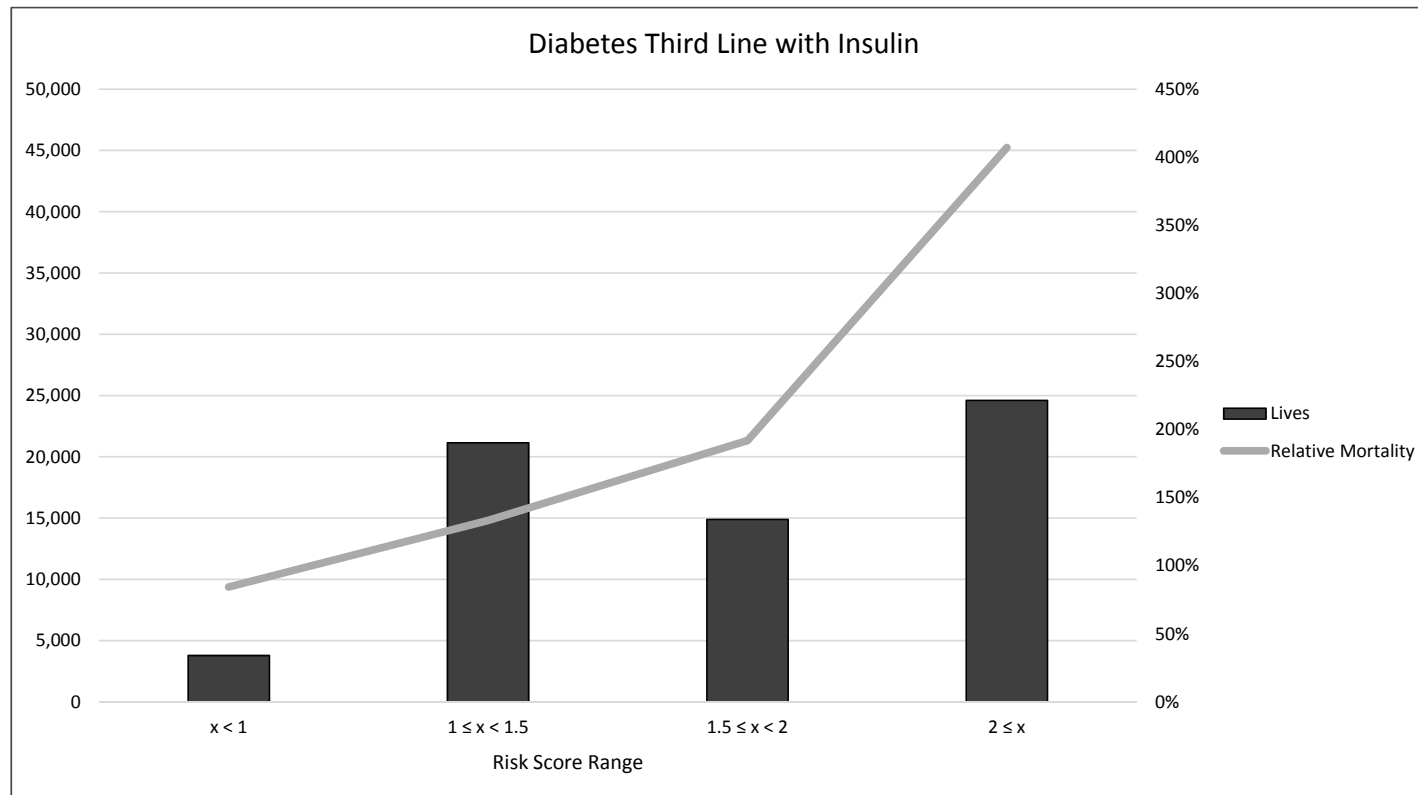
Predictive Model Applications

1	Individual Underwriting

2	Group Underwriting

3	Inforce Analysis

4	Market Segmentation

5	Pension Risk Transfer

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SI Case Study Background

- Mostly auto-decision via RxRules

- Risk Score as of time of underwriting

- Have deaths on issued **and declined** cases

SI Case Study #1 – Distribution of Lives

Risk Score Distribution by UW Decision
SI Case Study #1 - Hits Only

Average Score (Hits Only)	
Issue	0.96
Decline	1.52

Issue

Decline

# of Lives

Risk Score

0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 > 4.0

—— Lives - Issue   —— Lives - Decline

SI Case Study #1 - Relative Mortality

Relative Mortality by Risk Score and UW Decision
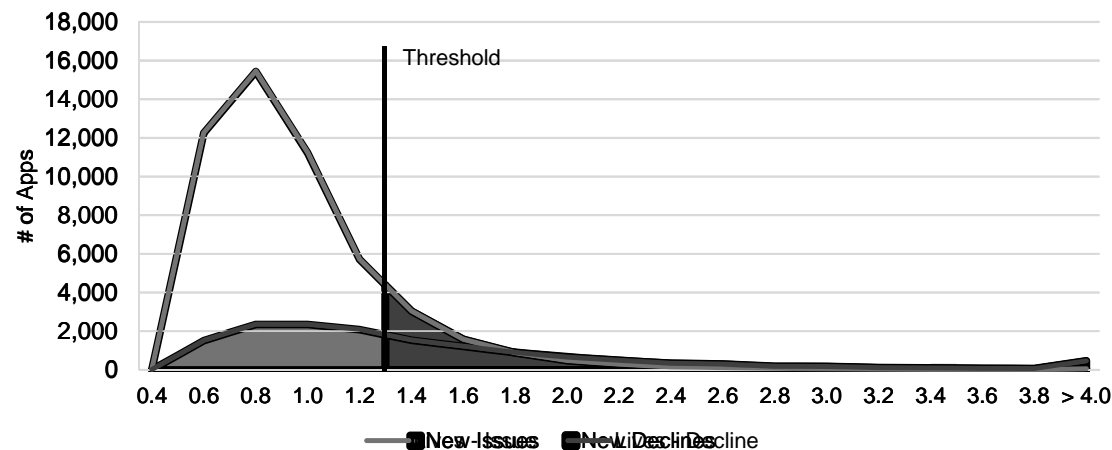SI Case Study #1 - (Hits Only)
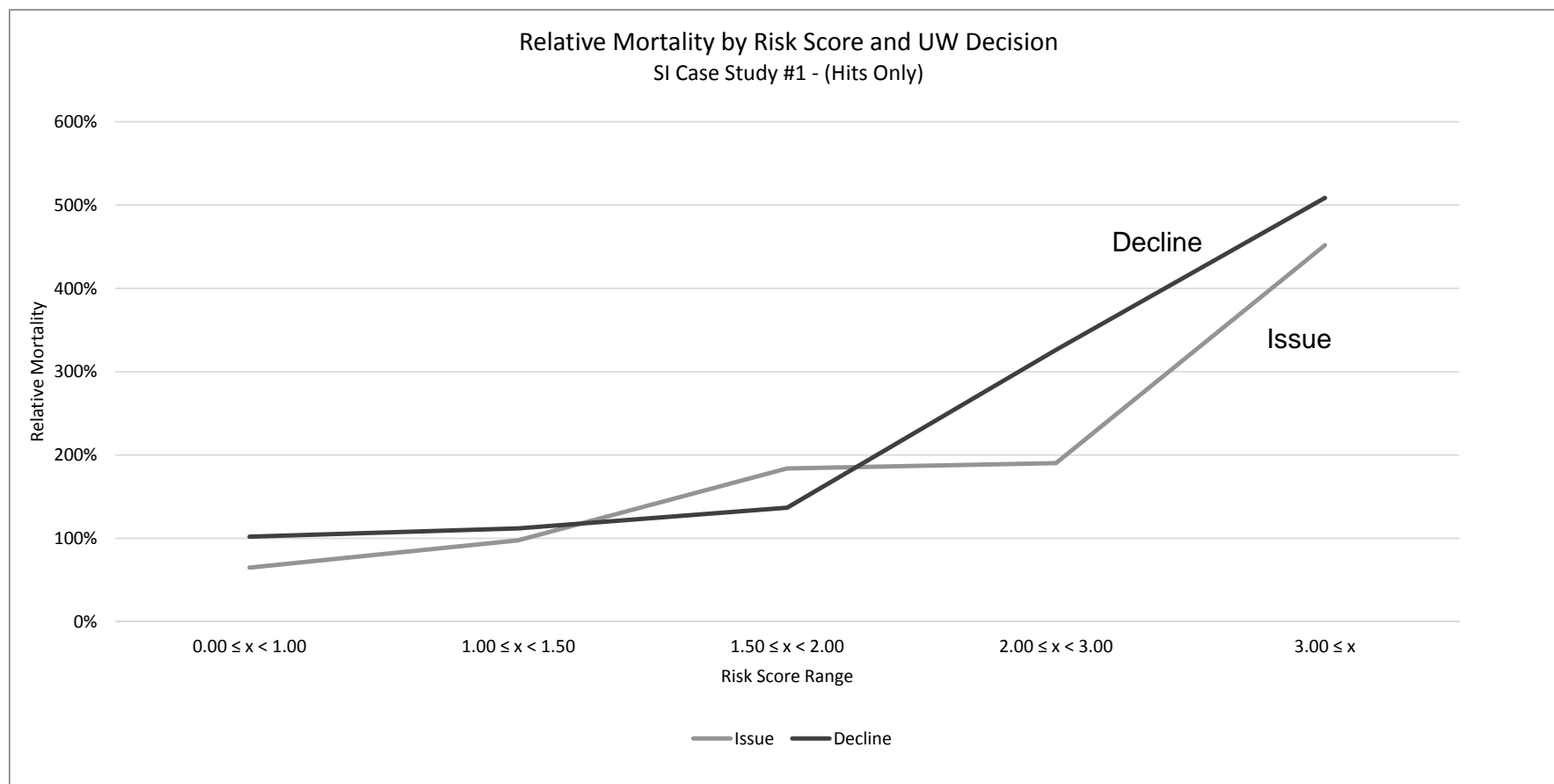
Thresholds can be adjusted to achieve desired business results.
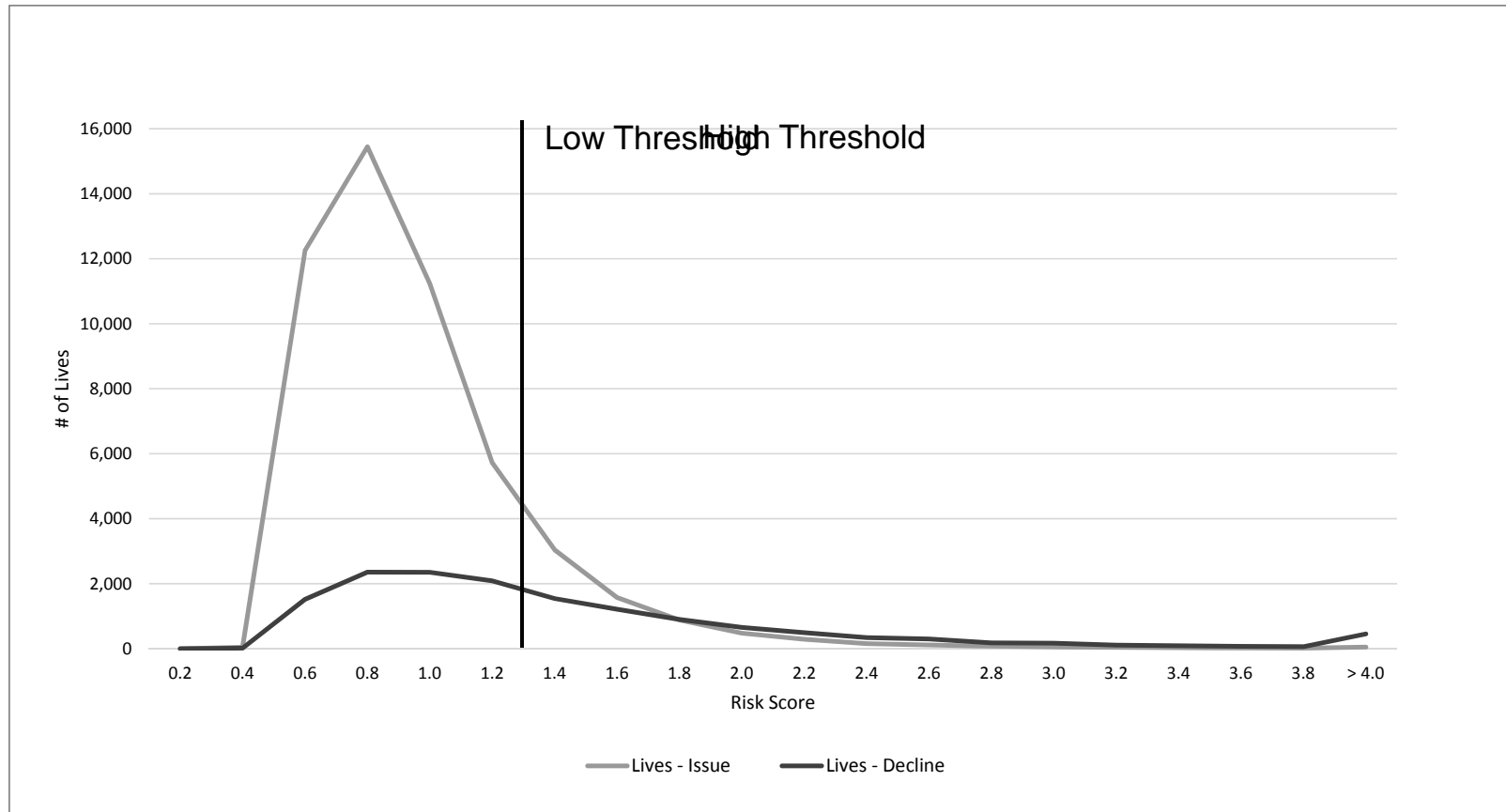
Set Risk Score threshold to issue the same amount of business.

- ▪ Some issued premium now gets declined

- ▪ Equal amount of declined premium now gets issued

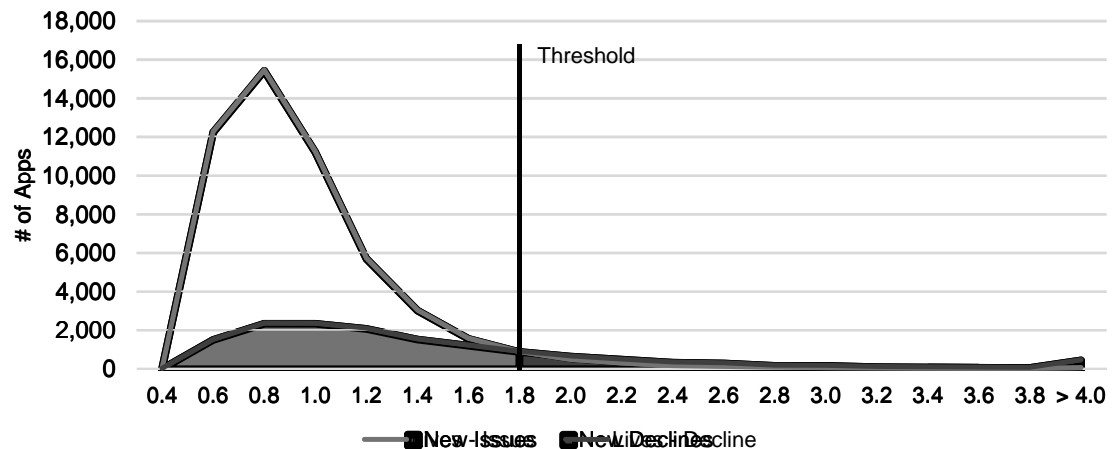| Issued Cases Relative A/E	
Before Risk Score	**After Risk Score**
83%	75%

Same amount of business issued
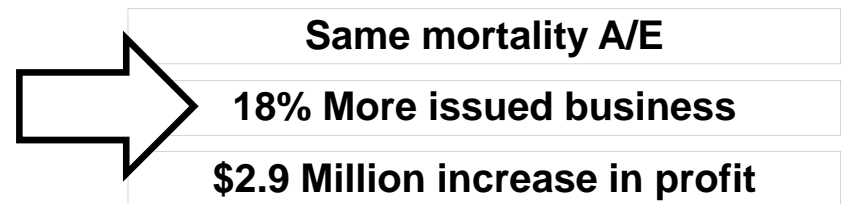
9% Mortality improvement

$4 Million increase in profit

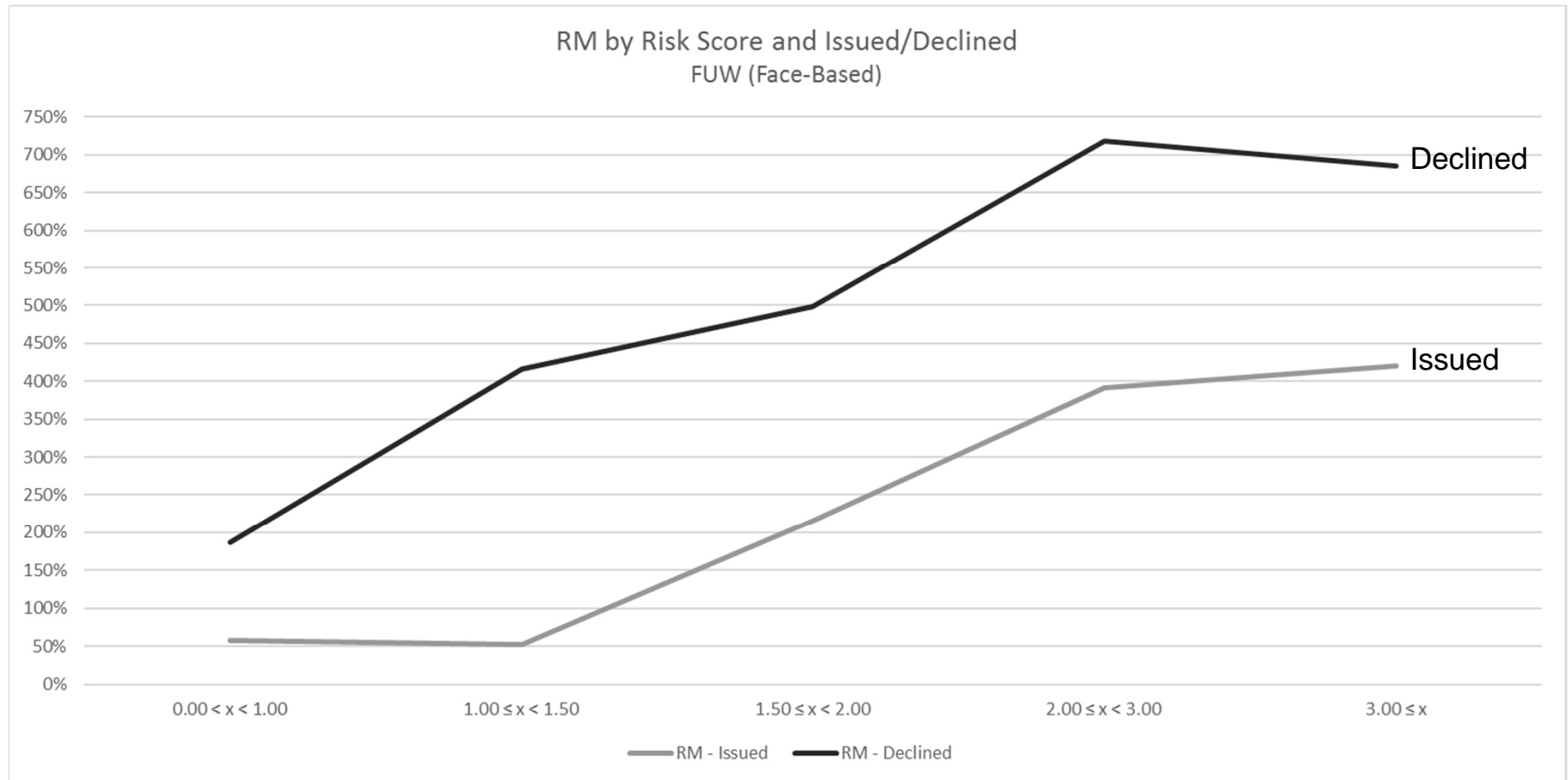# Set Risk Score threshold to maintain the same mortality A/E.

- Some issued premium now gets declined

- More declined premium now gets issued

Premium Issued	
Before Risk Score	**After Risk Score**
$56.1 M	$66.0 M

Same mortality A/E
18% More issued business
$2.9 Million increase in profit

Risk Score adds value to fully underwritten policies.

RM by Risk Score and Issued/Declined
FUW (Face-Based)

Questions?

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Thank you

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