



RGGA

Risk Factors

Past, Present and Future

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20 September 2017

RULES

OF THE



MANCHESTER

Loyal Orangemen's Sick & Funeral Society

HELD AT THE

ORANGE CLUB ROOMS, 3, RIDGEFIELD,

JOHN DALTON STREET, MANCHESTER.



Manchester :

ATLANTIC PRINTING WORKS, 159, ROCHDALE ROAD.

1893.

RGA

Historical Perspective

Historical View

History of Insurance

- **Greeks & Romans**
- **“Friendly Societies”**
 - Many versions; contribute to member emergencies
 - Fixed payment & group size
- **Modern Insurance**
 - 1750’s – Developments in Math & Statistics
 - 1762 – Equitable Society – age-based premiums, anyone could join
 - 1800’s – Life insurance started in the U.S.

FRIENDLY SOCIETIES ACT,
9 & 10 Victoria, cap. 27.

BURIAL SOCIETIES.

THE ACTUARY TO THE COMMISSIONERS FOR THE REDUCTION OF THE
NATIONAL DEBT'S

GRADUATED TABLE OF WEEKLY CONTRIBUTIONS,
PROVIDING SUMS PAYABLE AT DEATH OF MEMBER AND OF MEMBER'S WIFE

Age of Members.	Free to receive Benefits at end of	CONTRIBUTIONS PAYABLE		BENEFITS.	
		On Entrance	Weekly for the whole of Life	Sum payable at Death of Member	Sum payable at Death of Member's Wife
6 and under 12	6d.	One Farthing	£4.	Nil.
12 " " 18	1s.	One Halfpenny	£7.	Nil.
18 " " 23	1s. 6d.	Three Farthings	£10.	£3.
23 " " 28	Twelve	2s.	One Penny	£10.	£4.
28 " " 33	2s. 6d.	Five Farthings	£10.	£5.
33 " " 38	3s.	Three-halfpence	£10.	£5.
38 " " 43	Months.	3s. 6d.	Seven Farthings	£10.	£5.
43 " " 48	4s.	Two Pence	£10.	£5.
48 " " 53	4s. 6d.	Twopence-halfpenny	£10.	£5.
53 " " 60	5s.	Three Pence	£10.	£5.

Historical View

History of Underwriting

- In early 1800's, UW involved:
 - Personal declaration
 - References – friends & medical
 - Medical visit
- Early 1900's – non-medical
- 1890's – Mortality Studies
- 1920's – introduced Underwriters
- Underwriter knowledge was very limited in the early days.



Historical View

History of Preferred Risk

- **Gender** rates in the 1940's
- **SM/NS, Lab Testing** in 1970's
- 1980's – AIDS led to **blood testing** for smaller policies
- As a result, insurers found many other benefits and introduced **Preferred** rates in the 1980's
- Criteria: Medical history, Family history, Lifestyle factors





RGA

Today and the Future

Introduction

Potentially a much more holistic view of mortality

Demographics

- Age
- Gender

- Where you live
- Education
- Occupation

- Wealth & assets
- Income level
- Home value

- Marital status
- # of Children
- Car ownership

- Foreign residence / travel
- Credit & financial behavior
- Insurance purchasing
- Well-being
- Personality
- Benefit amount
- Investments
- Motorcycles

- Care provider
- Claims history

- Hobbies
- Driving behavior
- Active military
- Social media usage
- Social engagement
- Pet ownership
- Public records / bankruptcy

- Smoking
- Alcohol consumption
- Physical activity / Sitting
- Depression
- Stress
- Sleep
- Diet
- Medication adherence
- Lab data (blood & urine)
- BMI / physical measurements
- EKG's, medical imaging
- Cognitive testing, physical function, etc.

- Genetic data
- Prescription history
- Heart Rate
- 'Omic data

Behavioral

Health & Biometrics

Socio-Economic

Outside Forces →

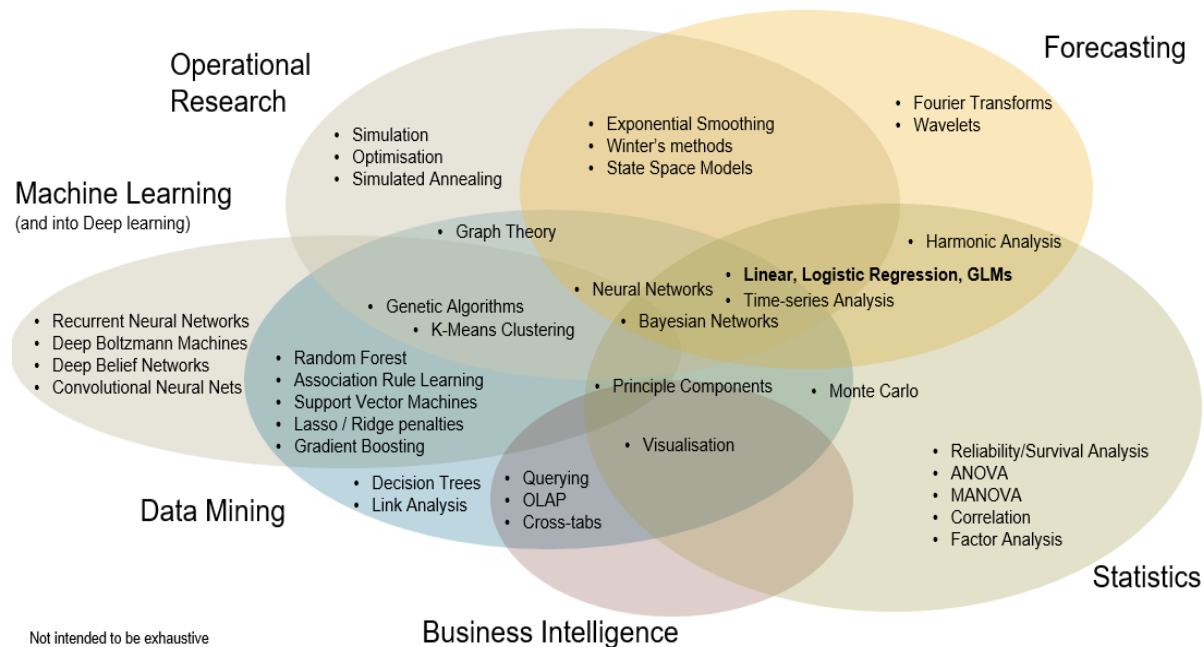
- Technology
- Environment
- Medical Advances

* Not an exhaustive list

Introduction

Common Themes

- Moving towards triage underwriting; Companies striving for instantaneous underwriting
- More complex models; interaction terms



Introduction

Common Themes

- Aspiring to replace impressions with data-driven evidence



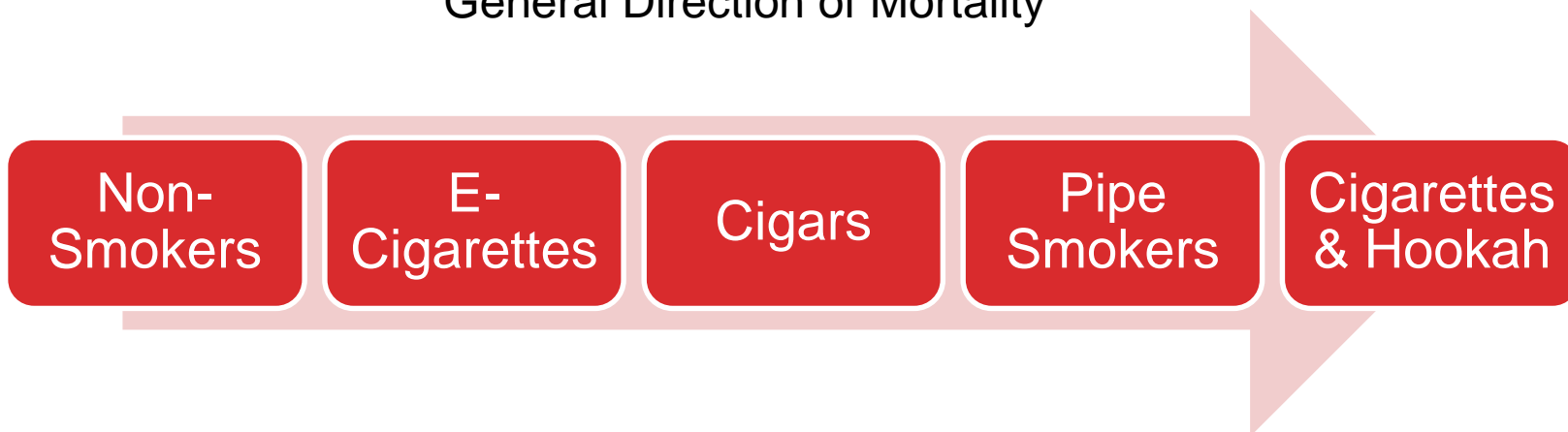
Risk Factors

Smoking & Alcohol



- On average, smokers have a life expectancy 10 years less than non-smokers – Risk varies by type (many factors)
- Varies by type, age, volume, etc.

General Direction of Mortality

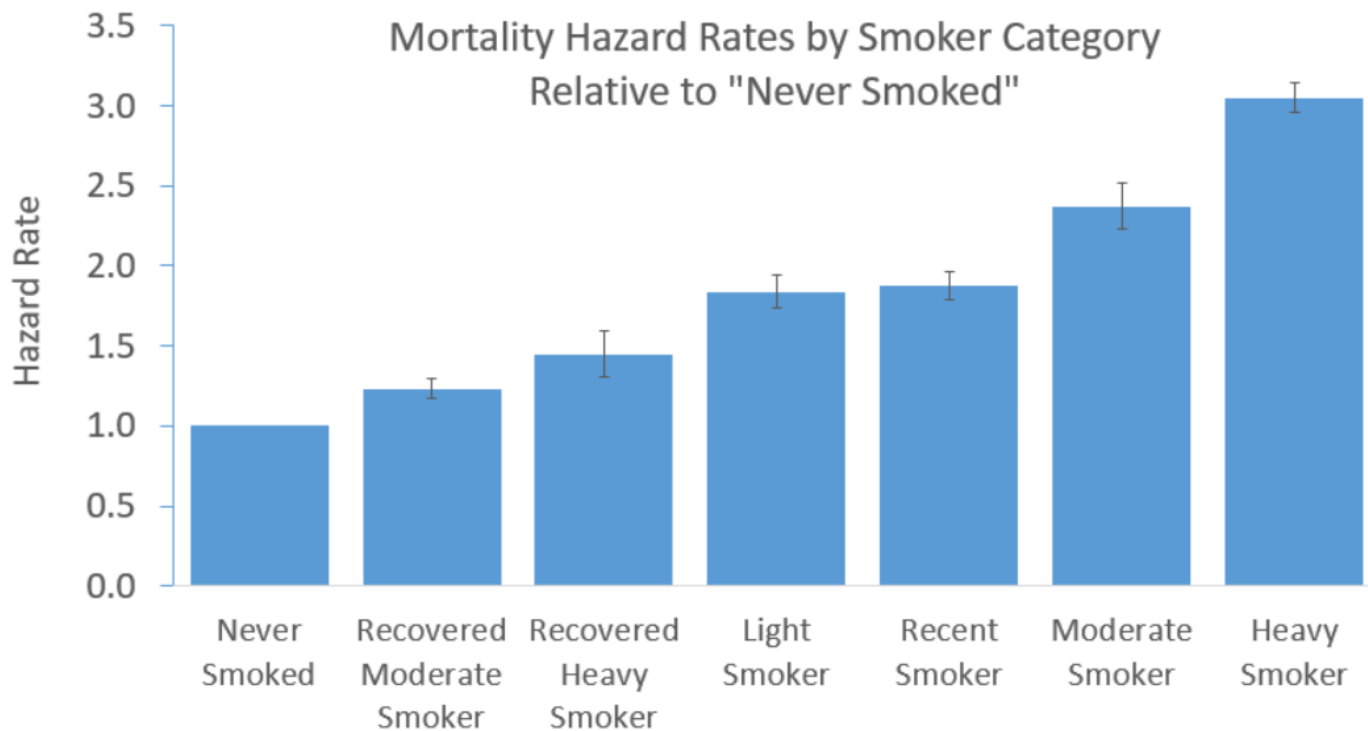


Risk Factors

Smoking & Alcohol



- Recovered smokers still face higher mortality
- Multivariate Study:



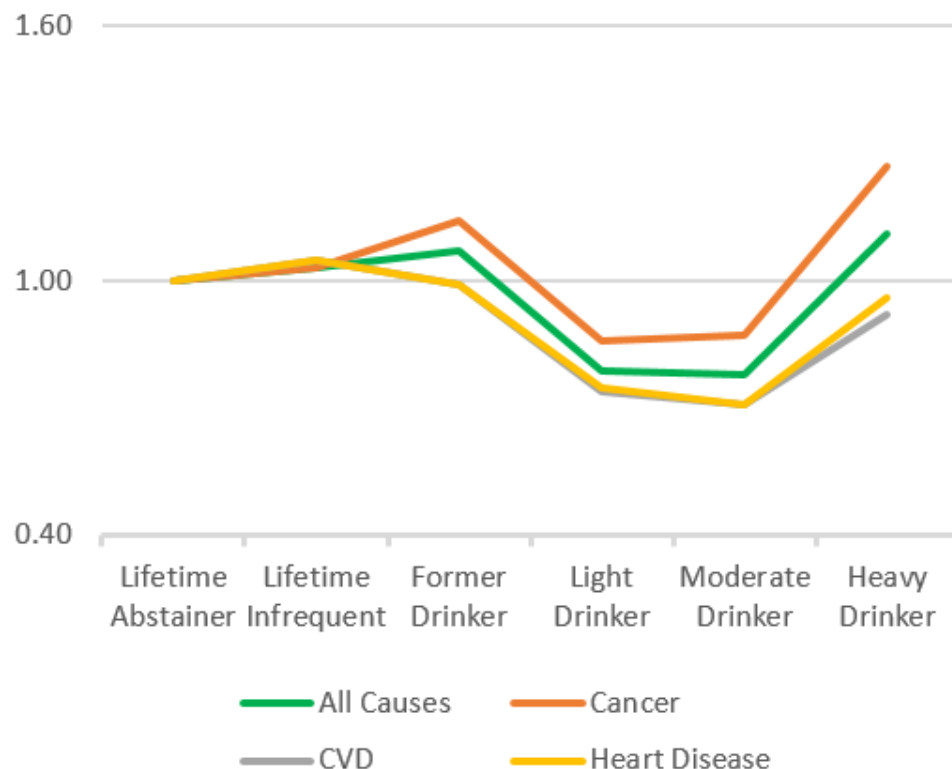
Risk Factors

Alcohol



- Study based on US Survey data
- Controlled for many variables (age, gender, education, race, marital, BMI, physical activity, smoking, diseases)
- “Optimal” levels varies by age and gender
- Varies by preferred type of alcohol consumed

Hazard Ratios by Cause of Death



Risk Factors



Prescription Histories

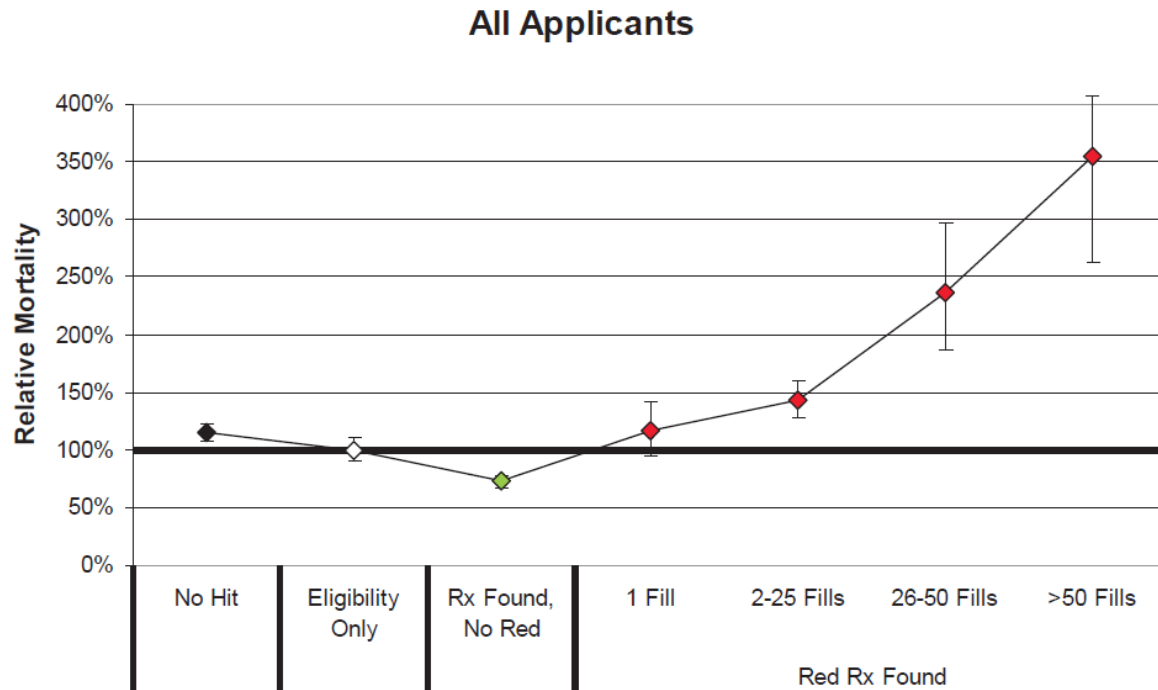
- Rx Data – valuable UW evidence in the U.S.
- Common data provided
 - Age, gender, eligibility period
 - Drug name, code, strength, quantity, refill information, dates
 - Specialty of prescribing physician
- Rx information is optimized through doctor & nurse expertise, rules and models
- 2009 RGA / Milliman study – goal to **quantify mortality risk** of applicants **based on their prescription drug history**
- Mortality study of over 1 million insurance applicants linked with their Rx histories of over 21 million prescription fills

Risk Factors

Prescription Histories



- Worst drugs coded as “Red” drugs
- Today, algorithms are getting more sophisticated to optimize the data available



Risk Factors



Genetics – Risks and Benefits

- Longer life? Better info; Lifestyle; Pharmacogenomics
- Risk in promotion
 - Reputational risk; Clinical medicine may not be ready
- Regulations
 - No insurer anywhere requires genetic testing
 - Laws vary by country & product; Constantly evolving - should promote “equality of information”
- Anti-selection
 - Study from 12 years ago... Those with genetic risk for Alzheimer's are 5.7 times more likely to purchase insurance
 - Too early to quantify risk of anti-selection or impact on morbidity or mortality with any degree of certainty. Need research.

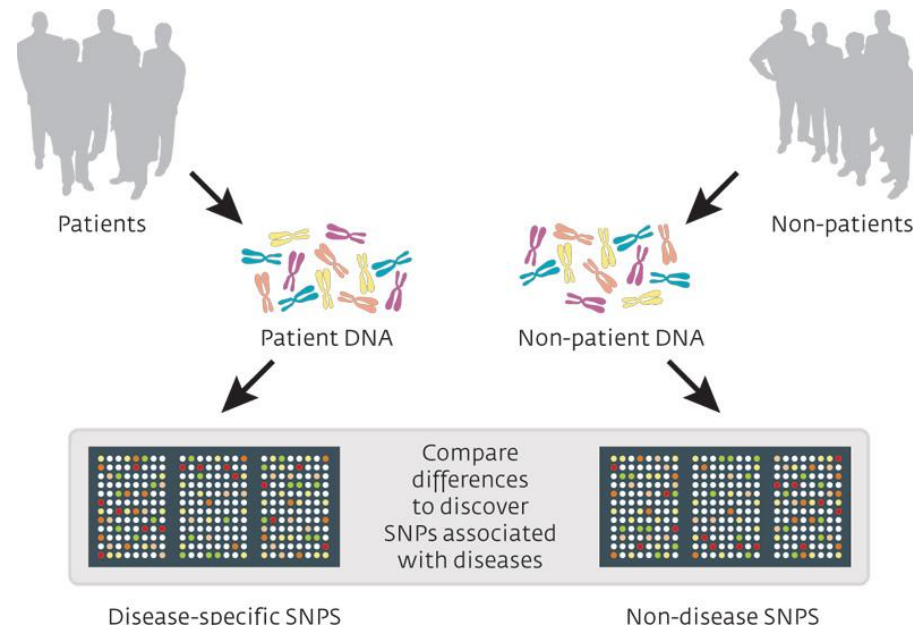
Risk Factors

Genetics – GWAS



- **Genome-wide association studies** (GWAS) help scientists to identify genetic variants associated with human diseases
- A GWAS may include 10,000 or so people with the same disease
- Testing millions of variants, standard practice was that the p-value had to be incredibly significant to claim association with a disease

- Conclusion might be: “Since it’s occurring too frequently, this particular genetic variation in that letter of the DNA (or SNP) is important for Alzheimer's”



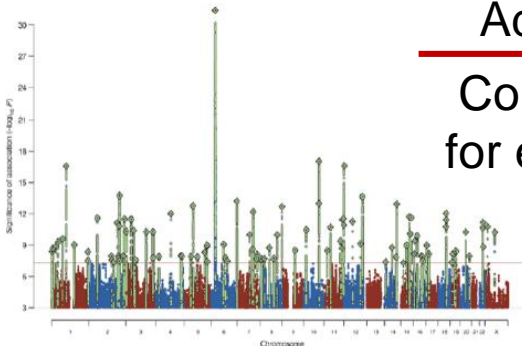
Risk Factors



Genetics – Polygenic Risk Scores

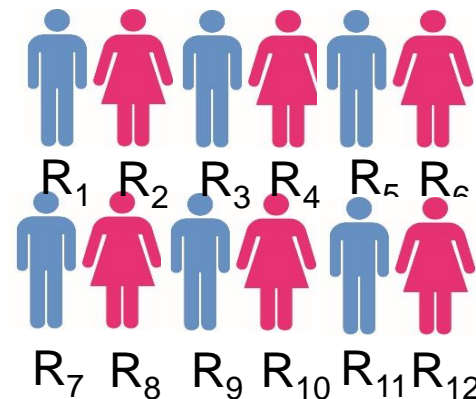
- **Polygenic Risk Scores** have been a game changer in the field of genetics!
- Instead of focusing on the most statistically significant SNP's, just **add up the odds ratios of all the relevant SNP's** to get the genetic risk score
- Sort of defies logic...add the effects of SNP's that aren't independently proven to be significant

Identify SNP's from several studies



Add up SNPs
Compute PRS
for each person

New Independent Study



Does the PRS predict disease?

How can we use the prediction?

Risk Factors

Driving Behaviors



- Study Data from past driving violations – rules & models to optimize
- Strong relationship between adverse driving records and mortality
- Commonly asked in Canada, Hong Kong, South Africa and U.S.
- **What underwriters look for:**
 - Traditional risk factors
 - Alcohol-related infractions
 - Reckless driving, Accidents
 - Moving violations
 - Drug use or possession
 - Suspensions
 - Medical history
 - Emerging risk factors
 - Poor equipment maintenance
 - Motorcycle infractions
 - Distracted driving, texting
 - Seat belt use
 - Risk taking behavior
 - Interaction with other courts

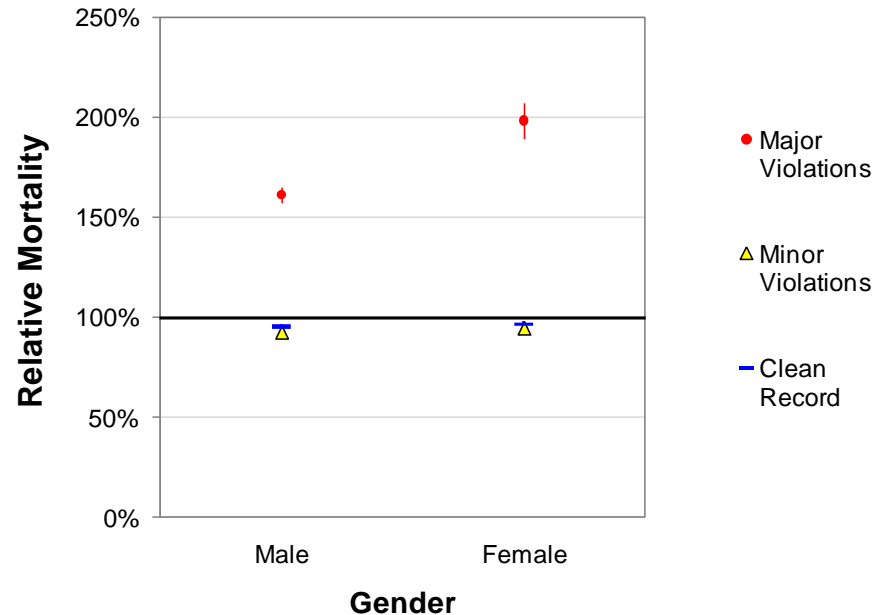
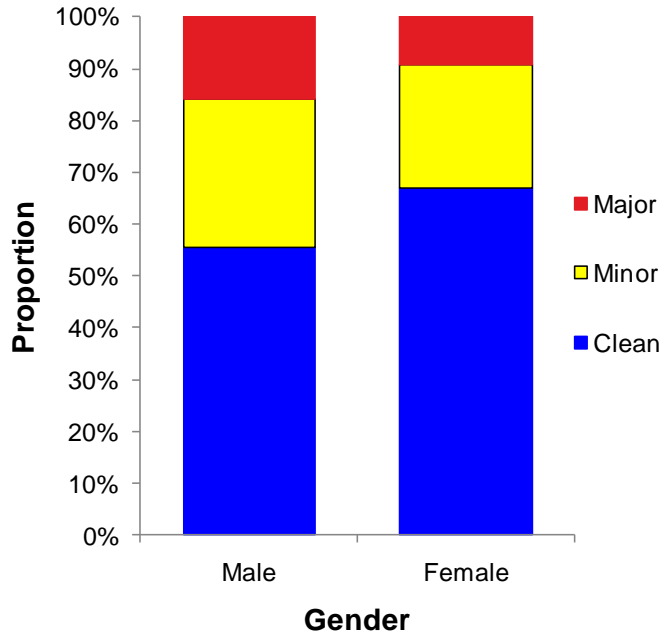


Risk Factors

Driving Behaviors



■ Prevalence and Mortality Results by Severity and Gender

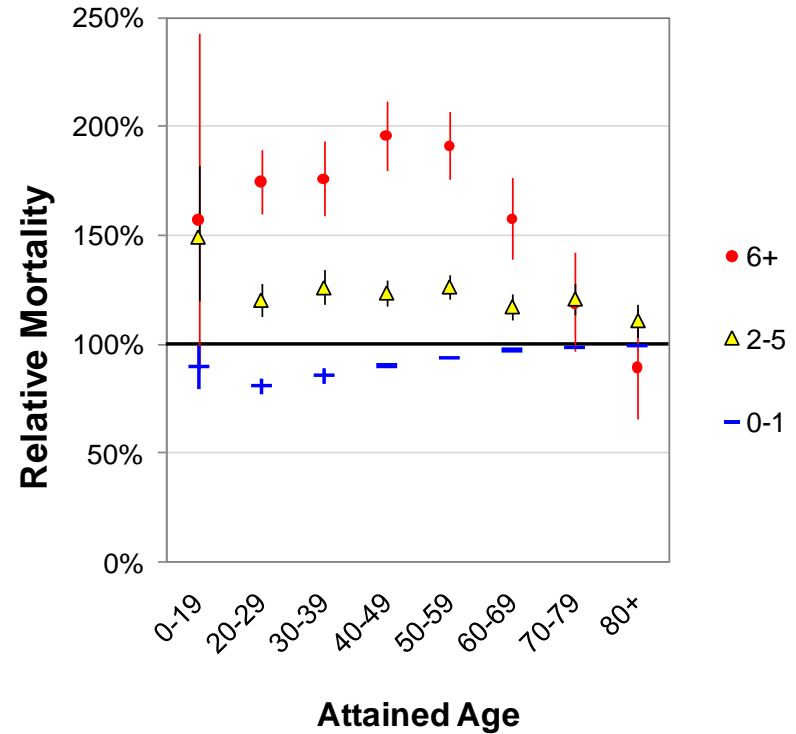
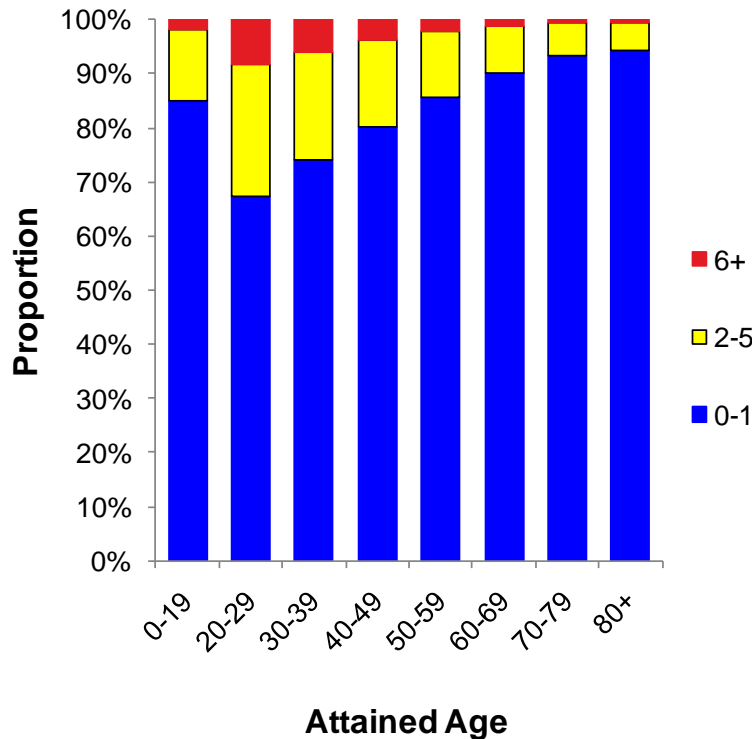


Risk Factors

Driving Behaviors



- Prevalence and Mortality Results by Violation Count and Age

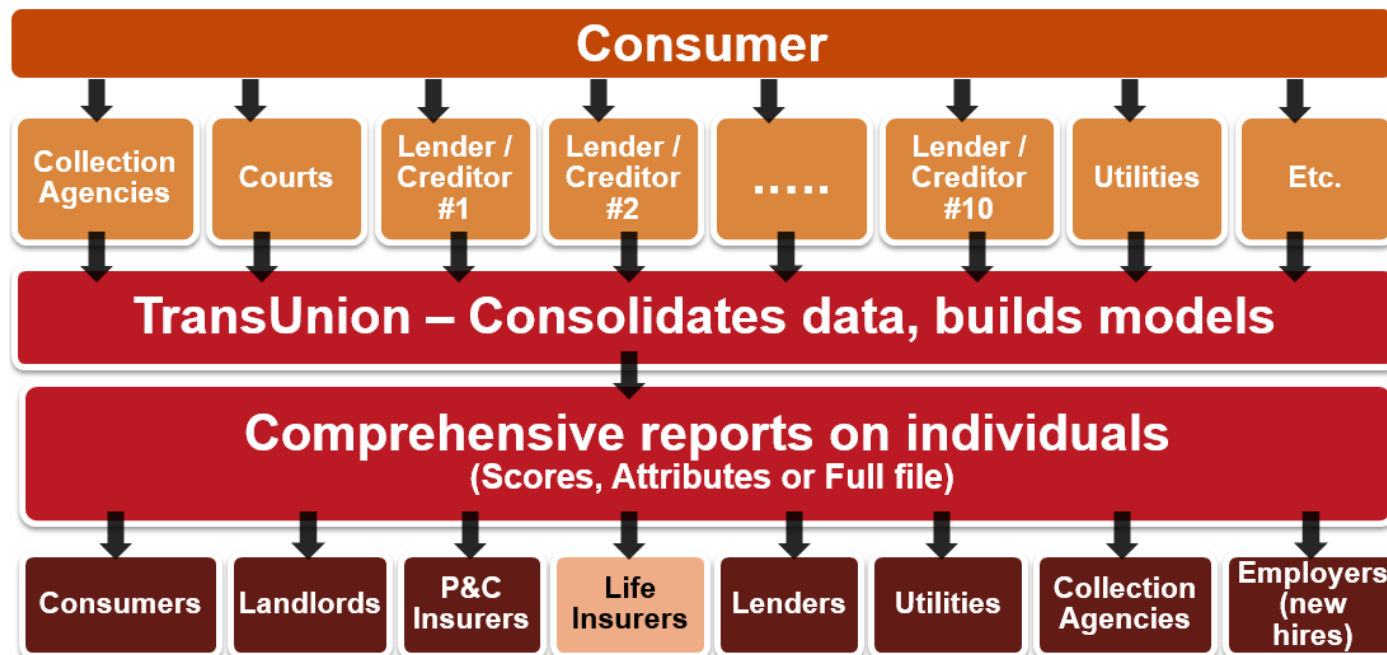


Risk Factors



Credit

- Credit-Based Insurance Scores used in P&C since the 90's
- Credit data also predictive of lapse and mortality
- Credit Bureau **data flow and the creation of models:**

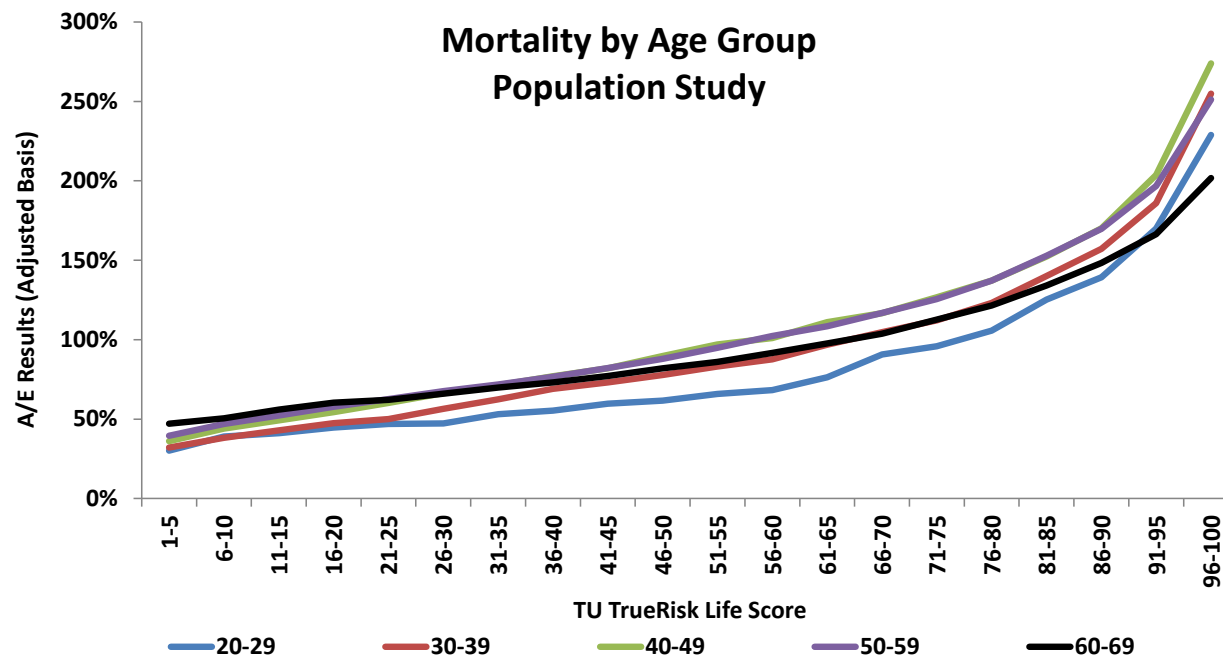


Risk Factors



Credit

- Credit data can differentiate mortality risk – 12 year mortality study of almost 18 million lives
- In population, 5x differential between best and worst:

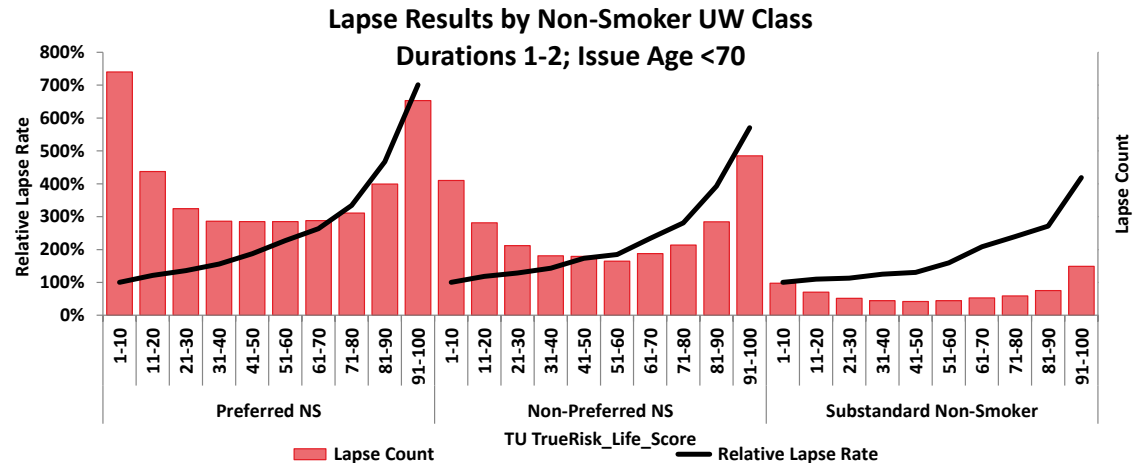
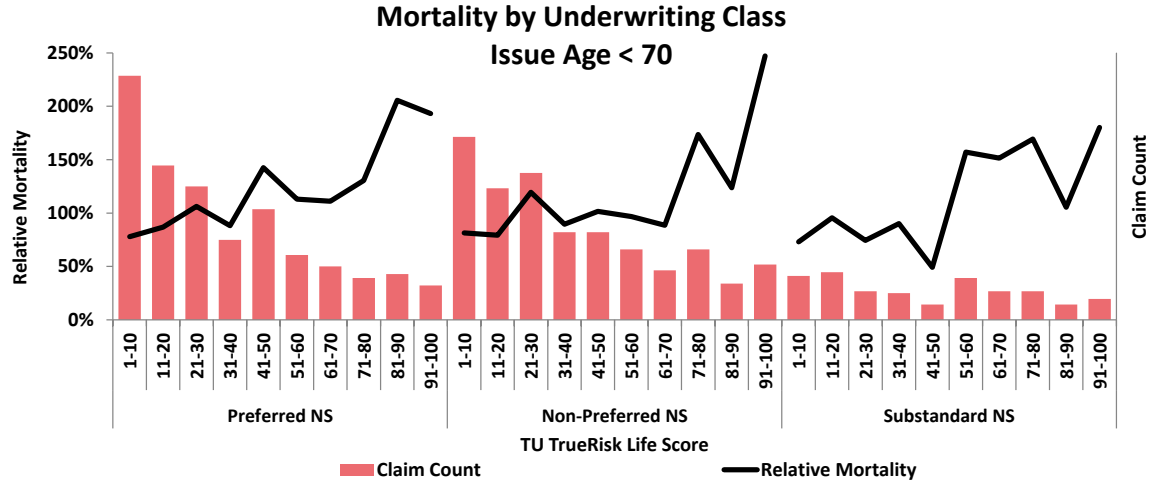


Risk Factors



Credit

- Also effective for fully underwritten business
- Many insurance applications:
 - Risk Segmentation
 - Accelerated Underwriting
 - Targeted Marketing
 - Inforce Policy Management

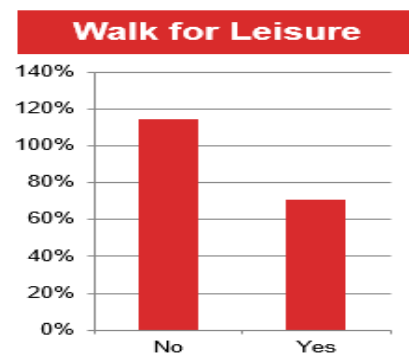
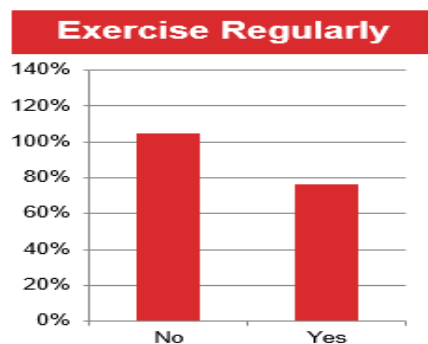
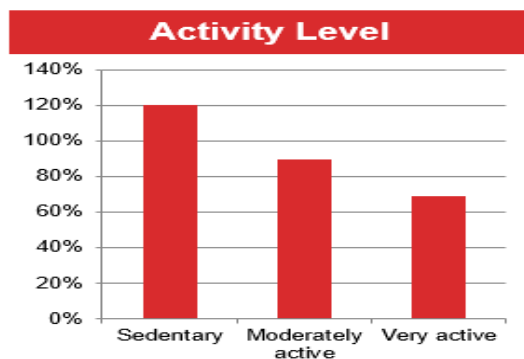


Risk Factors

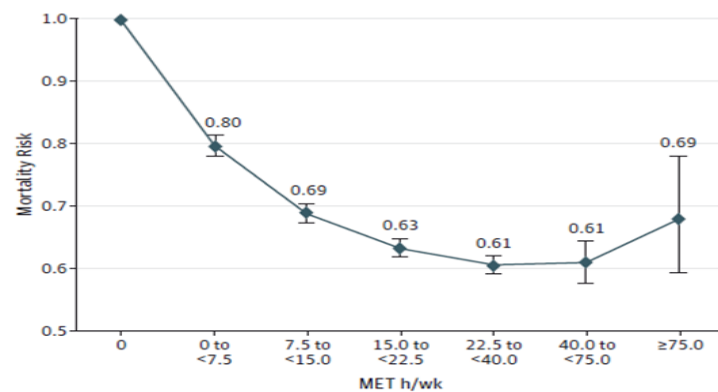
Wearables



- Insurers using wearables today mostly focus on **steps & activity**



- Increased steps / activity levels indicated lower mortality
- Impact of these variables varies by age



RGAs internal analysis based on US Survey Data

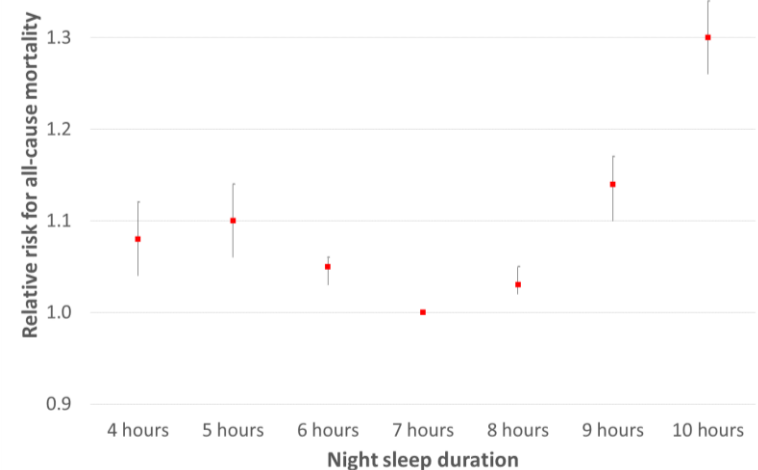
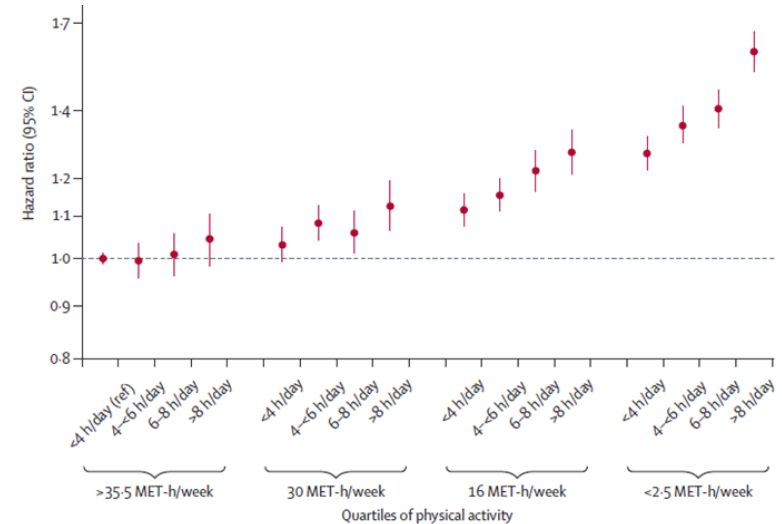
Arem et al (2015), *JAMA Intern Med.* 2015;175(6):959-967. <http://dx.doi.org/10.1001/jamainternmed.2015.0533>

Risk Factors

Wearables



- Some are also looking at **inactivity**, **heart rate** and **sleep**
- **Inactivity**
 - Meta-analysis suggests excessive inactivity is important to mortality
- **Resting Heart Rate**
 - Study controlled for many things including physical activity
 - Increase of 10 beats per minute impacts mortality by 5-10%
- **Sleep**
 - 7 hours sleep = lowest mortality



Risk Factors

Wearables



■ Other Metrics Available

- Heart rate (recovery, max, min, night-time, etc.)
- Stress
- VO2 max (max oxygen that can be used during exercise)
- Body composition – fat and muscle mass
- Body temperature

■ Emerging

- Blood pressure
- Pulse Wave Velocity
- Muscle oxygen levels
- Hydration
- Detecting /monitoring illness

Risk Factors

Wearables

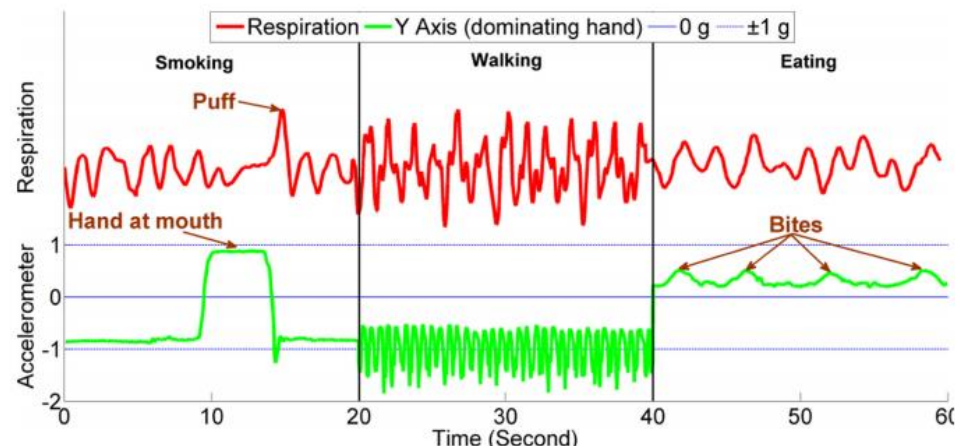


■ Future of Wearables in Insurance

- Increase engagement with the customers
- Customer segmentation and Cross-sell
- Risk-based pricing
- Post-issue underwriting & Claims (CI business?)
- Distribution (in the wearables ecosystem)

■ Smoker Identification??

- Movements?
- Physiological changes?
- New method: puffMarker
 - A multi-sensor approach



Outside Forces

Medical Advances

- Precision medicine and pharmacogenomics (drugs customized to a genetic profile)
- CRISPR gene editing
- Understanding Telomeres
- Printable organs (for transplants)
- Immunotherapy
- Regenerative medicine & stem cells



Outside Forces

Technology Solutions Appear Endless

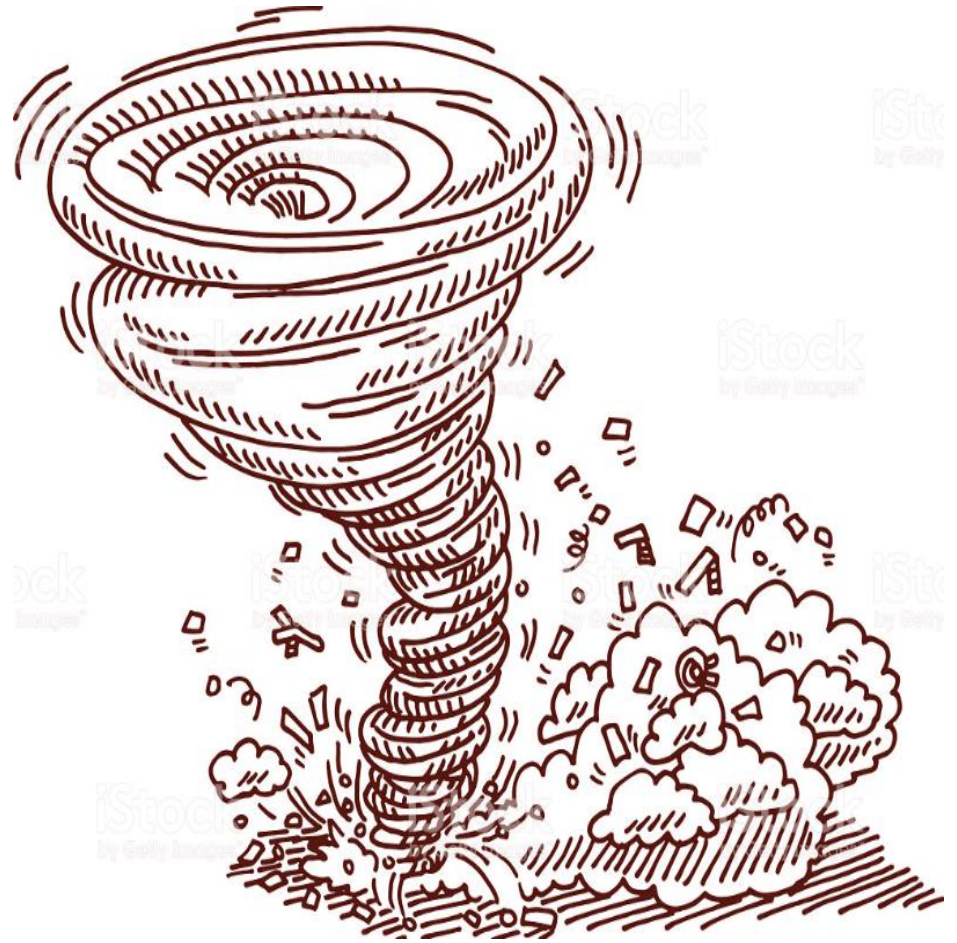
- Elderly Tech (webcams, learning, fall detection, photos, med management, volunteer, health & wellness, geofencing, ...)
- Electronic health records
- Global connectivity
- Digestible sensors
- Parabiosis
- Wearable medical devices
- Telemedicine / remote monitoring
- Virtual reality, AI, IoT, bioelectronics, nanotechnology, robotics, sensor miniaturization, cellular, robotic nurses, ...



Outside Forces

Environment and More

- Infectious diseases
- Pandemics
- Catastrophes
- Quality of health care
- Crime levels
- Antibiotic resistance
- Drugs (opioid abuse)
- Political (war, etc.),



Recap...

Complex world of mortality . . . And today we only covered a few

Demographics

- Age
- Gender

- Where you live
- Education
- Occupation

Socio-Economic

- Wealth & assets
- Income level
- Home value

- Foreign residence / travel
- Marital status
- # of Children

- Car ownership

- Insurance purchasing
- Well-being
- Personality
- Benefit amount
- Investments
- Motorcycles

- Care provider
- Claims history

- Hobbies
- Driving behavior
- Active military
- Social media usage
- Social engagement
- Pet ownership
- Public records / bankruptcy

- **Smoking**
- **Alcohol consumption**
- **Physical activity / Sitting**

- Depression
- Stress
- BMI
- Sleep
- Diet
- Family history
- Medical history
- Lab data (blood & urine)
- BMI / physical measurements

Health & Biometrics

- EKG's, medical imaging
- Cognitive testing, physical function, etc.
- **Genetic data**
- **Prescription history**
- **Heart Rate**
- 'Omic data

Outside Forces →

- **Technology**
- **Environment**
- **Medical Advances**



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Additional Thoughts

Final Thoughts

Need to Consider Both Sides...

What you could do

Limited only by
data and your
ability to use it

Frictionless delivery
of personalised
offerings

What you should do

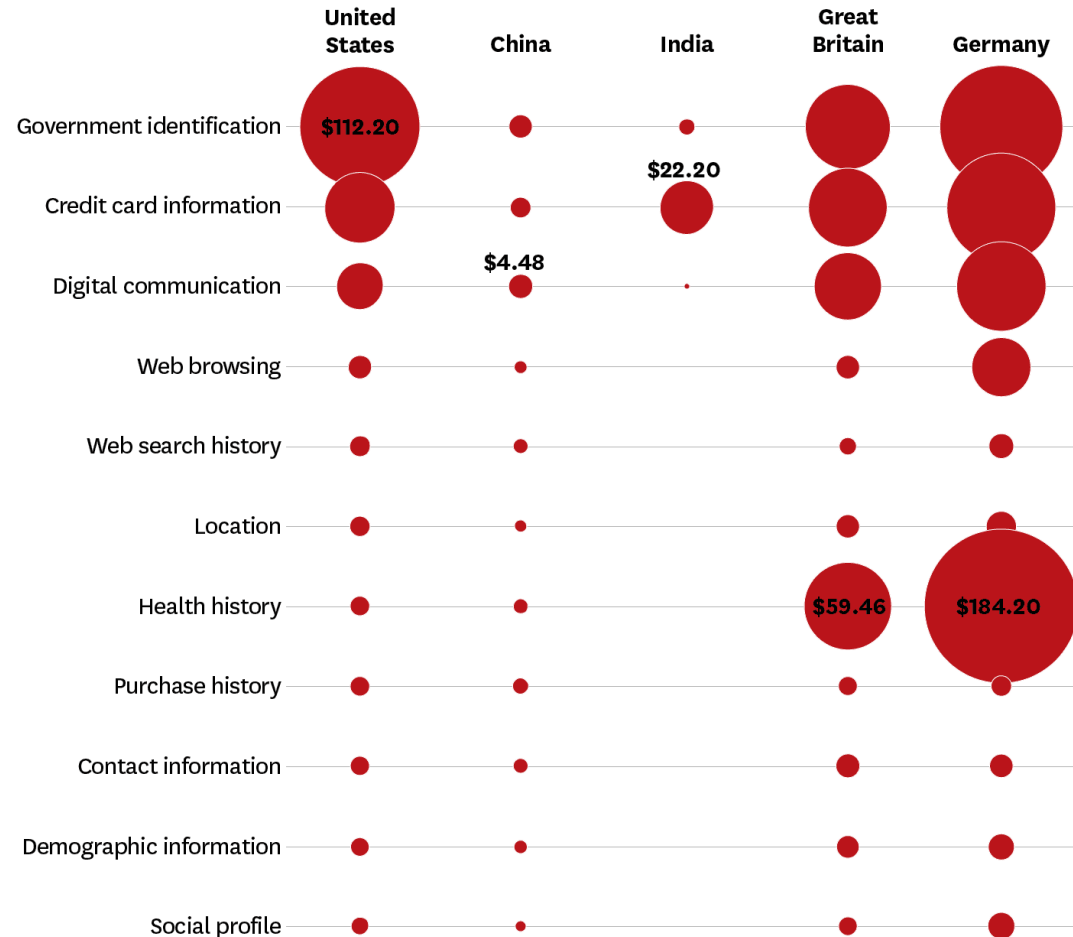
Be responsible
custodians of
your clients data

What your
customers want!

Final Thoughts

- Data concerns vary by country
 - Regulations (data, privacy, etc.)
 - Consumer views
 - Use in UW
- Risks and Rewards
- Survey of consumers
 - “How much would you pay to protect your _____ data?”

Putting a Price on Data



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