Brave New Worlds of Shared Information
Health and Care Conference 2013
Daniel Ryan

Brave New World (1932)

• Alpha plus -> Epsilon minus
• Physical & mental conditioning from test-tube to adulthood
• Fixed class hierarchy & dominance of social norms
• No marriage, family, religion or disease – but death at 60
• Progress sacrificed for stability
• Unrelenting focus on shared outcomes
Building blocks of traditional underwriting

- Importance of medical cohort studies focused on primary condition
- Use of own experience to calibrate and estimate socio-economic differences
- Modification for severity of condition and extent of treatment and/or control
- Multiple or addition to mortality, trending at older ages
- Allowance for anti-selection
- Accept, rating, postpone or decline

General Practice Research Database

GPRD\textsuperscript{Gold} Suite of Tools
The value of predictive underwriting

- The intelligent use of non-medical data held on consumers to reach a view as to their health status

- These insights can be used to reduce the amount of traditional underwriting (where there is an existing data-rich relationship in place)

  "You haven’t applied for protection, but based on what we know about you, we will pre-approve you and make you an offer"

- Alternatively, predictive techniques can enable you to triage the underwriting process

  "Now you are applying for protection, let’s run some data on you to remove certain tests, and speed up the process"
What do we need for predictive underwriting?

Two matchable depersonalised data sources

Risk data:
c. 50,000 final underwriting decisions from a Life Office
The more cases the better

Descriptive Data:
bank checking account, loyalty card, potentially home/motor insurance...
The richer the data the better

Correlations are found in the descriptive data (the "predictors")

Model can be run on whole customer universe to highlight the best prospects

Building a predictive model

- Any information held on a customer could be predictive of their health status – let the data do the talking
- Combining all the predictive variables, an algorithm is built that ranks each customer from worst to best prospect, in terms of "likelihood of being given standard rates at application stage"

\[ y = \frac{1}{1+e^{-y}} \]

where:
- \( x_1 \) is age related
- \( x_2 \) is related to value of home
- \( x_3 \) is a brand identifier
- \( x_4, x_5, x_7 \) are related to occupation
- \( x_6, x_9, x_{11} \) are account activity related
- \( x_8, x_{10} \) are neighbourhood / community related
What might we learn from the model?

This tells us, for example, that the top 5% of the model contains a "rated or decline" rate of 5%, as opposed to 14% were no model built (see "All" column).

Who knows what about me?

Age: 41
Married for 16 years
Father of 2

SN8 2DD
Using social media to link obesity & interests

Activity-related interests vs obesity in USA

TV interests vs obesity in New York City


http://www.plosone.org/article/info:doi/10.1371/journal.pone.0061373

Using social media to innovate insurance
Friendsurance and Facebook

Small Claims

Big Claims

Fraud

Risky Behavior

Small Claims

Mix & Sales

Administration

Standard

Allianz

Big Claims

Reduced fraud

Better risk selection

Reduced process cost

Lower cost of sales

Until now

With Friendsurance
PatientsLikeMe – patient led data sharing

Stephen Heywood
What do I know?

Age: 41
Father of 2
Married for 16 years

Advances in next-generation sequencing

Sanger (capillary) sequencing

Next generation sequencing

Cancer Genomics

- AML
- Melanoma
- Small-cell lung
- Breast
- Lung (NSCLC)
- Hepatocellular
- Multiple Myeloma
- CLL
- Mouse AML

- 2000
  - ~10 years
  - ~$ 3.5 billion
- 2005
  - ~3 years
  - ~$ 20 million
- 2008
  - ~4 months
  - ~$ 1.5 million
- 2010
  - ~1 month
  - ~$ 9,500 (Illumina)
- 2015
  - ~1 day
  - ?? $100

Institute and Faculty of Actuaries
Rapid reduction in sequencing costs

Source: http://www.genome.gov/sequencingcosts/

Number of genetic tests in clinical practice

May 2013

 GeneTests
 2,979 disease-genes
 1,056 tests in clinics
 612 laboratories
 561 GeneReviews

 UKGTN
 566 genetic diseases tested in UK Genetic Testing Network assessed by ACCE framework:
  - Analytical validity
  - Clinical validity
  - Clinical utility
  - Ethical, legal, social

Source: http://www.genome.gov/sequencingcosts/
**Genetic tests carried out in NHS**

10% annual growth rate

![Trend in clinical genetic testing](image)

Source: CMGS audit reports

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**Genetic tests disclosed to UK insurers**

23% annual growth rate

![Tests disclosed for all conditions by year](image)

Source: ABI Compliance Reports

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* reduction of life insurance business written during financial crisis

** equals ~2.2% of sold new life protection products in 2011 (1.65 mio)
### Variation in disclosure of predictive genetic tests by condition

<table>
<thead>
<tr>
<th>Disease</th>
<th>Gene(s)</th>
<th>CMGS 2010</th>
<th>ABI 2010</th>
<th>% disclosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast/Ovarian Cancer (BRCA1/2)</td>
<td>BRCA1, BRCA2</td>
<td>2224</td>
<td>291</td>
<td>13</td>
</tr>
<tr>
<td>Huntington's Disease</td>
<td>HD</td>
<td>404</td>
<td>148</td>
<td>37</td>
</tr>
<tr>
<td>Familial Adenomatous Polyposis (FAP)</td>
<td>APC</td>
<td>256</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>Myotonic Dystrophy (MD)</td>
<td>DMPK</td>
<td>147</td>
<td>61</td>
<td>41</td>
</tr>
<tr>
<td>Multiple Endocrine Neoplasia (MEN)</td>
<td>RET</td>
<td>105</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Familial Hypertrophic Cardiomyopathy</td>
<td>MYBPC3, MYH7, TNNT2,</td>
<td>557</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>Dilated Cardiomyopathy</td>
<td>TNN3, TPM1, MYL3, ACTC1,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRKAG2, GLA, MYL2, LMNA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long QT syndrome</td>
<td>KCNQ1, KCNH2, SCN5A</td>
<td>351</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Familial Hypercholesterolemia</td>
<td>LDLR, APOB, PCSK9</td>
<td>330</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>4374</strong></td>
<td><strong>624</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

* 75% of disclosed predictive genetic tests are negative

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### 23andme – Colorectal cancer marker

**New communities for genetic information**

**Average**

0.26 out of 100 people carrying a genetic variation are at risk of colorectal cancer between the ages of 50 and 80.

**Genes vs. Environment**

**5% attributable to genetics**

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Source: http://www.23andme.com
Identification of genetic markers for disease

• Identification of new genetic variants for inherited cancer risk
• Comparison of DNA over 200,000 people to find genetic alterations associated with breast, ovarian and prostate cancer
  - 49 new SNPs for breast cancer (2x more than known), 11 new SNPs for ovarian cancer, 26 new SNPs for prostate cancer (total of 78)
• Provides basis for development of new genetic tests for stratification into high- and low risk population groups
• Leading to future advances in screening programmes, preventive strategies, individualized treatment and/or lifestyle changes for people at higher risk

Personal genome project

• Project started by Professor George Church, Harvard Medical School, in 2006 with target of 100,000 volunteers
• Individuals willing to have their genomes, cells (saliva, blood, skin, iPS), extensive trait data

Genomes + Environments = Traits
The likelihood of divided futures
The Savage vs Mustapha Mond

- Health technology is a discontinuous innovation
- Chasm exists because of characteristics of "early majority" or pragmatists
  - desire for integrated solutions at reasonable price
  - appetite for standard, tested solutions

Google Glass – our attitudes to the future
10% would wear the glasses regularly
44% would not buy at current price of $1,500
45% would wear glasses for taking photos, video or as phone
39% would not buy at lower price of $1,000

Study of 1,000 US adults surveyed by BiTE Interactive
What information could they access in the future?

IBM Watson in healthcare

Source: Economist 23.02.13, Jeff Lichtman, Harvard,

Swiss Re OpenMinds Forum
Connecting Generations at 150th anniversary

Open access at openminds.swissre.com
Swiss Re OpenMinds Forum
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Open access at openminds.swissre.com -

Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.