Evidence, Underwriting and Mortality
Kevin Somerville, Medical Consultant,
Global Life and Health Underwriting, Swiss Re

Agenda

- Standard vs sub-standard, who decides?
  - Actuary and Underwriter or Actuary vs Underwriter
- The development of evidence based underwriting guidelines
  - Categorical vs continuous variables
  - Impact of changing patterns of disease and treatment
Increasing risk stratification

Pooling → Smaller risk pools → Actuarial assessment → Risk stratification

Risk assessment

- Aggregate rates (all ages, unisex, unismoke)
- By age
- Male/Female
- Smoker/non-smoker
- Preferred lives

Standard/impaired lives

By age

Male/Female

Smoker/non-smoker

Preferred lives

Standard/impaired lives
Increasing risk stratification

Risk stratification
Pooling

Smaller risk pools

Risk assessment

Aggregate rates (all ages, unisex, unismoke)

By age

Smoker/Non-smoker

Male/Female

Individual assessment

Preferred lives

Standard/impaired lives

Substandard vs standard risks: hypothetical mortality distribution

Actuarial assessment

Underwriting

Percentage of a hypothetical population of applicants

Increasing mortality/morbidity

Actuarial

Underwriting

Standard

Substandard

Declined
Large pool cross subsidisation: who sets the size of the standard risk pool?

Actuaries or life underwriters or a bit of both?

The standard risk pool

- affordable & beneficial to all standard risk applicants
- should not act as a barrier to low risk consumers in the standard risk pool
- large numbers allow aggregation of independent risks with less uncertainty (lower price)
- allows for differential pricing eg male/female, smoker/non-smoker
- allows for the existence of substandard risks ie a upper limit to the standard risk pool*

*Potential Public Health benefits: those who are exposed to high risks pay more, incentive to modify lifestyle
Possible causes for the reduction in standard rate acceptance for life insurance

- Highly competitive base premiums – a default move to preferred?
- Tightening up of underwriting criteria and recognition of combination risk such as CVS risk factors?
- Increase in prevalence of obesity, diabetes mellitus and mental illness disorders?
- More customer disclosure (clearer, more application questions; tele-underwriting impact)?
- Distributors ‘shopping’ a substandard case to a large number of insurers?
- Customer profile changing with more substandard lives applying for life insurance?

Insurance Screening: an example of non-medical limits

<table>
<thead>
<tr>
<th>Life Cover</th>
<th>Age (Next Birthday)</th>
<th>GPR only</th>
<th>Nurse Screening only</th>
<th>GPR, MER &amp; Full Haematology &amp; Biochemistry</th>
<th>ECG</th>
<th>PSA test (males)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 or less</td>
<td>N/A</td>
<td>£600.001</td>
<td>£1,500.001</td>
<td>£3,500.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>31-40</td>
<td>N/A</td>
<td>£500.001</td>
<td>£1,500.001</td>
<td>£3,000.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>41-45</td>
<td>N/A</td>
<td>£350.001</td>
<td>£1,000.001</td>
<td>£2,500.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>46-50</td>
<td>£300.001</td>
<td>£500.001</td>
<td>£1,000.001</td>
<td>£1,500.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>51-55</td>
<td>£100.001</td>
<td>£300.001</td>
<td>£1,000.001</td>
<td>£1,500.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>56-60</td>
<td>£100.001</td>
<td>£250.001</td>
<td>£1,000.001</td>
<td>£1,000.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>61-65</td>
<td>£35.001</td>
<td>£100.001</td>
<td>£500.001</td>
<td>£750.001</td>
<td>£1,000.001</td>
<td>N/A</td>
</tr>
<tr>
<td>66+</td>
<td>ALL</td>
<td>£100.001</td>
<td>£350.001</td>
<td>£500.001</td>
<td>£1,000.001</td>
<td>N/A</td>
</tr>
</tbody>
</table>

A cotinine test is required if there is a medical examination or screening.

Implications

- Pricing actuaries model experience based upon the rating cut-offs and philosophy used by underwriters based upon current non-medical limits
- Changing risk assessment has pricing implications
- The ratings thresholds are set by the pricing assumptions

Fundamental question for an underwriter to ask: what are the characteristics of the standard risk pool?

Agenda

- Standard vs sub-standard, who decides?
  - Actuary and Underwriter or Actuary vs Underwriter
- The development of evidence based underwriting guidelines
  - Categorical vs continuous variables
  - Impact of changing patterns of disease and treatment
Questions asked in developing life underwriting guidelines

- Does an applicant with one or more risk characteristics of interest........
  - risk factor eg obesity
  - an impairment eg diabetes mellitus
  - lifestyle/occupation eg pop star

- ...........have an absolute mortality risk that is consistent with that of the standard risk pool?

- If not what is the magnitude of the extra risk?
  - absolute (rate eg flat extra)
  - relative (ratio eg mortality ratio)

The concept of Evidence Based Medicine

‘.............the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.

The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research’

Sackett et al, BMJ, 1996
cebm.jr2.ox.ac.uk/ebmisnt.htm
The concept of Evidence Based Risk Assessment (EBRA)

... the conscientious, explicit and judicious use of current best evidence in making decisions about morbidity and mortality risk.

The practice of EBRA means integrating underwriting expertise with the best available clinical and insured lives evidence from systematic research.

....... in a format that is consistent with the on-going risk selection & pricing process

The aim is to have an underwriting manual which is evidence based and up to date

---

EBRA is not a new concept

The Specialised Mortality Investigation 1903
Medico-Actuarial Mortality Investigation 1909-1912
Supplement to the Medical Impairment Study 1929
Build and Blood Pressure Study 1959
    1959 Metropolitan Desirable Weight tables
Build Study 1979
Single Medical Impairment Study 1983
Multiple Medical Impairment Study 1983
Medical Risks: trends in mortality by age and time elapsed 1990
Standardised mortality methodology

*J. of Insurance Medicine* 36(3):185-188

Preparation of Mortality Abstracts

Brian Imamovic, DC, MSc, Associate Editor, Morality and Mortality

We revisit three important articles published in prior issues of the *Journal of Insurance Medicine* (JIM) that summarize the process of selecting articles for mortality analysis and abstract preparation. The article selection and analysis recommendations put forth in these reprints are part of the new knowledge of Insurance Medicine regularly presented at Morality courses sponsored by the American Academy of Insurance Medicine. The key concepts of the reprinted articles are reviewed, and key points are emphasized in this commentary. JIM readers are encouraged to submit abstracts for publication in JIM to contribute to this important body of knowledge. The reprint articles include: Kim’s “Mortality: non-life/alternative-insurance mortality: an introduction” (1994:2267-289); Bower and Kim’s “Guidelines for evaluation of follow-up articles and preparation of abstracts” (1994:2321-290); and Kim’s “Anatomy of an abstract” (1994:2344-45).

Address: Swiss Re Life & Health, 1700 Maguire Way, West Nyack, NY 10994; e-mail: brian.imamovic@swissre.com

Correspondent: Brian Imamovic, DC, MSc

Key words: Mortality analysis methods, life insurance

Received: January 9, 2004

Accepted: January 26, 2004
Evidence-based rating guidelines and risk assessment

Systematic Review of Evidence

- Emphasis on prognosis/outcome

Implications for risk assessment

- What is the baseline risk?
- Risk stratification

Underwriting guidelines

- Proprietary U/W manual

Evidence Based Risk Assessment

- Underwriter/CMO

Systematic Review

- Select topic & identify the question
- Systematic data gathering: Medline; EMBASE; insurance publications
- Assessment of study/data quality
- Analysis and interpretation of results
  - what is the best estimate of the risk
  - what is the comparator?
- Produce evidence based underwriting guidelines and a background paper
- Peer/intra-company review
Life Guide: print version!

EBR Guidelines: hierarchies of evidence

High relevance
- Justification paper based upon industry and clinical experience
- Systematic review and mortality analysis of well-conducted cohort studies
- Systematic review and mortality analysis of well-conducted case-control studies
- Analysis of a single large randomised control trial or observational study
- Opinion of (re)insurer’s internal expert committee
- Opinion of (re)insurer’s chief underwriter
- Wider market practice
- Opinion of (re)insurers’s Chief Medical Officer
- Opinion of individual underwriter

Low relevance
Categorical
Includes dichotomous variables eg normal/abnormal
Examples
- Sex
- Smoker/non-smoker
- Diagnosis eg diabetes mellitus, breast cancer
- Occupation

Continuous
Examples
- BMI
- Cholesterol
- Blood pressure
- Renal function (GFR)
- Number of cigarettes

Rock and Pop Star mortality

Bellis M et al., Elvis to Eminem: quantifying the price of fame through early mortality of European and North American rock and pop stars J Epidemiol Community Health 2007;61:896–901
Insured life mortality cf population mortality: implications for underwriting

Insured mortality: 70% of AM92 ULT

Familial hypercholesterolaemia: the importance of the comparator

<table>
<thead>
<tr>
<th>Observed and expected deaths by major cause and time period</th>
<th>Observed</th>
<th>Expected</th>
<th>O/E</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 1 January 1992 (person-years exposure = 15,557 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IHD</td>
<td>66</td>
<td>29.2</td>
<td>2.3</td>
<td>1.8, 2.9</td>
</tr>
<tr>
<td>Stroke</td>
<td>8</td>
<td>8.6</td>
<td>0.9</td>
<td>0.4, 1.8</td>
</tr>
<tr>
<td>Non-IHD cardiac</td>
<td>48</td>
<td>88.3</td>
<td>0.5</td>
<td>0.4, 0.7</td>
</tr>
<tr>
<td>Accidents/violence</td>
<td>3</td>
<td>4.6</td>
<td>0.7</td>
<td>0.1, 1.9</td>
</tr>
<tr>
<td>All cancers</td>
<td>19</td>
<td>42.3</td>
<td>0.5</td>
<td>0.3, 0.7</td>
</tr>
<tr>
<td>All-causes of death</td>
<td>114</td>
<td>117.5</td>
<td>1.0</td>
<td>0.8, 1.2</td>
</tr>
</tbody>
</table>

Neill et al, Atherosclerosis, 2005
Cholesterol distribution in insurance applicants: outcome

Data courtesy of Robert Stout, CRL

Prediction tools: low specificity and misclassification

Collins S, Altman D G, BMJ, 2010
BMI distributions vary between countries

Swiss Re Insured lives data

PSC study: smokers/non-smokers have different build risk profiles

Swiss Re

www.thelancet.com Published online March 18, 2009 DOI:10.1016/S0140-6736(09)60318-4
Mortality hazard ratios associated with BMI stratified by smoking

Relative mortality risk

Prospective Studies Collaboration, Lancet 2009

How BMI distribution affects mortality risk

Insured lives distribution, PSC risks

Prospective Studies Collaboration, Lancet 2009
How BMI distribution affects mortality risk

Changing baselines: contributions to the annual mortality improvement
Changes in major CVS risk factors

Current cigarette smoking ↓73% (68% - 78%)
BMI* ↑1.89 kg/m² (1.61 - 2.18)
Systolic blood pressure* ↓6.6 mm Hg (4.3 - 8.9)
HDL cholesterol* ↑ 0.16 mmol/L (0.13 - 0.20)
Non-HDL cholesterol* ↓ 0.28 mmol/L (0.16 - 0.40)

The British Regional Heart Study: 25 years from 1978, n= 7735 men.
The age-adjusted hazard of MI ↓ 3.8% (2.6% - 5.0%) pa which corresponds to a 62% decline over the 25 years

Age-adjusted values mean values*

Hardoon S et al, Circulation, 2008
Diagnostic tests for Diabetes Mellitus: changing lab criteria affect the risk

- 1979 (WHO; NDDG)
  - Fasting plasma glucose ≥ 7.6 mmol/l (140 mg/dl)
  - 2 hr OGTT glucose ≥ 11.1 mmol/l (200 mg/dl)

- 1997 (ADA)
  - Fasting plasma glucose ≥ 7.0 mmol/l (126 mg/dl)
  - recommended not using OGTT

- 1998 (WHO)
  - Fasting plasma glucose ≥ 7.0 mmol/l (126 mg/dl)
  - 2hr standard OGTT plasma glucose ≥ 11.1 mmol/l (200 mg/dl)

Diabetes mellitus: changing diagnostic criteria........... continued

- 2009 (IEC: ADA, IDF, EASD)
  - HbA1c A1C ≥ 6.5 % using a standardised test (to DCCT)
  Or
  - FPG ≥ 7.0 mmol/l (126 mg/dl)
  Or
  - Two-hour plasma glucose ≥ 11.1 mmol/l (200 mg/dl) during a standardised OGTT
  Or
  - Classic symptoms of hyperglycaemia or hyperglycaemic crisis, a random plasma glucose ≥ 11.1 mmol/l (200 mg/dl)
How helpful is the new definition of diabetes mellitus?

"... the limited sensitivity of the A1C test may result in missed or delayed diagnosis of type 2 diabetes, whereas the use of current OGTT criteria will fail to identify a high proportion of individuals with A1c >6.5%.

*Caroline Kramer et al, Diabetes Care, 2010*

---

**Summary**

- Applicants for private life and health insurance are risk assessed
- Underwriters and actuaries are the risk assessors
- Underwriters put applicants into homogeneous risk groups using evidence based guidelines
- The development of evidence based guidelines is a mammoth undertaking
- There is feedback from actuaries and underwriters to ensure that the risk assessment process and the guidelines are in line with what is happening
- Diagnostic criteria and the distribution of mortality risk factors can alter, these may require changes to underwriting guidelines
Thank you

Basic Copyright Notice & Disclaimer for Swiss Re Presentations provided to External Parties

©2009 Swiss Re. All rights reserved. You are not permitted to create any modifications or derivatives of this presentation without the prior written permission of Swiss Re.

This presentation is for information purposes only and contains non-binding indications as well as personal judgment. It does not contain any recommendation, advice, solicitation, offer or commitment to effect any transaction or to conclude any legal act. Any opinions or views expressed are of the author and do not necessarily represent those of Swiss Re. Swiss Re makes no warranties or representations as to this presentation’s accuracy, completeness, timeliness or suitability for a particular purpose. Anyone shall at its own risk interpret and employ this presentation without relying on it in isolation.

In no event will Swiss Re or one of its affiliates be liable for any loss or damages of any kind, including any direct, indirect or consequential damages, arising out of or in connection with the use of this presentation.