



The Expanding Role of the Actuary— Evidenced-Based Underwriting

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Actuaries and Underwriting



Two Deaths from Phthisis in the Family.

- In 1894 the Dan noted that the number of deaths from phthisis is lower than in general deaths from phthisis and more deaths from phthisis

Age. Years.	MALES.			FEMALES.		
	Number of Deaths			Number of Deaths.		
	Actual.	Expected.		Actual.	Expected.	
According to General Table.		According to Phthisical Table.	According to General Table.		According to Phthisical Table.	
1—15	9	2.4	4.5	3	1.7	2.1
15—35	54	23.3	32.4	42	17.9	30.1
35—65	46	36.1	41.2	40	34.1	31.6
Total.....	109	62	78	85	54	64

Three Deaths from Phthisis in the Family.

1—15	4	0.5	1.0	1	0.4	0.4
15—35	15	7.3	10.1	14	4.9	8.3
35—65	17	11.9	13.5	14	10.3	9.7
Total.....	36	20	25	29	16	18

Actuaries and Underwriting



- In 1894 the Danish statistician Harald Westergaard noted that the mortality in families where only one death from phthisis (wasting away) has taken place is lower than in families with two deaths from phthisis and much lower in families with three deaths from phthisis
- **UK actuary Robert Mackenzie Moore published in 1914 mortality differences between alcohol abstainers and non-abstainers**

Actuaries and Underwriting



- **1932: Publication of the “Medical Impairment Ratings” manual – based on a 1929 study**
 - Actuarial Society of America
 - Association of Life Insurance Medical Directors
- **The committee wish to emphasise**
 - Some ratings rest on considerable data
 - Some on scant material
 - Some have been fixed after considerable discussions
- **Manual was not updated after 1951 study (anti-trust)**

UK Continuous Mortality Investigation

Per Policy Guide 1.6



- Previously, the CMI had requested that an Impaired Code be provided for rated policies so that relevant data could be used for the Impaired Lives Mortality Investigation
- CMI has ceased collecting data for this investigation after 2006



EC Anti-discrimination directives



2000/43/EC	<ul style="list-style-type: none">• Anti-Racism Directive• Race, ethnic origin
2000/78/EC	<ul style="list-style-type: none">• Equal treatment in employment and occupation• Age, religion, disability
2002/73/EC	<ul style="list-style-type: none">• Gender Directive• Access rights to employment
2004/113/EC	<ul style="list-style-type: none">• 2nd Gender Directive• Access to and supply of goods and services

Article 5 of 2004/113/EC

Actuarial Factors



- For all new contracts after 21.12.07: the use of sex as a factor in the calculation of premiums and benefits for the purposes of insurance shall not result in differences in individuals' premiums and benefits.
- Member States may permit proportionate differences in individuals' premiums and benefits where the use of sex is a determining factor in the assessment of risk based on relevant and accurate actuarial and statistical data. ... accurate data relevant to the use of sex as a determining actuarial factor shall be compiled, published and regularly updated.
- By now, all directives should be implemented into local legislation.

Continuous Mortality Investigation

www.actuaries.org.uk/knowledge/cmi/gender

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Gender differentials

Actuaries | Knowledge services | Continuous Mortality Investigation (CMI) | Gender differentials

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From 6 April 2008, the Sex Discrimination (Amendment of Legislation) Regulations specify certain conditions under which insurance companies are allowed to differentiate premiums based on gender. One condition is that the use of gender as a factor in the assessment of risk for individual policies is based on relevant and accurate statistical data. A second condition is that this data must be compiled, published and regularly updated in accordance with guidance issued by HM Treasury **Latest guidance, March 2008**

Data in respect of the following types of insurance can be found by clicking on the links below:

You may also be interested

On this site

Life base mortality tables
Completed research
Mortality Research Steering
Group

External sites

Life tables (GAD)

Downloads

Scoping mortality research:
report

Risk selection under the microscope

- Regulator
- Ombudsman
- NGOs:
“Treating Customers Fairly”
- Law makers



Financial
Ombudsman
Service



European Network Against Racism
Réseau européen contre le racisme
Europäisches Netz gegen Rassismus



AGE
Concern

More to come



April 2009:
5th EC- Directive
Proposal on
anti-discrimination

- Equal treatment beyond employment incl. access to goods
- Age, disability, religion etc.

Article 2 § 7



- **Member States may permit proportionate differences in treatment where,...., the use of age or disability is a determining factor in the assessment of risk based on relevant actuarial *principles, accurate statistical data or medical knowledge*, shall not be deemed to constitute discrimination.**
- **... data should be accurate, recent, and relevant and made available on request, in an accessible way.** The actuarial and risk factors should reflect positive changes in life expectancy and active ageing as well as increased mobility and accessibility for people with disabilities. The service provider must be able to objectively demonstrate significantly higher risks and ensure that the difference in treatment is objectively and reasonably justified by a legitimate aim and the means of achieving that aim are proportionate, necessary and effective.

Article 2 § 7



- **Last minute change in Art. 2, §7 was adopted by a 1-vote majority**
- **Confusion exists as regard to final wording of adopted text**
- **Several member states oppose the directive**
- **For the proposal to become EU legislation all member states must approve the directive in the European Council**

Principles of private insurance




Establishing risk categories

- Comparable situations must not be treated differently and different situations must not be treated in the same way
- Risk assessment / risk categorisation shall NOT be arbitrary or capricious

The Debate



Risk selection is using age and sex over which individual has no control, and health over which individual has some control



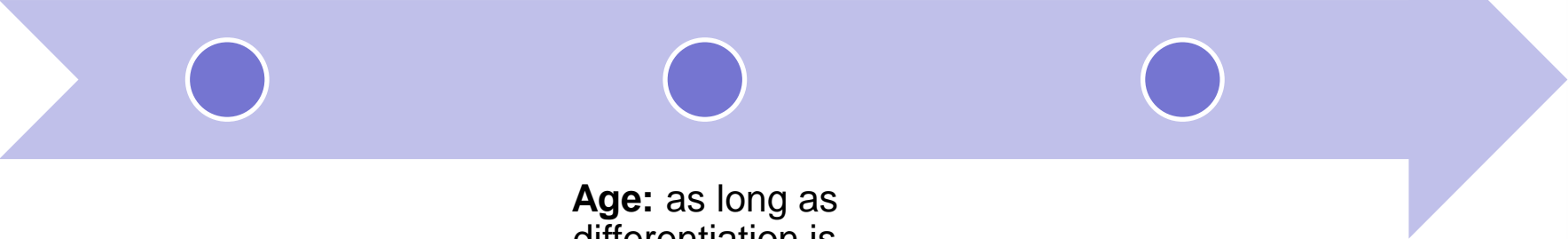
On-going debate on discrimination puts practices of insurers into the spotlight and are being examined for fairness

UK Equality Bill



Gender: as long as differentiation is reasonable and supported by reliable, actuarial evidence. Such data must be regularly updated and published.

Disability: as long as differentiation is – inter alia – based on relevant and current actuarial or statistical data, medical research information or medical reports about an individual.



Age: as long as differentiation is reasonable and supported by reliable, actuarial evidence. Such data must be regularly updated and published.

And elsewhere?



- **Australia: Section 46 of the Disability Discrimination Act 1992**
 - Discrimination against a person with a disability if
 - You can reasonably use and rely upon available information
 - Your decision can be reasonably based on the relevant information
- **New Zealand: Human Rights Act Guidelines 1993/2007**
 - Different terms and conditions (incl. deferral) for sex, disability and age
 - Regarding disability insurers can rely on reputable medical or actuarial advice or opinion, if reasonable
- **HK: Disability Discrimination Ordinance 1995**
 - Differential treatment if it is effected by reference to actuarial or other data from a reliable source



Consequence



- Industry is constantly challenged to justify decisions
- The burden is upon the industry
 - **Discrimination based on evidence**
 - Transparent products (what is covered, what not)
 - Fair questions / getting all the necessary evidence

Rationale for Evidence-Based Underwriting



Appropriateness

- To ensure underwriting guidelines used are based on suitable actuarial and medical research

Justification

- To have reasoned and defensible evidence available for our recommended underwriting guidelines

Alignment

- To ensure underwriting manuals are justifiable in terms of equality and anti-discrimination laws

Rationale for Evidence-Based Underwriting



Updates

- Mortality/Morbidity improvement/deterioration and medical advances require regular reviews

Competition

- To offer terms to as many people as possible – also at the edges

Profitability

- To write all risks (incl. sub-std. risks) with a reasonable chance of success

Know How

- To demonstrate the industry's knowledge of risk assessment / risk categorisation

Is the work clear-cut?



Lack of data

- **Lack of 'local' medical, statistical, actuarial or other data**
- Lack of 'insured' lives data
- Paucity of data – sizeable volumes necessary to make believable judgments
- Lack of co-morbid effects – combination of e.g. build, diabetes and cholesterol

Interpretation

- **Statistics alone – as frequently suggested by legislator – would not result in a common underwriting guideline**

Methodology

- **More importantly it is to have a robust EBU approach and an experienced inter-disciplinary team**

Bringing it together

- **Need to have experts who can interpret the material and identify what is important and how to make it work for our purposes!**

EBU Decision-Making



Transform the u/w problem into few key questions

- Available health information of applicant
- Cost-effective tests
- Relevance / Prevalence in target market
- ...

Internal evidence

- Acquired knowledge
- Own statistics

Finding external evidence

- Journals, databases, experts
- Value highly variable

Critical appraisal

- Are results valid?
- Are they important for prediction of long-term risk?
- Do results apply to insured lives?
- Geographic differences?

Integration

- Internal and external evidence may be
 - Supportive
 - Non-supportive
 - Conflicting

Evaluation

- Practical outcome?
- Competitive?
- Opportunities for improvement

EBU – necessary comprehension



**Basic medical
knowledge**

**Differences
between
insurance and
clinical medicine**

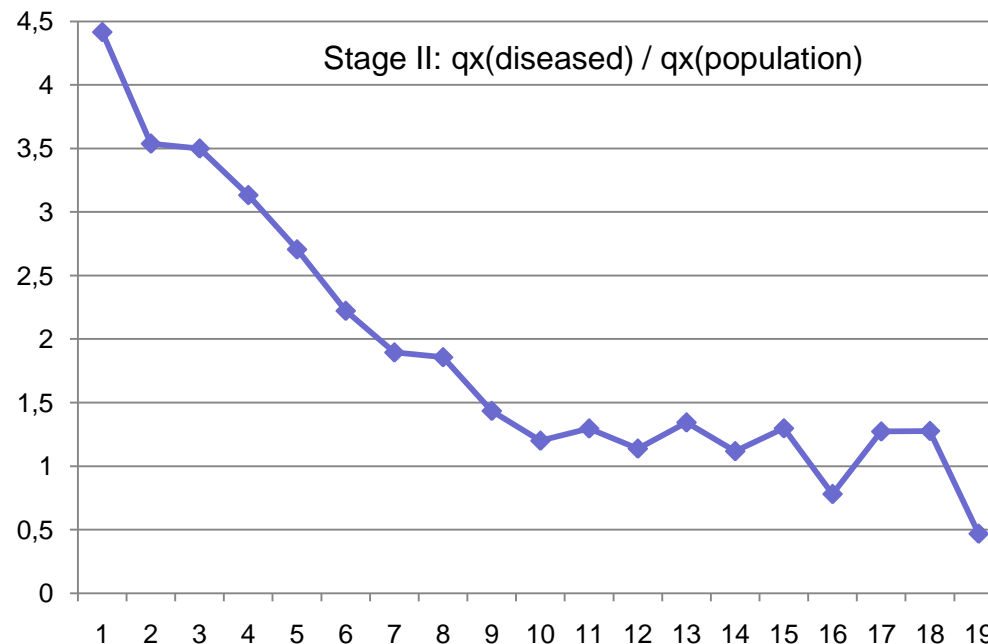
**Underwriting
process**

Example: Critical Appraisal 'Underwriting Effect'

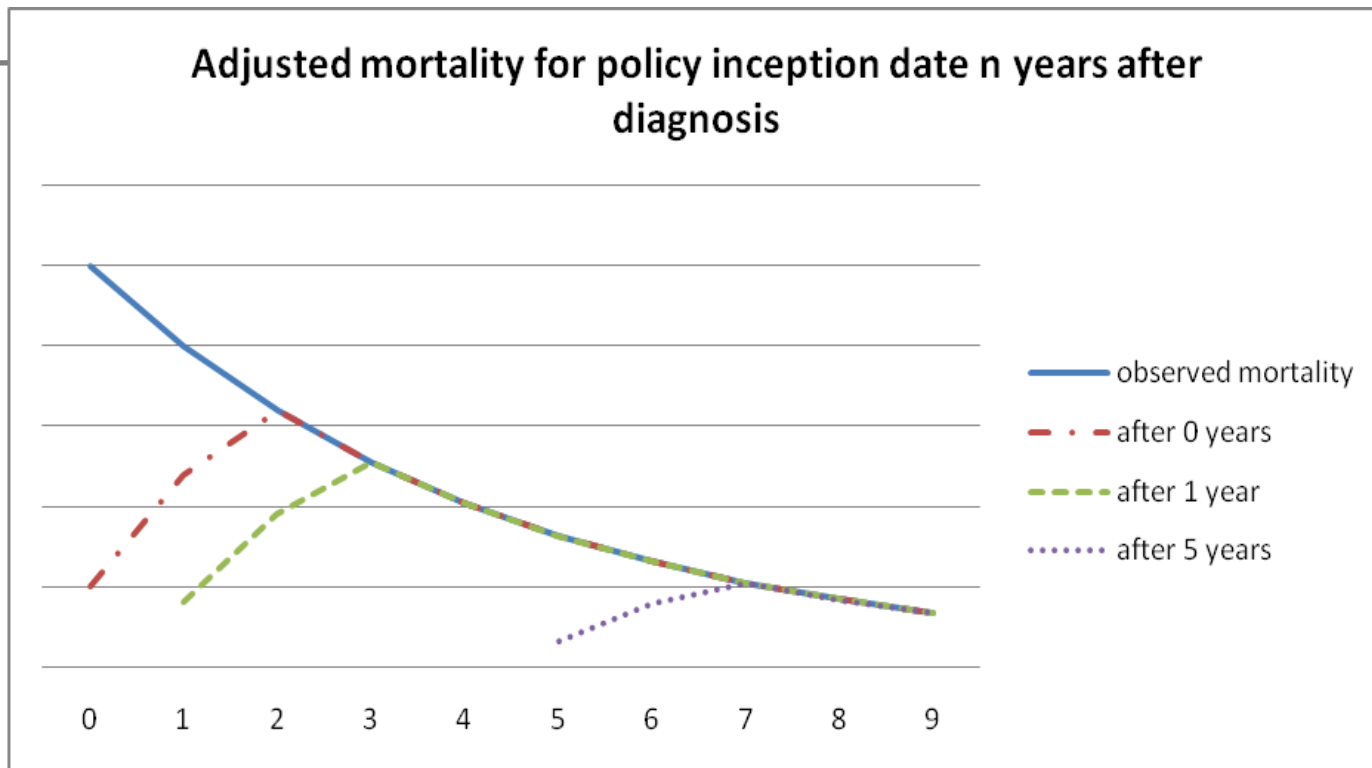


- **U.S. SEER data is seemingly best data source for colon cancer**

Males and Females, ages 20-69, stage II, 7,300 deaths amongst diseased



Example: Critical Appraisal 'Underwriting Effect'



- **Underwriter “identifies” risks with less positive outlook than \emptyset**
 - x% lower mortality in duration 0
 - y% in policy duration 1

Example: Transformation

Example: Practical Outcome



- Different staging systems and migration of staging makes past data difficult to interpret when medical reports use new staging

I		II		III			IV	Dukes
I		IIA	IIB	IIIA	IIIB	IIIC	IV	AJCC
T1N0M0	T2N0M0	T3N0M0	T4N0M0	T1,2N1M0	T3,4N1M0	TxN2M0	TxNxM1	"TNM"

- **Other considerations:**
 - Do we want to offer rates significantly above standard (e.g. +1000%)?
 - How do we charge the extra risk (evenly or front-loaded; absolute per mille or relative or combination)

Example: Clinical vs Insurance Medicine



- **Abnormally high cholesterol levels are strongly associated with cardiovascular disease.**
- **Total cholesterol is the sum of HDL, LDL, and VLDL. Usually, only the total, HDL, and triglycerides are measured. For cost reasons, VLDL and LDL are estimated.**

Example: Clinical vs Insurance Medicine



- Therapeutic lifestyle changes remain an essential modality in clinical management
- Trials confirm the benefit of cholesterol-lowering therapy in high-risk patients and support the ATP III treatment goal of low-density lipoprotein cholesterol 100 mg/dL (*Circulation. 2004;110:227-239.*)

Clinical focus

- Drug therapy
- Lowering LDL

Example: Clinical vs Insurance Medicine



- Different lipid measures for predicting CHD: Hazard ratios for a std. deviation increment were estimated for a multivariate model adjusted for age, systolic BP, antihypertensive treatment, DM and smoking:

	male		Female	
	HR (95% CI)	P value	HR (95% CI)	P value
HDL	0.71 (0.60-0.83)	<0.001	0.72 (0.57-0.92)	0.007
TC/HDL	1.39 (1.22-1.58)	<0.001	1.39 (1.17-1.66)	<0.001
LDL/HDL	1.35 (1.18-1.54)	<0.001	1.36 (1.14-1.63)	<0.001
Non-HDL	1.22 (1.06-1.40)	0.005	1.28 (1.06-1.56)	0.01
TC	1.12 (0.97-1.28)	0.11	1.18 (0.96-1.44)	0.11
LDL	1.11 (0.97-1.27)	0.14	1.20 (0.99-1.46)	0.06

- HDL-cholesterol and the lipid ratios TC/HDL and LDL/HDL performed best in terms of risk prediction.

• Source: Ingelsson E, Schaefer EJ, Contois JH, et al. Clinical Utility of Different Lipid Measures for Prediction of Coronary Heart Disease in Men and Women. JAMA. 2007. 298:776-785.

**Insurance
focus**

- Long-term view on current status
- HDL ratios more critical

Critical Appraisal



Contradicted and Initially Stronger Effects in Highly Cited Clinical Research

John P. A. Ioannidis, MD

CLINICAL RESEARCH ON IMPOR-

Context Controversy and uncertainty ensue when the results of clinical research on the effectiveness of interventions are subsequently contradicted. Controversies are most prominent when high-impact research is involved.

Conclusions Contradiction and initially stronger effects are not unusual in highly cited research of clinical interventions and their outcomes. The extent to which high citations may provoke contradictions and vice versa needs more study. Controversies are most common with highly cited nonrandomized studies, but even the most highly cited randomized trials may be challenged and refuted over time, especially small ones.

JAMA. 2005;294:218-228

www.jama.com

Quality of Underwriting Decisions are – in general – good



Mortality Risk Prediction by an Insurance Company and Long-Term Follow-Up of 62,000 Men

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Conclusions: Men applying for insurance clearly had better survival relative to the general population. Readily available medical evaluation enabled accurate prediction of the mortality risk of large groups, but the deceased men could not have been identified with the applied prediction method.

Question



- **Does your life office conduct retrospective studies to see if your underwriting assessments have been accurate / profitable ?**

Conclusion



- **Legislation requires evidence for risk categorisation**
- **Industry needs to collect more data**
- **Actuaries have to get involved and this requires**
 - More experience in biostatistics
 - Thorough understanding of the underwriting process
 - Basic medical knowledge

Biostatistics – An optional course for Master of Applied Statistics (ANU)

This is a course which studies some statistical techniques which are mainly or extensively used in medical statistics. The main area of discussion is the analysis of biostatistical and clinical trial data. Topics: prospective, cross sectional & retrospective trials; mortality; incidence, prevalence; relative risks; odds ratio; meta analysis; testing survival curves; Kaplan-Meier estimate; Cox regression; competing risks.

Contact Details



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