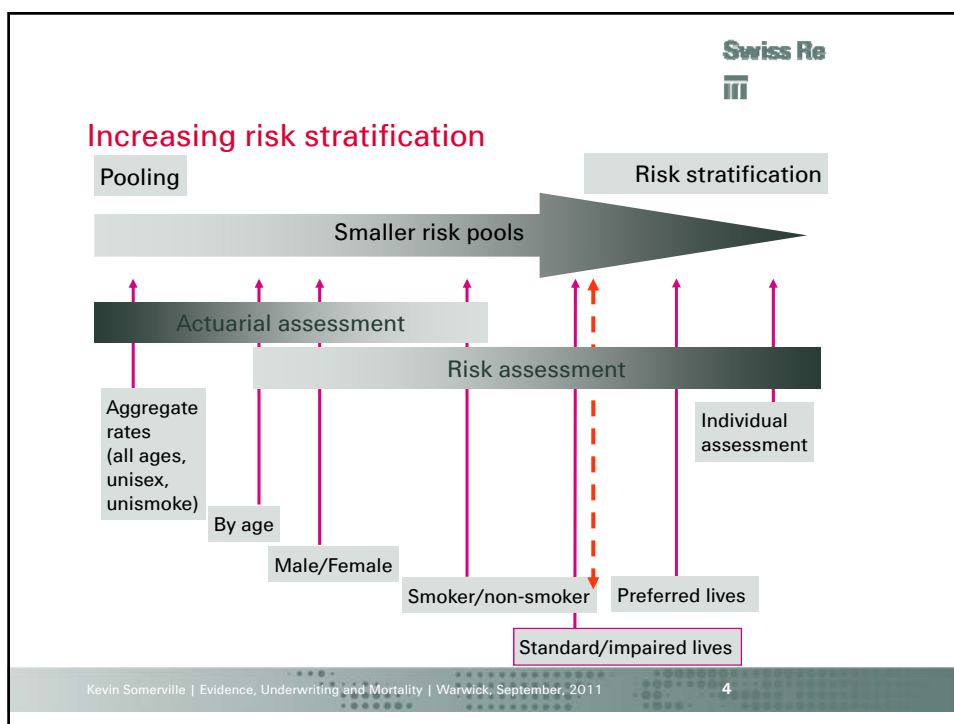
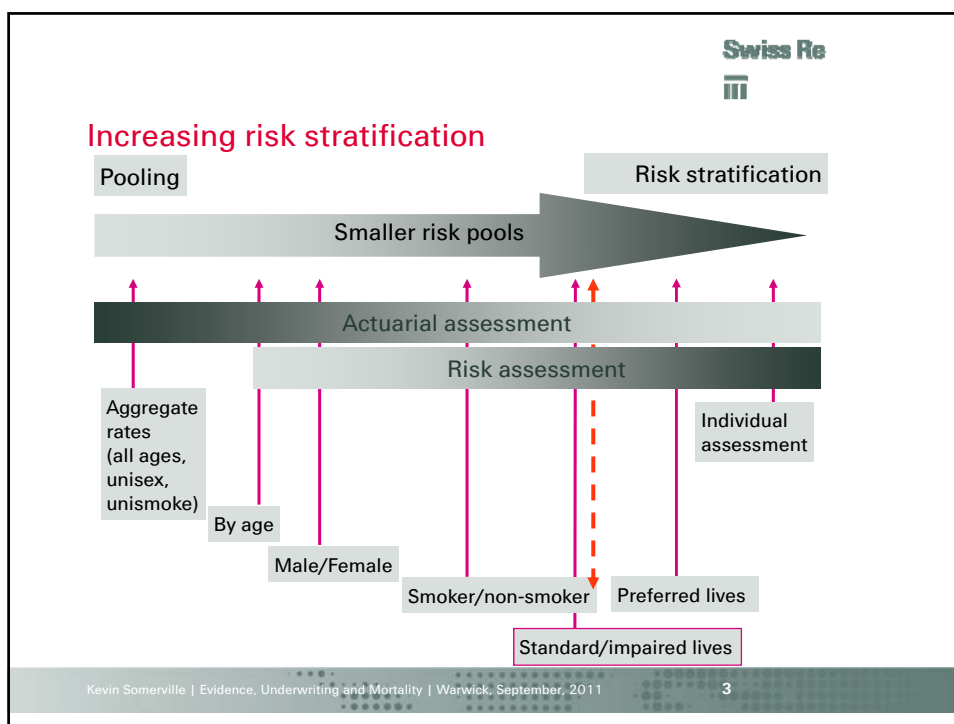


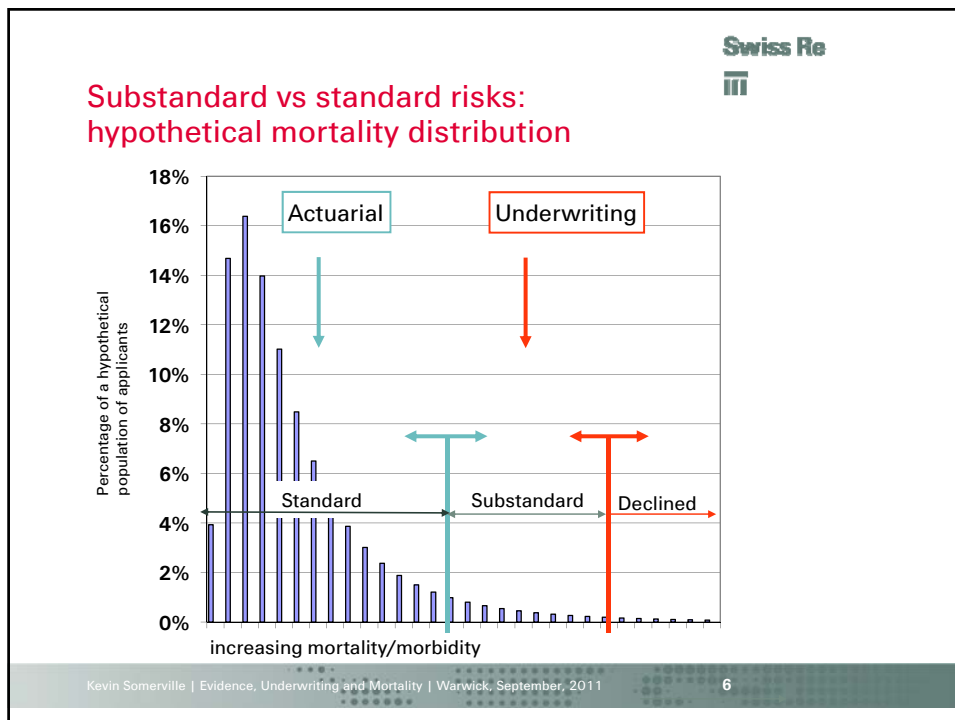
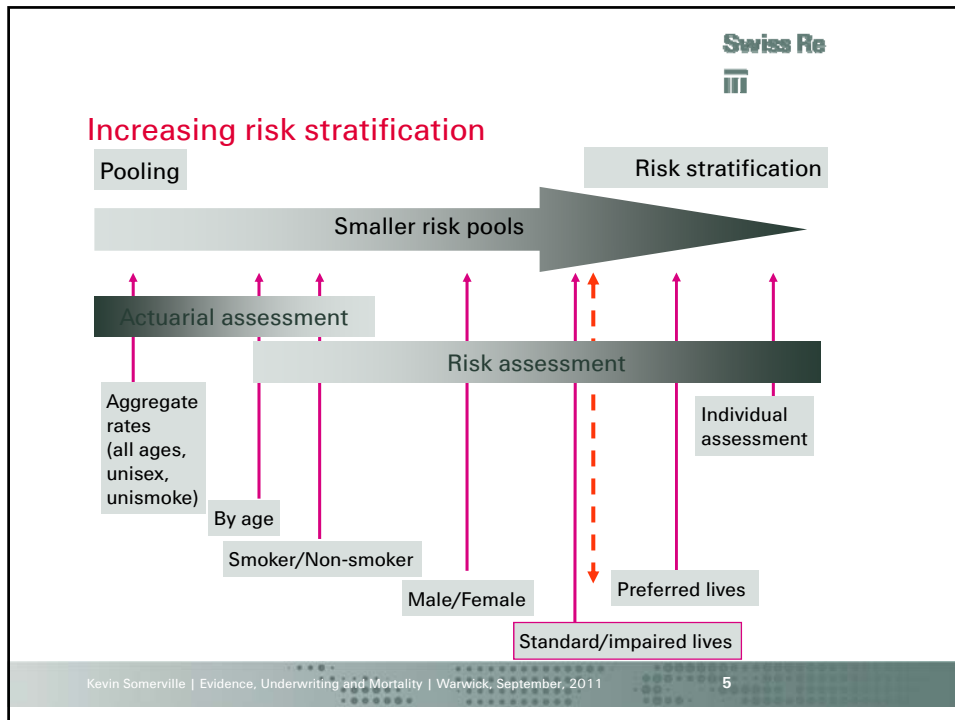
## Agenda

- 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

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## 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 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\*

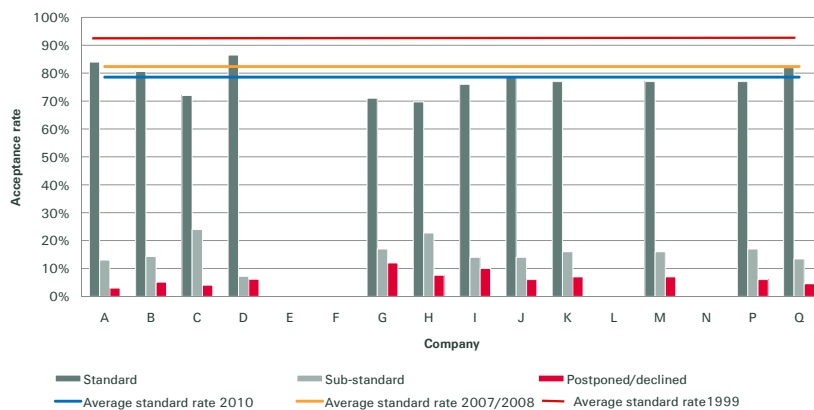
\*Potential Public Health benefits: those who are exposed to high risks pay more, incentive to modify lifestyle

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## Acceptance rates - Life



Swiss Re: Underwriting Watch 2011  
Swiss Re: Medical Costs Survey, 1999

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## 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

Life Cover					
Age (Next Birthday)	GPR only	Nurse Screening only	GPR, MER & Full Haematology & Biochemistry	Ex ECG	PSA test (males)
30 or less	N/A	£600,001	£1,500,001	£3,500,001	N/A
31-40	N/A	£500,001	£1,500,001	£3,000,001	N/A
41-45	N/A	£350,001	£1,000,001	£2,500,001	N/A
GPR & Nurse Screening					
46-50	£300,001	£500,001	£1,000,001	£1,500,001	N/A
51-55	£100,001	£300,001	£1,000,001	£1,500,001	N/A
56-60	£100,001	£250,001	£1,000,001	£1,000,001	N/A
61-65	£35,001	£100,001	£500,001	£750,001	£1,000,001
66+	ALL	£100,001	£350,001	£500,001	£1,000,001

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

<https://extranet.friendslife.co.uk/pub/doc/documents/PRUG5.pdf>





## 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?

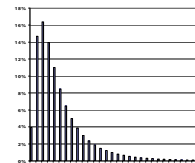


## Agenda

- Standard vs sub-standard, who decides?
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## 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](http://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



**Swiss Re**  








1962                      1977                      1985                      1992




1998                      2006

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**Swiss Re**  


## Standardised mortality methodology

JOURNAL OF INSURANCE MEDICINE  
Copyright © 2004 Journal of Insurance Medicine  
J Insur Med 2004;36:115-118

### MORTALITY METHODS

### Preparation of Mortality Abstracts

*Brian Ivanovic, DO, MS, Associate Editor, Mortality and Morbidity*

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 core knowledge of Insurance Medicine regularly presented in Mortality 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 reprinted articles include Kita's "Morbidity/mortality abstraction-finding suitable articles" (1990;22:267-288), Singer and Kita's "Guidelines for evaluation of follow-up articles and preparation of abstracts" (1991;23:21-29), and Kita's "Anatomy of an abstract" (1991;23:44-45).


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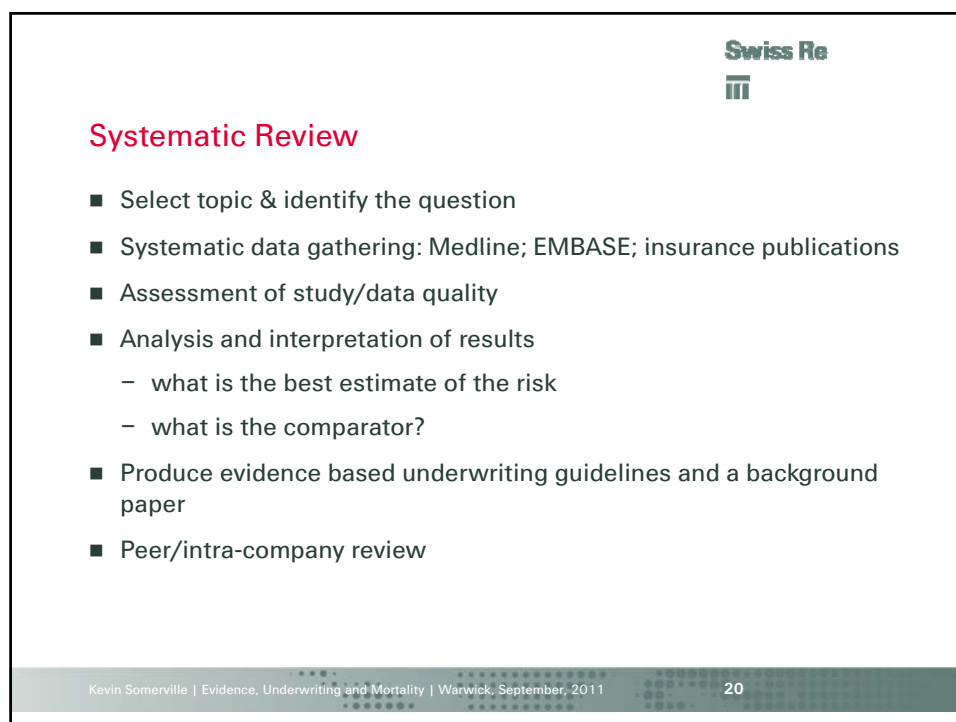
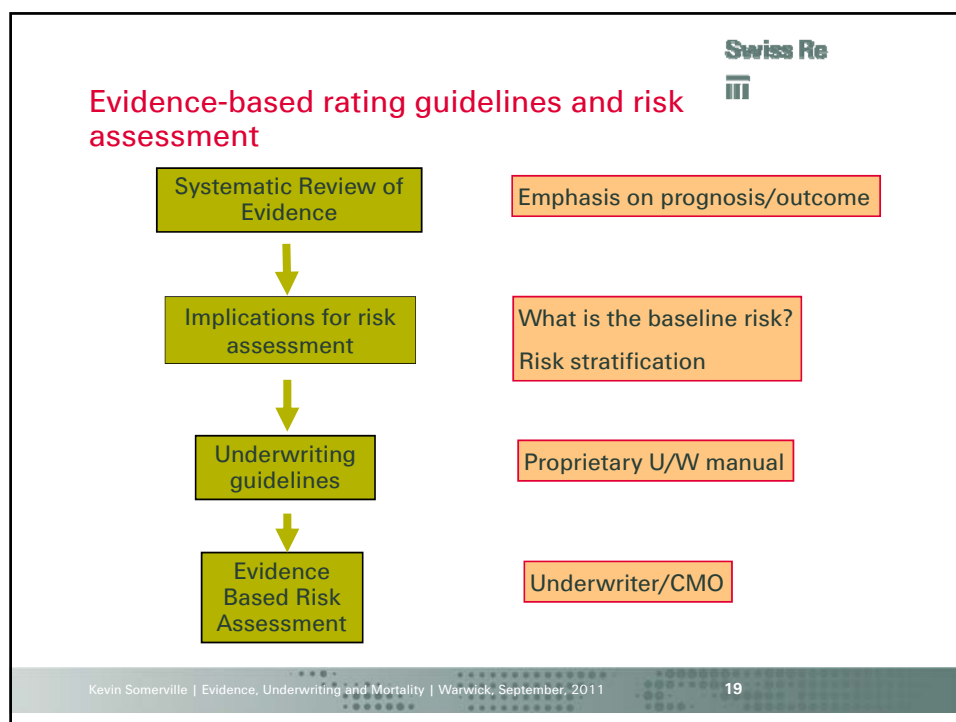
**Key words:** Mortality analysis methods, life insurance.

**Received:** January 9, 2004

**Accepted:** January 28, 2004



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Life Guide: print version!



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## EBR Guidelines: hierarchies of evidence

High  
relevance



Low  
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

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## The two types of risk differentiation

### 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

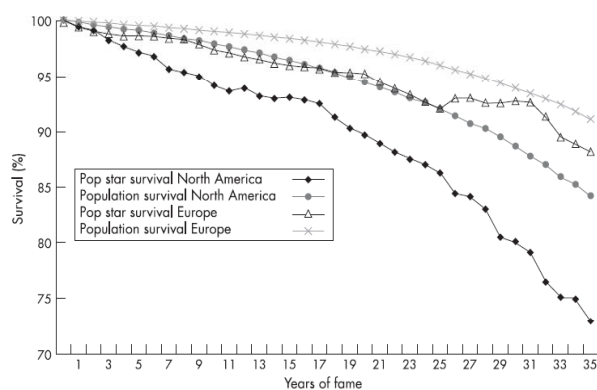
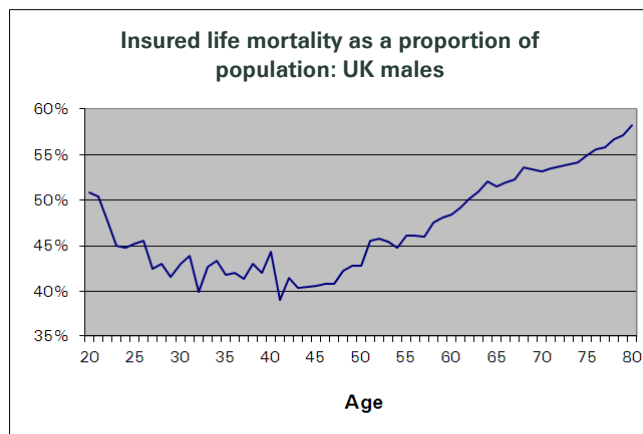


Figure 2 Comparative survival curves for North American and European pop stars and demographically matched general populations.

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 of population mortality: implications for underwriting



Population mortality: 1998-2000, GAD update  
Insured mortality: 70% of AM92 ULT

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## Familial hypercholesterolaemia: the importance of the comparator

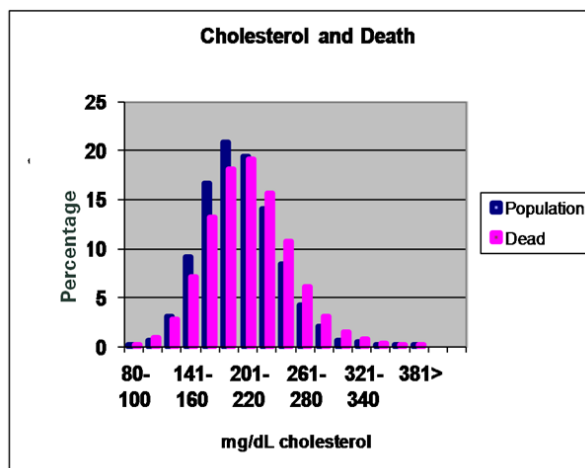
Observed and expected deaths by major cause and time period				
From 1 January 1992 (person-years exposure = 15,557 years)				
	Observed	Expected	O/E	95% CI
IHD	66	29.2	2.3	1.8, 2.9
Stroke	8	8.6	0.9	0.4, 1.8
Non-IHD cardiac	48	88.3	0.5	0.4, 0.7
Accidents/violence	3	4.6	0.7	0.1, 1.9
All cancers	19	42.3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

Neill et al, Atherosclerosis, 2005

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## Cholesterol distribution in insurance applicants: outcome

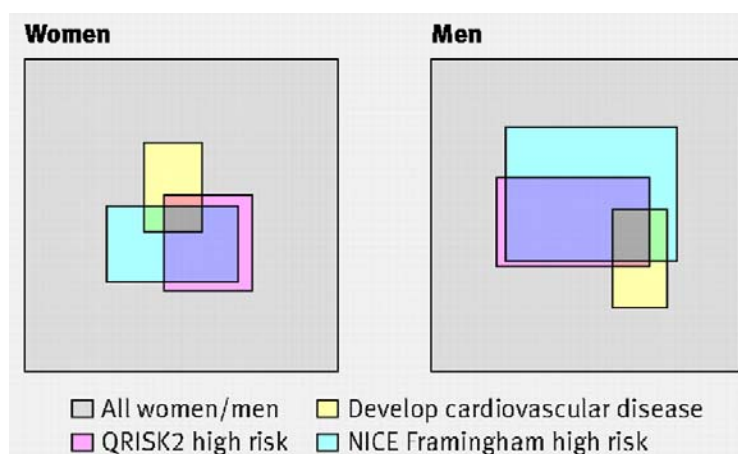


Data courtesy of Robert Stout, CRL

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## Prediction tools: low specificity and misclassification

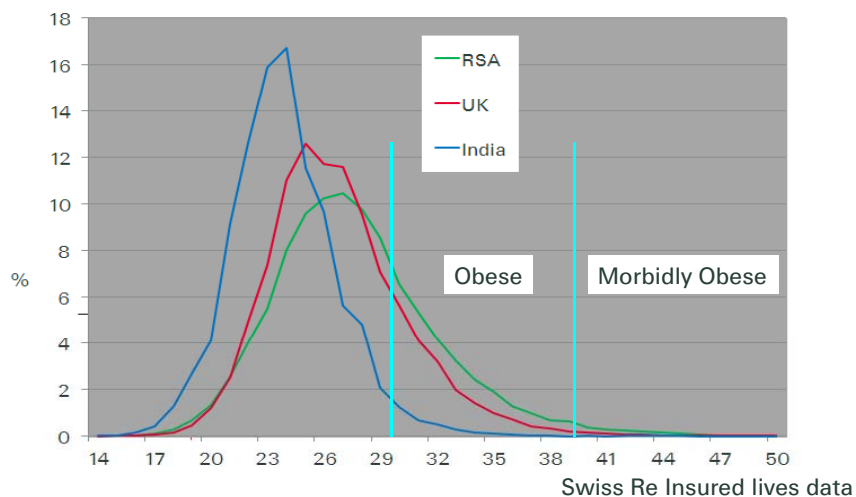


Collins S, Altman D G, BMJ, 2010

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## BMI distributions vary between countries



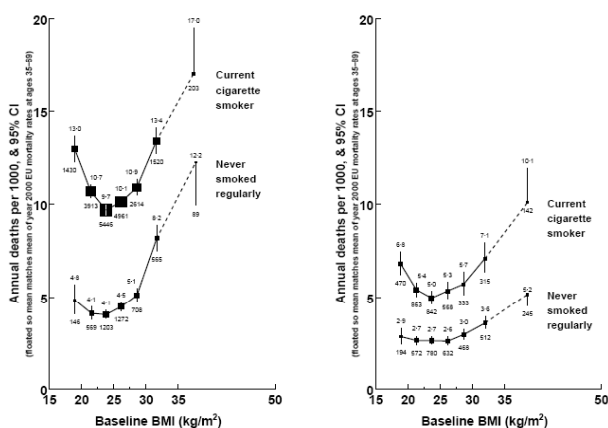
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## PSC study: smokers/non-smokers have different build risk profiles

(a) Male (35-69 years)

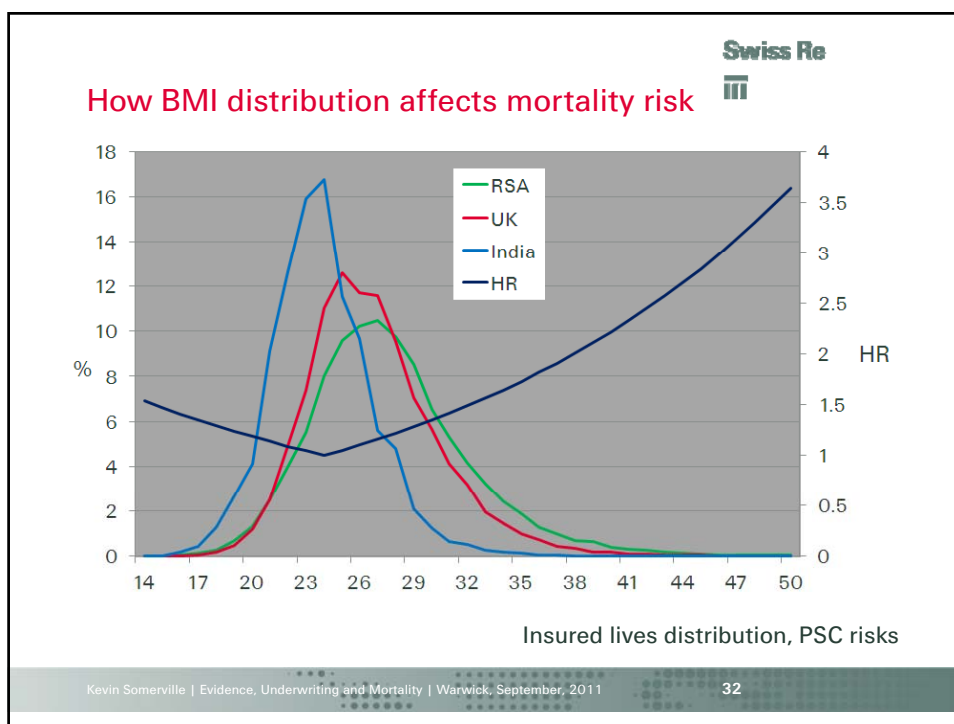
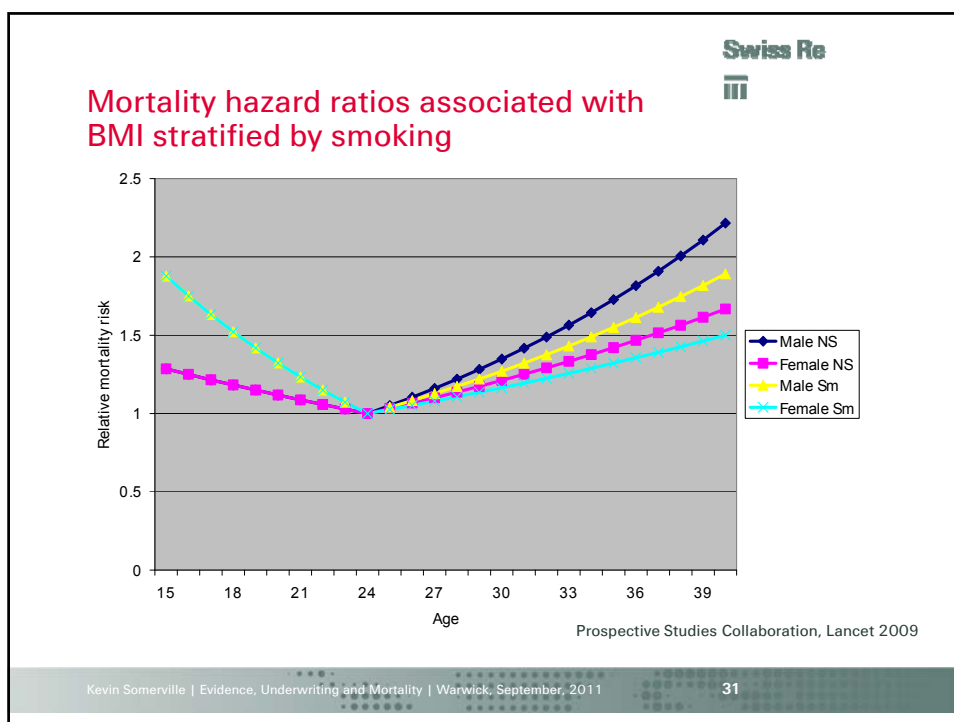
(b) Female (35-69 years)



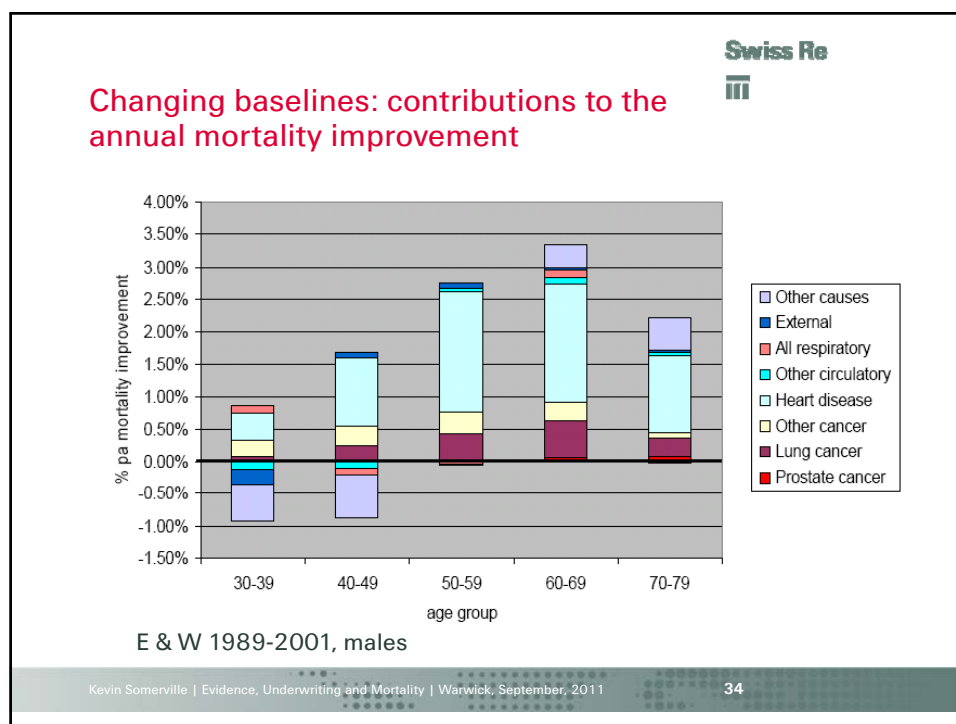
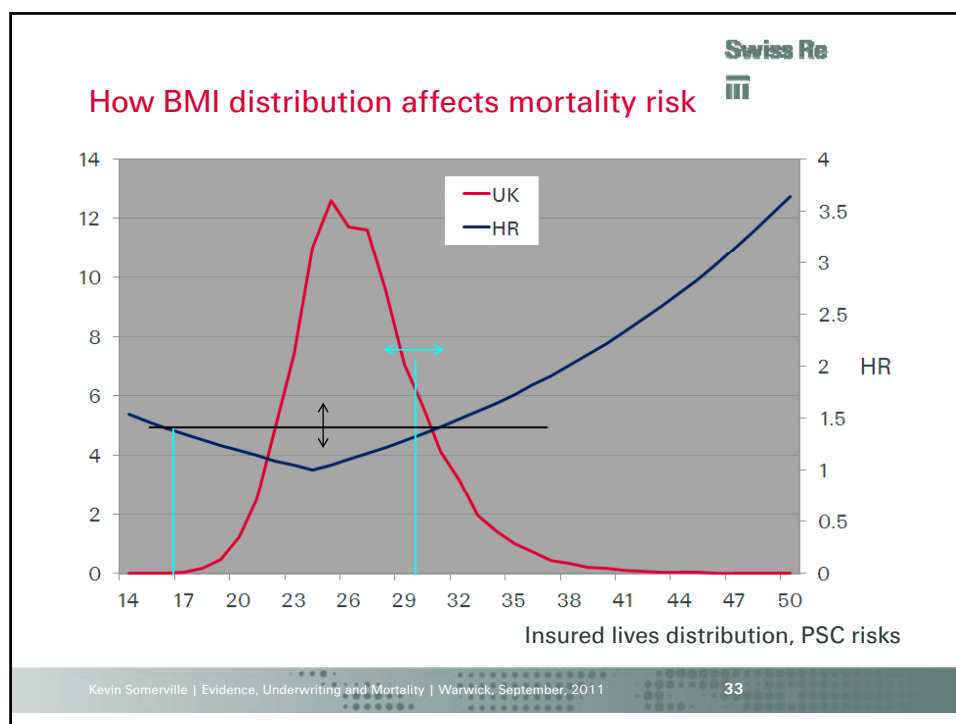
www.thelancet.com Published online March 18, 2009 DOI:10.1016/S0140-6736(09)60318-4

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### Changes in major CVS risk factors

Current cigarette smoking	↓ 73% (68% - 78%)
BMI*	↑ 1.89 kg/m <sup>2</sup> (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\*

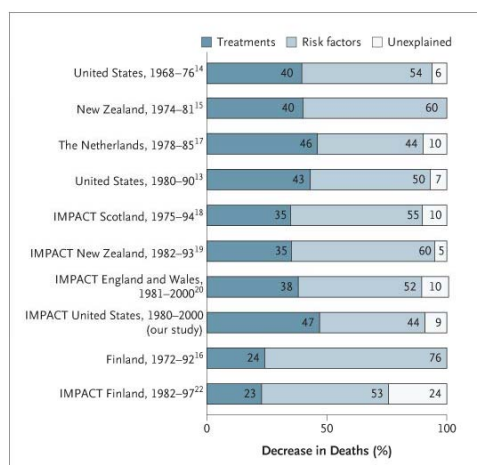
Hardoon S et al, Circulation, 2008

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### Reduction in IHD Deaths: Secondary Treatments and Risk-Factor Contributions



Ford E et al., NEJM, 2007

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### Diagnostic tests for Diabetes Mellitus: changing lab criteria affect the risk

- 1979 (WHO; NDDG)
  - Fasting plasma glucose  $\geq 7.6$  mmol/l (140 mg/dl)
  - 2 hr OGTT glucose  $\geq 11.1$  mmol/l (200 mg/dl)
- 1997 (ADA)
  - Fasting plasma glucose  $\geq 7.0$  mmol/l (126 mg/dl)
  - recommended not using OGTT
- 1998 (WHO)
  - Fasting plasma glucose  $\geq 7.0$  mmol/l (126 mg/dl)
  - 2hr standard OGTT plasma glucose  $\geq 11.1$  mmol/l (200 mg/dl)



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

2009 (IEC: ADA, IDF, EASD)

- HbA1c A1C  $\geq 6.5$  % using a standardised test (to DCCT)

Or

- FPG  $\geq 7.0$  mmol/l (126 mg/dl)

Or

- Two-hour plasma glucose  $\geq 11.1$  mmol/l (200 mg/dl) during a standardised OGTT

Or

- Classic symptoms of hyperglycaemia or hyperglycaemic crisis, a random plasma glucose  $\geq 11.1$  mmol/l (200 mg/dl)



## How helpful is the new definition of diabetes mellitus?

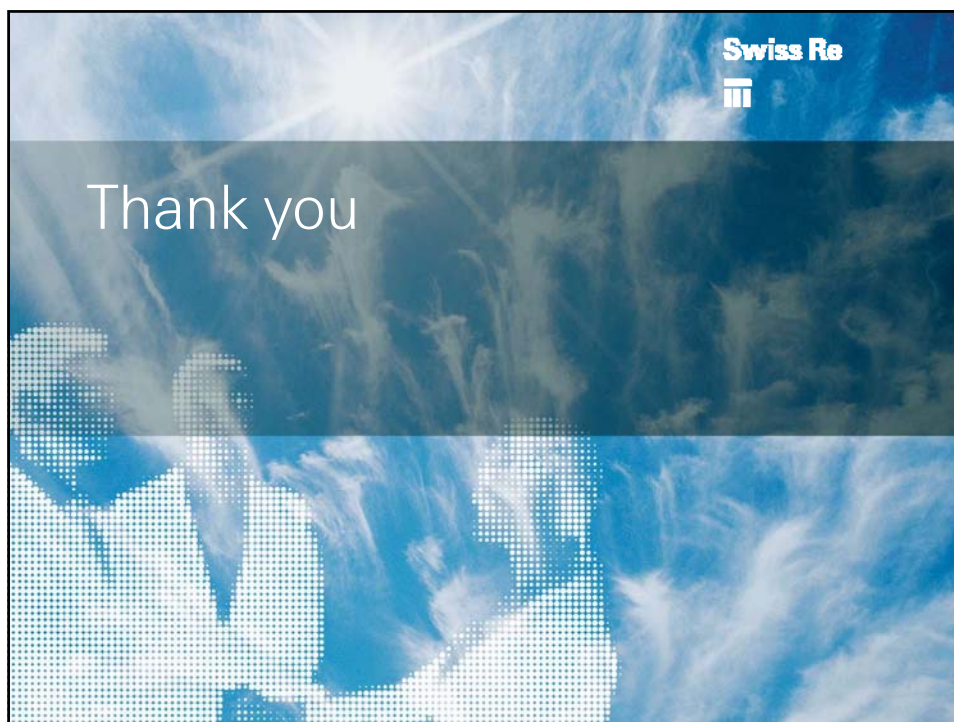
"... the limited sensitivity of the A1C test may result in missed or delayed diagnosis of type 2 diabetes, whereas the use of current OGTT criteria will fail to identify a high proportion of individuals with A1c >6.5%."

*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



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