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Study of Insurance Economics

Études et Dossiers

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**3rd Health and Ageing Conference on
Longevity – a Medical and Actuarial Challenge**

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Layout & Distribution: Pascal Clerc

The Challenge to Insurers presented by the Multi-Factorial Nature of Longevity

Steve Wilson

Contents



- The insurance processes
- Longevity and mortality in insurance
- Current issues in the UK
- Our challenge as professionals

Insurers both price contracts and reserve contracts once written



- Pricing determines the original terms of the contract
 - reflects consumer needs and market pressures as well as underlying risk
- Reserving is the process of estimating future payments
 - aim to ensure adequate funds are set aside
 - usually based on more conservative assumptions than pricing

Both pricing and reserving allow for multiple variables – mortality is just one of these



- Life insurance products are typically long-term in nature and so must allow for the time value of money
- Assumptions on future investments returns are key ...
- ...as are assumptions on future surrender levels
- Many savings products have guarantees
- So, mortality risk frequently receives less attention than investment risk
 - but can be very significant

Mortality / longevity are themselves the result of multiple factors



- Gender
- External environment
- Public health and treatment advances
- Behavioral risk factors
- Genetic profile
- Random events

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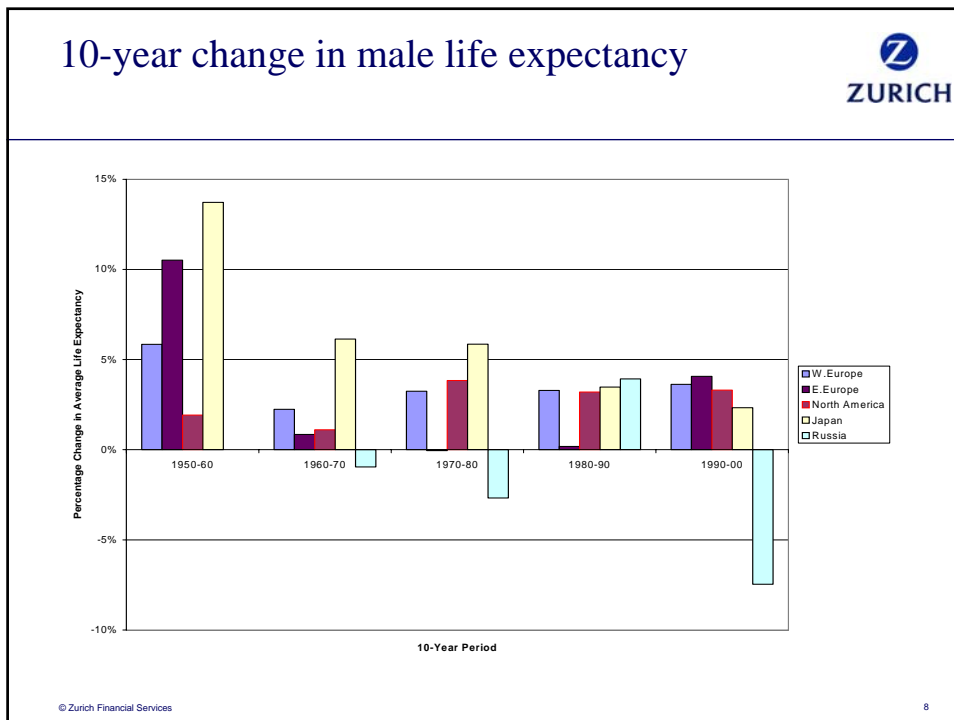
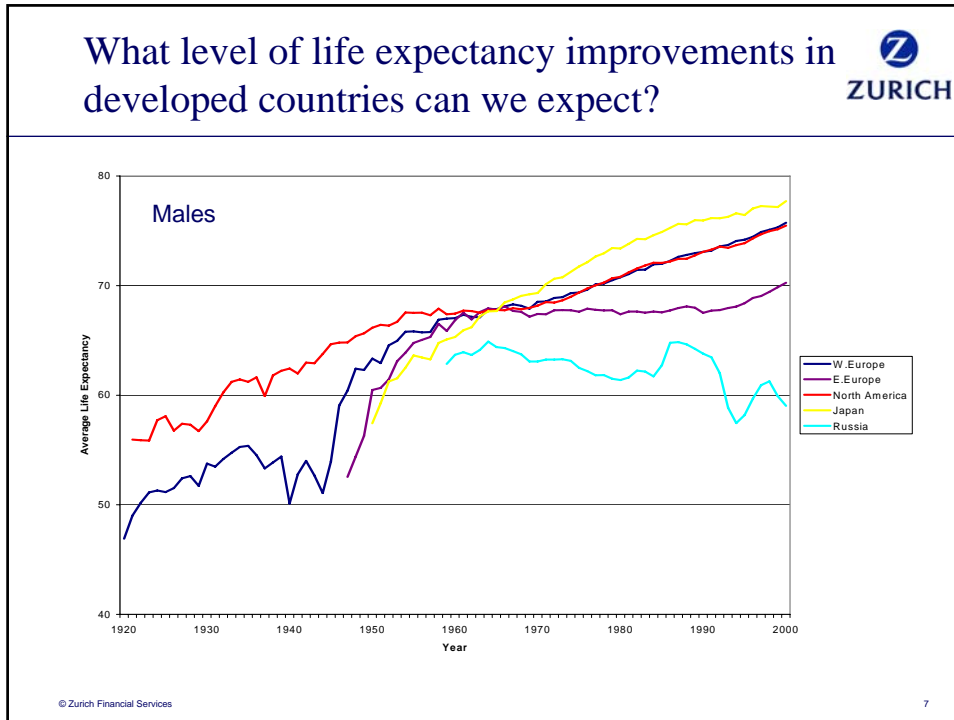
It is essential for insurers to understand future mortality trends



- Long-term nature of products means small annual deviations can accumulate ...
- ... so even small percentage changes in reserves may be costly relative to an insurers annual revenues
- Market dynamics create competitive pressures
- Increasingly solvency tests require insurers to model the capital needed to cover extreme events

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Longevity & mortality issues differ by type of insurance



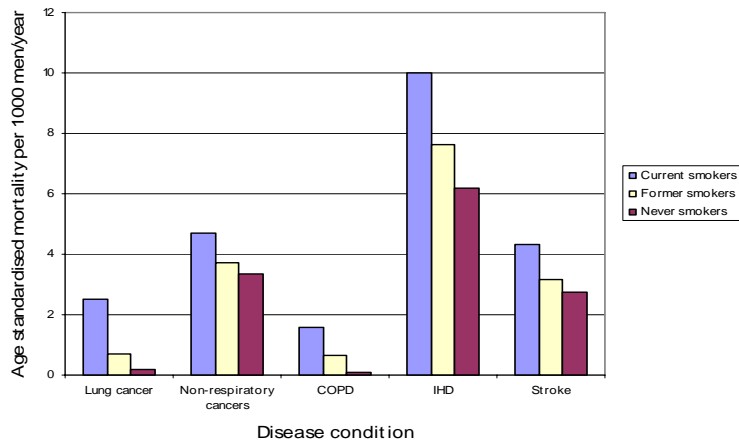
- Life insurers – assured lives
 - Smoking, obesity & pandemics
- General insurers
 - Exposure to industrial disease
- Life insurers – annuitants
 - Future mortality improvements

Longevity & mortality issues differ by type of insurance



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Smoking has a well established effect on mortality



British Doctors Study – (1951-2001)
(Doll et al, BMJ, 2004)

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The impact at later ages is significant

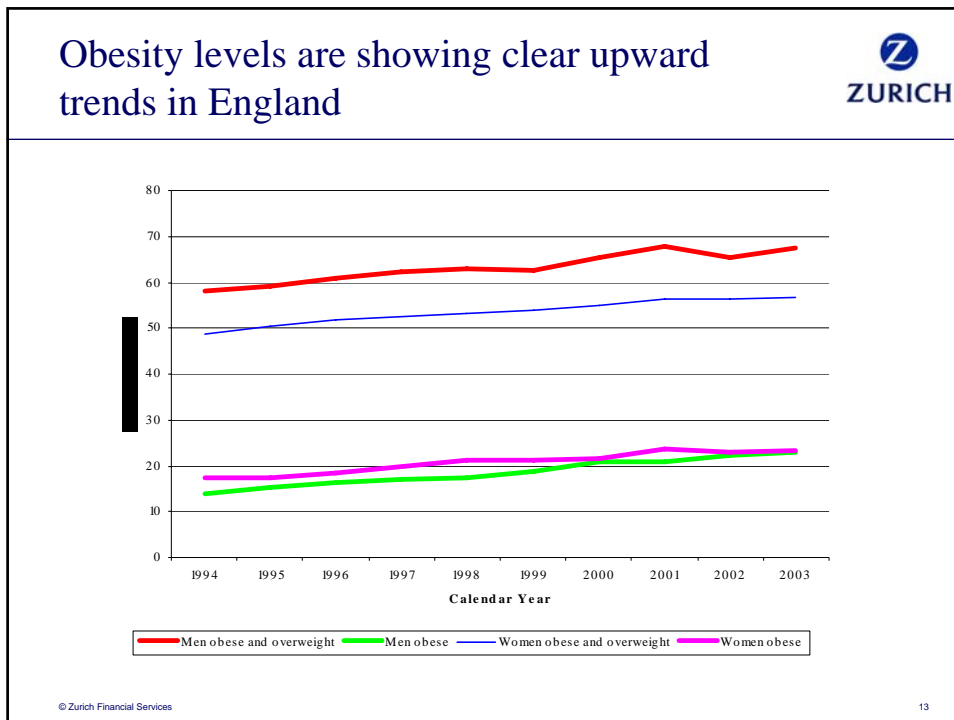


Study decade	Probability of 70 year old surviving to age 90 (%)	
	Non-smoker	Smoker
1951-61	12	10
1961-71	17	9
1971-81	20	7
1981-91	26	7
1991-2001	33	7

British Doctors Study – (1951-2001)
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Increases in obesity levels are expected to result in higher mortality

- Obesity leads to Type 2 diabetes and cardiovascular disease
- US study (1976-2000) of 116 500 nurses tracked over 24 year period identified mortality risk factors:
 - Physical activity
 - Body mass index (BMI)
- Obesity and physical activity levels difficult to predict
- Could significantly impact critical illness policies and term insurance
- Possible favorable impact on deferred annuities

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The insurance industry now recognizes that pandemics present a real threat



- Avian flu has raised awareness and generated widespread concern
- Rating agencies, regulators and other modeling organizations are actively looking at the impact of pandemics
- Worst case modeling shows extreme financial losses
- Some regulators now require pandemic scenarios in their solvency tests
- The impact on life insurers is highly dependent on the age profile of those affected

Longevity & mortality issues differ by type of insurance



- Life insurers – assured lives
 - Smoking, obesity & pandemics
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Industrial diseases have dominated the industry's agenda for many years



- Although low impact as a cause of death, industrial diseases have been a major cost to general insurers
- The main impacts have been in the US and the UK under Worker's Compensation and Employer's Liability policies
- Asbestos related diseases are the biggest source, and are especially problematic owing to the very long latency period
- Pricing for these very long tail claims because of the long time from policy inception to claim

Longevity & mortality issues differ by type of insurance



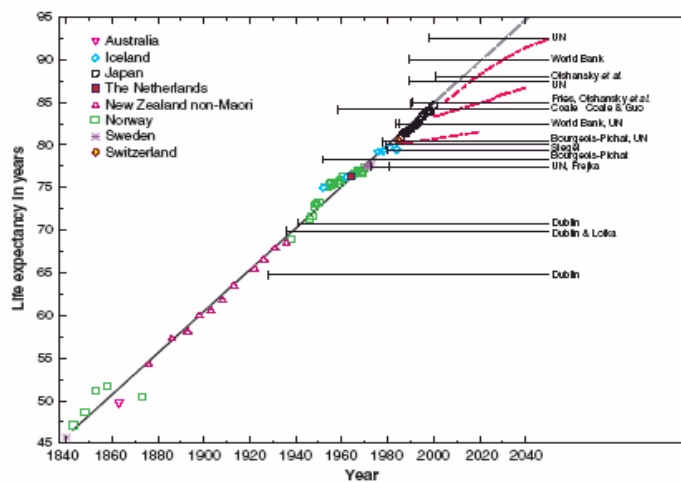
- Life insurers – assured lives
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There is no consensus on the level of future improvements



- Demographers hold opposing views over achievable limits
- Biological warranty period (Carnes, Olshansky, Grahn)
 - Functional overcapacity prior to reproductive age subsequently degraded
 - Treatment of disease underlying principal causes of death has limited benefit
 - Absence of treatment for slowing or reversing aging process
 Current practical limit on life expectancy
 ⇒
- Broken limits to life expectancy (Vaupel & Oeppen)

Historical studies have consistently underestimated life expectancy



(Oeppen & Vaupel – Science, 2002)

Longevity is currently a hot topic in the UK

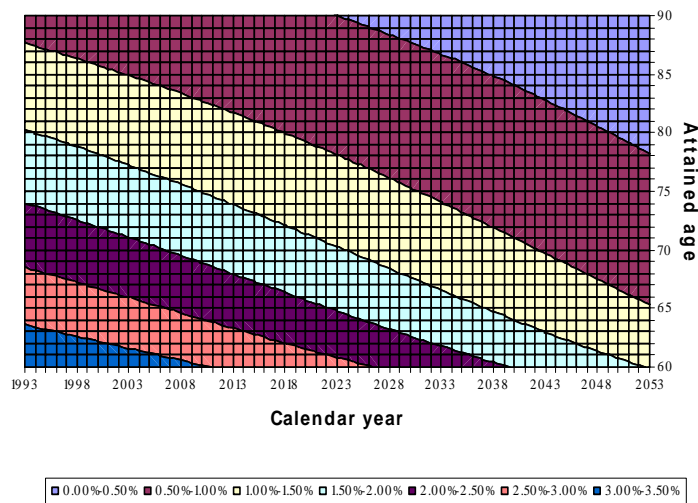


- Mortality improvements can be determined either by:
 - A) using models to forward project historical patterns, or
 - B) making predictions based on medical expert & demographer opinion
- The UK's Continuous Mortality Investigation Bureau (CMIB) uses approach A)
- Two-way generational tables have been in use since the 1980's
- The CMIB has just released two new models

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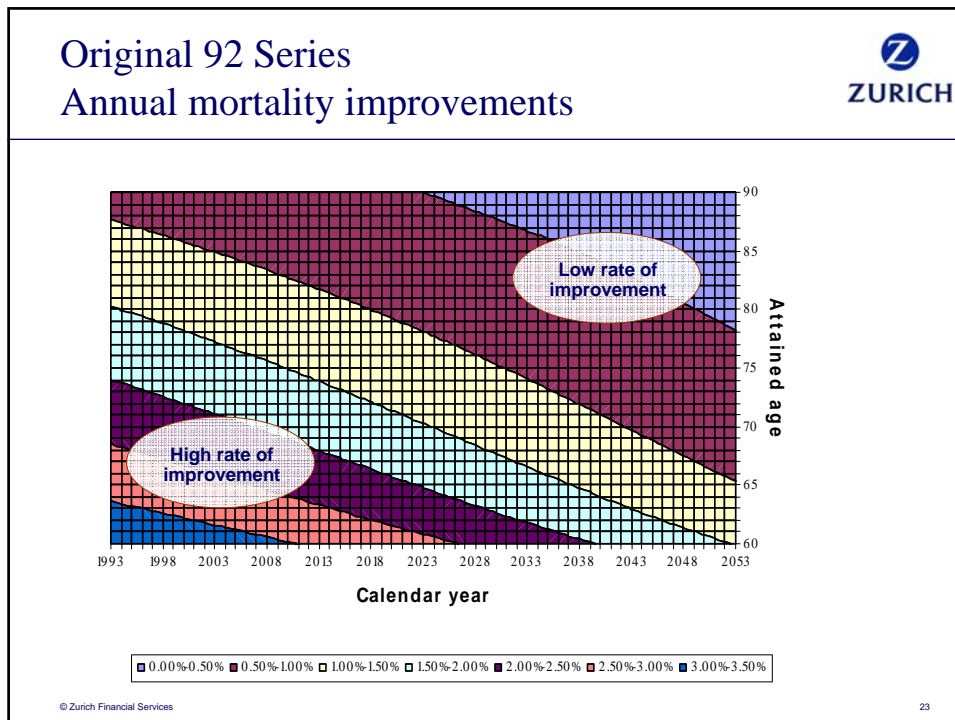
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Original 92 Series Annual mortality improvements



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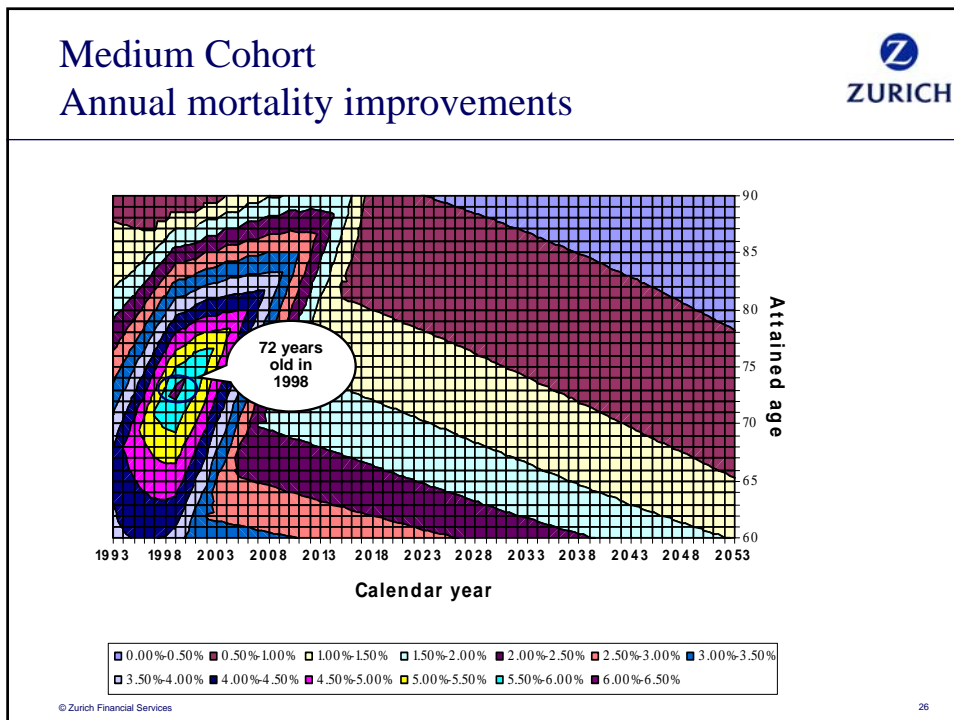
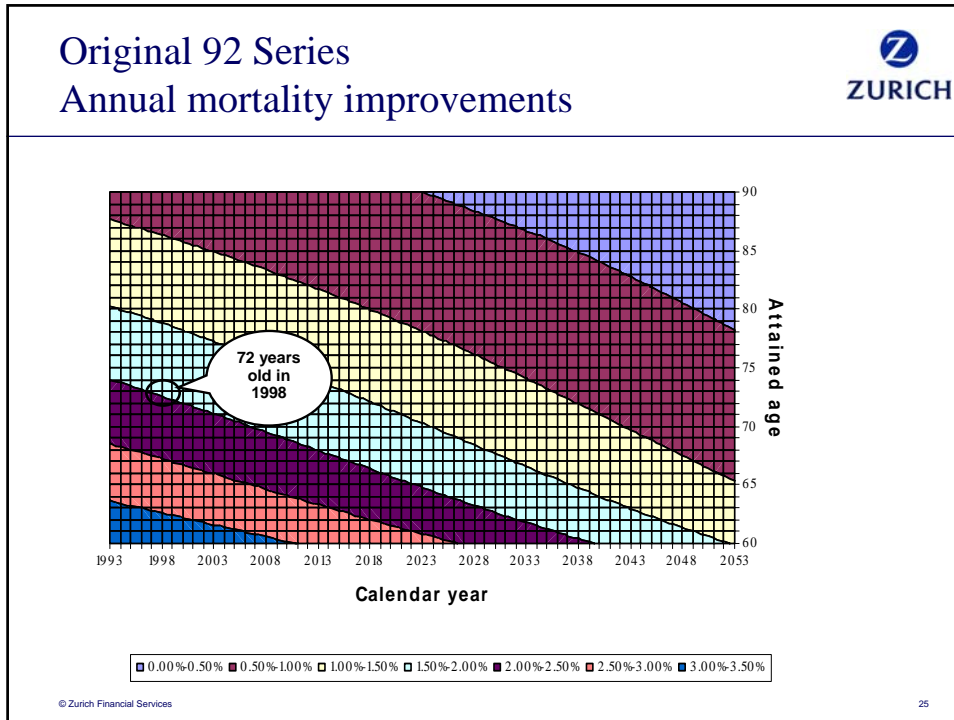
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In 2002 the CMIB published the “cohort” table

- Identification of cohort born in 1926 with higher mortality improvements than earlier/later cohorts
- The data indicates this; possible causes
 - Smoking pattern
 - Dietary changes before and after WWII

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The CMIB has just released two new models in addition to the “cohort” table

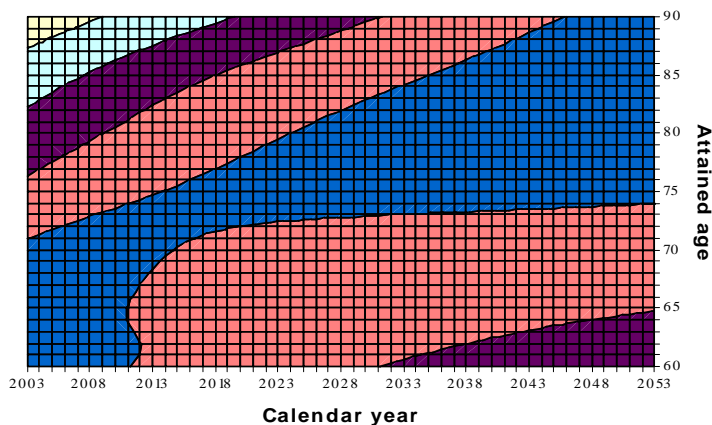


- P-spline:
 - Fitting and projecting a smoothed surface to mortality by attained age and either calendar year or year of birth
- Lee-Carter:
 - A stochastic mortality model fitted to attained age and calendar year
- These models have both very different shape and outputs

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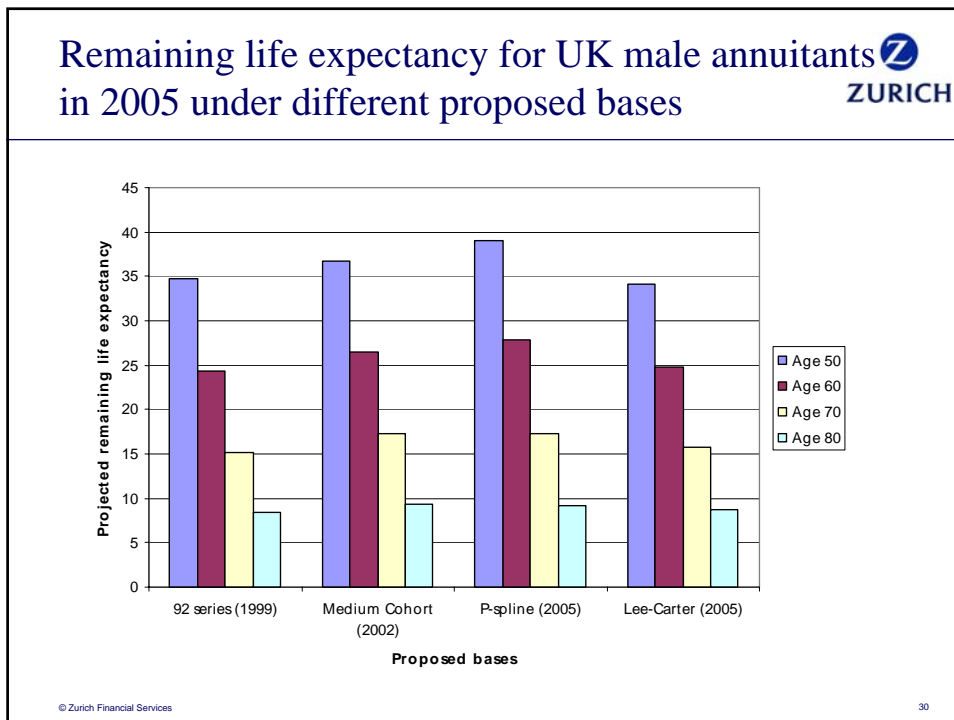
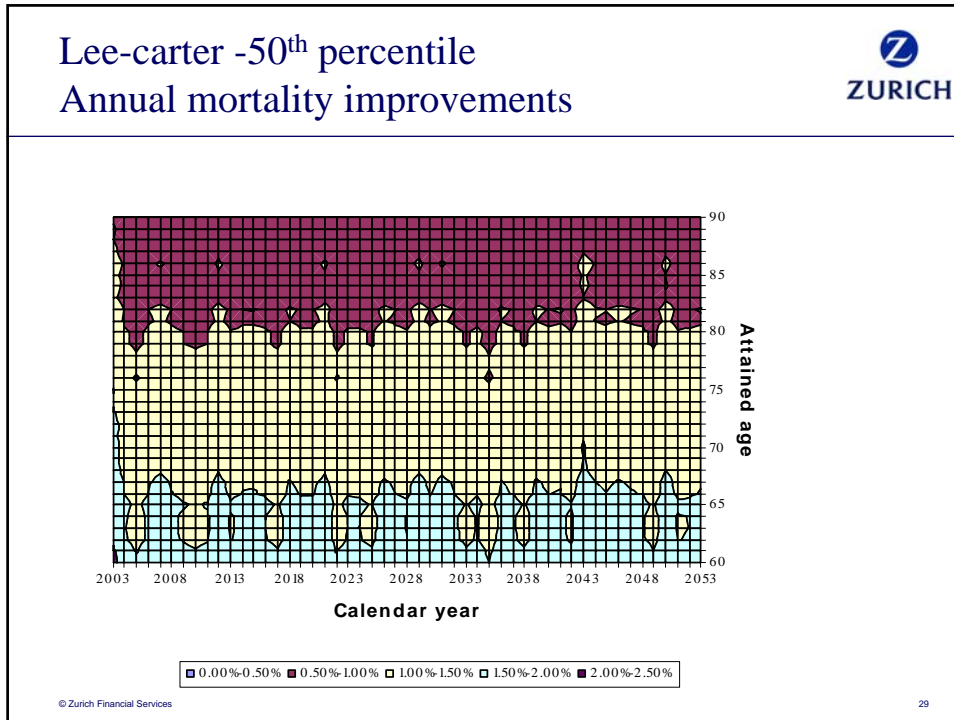
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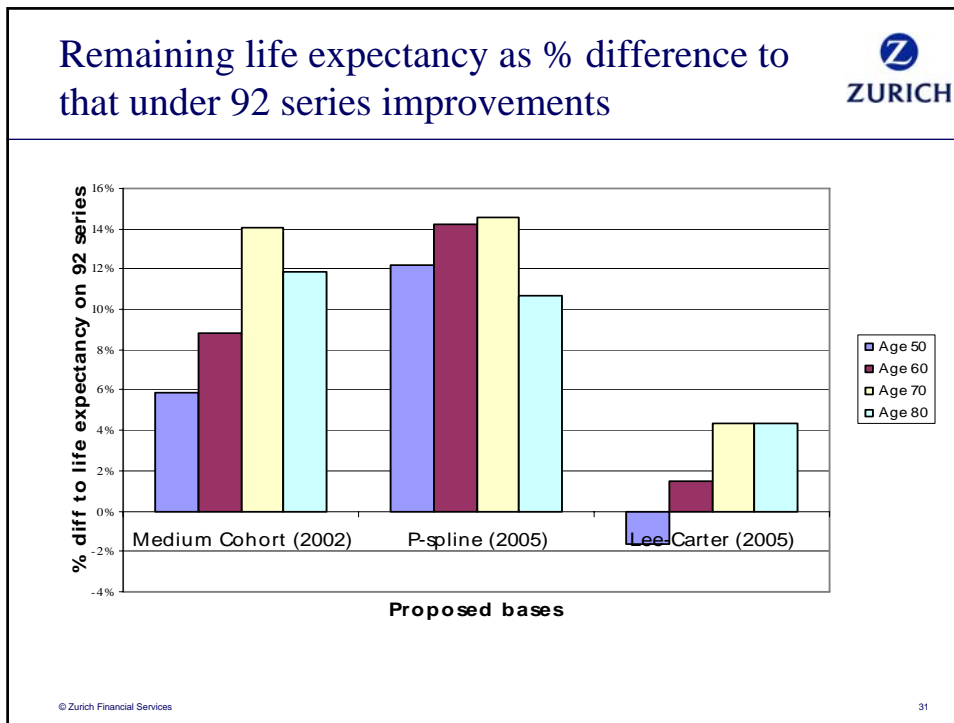
P-spline (age-cohort) – 50th percentile Annual mortality improvements



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In summary

- Mortality / longevity risks affect insurers in a number of ways
- The long-term nature of savings and annuity products mean predicting future trends is key
- Competitive pressures, accounting standards and regulatory requirements mean models and assumptions need to be:
 - Widely accepted
 - Credible
 - Understandable

Today's challenge is as much about communicating our models as it is developing them

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