

Younger Members Convention, Birmingham

# Managing longevity risk

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# Managing longevity risk — plan of talk

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1. Investing in heart disease
2. Capital-market solutions
3. Socio-economic group
4. Bespoke risk models
5. Summary and questions

# 1. Investing in heart disease

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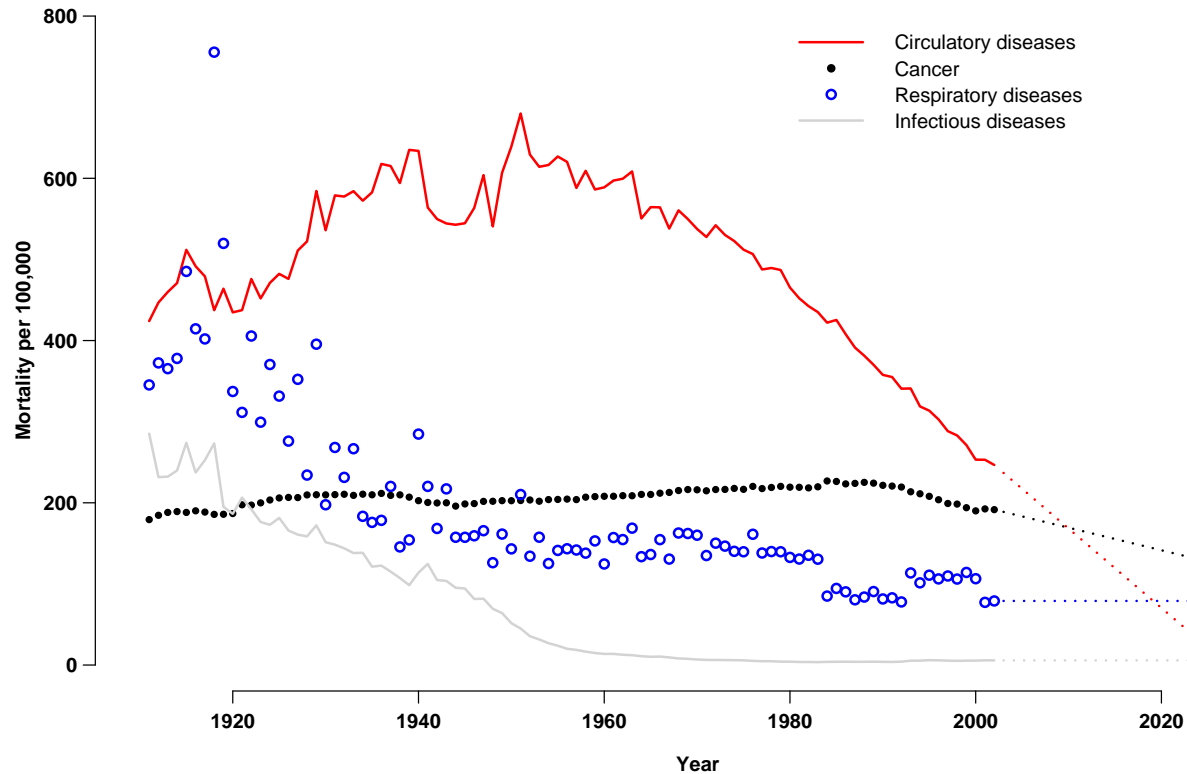
# Reliance of pension sponsor on CHD

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Cause	45–64	65–84	85+
Infectious diseases	6	30	160
Injury and poisoning	37	62	330
Respiratory diseases	45	587	3,882
Cancers	240	1,382	3,394
Circulatory diseases	225	1,784	7,813
All causes	644	4,316	18,803

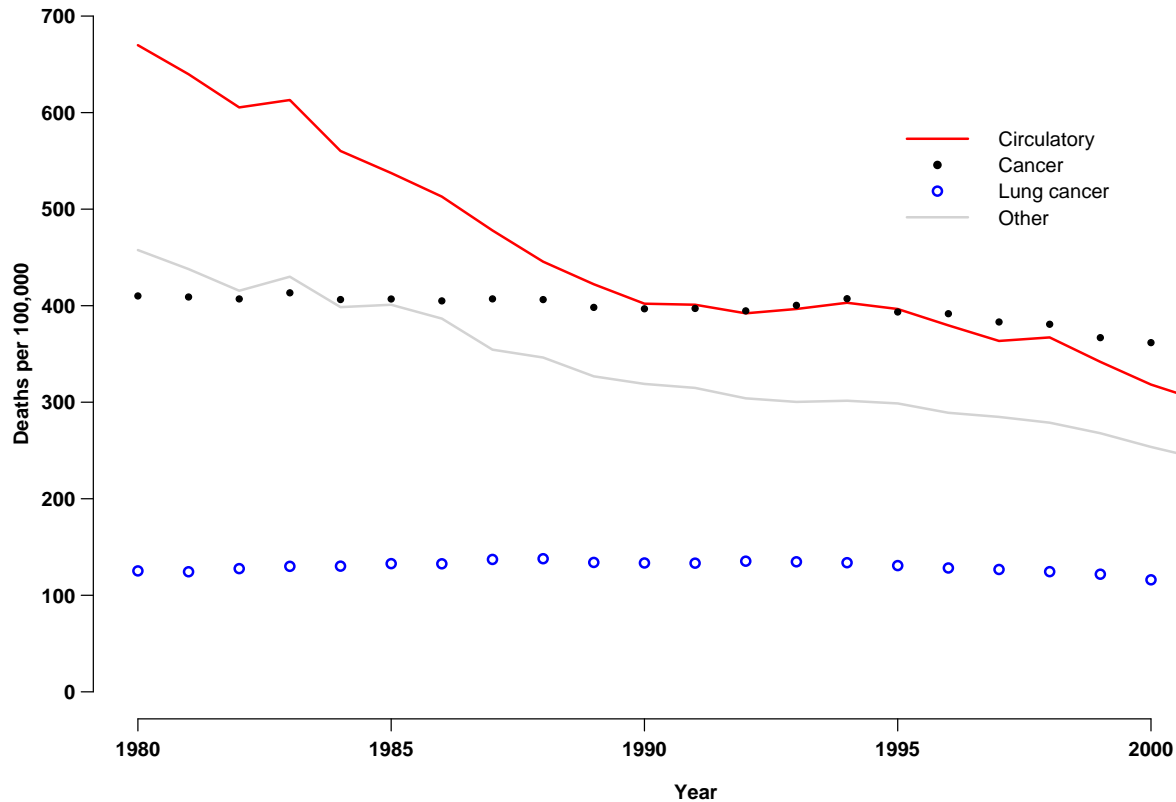
Source: Selected causes of death for males, 2003, ONS data for England and Wales.

# 20th century mortality



Source: ONS data

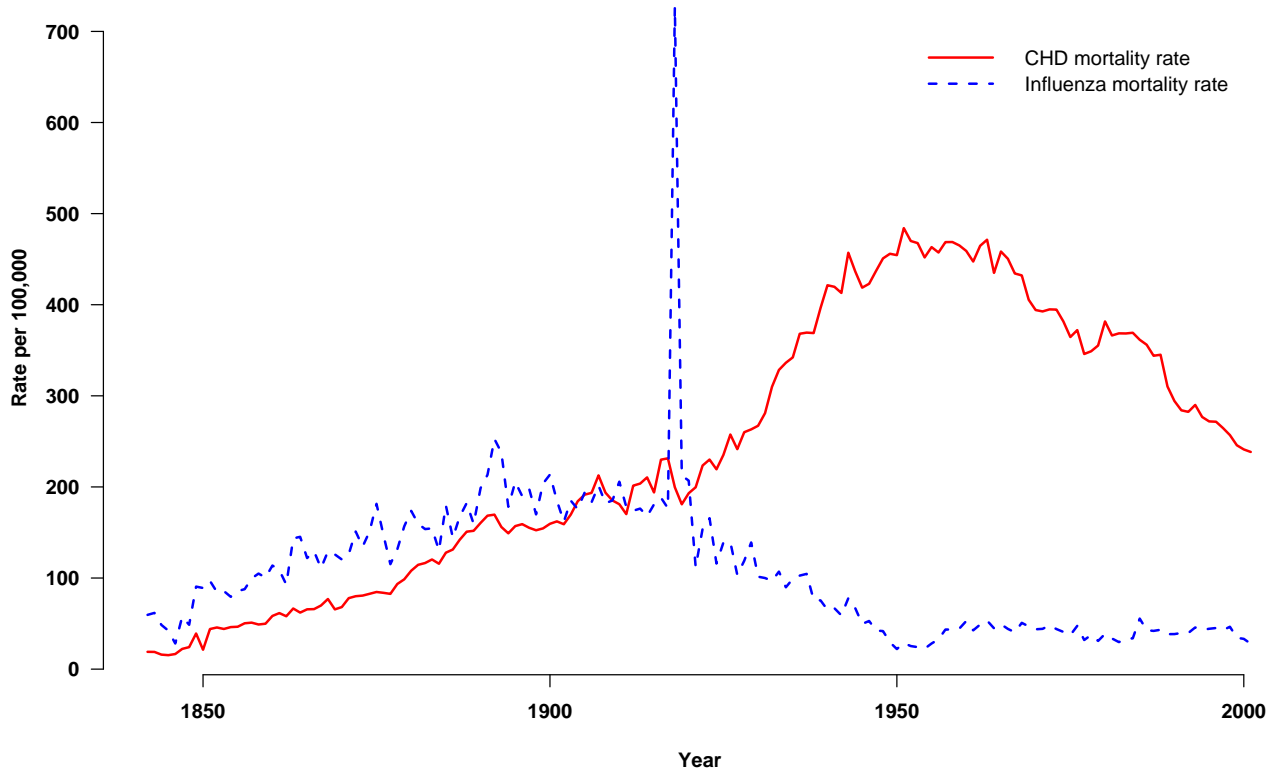
# Italian mortality, 50–74 (males and females)



Source: Cocevar, 2007

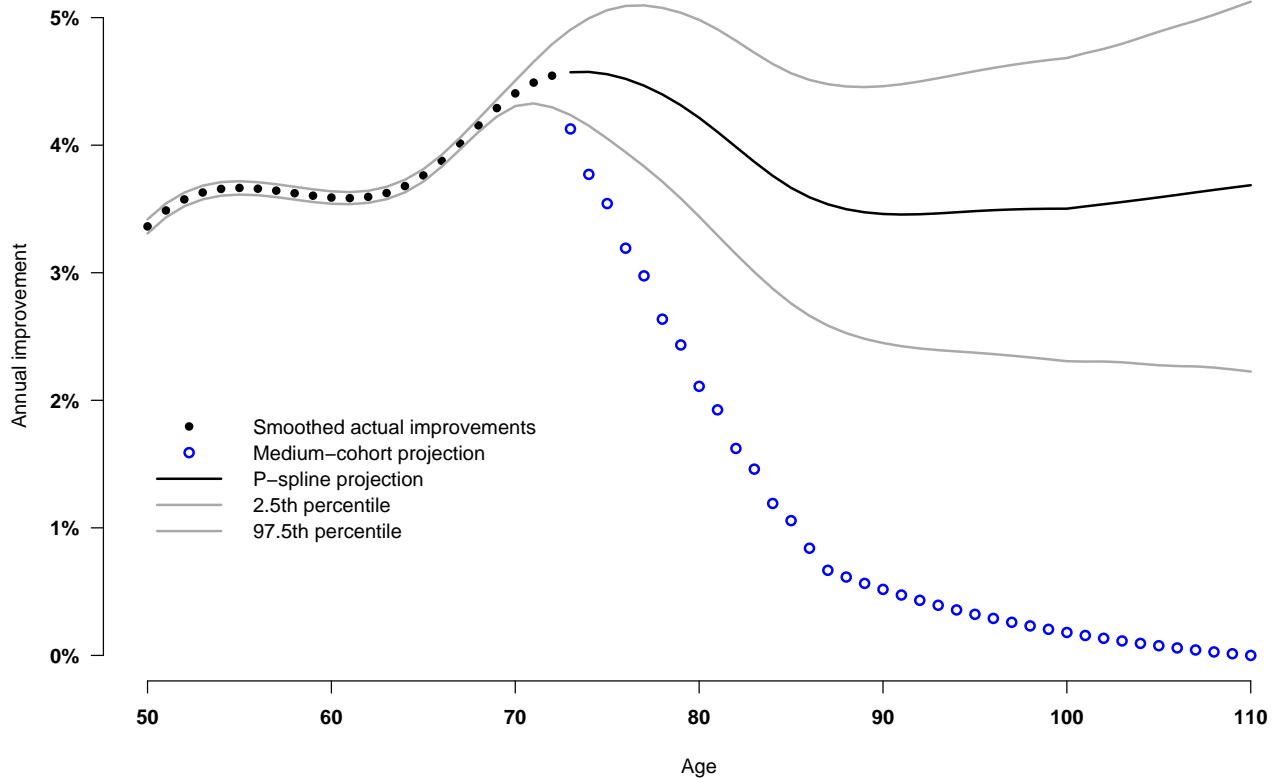
# Rise and fall of heart-disease mortality

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Source: Azambuja and Levins (2007). Data from Massachusetts Department of Public Health “Registry of Vital Records and Statistics”.

# Adequacy of improvement basis



Source: Richards et al (2007)

## 2. Capital-market solutions

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# Basis risk

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<b>Scheme</b>	<b>Members</b>	<b>Concentration*</b>
E	40	11%
H	800	12%
C	5,300	6%

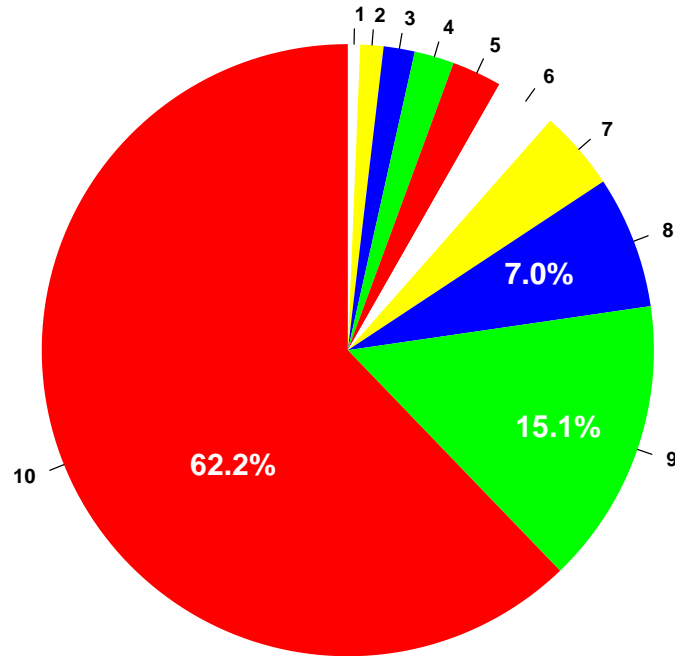
Largest scheme (C) pays 50% of all pensions to just 6% of members.

Source: Richards Consulting calculations using Prudential data.

\* Concentration is the percentage of members accounting for half of all pensions in payment.

# Concentration of income by membership decile

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Source: Richards Consulting calculations using Prudential data for Scheme C.

# Concentration of risk

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- Gini co-efficient measures income inequality
- 36.8% for UK, one of the more unequal countries
- 70.8% for Scheme C

Source: [mortalityrating.com](http://mortalityrating.com)

# Current scheme options

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- Buy-out: total defeasance of legal and economic risks
- LDI: some hedging of economic risks, none of longevity or legal risk
- Securitization
- Options and reinsurance
- Derivatives and indices

# Risks with buy-out

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- Individual buy-out policies upon wind-up are safe
- Buy-out policies as ongoing scheme asset still risky
- *Uberima fides* applies to scheme, not insurer

# Options and reinsurance

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Scheme	Members	Option cost
E	40	7.7%
H	800	2.6%
C	5,300	0.6%

Source: Richards Consulting calculations using Prudential data.

Option cost is percentage of reserves calculated at 5% interest using 90% PNxA00 with medium-cohort improvements with a 1.5% p.a. floor. Pensions assumed escalating at 2.5% per annum.

# Securitization

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- Transfer as much economic and longevity risk as you want
- Trustee-friendly as AAA-rated
- Enhances employer covenant
- Investor-friendly as limited longevity risk
- Not insurance, so lower capital requirements

# Legal wrinkles with securitization

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- LDI leaves scheme with all legal and economic risks
- Insurers may not honour scheme-asset buy-outs in extreme cases
- Securitization not yet recognized in PPF process for employer insolvency

# Derivatives and indices

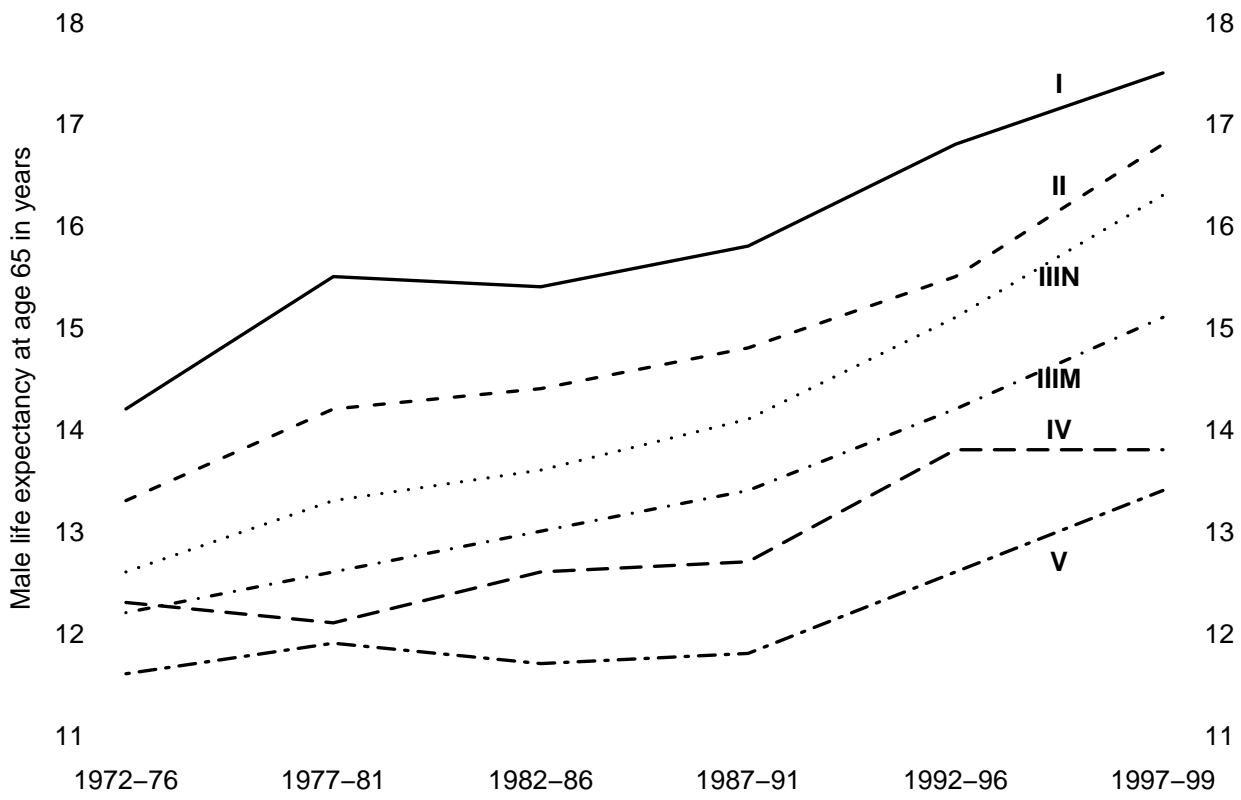
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- Index-based contracts based on population statistics
- Examples: LifeMetrics (JPMorgan) and Credit Suisse
- Substantial basis risk
- Partial coverage (e.g. 30%) often most efficient

# 3. Socio-economic group

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# Retirement life expectancy by socio-economic group



Source: ONS Longitudinal Survey.

# Financial impact of lifestyle

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## Financial impact of mortality rating factors

<b>Factor</b>	<b>Step change</b>	<b>Reserve</b>	<b>Change</b>
Base case	-	13.39	-
Gender	Female-male	12.14	-9.3%
Lifestyle	Top-bottom	10.94	-9.9%
Duration	Short-long	9.88	-9.7%
Pension size	Large-small	9.36	-5.2%
Region	South-North	8.90	-4.9%
Overall	-	-	-33.6%

Source: Richards and Jones (2004), page 39.

# Why fund size is not reliable

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- Stakeholder fund of £8,583
- Poor? Higher-mortality group?
- But AVC fund elsewhere of £42,808...
- ...giving total fund of £51,391...
- ...so not poor and likely light mortality!

# How not to do postcode rating

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- Beware any solution based on regional or population data!
- Test: EH4 2AB v. EH11 2AS
- Rating the two the same is simply wrong

# 4. Bespoke risk models

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# Limitations of postcode-only solution

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- Scheme has credible data: 9,000 lives
- A/E suggests 150% PCMA00
- Postcode model suggests 110% PCMA00
- Which is correct?

# Limitations of A/E analysis

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- Vulnerable to shifts in membership profile
- Barber judgement
- De-industrialization

# Survival models

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- Statistical models, so better than A/E calculations
- Full and efficient use of data, so better than GLMs
- Can handle age, gender, postcode, pension size
- ... also cohort, region, time trend and duration
- Models can be fitted weighted by pension size or reserve
- Bootstrapping can check financial applicability

# 5. Summary and questions

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## 5. Summary and questions

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- Strong pattern of mortality improvements likely to continue
- Medium cohort inadequate for best-estimate purposes
- Capital-market alternatives to buy-out
- Postcode rating for socio-economic mix
- Survival models best for bespoke risk analysis

# References

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LONGEVITAS **2006** *Modelling pensioner mortality*, [www.longevity.co.uk](http://www.longevity.co.uk)

COCEVAR, P. **2007** *An analysis of recent mortality trends in the Italian population using penalised B-spline regression*, submitted paper

RICHARDS, S. J. AND JONES, G. L. **2004** *Financial aspects of longevity risk*, SIAS

RICHARDS, S. J., ELLAM, J. R., HUBBARD, J., LU, J. L. C., MAKIN, S. J. AND MILLER, K. A. **2007** *Two-Dimensional Mortality Data: Patterns and Projections*, British Actuarial Journal (to appear)

