# Recent developments in mortality

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PATERNOSTER

# Recent developments in mortality

What is causing the life expectancy of pensioners in the UK to increase?

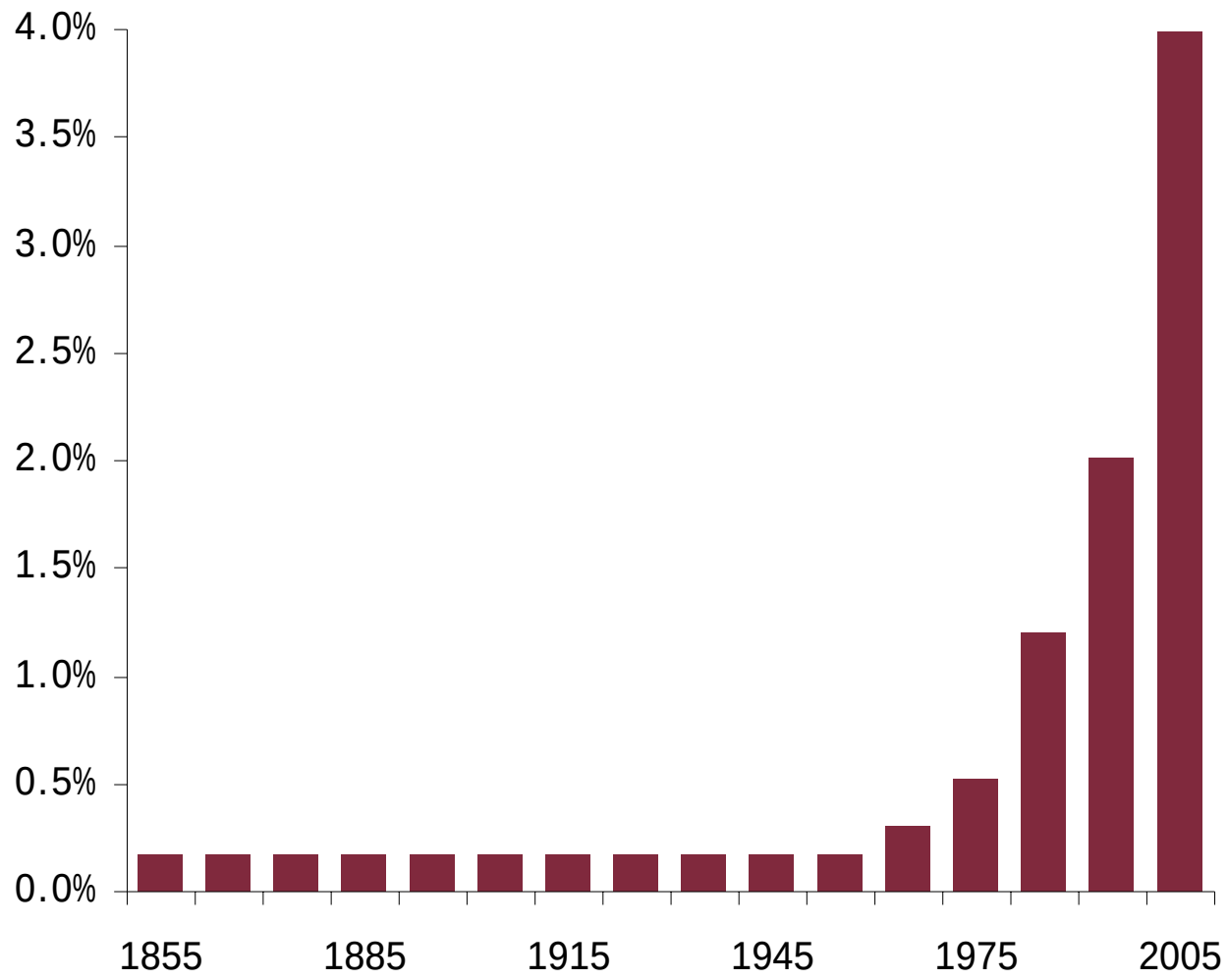
How can this understanding be used to interpret mortality projections?

# We are seeing unprecedented change

For men aged **65-74** in England & Wales the reduction in mortality rates over the past **15 years** was similar to that achieved over the previous **150 years**

# We are seeing unprecedented change

**Average annual reduction in mortality rates for men in England & Wales aged 65-74 (smoothed)**

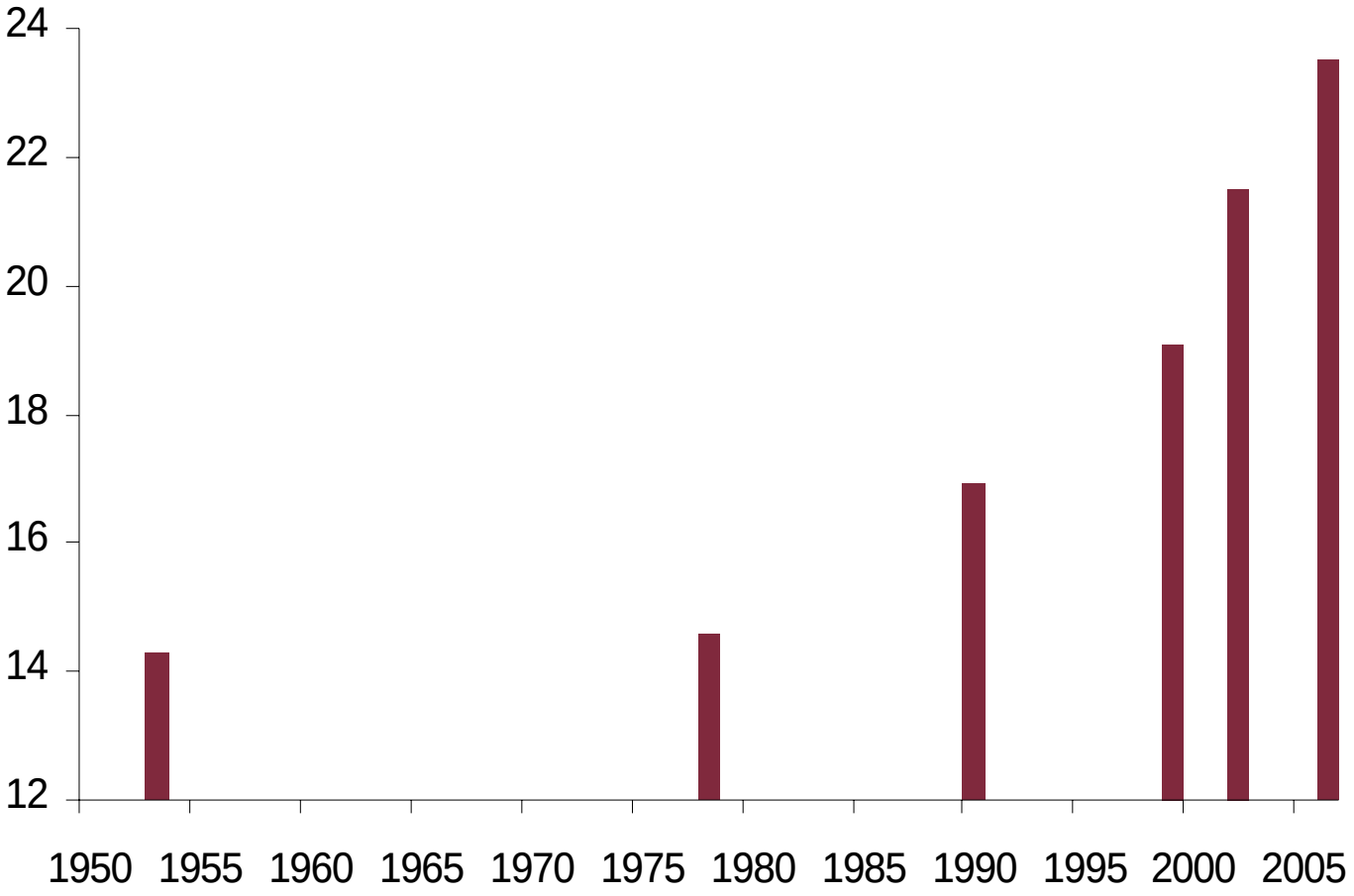


## We are seeing unprecedented change

In the UK actuaries' estimates of male life expectancy at retirement have probably changed more in the past **10 years** than in the previous **100 years**

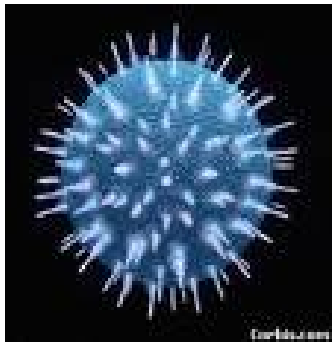
# We are seeing unprecedented change

**Projected life expectancy for male pensioners aged 65 based on published actuarial tables and projections**



# Partly due to the emergence of the “cohort effect”

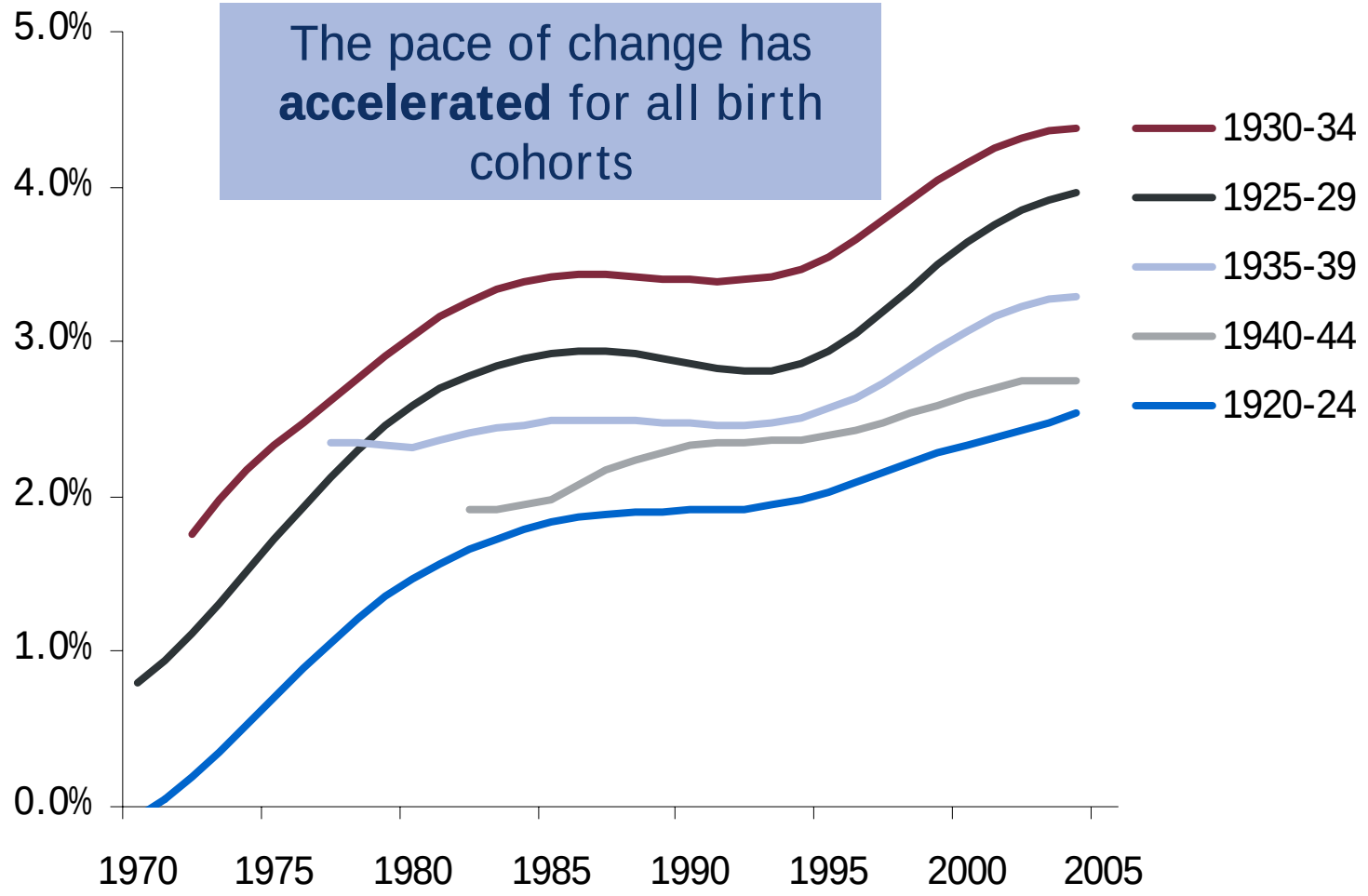


In the UK men and women **born in the period 1925-45** have experienced more rapid reductions in mortality rates than generations born either before, or after, this period

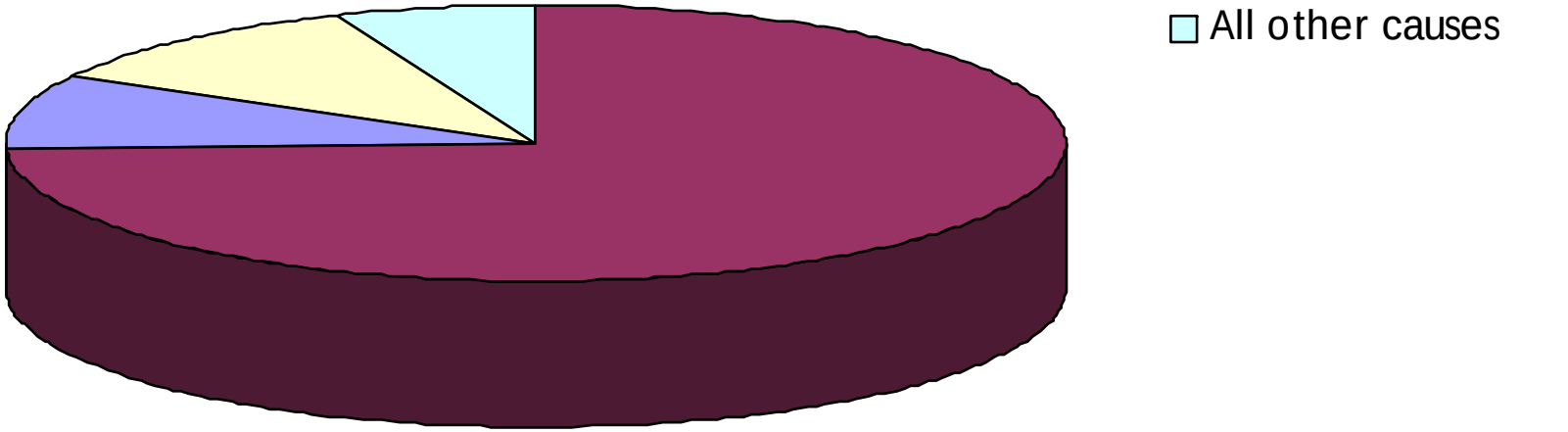
# But not entirely…

**Annual reduction in mortality rates for men in England & Wales by year of birth (smoothed)**



# Circulatory disease mortality dominates trends

**Share of current improvements for 1930-34 birth cohort, males in the population of England & Wales, by cause of death**



# Using the p-spline model with cause-of-death data

Mortality data by cause of death for England & Wales is generally available in 5-year age bands

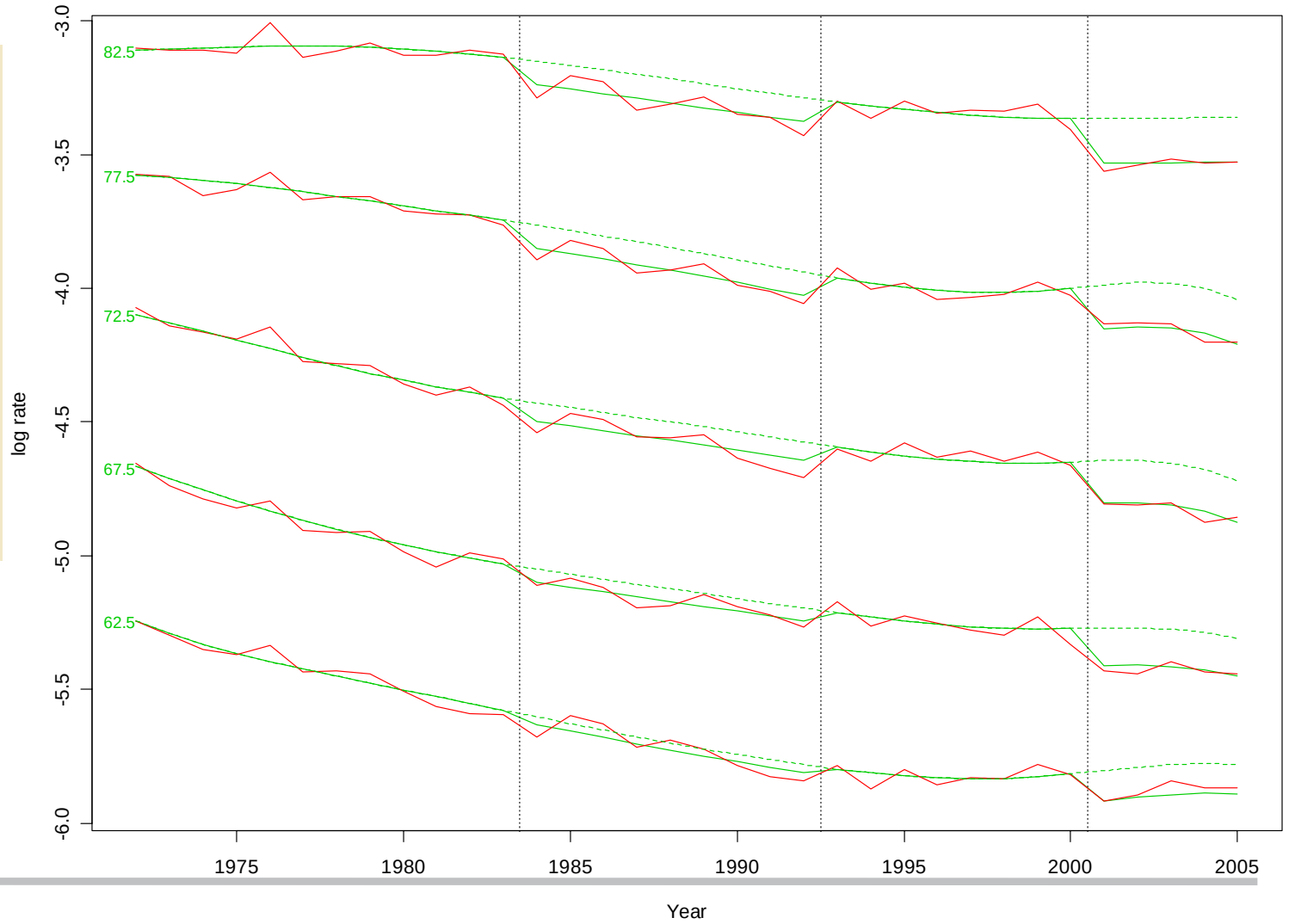
Causes need to be sub-divided into relatively broad categories

It is important to allow for the impact of changes in cause classification and methodology

A model has been developed with James Kirkby

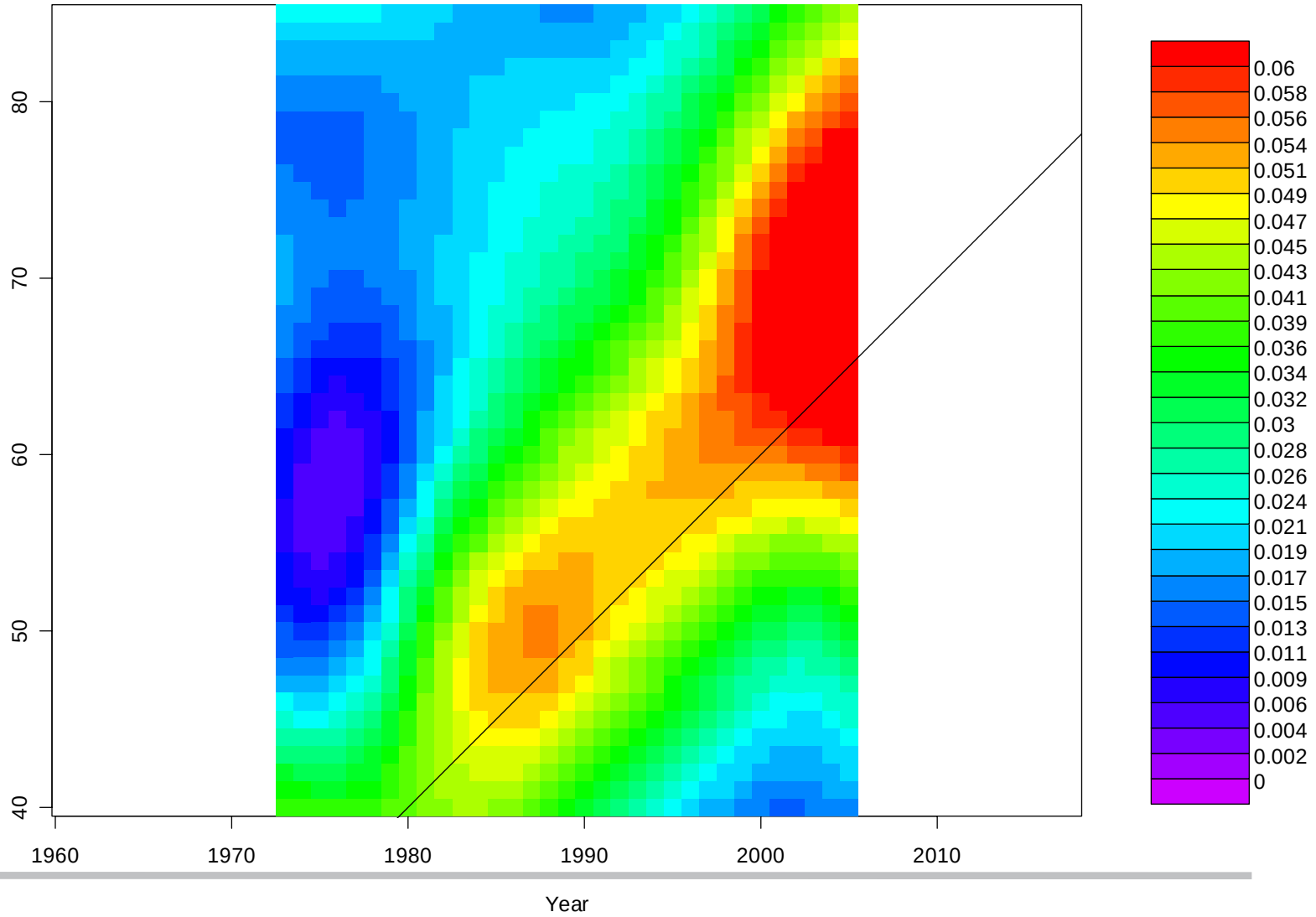
# Model needs to allow for step-changes in cause classification

**Raw, smoothed and adjusted log mortality rates for males in England & Wales for all causes other than circulatory and cancer by age**



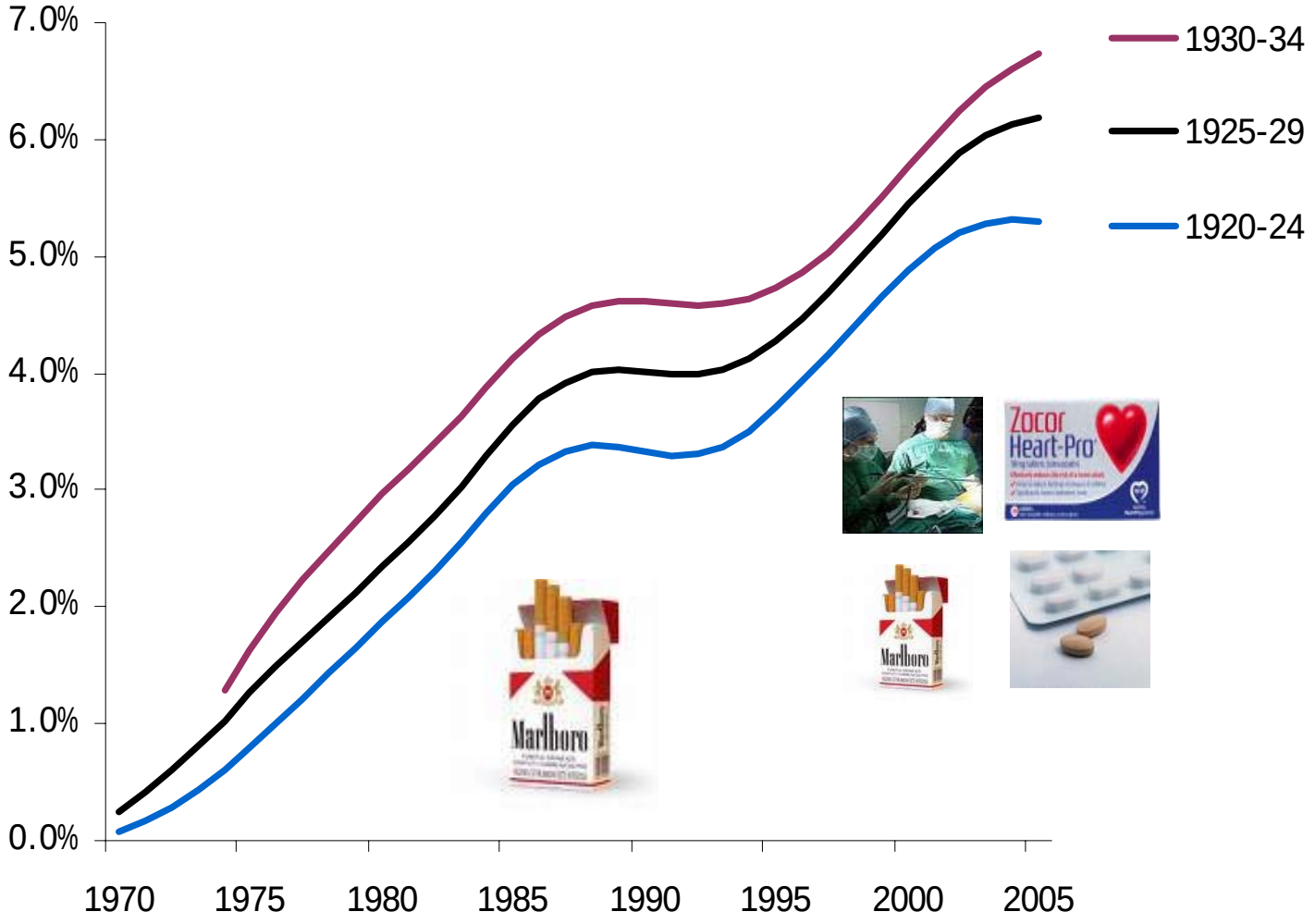
# Model fitted to circulatory causes

**Annual mortality rate decline by age and calendar year derived using a p-spline model fitted to mortality rates for males in England & Wales for all circulatory causes**



# Accelerating improvements for circulatory disease

**Annual reduction in circulatory disease mortality rates for men in England & Wales by year of birth (smoothed)**



# The National Service Framework (NSF) for Heart Disease

Requires the NHS and partner agencies to aim to **reduce the prevalence of risk factors** in the population

Requires GPs and care teams to identify appropriate **treatment for all people with cardiovascular disease**

Requires GPs and care teams to identify appropriate **treatment for all people** *at significant risk* **of developing cardiovascular disease**

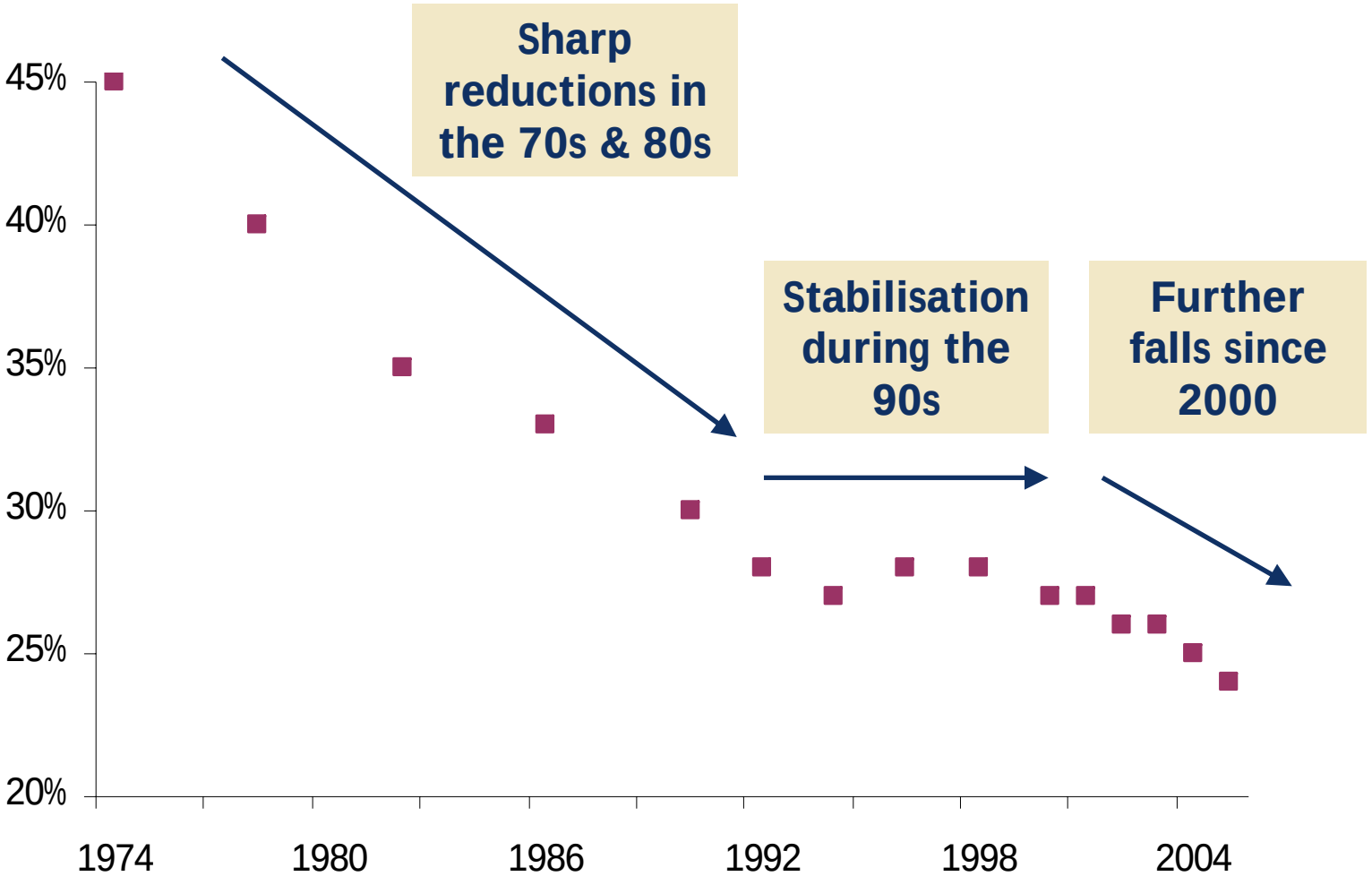
Sets **standards for treatment** of heart attack, angina and heart failure

# Heart Disease NSF progress report for 2006

| | Then | Now |
|---|---|---|
| Adult smoking prevalence | **28%** (2000) | **24%** (2004) |
| Estimated number of lives saved with statins p.a. | **2,900** (2000) | **9,700** (2005) |
| Number of patients waiting over 3 months for heart surgery | **5,663** (Apr 2002) | **Zero** (Mar 2005) |
| Percentage of heart attack victims given thrombolysis within 30 mins of arrival at hospital | **38%** (2000) | **83%** (Apr 2005 to Mar 2006) |
| Consultant cardiologists | **467** (1999) | **725** (Sept 2005) |

# Cigarette smoking trends

**Prevalence of cigarette smoking among adults in Great Britain, source: ONS**



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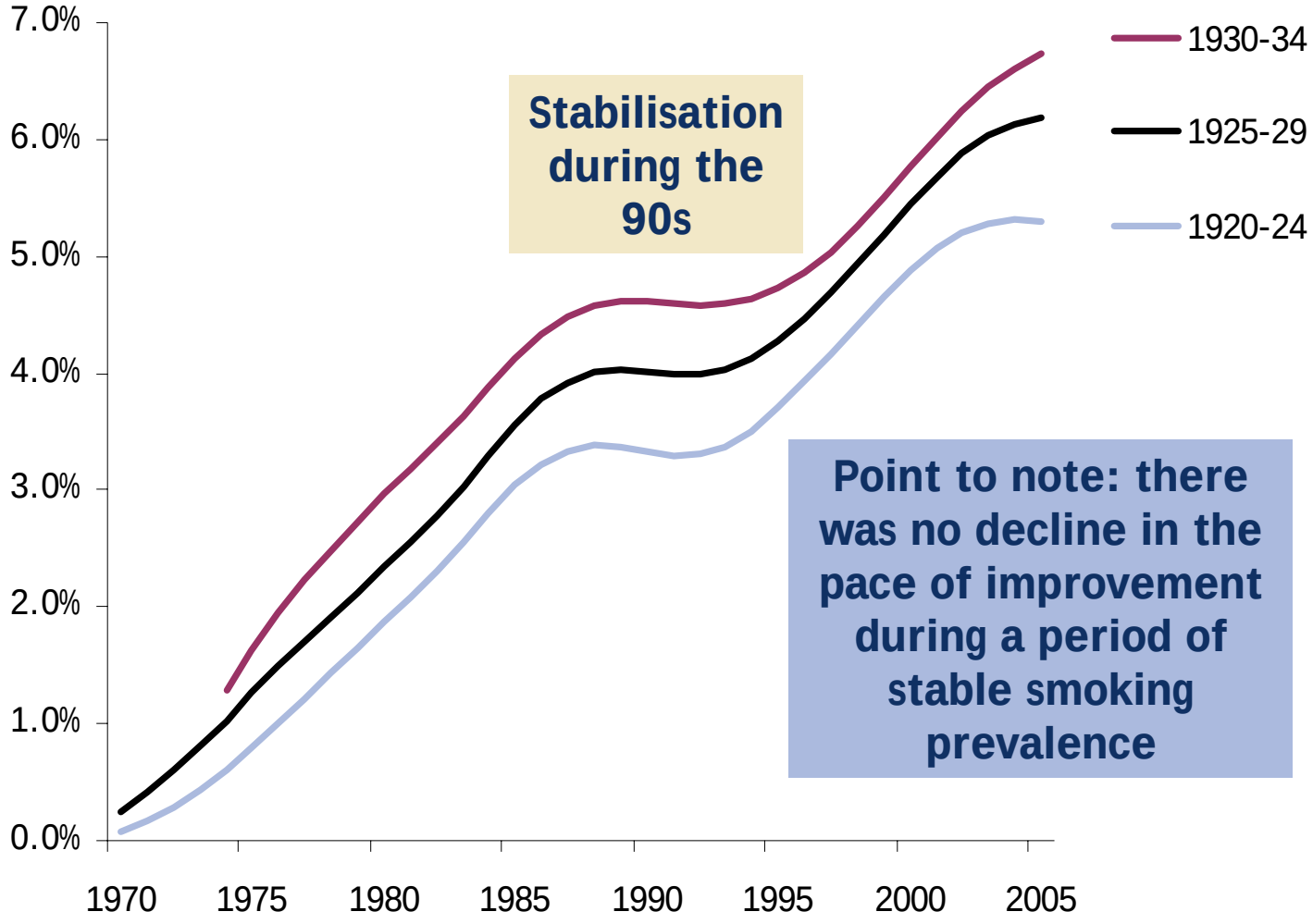


# Further impetus for reductions in cigarette smoking

In England the ban on smoking in enclosed public places will come into force on 1 July 2007

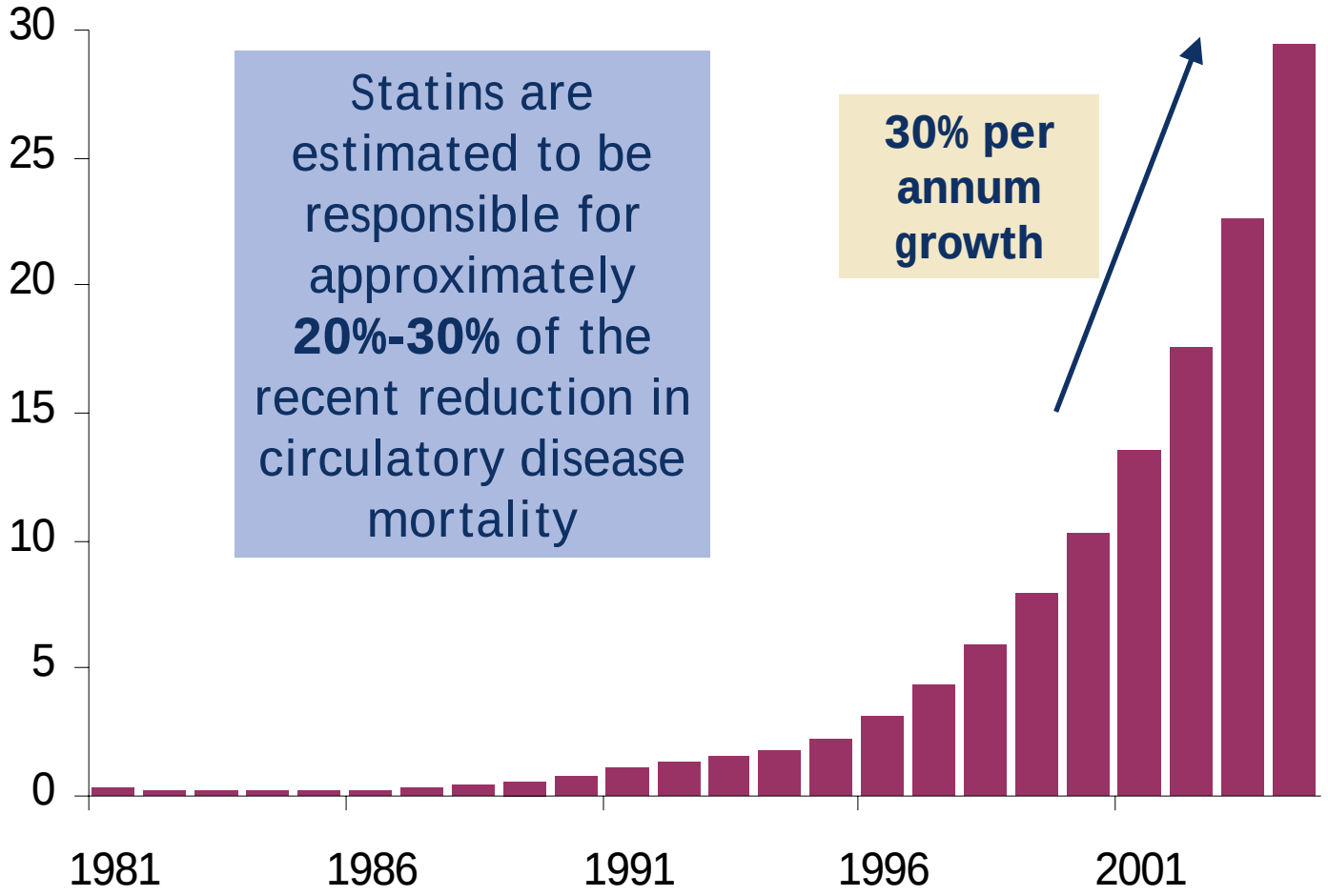
The EU is considering a Europe-wide ban

There is evidence that media campaigns are becoming more effective

Surveys suggest that smoking is becoming less socially acceptable

# Use of statins has shown rapid growth

**NHS prescriptions for lipid regulating drugs, including statins (millions) in England, source: DoH**



# More on statins

The NHS spends more on statins than any other class of drug

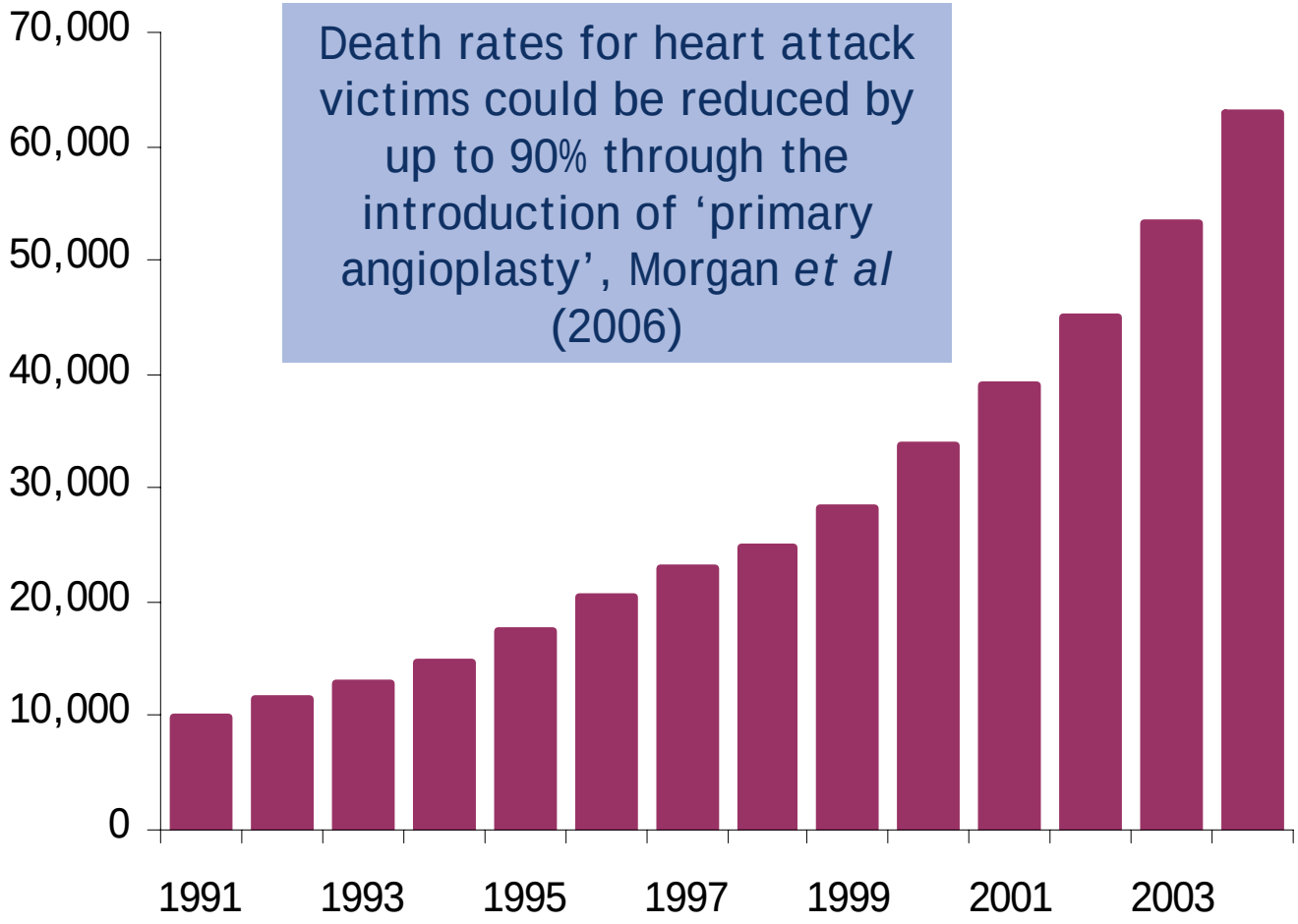
In 2006 the National Institute for Health and Clinical Excellence (NICE) revised its guidelines for statin prescription, making a further **3.3 million** people eligible for statin treatment on the NHS

*Simvastatin* has been available without prescription since July 2004

High doses of statins have been found to reverse atherosclerosis, JAMA 2006

# Angioplasties have become increasingly common

**Number of percutaneous coronary interventions per year, 1980-2004, United Kingdom, source: BCIS**




Death rates for heart attack victims could be reduced by up to 90% through the introduction of 'primary angioplasty', Morgan *et al* (2006)

# Views on future circulatory disease mortality

*"Premature death from heart disease could be eliminated within 10 years"* - Professor Roger Boyle, National Director for Heart Disease & Stroke (2004)

Cardiovascular disease could be reduced by 80%, Professors Wald & Law (2003)

Relatively modest changes in population cholesterol, blood pressure and smoking levels could reduce heart disease mortality by 50%, Health Development Agency (2004)

Medical experts tend to suggest 20-year reductions for circulatory disease mortality in the range 60%-75%, personal communication

# Alternative projections…

**Average annual reduction in circulatory disease mortality rates for men in England & Wales born in 1930-34 (smoothed)**

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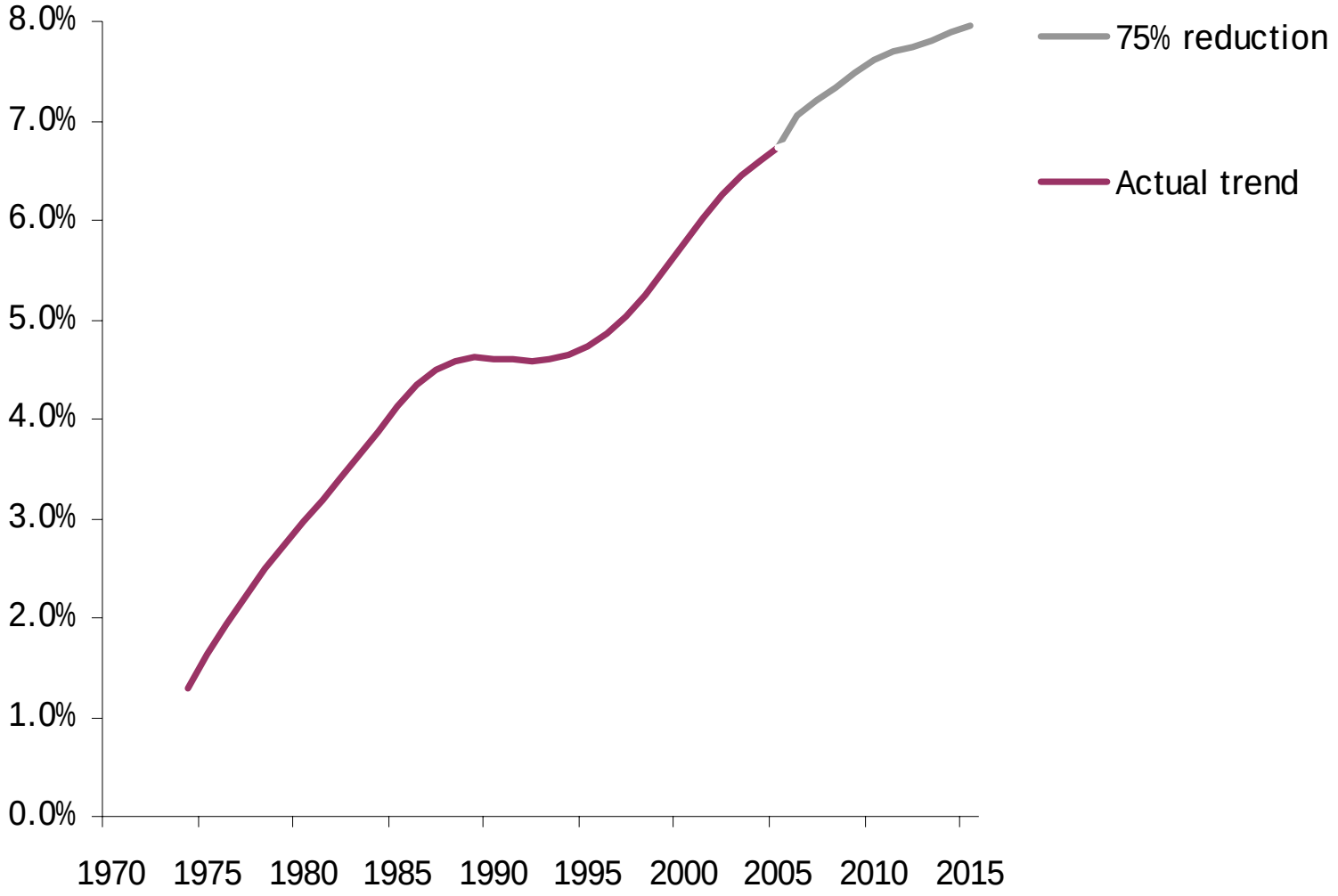

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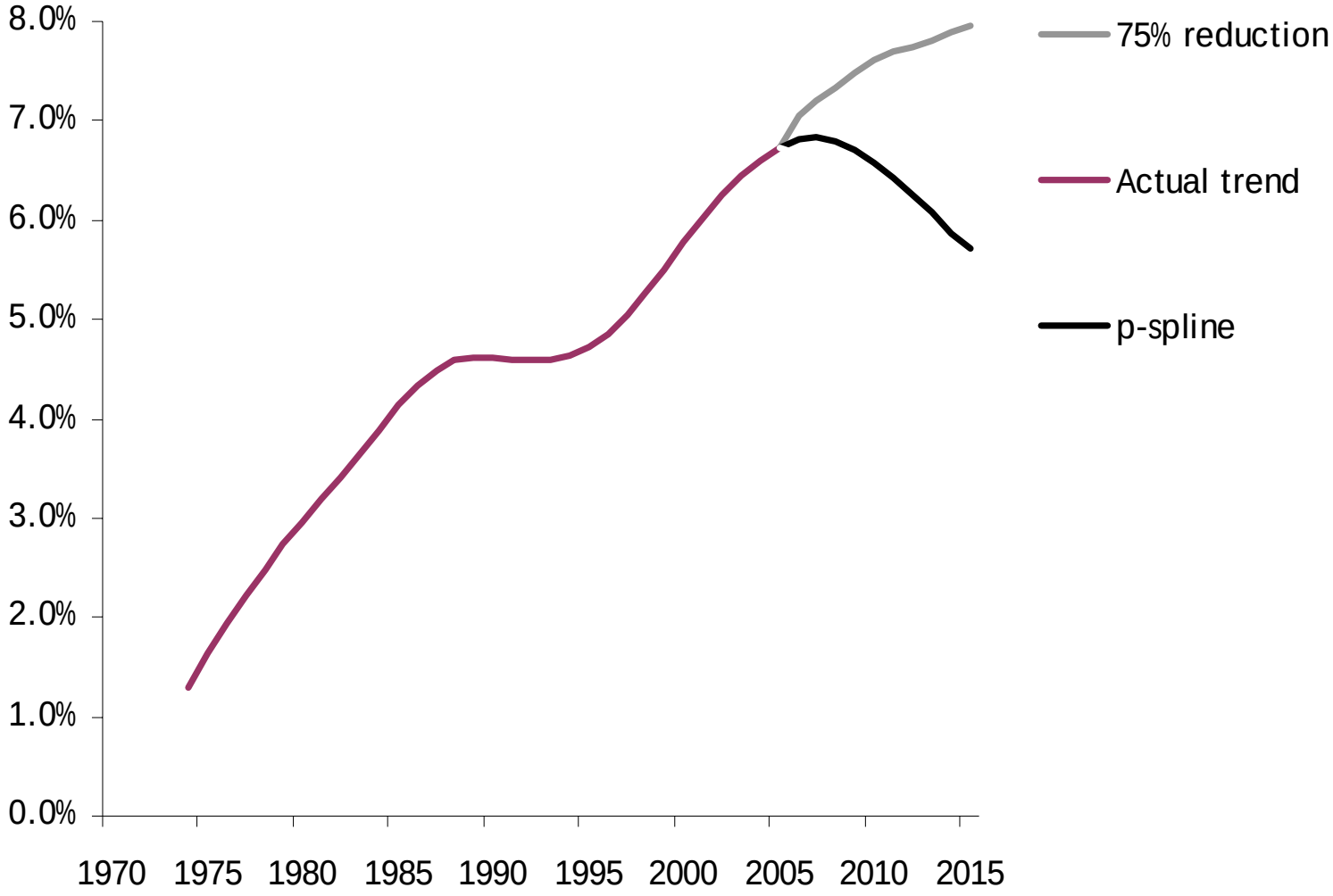

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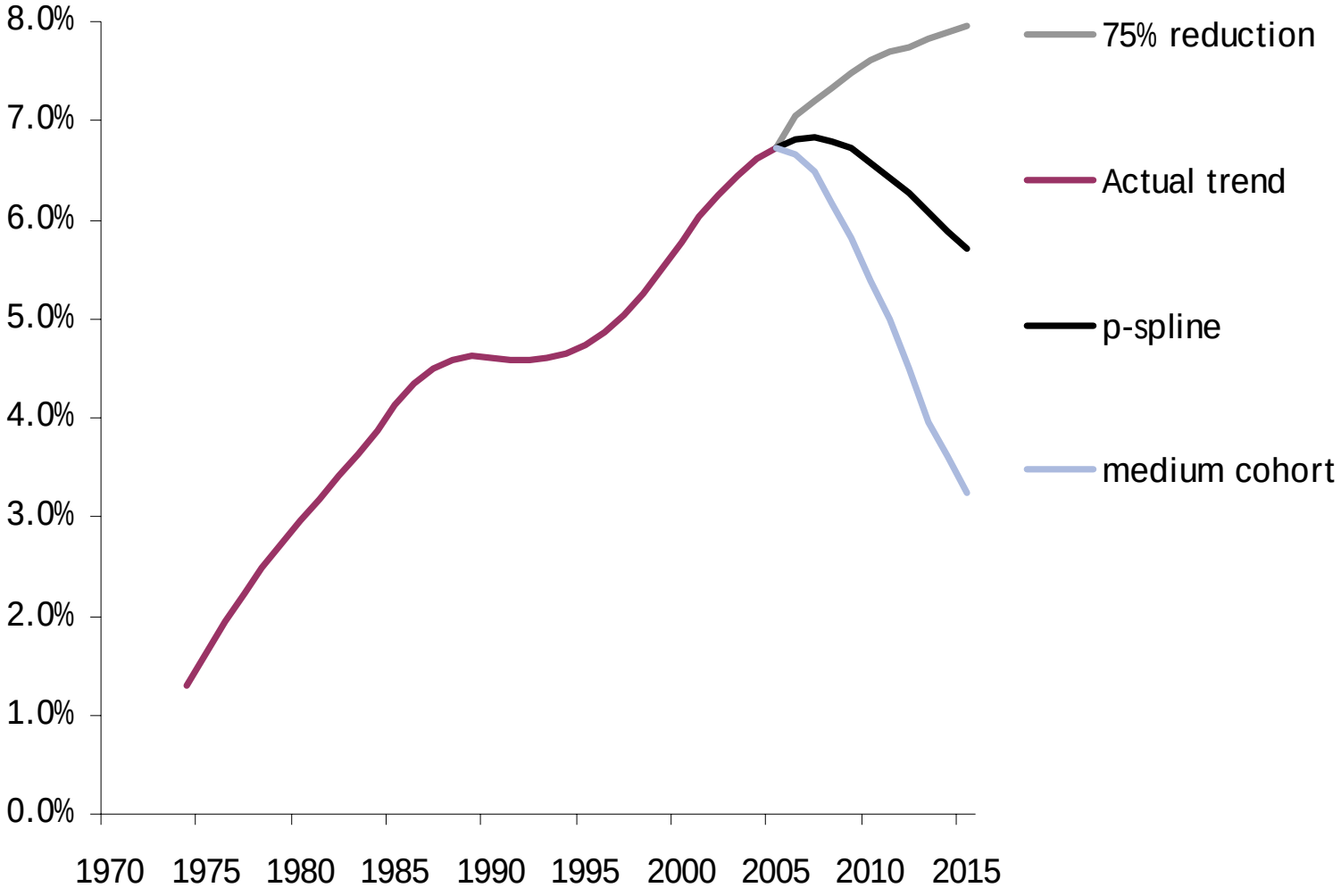

# The medium cohort projection

Published by the Continuous Mortality Investigation (CMI) in 2002

Based on data to 1999

Assumed the “cohort effect” would begin to fade away immediately to disappear completely by 2020

[Until recently] widely for annuity pricing

Actuaries advising pension schemes have been slower adopters

# Four categories of projection basis

"Continued acceleration"

"Trend reversal"

"Extreme trend reversal"

"No future improvements"

**Classification by outcome rather than methodology**

## “Continued acceleration”

The pace of improvement **continues to accelerate** in line with recent trends. Medical advances continue to occur at a faster and faster pace.

As each major cause of death is reduced, resources are re-deployed to tackle the causes that have become more significant as a result.

## “Trend reversal”

Mortality rates from circulatory disease continue to reduce rapidly but **other causes of death prove more difficult to eliminate**. The total pace of improvement slows as deaths from heart disease and stroke become less common.

Generations born in the post-war years continue to experience less rapid improvement as increasing obesity and alcohol-related illness take their toil.

## “Extreme trend reversal”

As per “trend reversal”, **but the pace of change in circulatory disease mortality also reduces sharply**.

Typical justifications tend to focus on trends in cigarette smoking and/or rising obesity levels.

## “No future improvements”

Does it exactly what it says on the tin!

Possibly justified with reference to obesity, bird flu, climate change and perhaps the feeling that this whole mortality improvement thing is over-hyped and, besides, who can tell what’s going to happen in the future anyway…

# Commonly used projections

*Continued acceleration*

*Trend reversal* → Equivalent to using the *long cohort* projection or the *medium cohort* projection with a relatively high improvement floor (say 1.5% to 2.0% per annum).

*Extreme trend reversal* → Equivalent to using the *short cohort*, *medium cohort* or the *medium cohort* projection with a relatively low improvement floor (say 1.25% or below).

*No future improvements*

## Current practice

| | |
|---|---|
| *Continued acceleration* | Consistent with methodologies used by some insurance companies for Individual Capital Assessment (ICA) calculations. |
| *Trend reversal* | Increasingly used by insurance companies for pricing/reserving. |
| *Extreme trend reversal* | Used by some insurance companies for pricing/reserving. Used by many consultancies for pension scheme valuation. |
| *No future improvements* | Rare. But can still be found! |

# Four categories of projection basis

"Continued acceleration"

"Trend reversal" → **Most suitable category to use for a realistic assessment of pension liabilities**

"Extreme trend reversal"

"No future improvements"

# Four categories of projection basis

"Continued acceleration" → **Should be illustrated by scenario generation or stochastic modelling**

"Trend reversal"

"Extreme trend reversal" → **Should be illustrated by scenario generation or stochastic modelling**

"No future improvements"

# The financial effect of different assumptions

- For a typical pension scheme the difference between "no future improvements" and "continued acceleration" could be in the region of **30%**
- Aggregate UK pension scheme liabilities may be understated by approximately:-
  - **£75bn** using a "trend reversal" projection
  - **£175bn** using a "continued acceleration" scenario.



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