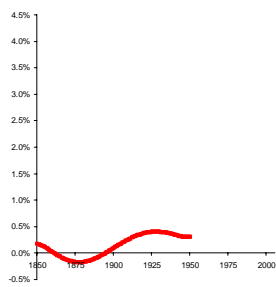


## The longevity revolution

Richard Willets, Paternoster

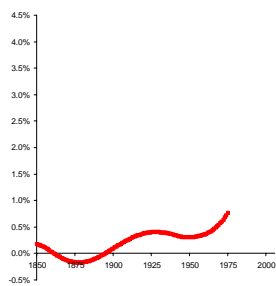
### The longevity revolution?



Source: own calculations using HMD/ONS data

Smoothed annual  
rate of mortality  
improvement,  
males, England &  
Wales, aged 70-79

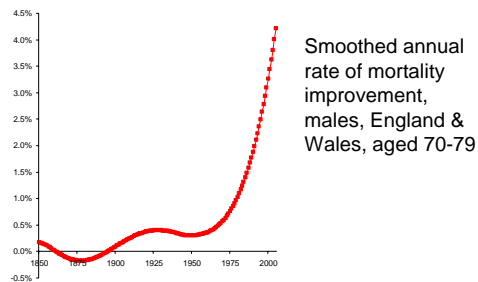
### The longevity revolution?



Source: own calculations using HMD/ONS data

Smoothed annual  
rate of mortality  
improvement,  
males, England &  
Wales, aged 70-79

## The longevity revolution?



Source: own calculations using HMD/ONS data

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## Some audience participation...

**Question 1: Ignoring the influence of cohort effects, how is the pace of improvement in mortality rates for people in the UK aged 60-89 likely to change over the next decade?**

- a) The rate of improvement will accelerate sharply
- b) The rate of improvement will accelerate
- c) The rate of improvement will stay broadly unchanged
- d) The rate of improvement will decelerate
- e) The rate of improvement will decelerate sharply

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## Some audience participation...

**Question 2: What is your best-estimate of the annual rate of mortality improvement which people in the UK aged 60-89 will be experiencing in 25 years time?**

- a) Less than 1.0% p.a.
- b) Greater than or equal to 1.0% but less than 1.5% p.a.
- c) Greater than or equal to 1.5% but less than 2.0% p.a.
- d) Greater than or equal to 2.0% but less than 2.5% p.a.
- e) Greater than or equal to 2.5% p.a.

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## The longevity revolution

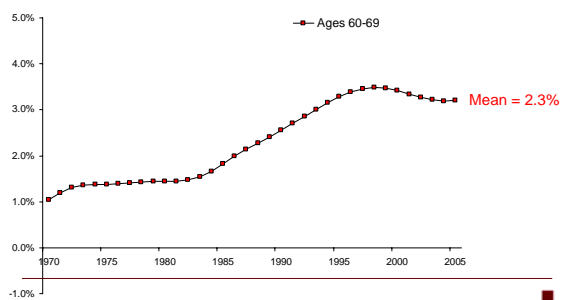
### Agenda:

- Understanding the acceleration
- Ten arguments for further acceleration
- Ten arguments for deceleration
- Your views/questions

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age group

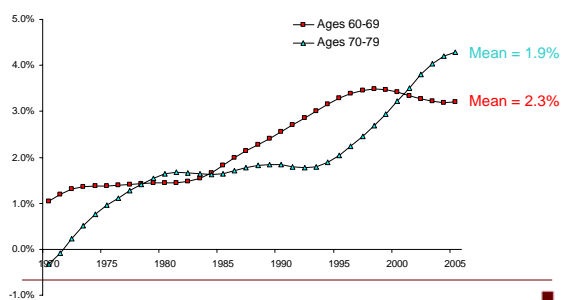


Source: own calculations using ONS data, improvements consistent with PSAC\_Male\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age group

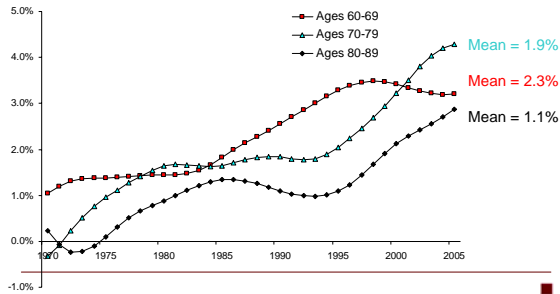


Source: own calculations using ONS data, improvements consistent with PSAC\_Male\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age group

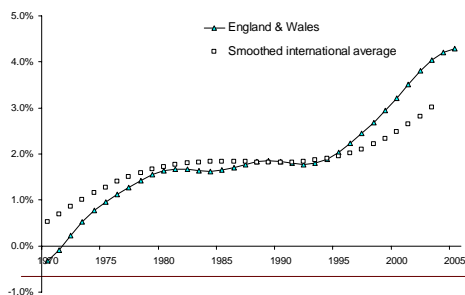


Source: own calculations using ONS data, improvements consistent with PSAC\_Male\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, males aged 70-79

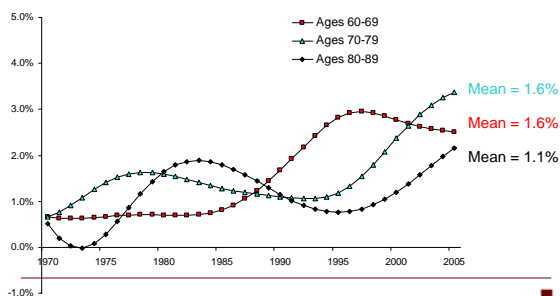


Source: own calculations using HMD/ONS data. International average based on data from 13 countries (Australia, Canada, Finland, France, Italy, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, USA & W. Germany).

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## Understanding the acceleration

Annual rate of mortality improvement, females, England & Wales, by age group

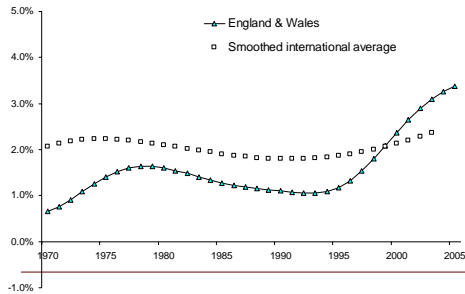


Source: own calculations using ONS data, improvements consistent with PSAC\_Female\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, females aged 70-79

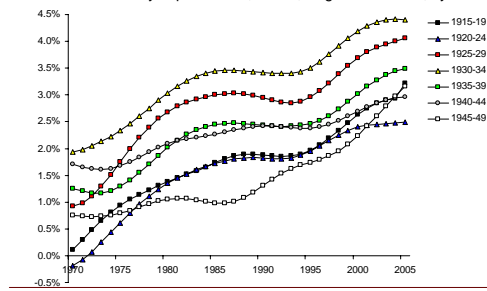


Source: own calculations using HMD/ONS data. International average based on data from 13 countries (Australia, Canada, Finland, France, Italy, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, USA & W. Germany).

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by birth cohort

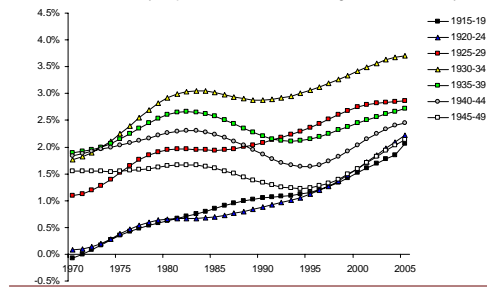


Source: own calculations using ONS data, improvements consistent with PSAC\_Male\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, females, England & Wales, by birth cohort

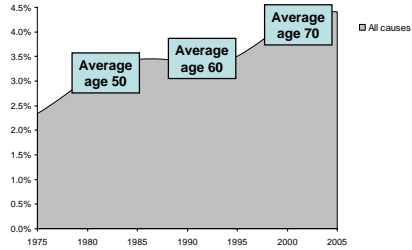


Source: own calculations using ONS data, improvements consistent with PSAC\_Female\_ONS\_2005\_50 from the CMI library of mortality projections

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, 1930-34 birth cohort, contribution by cause of death



Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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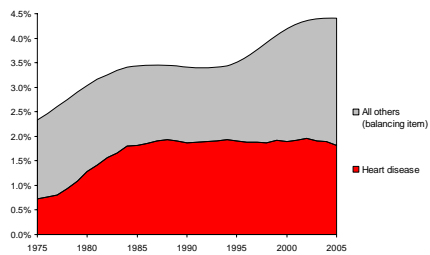
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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, 1930-34 birth cohort, contribution by cause of death



Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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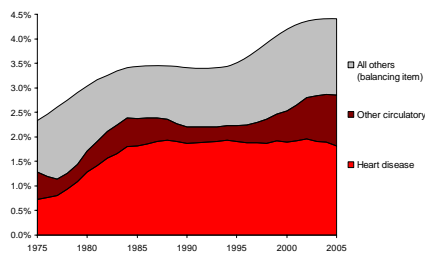
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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, 1930-34 birth cohort, contribution by cause of death



Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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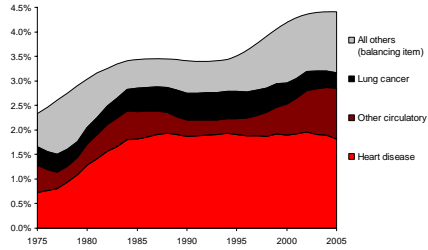
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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, 1930-34 birth cohort, contribution by cause of death

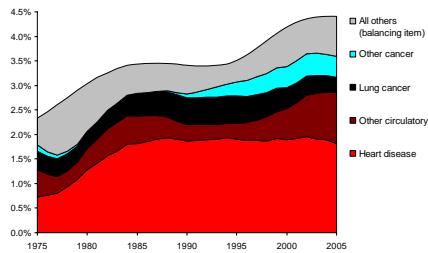


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, 1930-34 birth cohort, contribution by cause of death

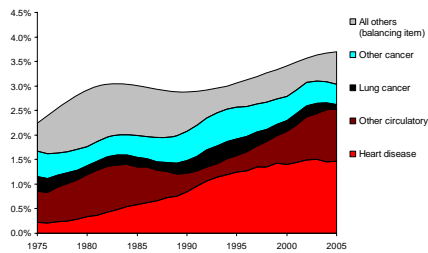


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of mortality improvement, females, England & Wales, 1930-34 birth cohort, contribution by cause of death

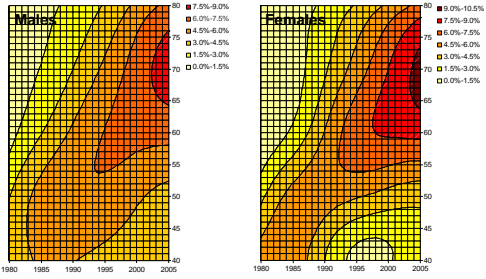


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of improvement in mortality from heart disease, England & Wales

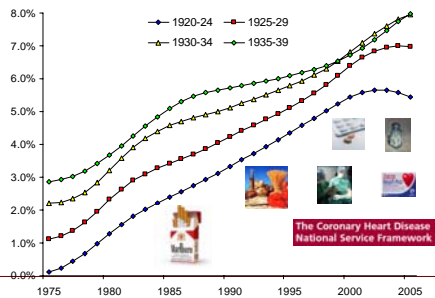


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of improvement in mortality from heart disease, males, Eng & Wales,

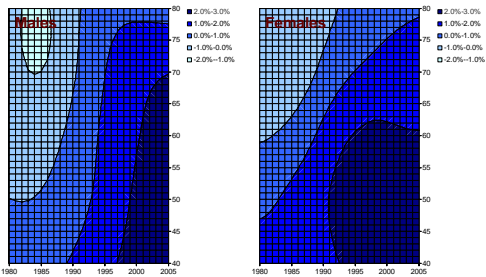


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of improvement in mortality from cancer (excl lung), Eng & Wales



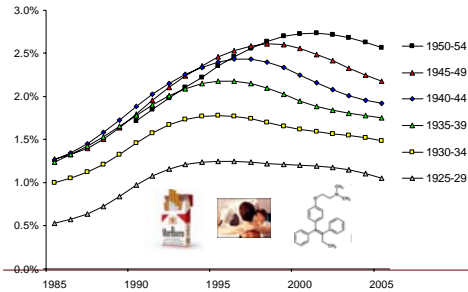
Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of improvement in mortality from cancer (excl lung), females, E&W

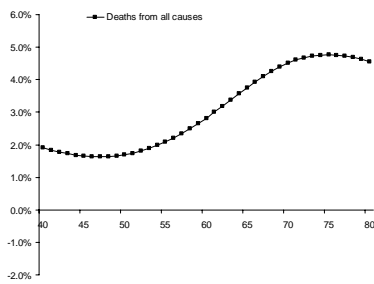


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age

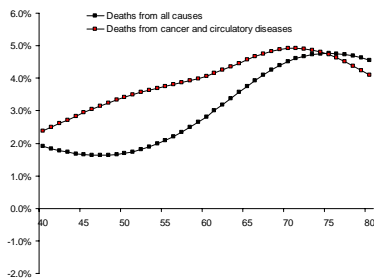


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age

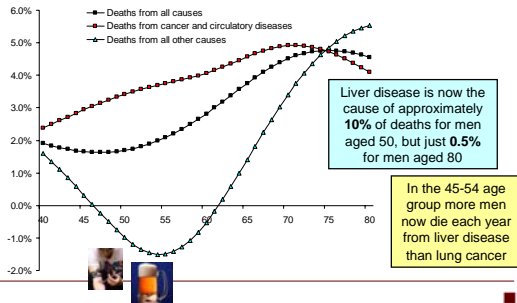


Source: own calculations using ONS data and a variant of the p-spline model developed by Paternoster to model mortality by cause of death

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## Understanding the acceleration

Annual rate of mortality improvement, males, England & Wales, by age



*"10-year projections have some connection with reality. 50-year projections are problematic. 100-year projections are perhaps best done by science-fiction writers."*

## 10 arguments for further **acceleration**:

1. Scientific innovation in general, and medical advances in particular, are occurring at a faster and faster pace

**10 arguments for further acceleration:**

2. The causes of death experiencing the most rapid improvements are (relatively speaking) more significant at older ages. As birth cohorts age they are likely to experience accelerating improvements.

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**10 arguments for further acceleration:**

3. The main factors underlying the recent acceleration in heart disease improvements are likely to continue in the next decade: i.e. further improvements in cholesterol and blood pressure levels, reduced smoking prevalence and continued expansion in therapies provided by the NHS

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**10 arguments for further acceleration:**

4. In particular, prevalence of cigarette smoking is likely to fall significantly over the next decade (the Paternoster panel of epidemiologists suggested 17.5% prevalence among UK adults by 2015)

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**10 arguments for further acceleration:**

5. Furthermore, average population blood pressure levels are also likely to fall significantly (the Paternoster panel of epidemiologists suggested that the average blood pressure for a 70-year old male in 2015 is likely to be the same as for a 50-year old in 2005)

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**10 arguments for further acceleration:**

6. Use of medication to control blood pressure and cholesterol levels has been increasing at an exponential rate (and scientists have begun discussing the possibility of polypills)

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**10 arguments for further acceleration:**

7. There has been extra-ordinary growth in public interest in healthier diets. This trend is likely to continue in the future, mirrored by the FSA and politicians. In the short-term particular attention is likely to be focussed on reducing intake of dietary salt and saturated fats

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**10 arguments for further acceleration:**

8. *"We are about to experience a genetic revolution which will see a leap in cure rates for cancer and a whole range of new, effective treatments..."*

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**10 arguments for further acceleration:**

9. Further development of vaccines and screening programmes for different cancer types are likely (the National Screening Programme for Bowel Cancer commenced in 2006/07, initially offering screening every two years to people aged 60-69)

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**10 arguments for further acceleration:**

10. The impact of lifestyle, and in particular diet, on cancer incidence is being increasingly understood. This research is likely to have a greater influence on trends in cancer incidence in the future

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**10 arguments for deceleration:**

1. The contribution to aggregate improvements from heart disease has peaked and will inevitably decline as deaths from heart disease become less common

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**10 arguments for deceleration:**

2. More generally, over the past decade we have seen a particularly favourable set of circumstances drive particularly rapid improvements. Over the long-run, long-term averages offer a better guide to the pace of likely future change

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**10 arguments for deceleration:**

3. Increasing obesity, especially among post-war generations, is a 'timebomb' which will become more and more significant as the epidemic 'matures'

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**10 arguments for deceleration:**

4. Since the 1960s the prevalence of cigarette smoking in the UK has fallen dramatically, but the pace of reduction has been much slower since the 1990s. The potential for reductions of the magnitude seen in the 1960s, 1970s and 1980s no longer exists

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**10 arguments for deceleration:**

5. The people who haven't died of heart disease and cancer (because of improvements in treatment) are more vulnerable to mortality from other causes

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**10 arguments for deceleration:**

6. In many cases cancer *incidence* rates have been increasing steadily

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**10 arguments for deceleration:**

7. Excess alcohol consumption, increasing drug use, stress, longer-working hours and more sedentary lifestyles may have a negative influence on mortality rates in the future, particularly among post-war generations

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**10 arguments for deceleration:**

8. The potential threat from infectious disease (and in particular hospital-acquired infections) has increased in recent years

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**10 arguments for deceleration:**

9. Issues related to global population growth, finite natural resources and/or climate change may threaten economic stability and divert resources away from health

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**10 arguments for deceleration:**

10. "...if we make major improvements in population health in terms of heart disease, cancer, etc... people will live long healthy lives until their 70s and 80s and will then have natural age-related organ decline and failure in the few years prior to death."

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**Have I missed anything important..?**

**Pause for suggestions...**

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**Your view...**

**Question 1: Ignoring the influence of cohort effects, how is the pace of improvement in mortality rates for people in the UK aged 60-89 likely to change over the next decade?**

- a) The rate of improvement will accelerate sharply
- b) The rate of improvement will accelerate
- c) The rate of improvement will stay broadly unchanged
- d) The rate of improvement will decelerate
- e) The rate of improvement will decelerate sharply

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## The long-term outlook

### Assumptions used in practice:

- ONS 2006-based projection (published Oct 2007)
  - Improvements generally tend towards a long-term rate of **1% p.a.** over a 25-year period
  - "The average annual rate of improvement over the whole of the 20th century was around 1% for both males and females although the improvement rates vary by age"
  - Improvements for individuals born in the period 1923-1940 tend towards long-term rates in excess of 1% p.a. (2.5% p.a. for people born in 1931)
  - The "high variant" projection assumes a long-term rate of **2% p.a.** (3.5% for people born in 1931)
  - The "low variant" projection assumes a long-term rate of **0% p.a.** (1.5% for people born in 1931)

## The long-term outlook

### Assumptions used in practice:

- Stephen Baxter, Institute of Actuaries Sessional Meeting (Feb 2007)
  - Suggested underpins of **1.25% p.a.** for males, **0.75% p.a.** for females
  - Based on an analysis of long-term trends in life expectancy at age 65 for the population of England & Wales, stripping out the impact of the 'cohort effect'

## The long-term outlook

### Assumptions used in practice:

- Pension Protection Fund, Annual Report (Oct 2007)
  - Assumption for future improvements in valuation basis:- long cohort with a floor of **1.5% p.a.** for males, **1.0% p.a.** for females

	Actual overall annual rates of mortality improvement	
	Males	Females
Last 22 years	2.0%	1.3%
Last 42 years	1.5%	1.3%
Last 72 years	1.2%	1.2%

## The long-term outlook

### Assumptions used in practice:

- Life office FSA Returns
  - improvement 'floors' of varying strength (typically in the range **0.75% p.a.** to **2.0% p.a.**) are often added to interim cohort projections

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## Your view...

**Question 2: What is your best-estimate of the annual rate of mortality improvement which people in the UK aged 60-89 will be experiencing in 25 years time?**

- a) Less than 1.0% p.a.
- b) Greater than or equal to 1.0% but less than 1.5% p.a.
- c) Greater than or equal to 1.5% but less than 2.0% p.a.
- d) Greater than or equal to 2.0% but less than 2.5% p.a.
- e) Greater than or equal to 2.5% p.a.

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## Any questions...?

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## The longevity revolution

Richard Willets, Paternoster

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