Current Developments in Aging and Mortality
Tuesday, April 18, 2017
Budapest Marriot Hotel

Is longevity *still* improving?

Brian Ridsdale
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Chairman, IAA Mortality Working Group

With thanks to:

Adrian Gallop, Jon Palin, Richard Willets, Magali Barbieri, Assia Billig, Al Klein, Sam Gutterman, Michael Sherris, Kriszti Halay, David Raymont and many others

Is longevity *still* improving?

Is longevity *still* improving?

"In some countries, recent years of heavier mortality cast doubt on assumptions about future mortality improvements. It's a subject of particular interest to life and pensions actuaries. What do we know so far?"

Terminology

ONS = Office for National Statistics (UK)

SMR = Age-Standardised Mortality Rate

E & W = England and Wales

EOL = "Life expectancy" = Period life expectancy

(unless specifically mentioned)

Improving longevity

We are accustomed to seeing longevity improving in developed countries

but not always

Quality warning:

It is hard to get up-to-date figures. Human Mortality Database is an excellent resource, but recent past is difficult to access anywhere

Need to revert from Life Expectancies to SMRs and even crude death rates to estimate rate of mortality improvement

Is longevity *still* improving?

30 years of improving longevity

What countries?

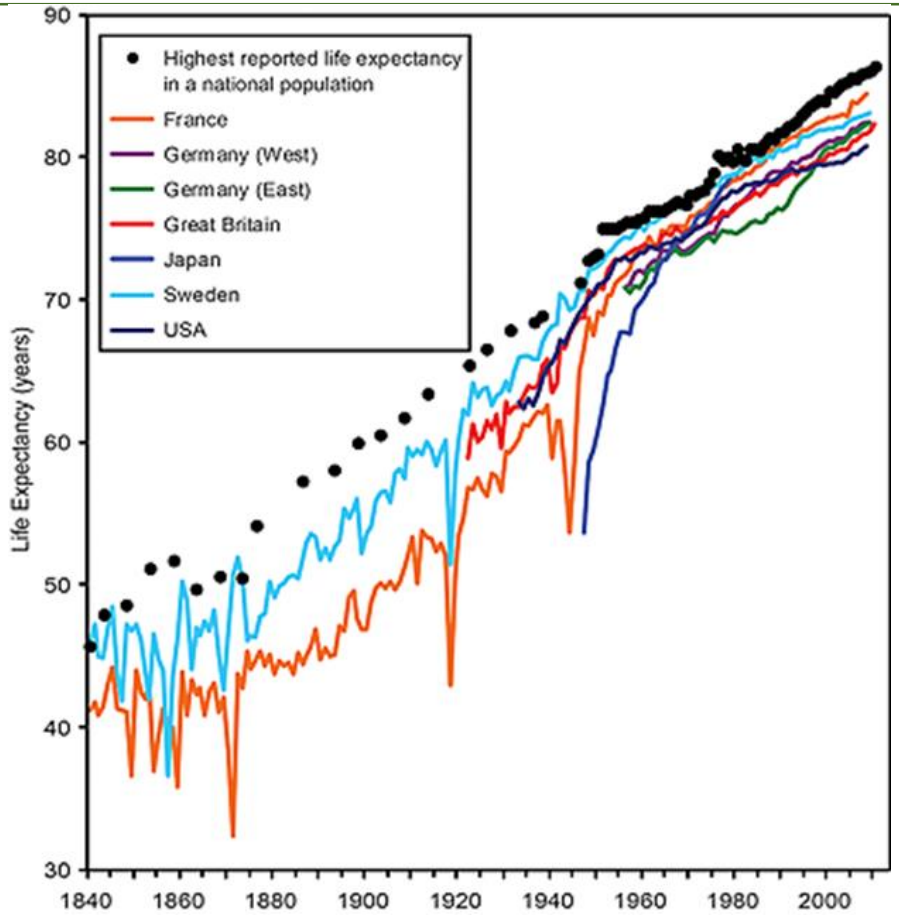
Recent developments

"Blip" or long-term change?

Causes

What are actuaries doing?

Female Life Expectancy in Developed Countries: 1840-2009



Source: Highest reported life expectancy for the years 1840 to 2000 from online supplementary material to Oeppen J, Vaupel JW. Broken limits to life expectancy. *Science* 2002; 296:1029-1031. All other data points from the Human Mortality Database (http://www.mortality.org) provided by Roland Rau (University of Rostock). Courtesy National Institute of Aging

Is longevity *still* improving?

30 years of improving longevity

What countries?

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What are actuaries doing?

What countries?

UK constituent countries

Rest of Europe, eg: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Australia

Canada

US

England and Wales
The future?

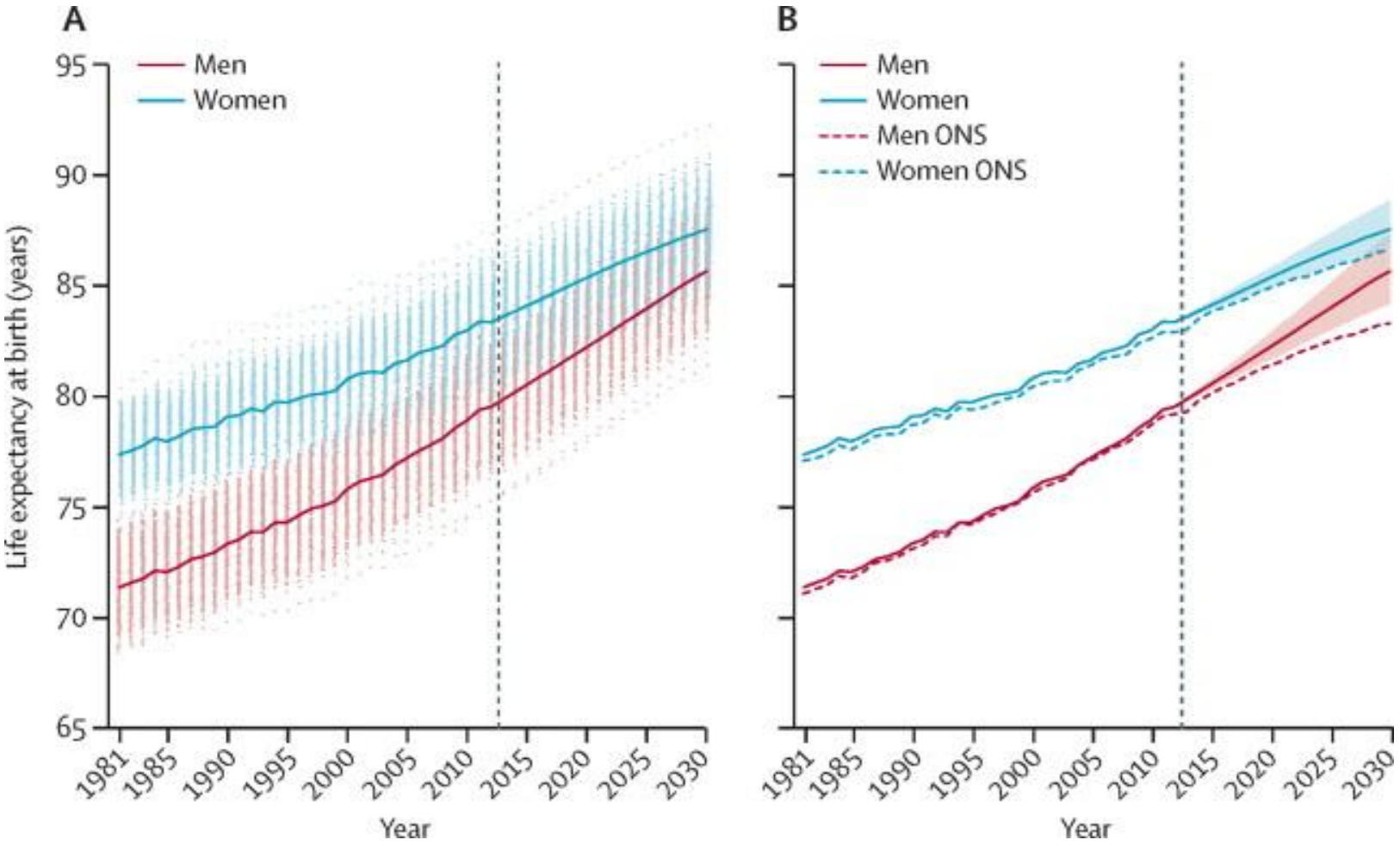
The future of life expectancy and life expectancy inequalities in England and Wales: Bayesian spatiotemporal forecasting

Bennett et al the Lancet July 2015

"Between 1981 and 2012, life expectancy increased by 8·2 years for men and 6·0 years for women"

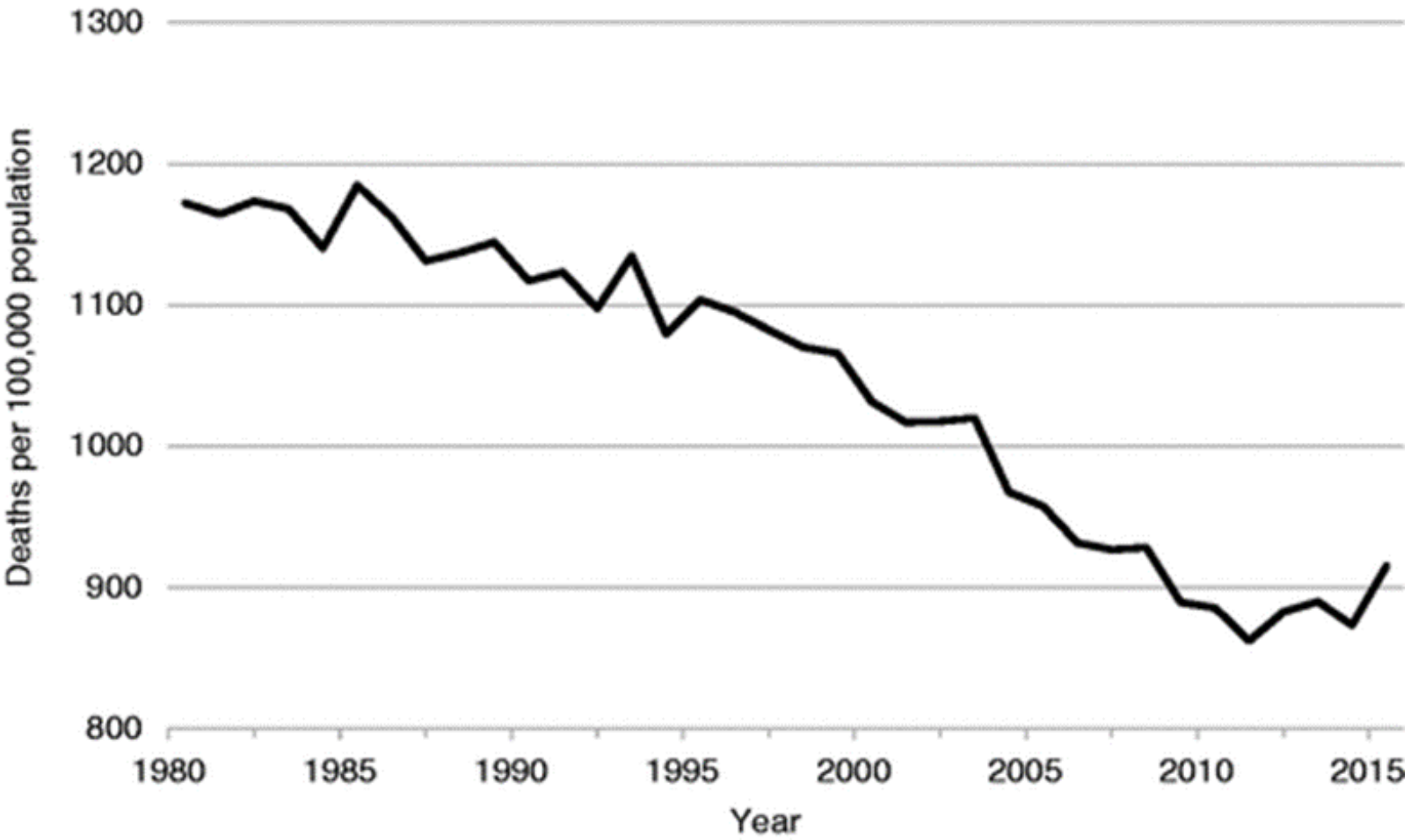
- *"Life expectancy at birth in England and Wales was 79·5 years … for men and 83·3 years … for women in 2012."*
- *"National life expectancy in 2030 is expected to reach 85·7 (up 6.2 years) for men and 87·6 years (up 4.3 years) for women"*
- They compare their forecasts with those of the ONS, and conclude that the ONS principal projections are significantly too low.

The future of life expectancy? England and Wales



The future of life expectancy and life expectancy inequalities in England and Wales: Bayesian spatiotemporal forecasting: Bennett et al the Lancet July 2015

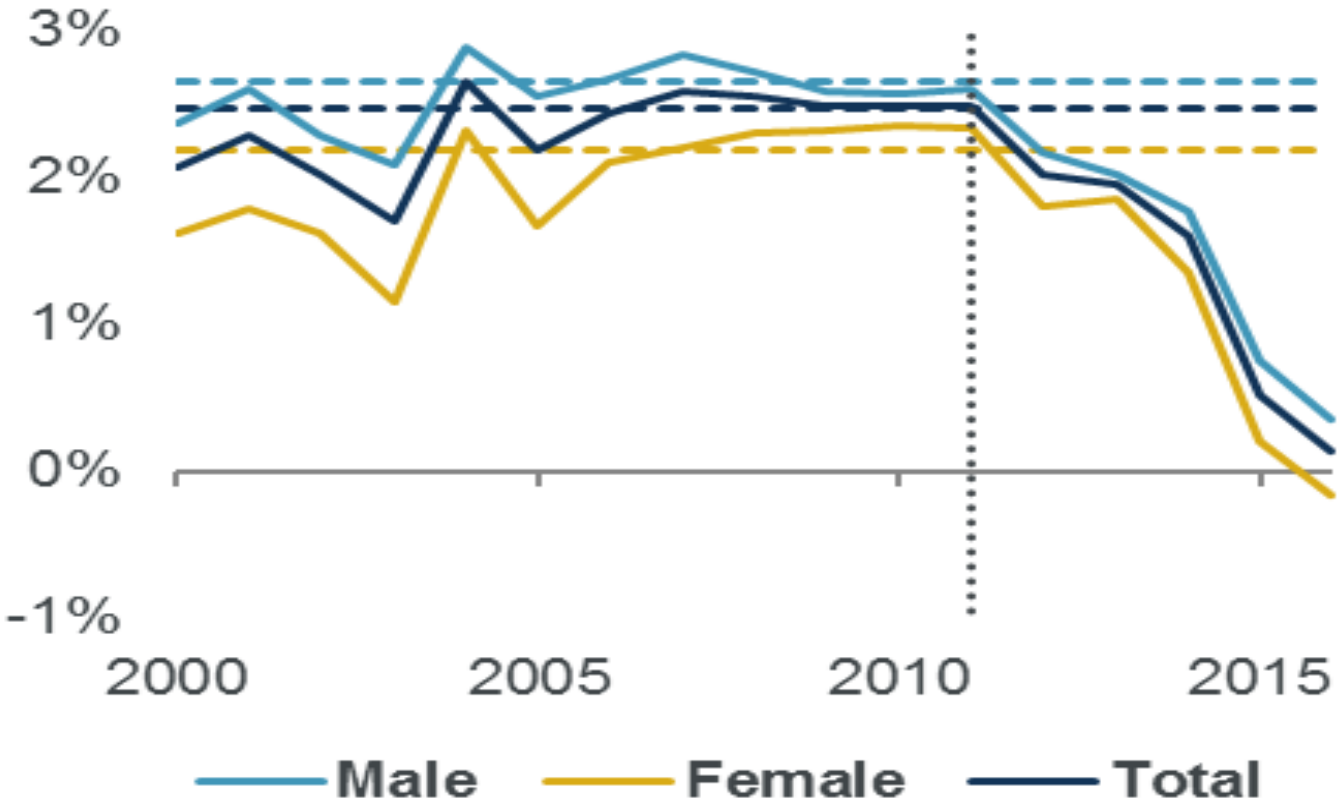
England and Wales
Age-standardised mortality



England and Wales

Five-year average annual mortality improvements

Five-year average annual mortality improvements (solid) compared to trends from 2000-2011 (dashed)

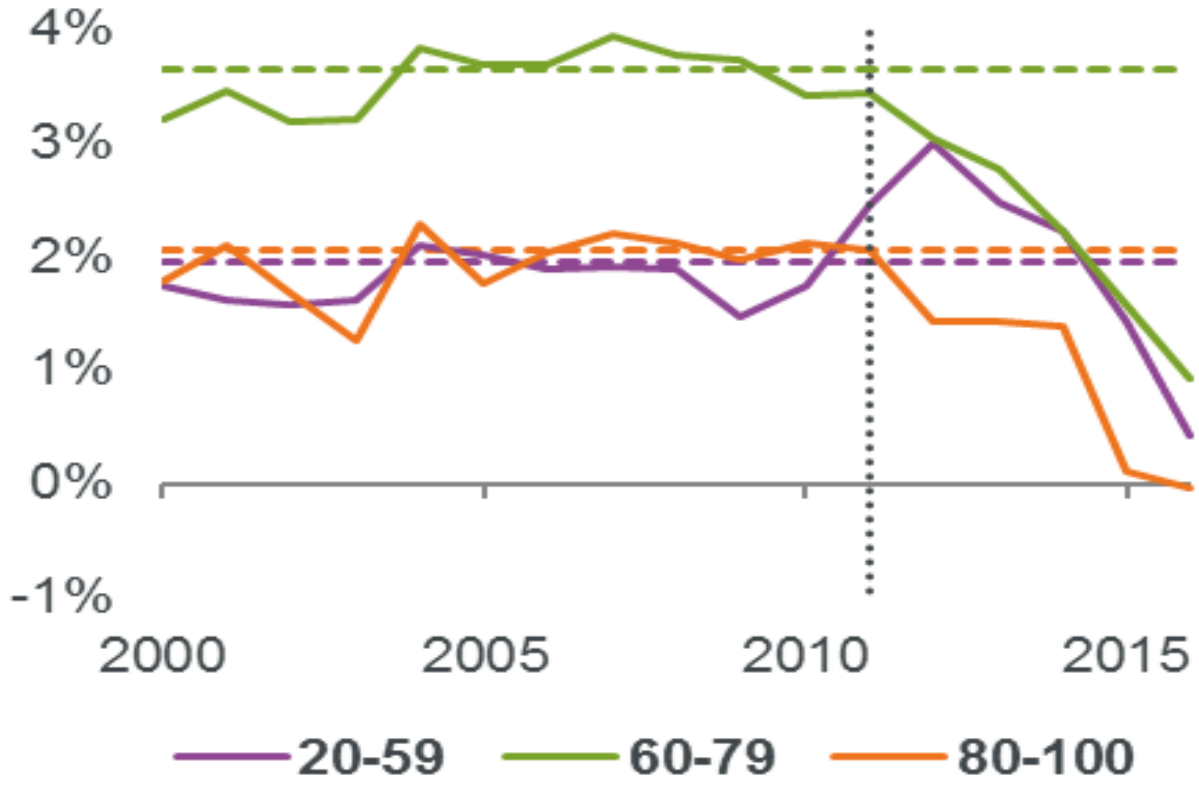


Source: CMI Working Paper 97, 27 Mar 2017 Chart 2E

England and Wales

affects all age bands

The average mortality improvements affect all age bands
Five-year average mortality improvements for different age bands (male shown)



Source: CMI Working Paper 97, 27 Mar 2017 Chart 2G/H

England and Wales

Annual mortality improvements

Conclusion:

Mortality improvements have declined from 2-3% per annum in 2000-2010 to near zero by 2016

Source: CMI Working Paper 97, 27 Mar 2017

What countries?

UK constituent countries

Rest of Europe, eg: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Australia

Canada

US

Europe

France, Germany, Italy, Netherlands, Spain, Sweden, UK, Hungary

Took latest published *provisional* EOLs and compared past 5 years' improvements against previous 5 years

Europe: comparing past 5 years gains in EOL from birth with prev. five

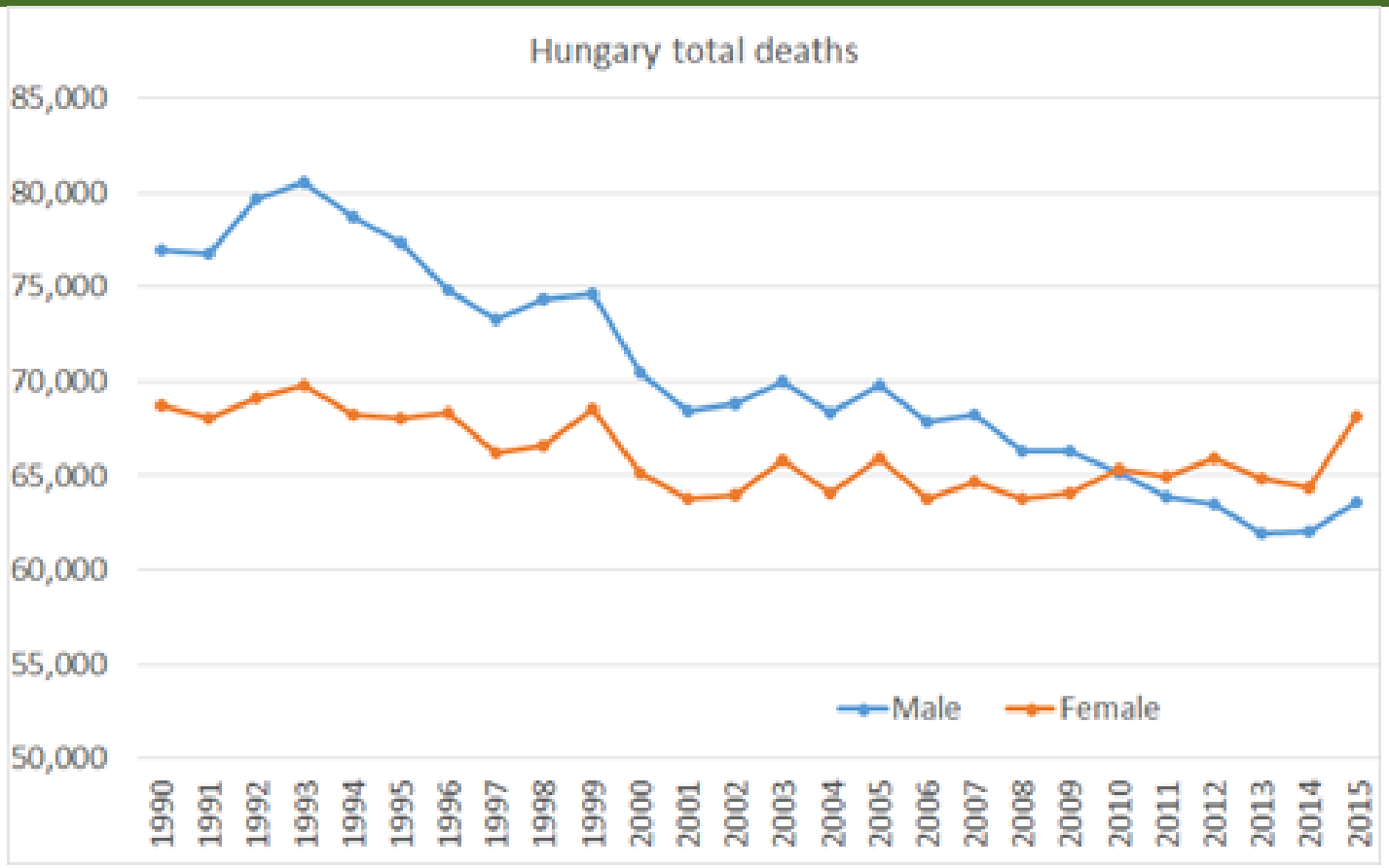
(in decimals of a year: 0.200 = 20% of a year)

Country	Last year	Male		Female		Reduction in annual increase	
		Prev 5	Past 5	Prev 5	Past 5	M	F
France	2016	0.240	0.200	0.160	0.080	0.040	0.080
Germany	2013/14	0.260	0.134	0.162	0.094	0.126	0.068
Italy	2015	0.239	0.172	0.153	0.061	0.067	0.092
Netherlands	2015	0.320	0.180	0.220	0.080	0.140	0.140
Spain	2015	0.406	0.175	0.299	0.076	0.231	0.223
Sweden	2016	0.218	0.154	0.152	0.084	0.064	0.068
UK	2015	0.304	0.132	0.230	0.072	0.172	0.158
Hungary	2015	0.400	0.320	0.280	0.080	0.040	0.200

Source: Provisional figures Courtesy Adrian Gallop , Kriszti Halay - own calculations E&OE !

Europe: Hungary total deaths

showing 2015 peak experienced in many European countries



Source: Kriszti Halay

Europe: comparing past 5 years gains in EOL at 65 with previous five yrs

(in decimals of a year: 0.100 = 10% of a year)

Country	Last year	Male		Female		Reduction in annual increase	
		Prev 5	Past 5	Prev 5	Past 5	M	F
France	2016	0.180	0.100	0.120	0.060	0.080	0.060
Germany	2013/14	0.172	0.076	0.124	0.068	0.096	0.056
Italy	2015	0.160	0.107	0.119	0.040	0.054	0.079
Spain	2015	0.256	0.078	0.262	0.046	0.177	0.216
Sweden	2016	0.152	0.128	0.092	0.062	0.024	0.030
UK	2015	0.225	0.084	0.187	0.029	0.141	0.157

Source: Provisional figures Courtesy Adrian Gallop - own calculations E&OE !

What countries?

Rest of Europe, eg: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Comparing past 5 years improvements against previous 5 years improvements, the rate of improvement is lower

for all countries,
from birth and from age 65, and
for both sexes

(the situation is likely to improve for 2016, but may fall back again for 2017)

What countries?

UK constituent countries

Rest of Europe, eg: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Australia

Canada

US

Australia

HMD (*last year 2014*): Australia's aggregate life expectancy from birth grew on average by

- 1990 to 1999 0.309 years per annum
- 2000 to 2009 0.249 years per annum
- 2010 to 2014 0.17 years per annum

ABS 2014 to 2015: Australia's SMR stayed same(5.5)

"So there appears to be slowing of the rate of improvement in recent years. This has to be interpreted in terms of the volatility of mortality rates …. "

Sources: HMD, ABS Michael Sherris

What countries?

UK constituent countries

Rest of Europe: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Australia

Canada

US

Canada : recent figures?

Official figures for Canada only go to 2012

How can we get a clue at more recent developments?

2 sources of recent figures:

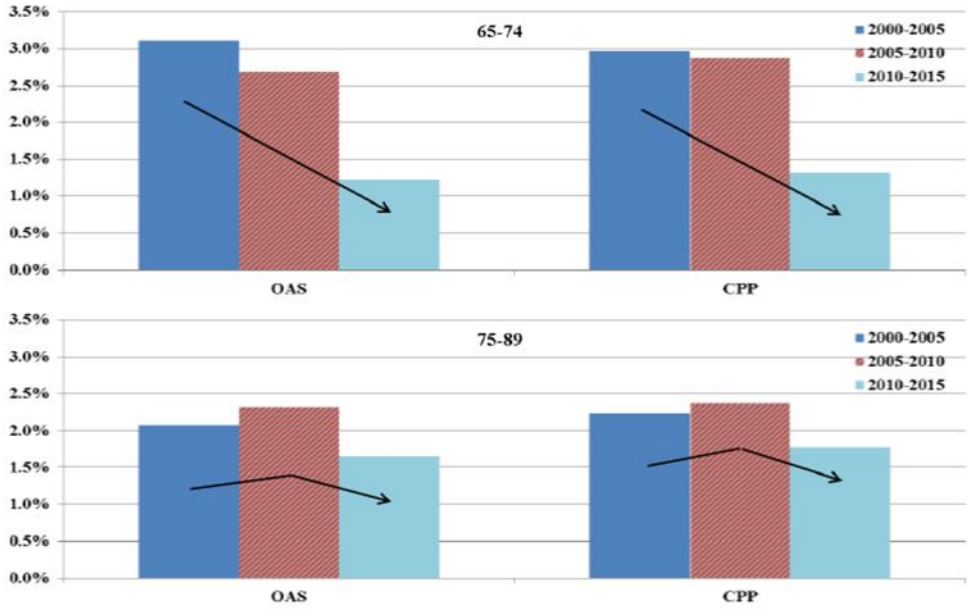
- **Canada Pension Plan** covers all workers except Quebec, and the Old Age Security Program covers 97% of Canadian Population 65+ (*Courtesy Assia Billig*)

- **Quebec** has its own statistics. They show that life expectancy at birth has not fallen (and almost always increased) over each five-year period from 1930 until 2015.

Courtesy Assia Billig, Actuary, OCA and OFI

Canada: Canada Pension Plan

CPP-OAS Average Annual Mortality Improvement Rates (males)



Source: Office of the Chief Actuary calculations.

OSFI BSIF

Office of the Chief Actuary **Bureau de l'actuaire en chef**

22

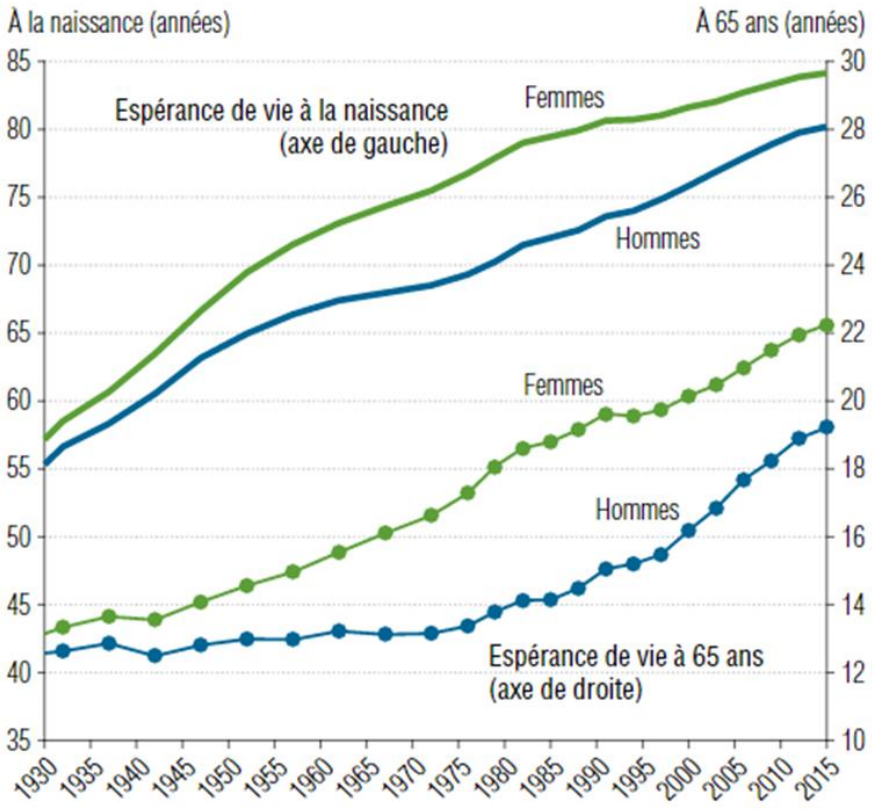
So a slowdown in improvements for over 65s in Canada

Courtesy Assia Billig, Actuary, OCA and OFI

Canada: Quebec

Figure 2

Espérance de vie à la naissance et à 65 ans, Québec, 1930-2015[p]



Sources : Base de données sur la longévité canadienne, adapté par Institut de la statistique du Québec (1930-1974) et Institut de la statistique du Québec (1975-2015).

Courtesy Assia Billig, Actuary, OCA and OFI

Canada: Quebec

Quebec: Recent trends

Life expectancy at birth and at 65, Quebec (combined)

			Improvement (months)	
	at birth	at 65	at birth	at 65
2000-2002	79.1	18.5		
2005-2007	80.4	19.5	3.12	2.40
2010-2012	81.7	20.4	3.12	2.16
2013-2015	82.2	20.8	2.00	1.60
2015 est	82.2	20.8		

So there appears to be a slowdown in improvements in Quebec

1st 3 cols: Décès et mortalité, chapitre 3 dans *Le bilan démographique du Québec*
Improvement: own calculation (different)

What countries?

UK constituent countries

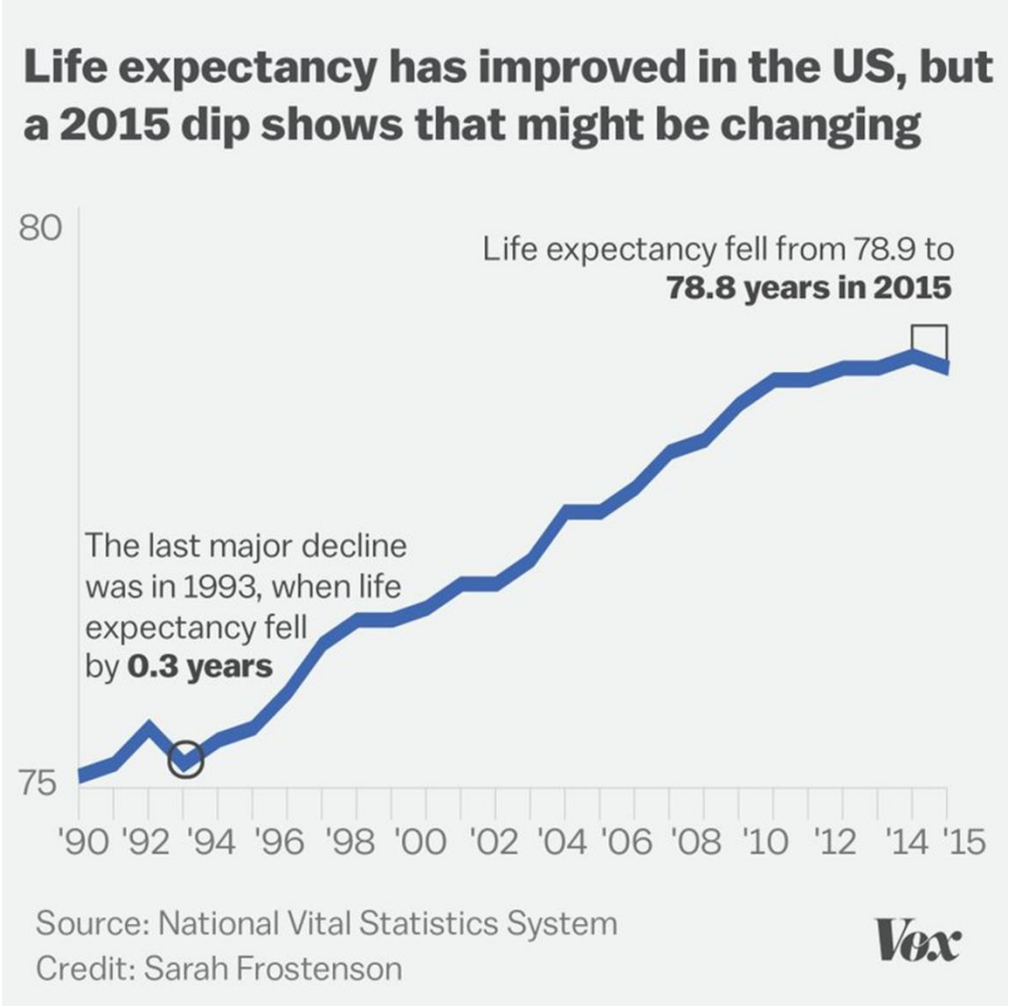
Rest of Europe: France, Germany, Hungary, Italy, Netherlands, Spain, Sweden

Australia

Canada

US

US to 2015



Decline

Flattening of slope

US to Q3 2016

What about 2016?

Annual change in rolling age-adjusted mortality rates

2014 Q1	to	2015 Q1	2.0%
2014 Q3	to	2015 Q3	2.6%
2015 Q3	to	2106 Q3	-2.5%

Source: Sam Gutterman

So, have longevity improvements reduced?

In the past five years:

UK England and Wales yes

Rest of Europe: France, Germany, Hungary, Netherlands, ……., likely

Australia maybe

Canada likely

USA yes

So, *why* have longevity improvements reduced?

Is this just a "blip"?

Just excess winter mortality?

Or is it a trend?

Winter mortality in Europe 2014/17

Excess winter mortality affects age groups differently

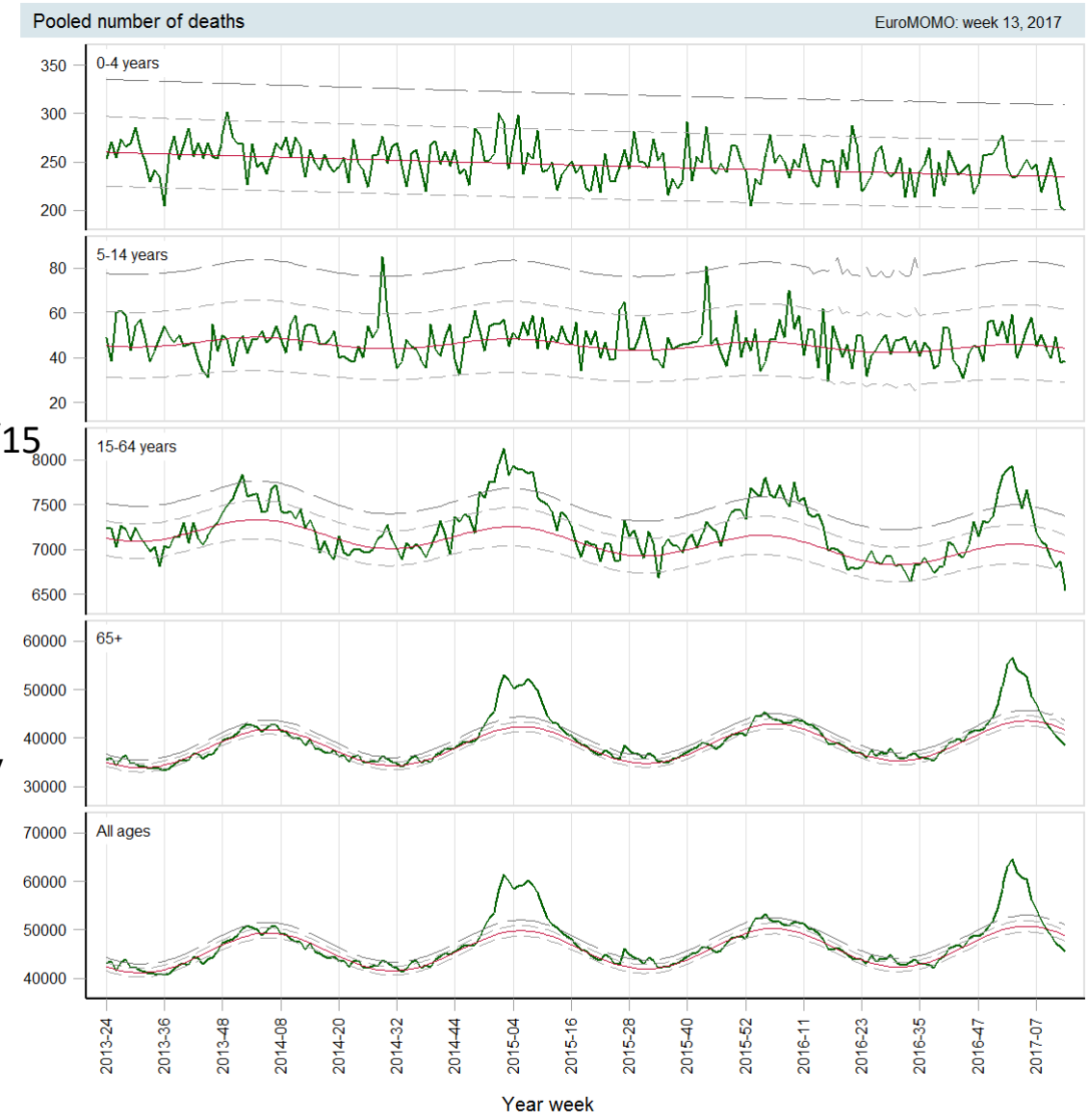
Winter excess deaths have a major impact

See EuroMOMO = European monitoring of excess mortality for public health action

Pooled estimates of weekly total number of all-cause deaths in the winter seasons

Note particularly Winters of 2014/15 and 2016/17

Source: EuroMOMO



Winter 2014/15

Normal excess
Winter mortality

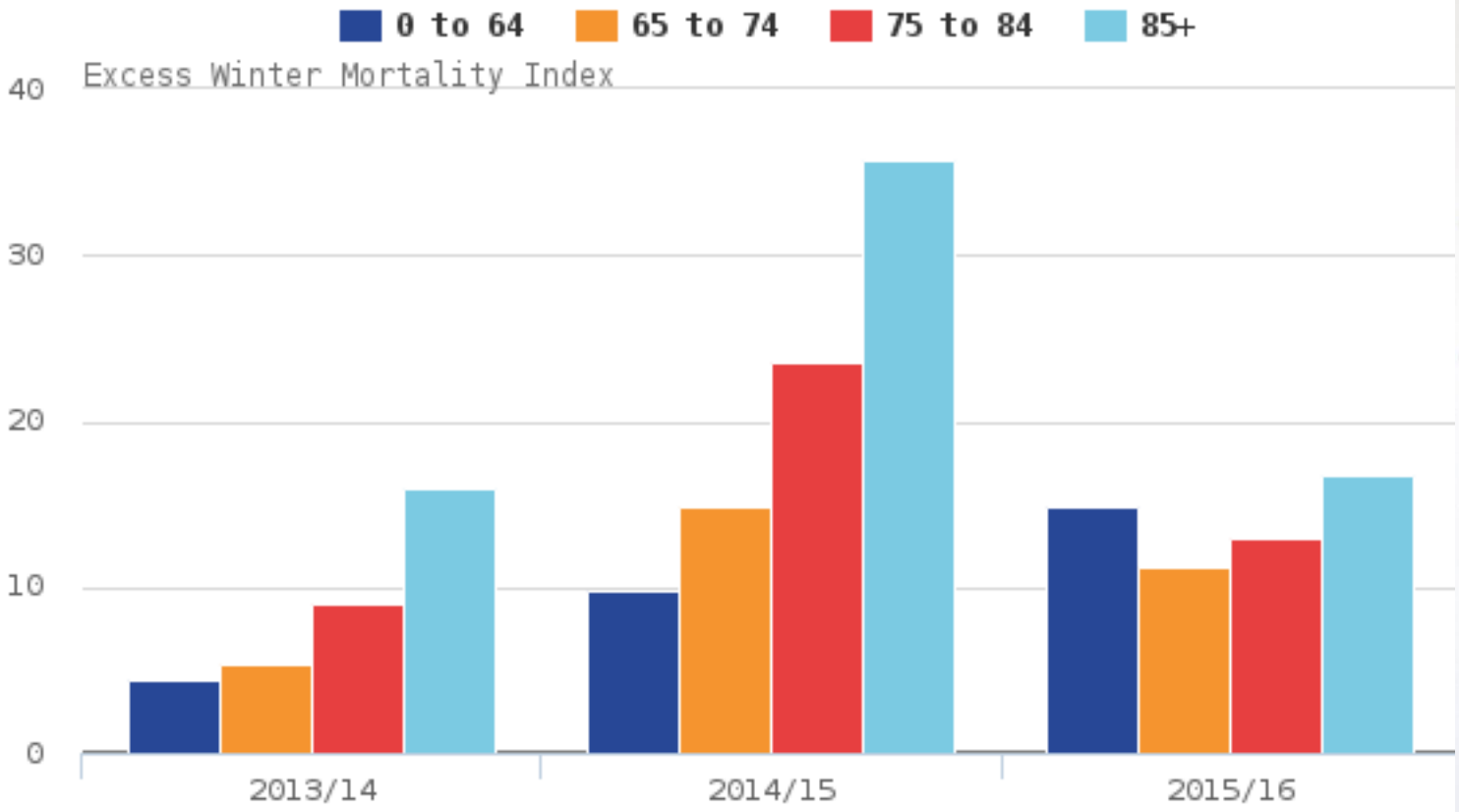
Source: EuroMOMO

Winter 2016/17

Participating countries:
Belgium, Denmark, [illegible], Norway, Portugal, Spain, Sweden, Switzerland, UK (England), UK (Scotland), UK (Wales)

Winter mortality in E & W 2014/17

Excess winter mortality affects age groups differently



Source: Excess winter mortality in England and Wales: 2015/16 (provisional) and 2014/15 (final) ONS

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So, *why* have longevity improvements reduced?

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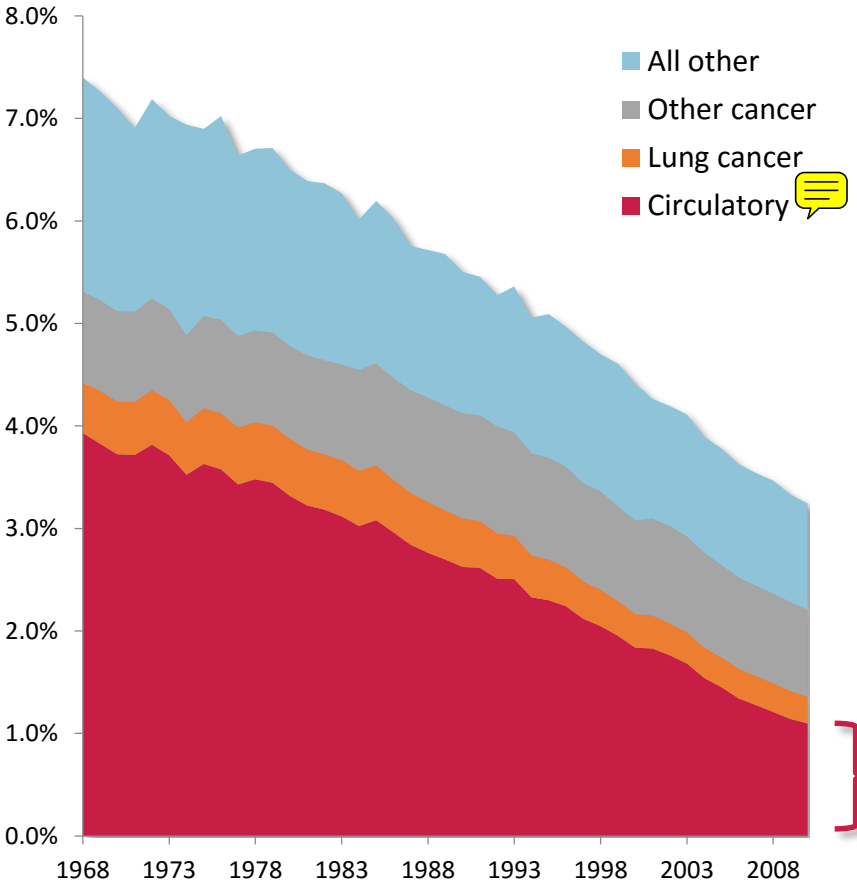
Look at overall ***improvements*** age 60 – 89 since 1968 ....

Courtesy CMI, Richard Willets, Jon Palin

Improvements by cause of death

Age-standardized mortality rate for ages 60-89, males in England & Wales, by cause of death group, 1968 to 2010

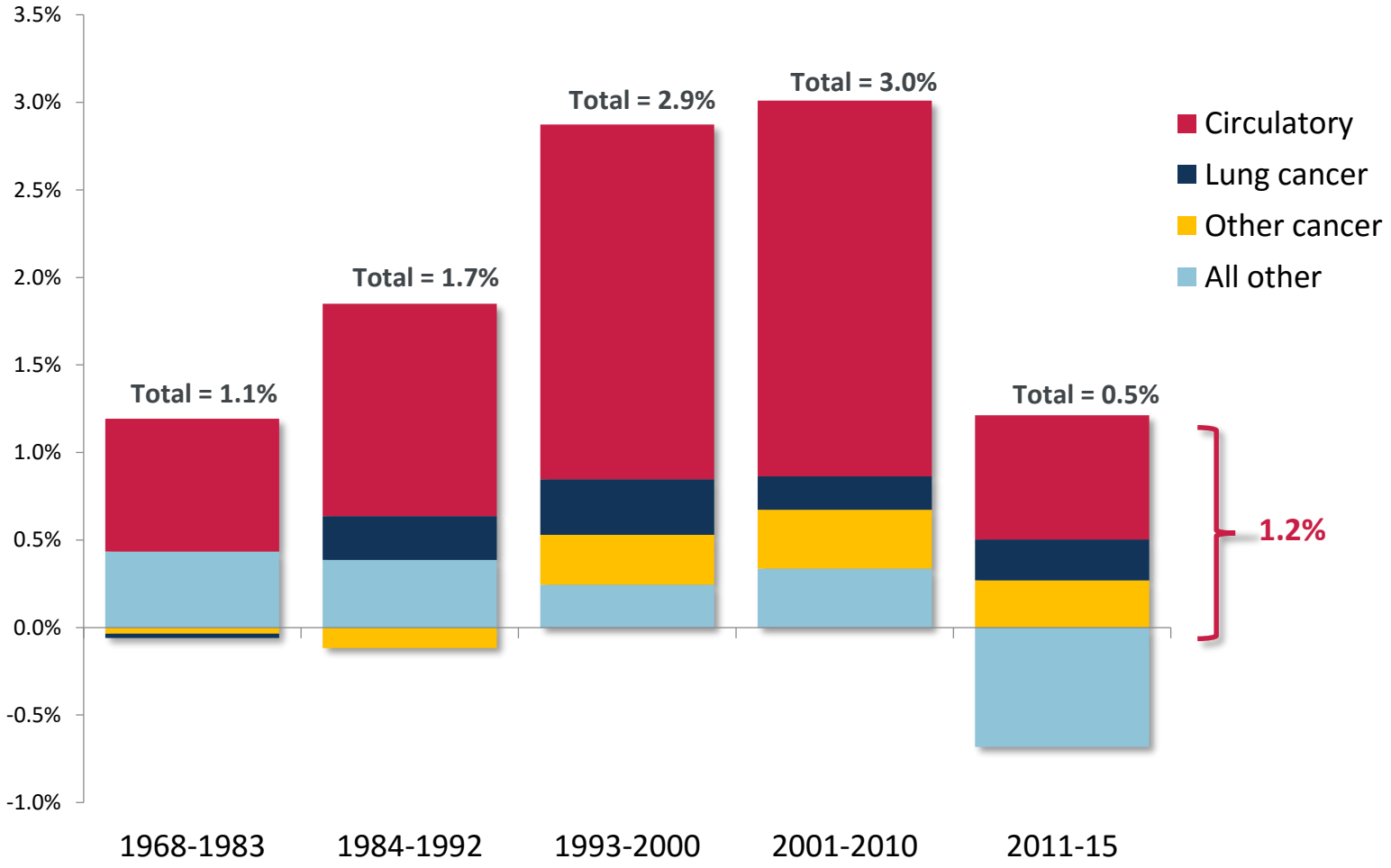


- In the period up to 2010 death rates from circulatory causes fell by up to 75%
- Around 70% of the total improvement was due to this
- The improvement was driven by a range of different of factors, the most significant of which was reduced smoking
- The potential for future improvement in circulatory causes is more limited

Source: SIAS/CMI meeting – Mortality improvements in the next decade 11 April 2017
Courtesy Richard Willets

Improvements by cause of death

Average annual rate of improvement for ages 60-89, males in England & Wales, decomposed by cause of death group, 1968 to 2015



Source: SIAS/CMI meeting – Mortality improvements in the next decade 11 April 2017
Courtesy Richard Willets

“just a blip”? UK 2015

The possibility that the cuts to health and social care are implicated in almost 30,000 excess deaths is one that needs further exploration

The Royal Society of Medicine

Commentary

Journal of the Royal Society of Medicine; 0(0) 1–7
DOI: 10.1177/0141076817693600

What caused the spike in mortality in England and Wales in January 2015?

Lucinda Hiam[1], **Danny Dorling**[2], **Dominic Harrison**[3] and **Martin McKee**[1]

[1]London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK
[2]School of Geography and the Environment, University of Oxford OX1 3QY, UK
[3]Blackburn with Darwen Borough Council, Blackburn BB2 1DH, UK
Corresponding author: Lucinda Hiam, Email: lucinda.hiam@student.lshtm.ac.uk

Introduction

In the accompanying paper, we described the exceptionally large increase in mortality in England and Wales in 2015, showing how it was driven by deaths

Yugoslavia.[3] The apparent stagnation in life expectancy in Malta in the 1970s was due to a failure to update population estimates (J Mamo, personal communication). Problems with numerators most often affect cause specific death rates, due to changes in

while the reduced efficacy of the influenza vaccine being used may have played some role in the January 2015 mortality spike, this is likely to have been limited.

“the evidence points to a major failure of the health system, possibly exacerbated by failings in social care”

What caused the spike in mortality in England and Wales in January 2015? Hiam et al. Journal of Royal Society of Medicine, 2017

Is it a trend? UK

Underfunded public health and care services - UK

- *"the evidence points to a major failure of the health system, possibly exacerbated by failings in social care"*

- *"The possibility that the cuts to health and social care are implicated in almost 30,000 excess deaths is one that needs further exploration"*

Not a blip, a social care issue that may not be resolvable

What caused the spike in mortality in England and Wales in January 2015? Hiam et al. Journal of Royal Society of Medicine, 2017

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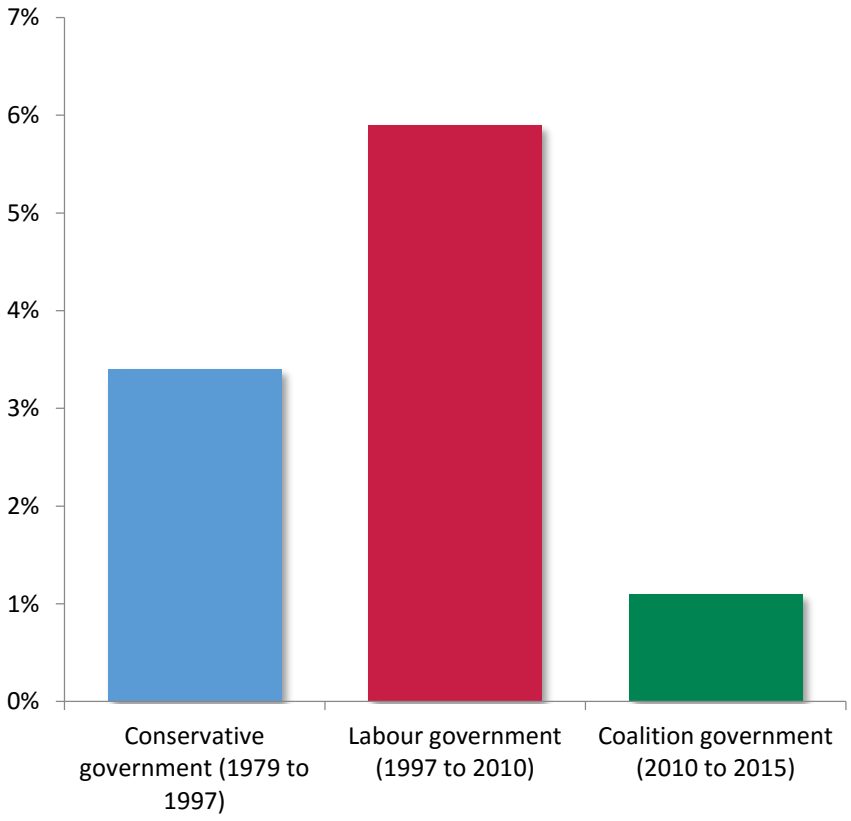
Correlation is not causation

Average annual increase in National Health Service (NHS) expenditure (source: IFS)



Source: SIAS/CMI meeting – Mortality improvements in the next decade 11 April 2017
Courtesy Richard Willets

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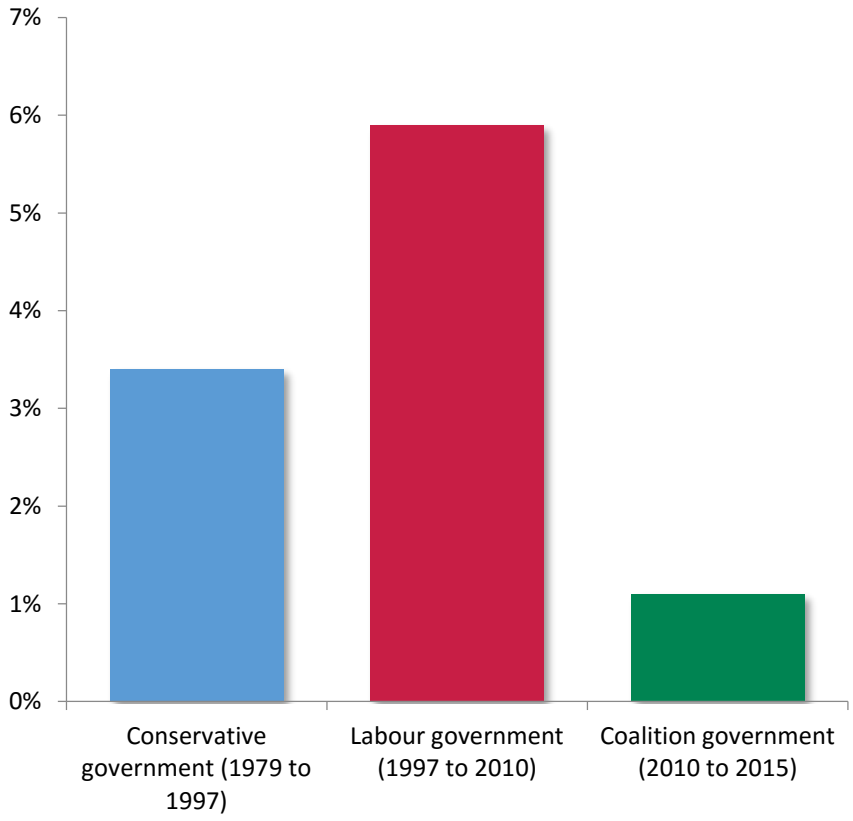
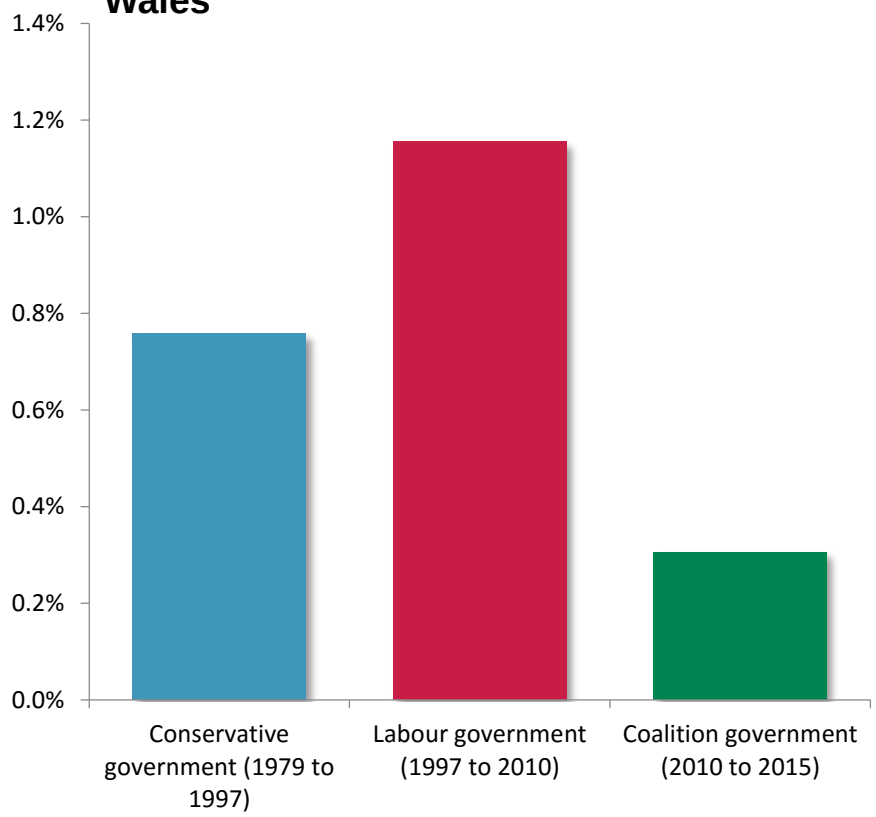


Average annual increase in life expectancy at age 65, England & Wales



Source: SIAS/CMI meeting – Mortality improvements in the next decade 11 April 2017
Courtesy Richard Willets

Concluding thoughts from Richard Willets, Expert Longevity Consultant, Just

- The deceleration can be partly explained by the reduced contribution to aggregate improvements from circulatory causes
- This has been exacerbated by mortality increases in a range of miscellaneous causes
- Therefore the fall in improvements can be seen as:-
  - a reversion to a more typical aggregate rate of change (following a period of unusually rapid improvement); plus
  - the impact of economic austerity (NHS & social care funding)
- Therefore lower improvements are not likely to be temporary (i.e. they are not a 'blip')
- There is a case to reduce the value of the 'smoothing parameter' when using CMI_2016

Source: SIAS/CMI meeting – Mortality improvements in the next decade 11 April 2017
Courtesy Richard Willets

So, why have longevity improvements reduced?

Is this just a “blip”?

- Just excess winter mortality

Or is it a trend?

- Underfunded public health and care services - UK
- Social change

Is it a trend? U.S.

Mortality in the United States, 2015

- Life expectancy for the U.S. population in 2015 was 78.8 years, a decrease of 0.1 year from 2014.
- The age-adjusted death rate increased 1.2% from 724.6 deaths per 100,000 standard population in 2014 to 733.1 in 2015.
- The 10 leading causes of death in 2015 remained the same as in 2014. Age-adjusted death rates increased for eight leading causes and decreased for one.

NCHS Data Brief No. 267 2016 Data from the National Vital Statistics System

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Is it a trend? U.S.

Rising mortality for US White non-Hispanics

US has seen rising mortality.

Could it be flu or other transitory causes, or something deeper?

"Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century" Case and Deaton

Case, A.; Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. Proceedings of the National Academy of Sciences (2015) 112

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Is it a trend? U.S.

Rising mortality for US White non-Hispanics

"Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century" Case and Deaton

1. **Compares the mortality for 45 to 54 year-old US White non-Hispanics, US Hispanics against population of six other countries**

   All-cause mortality, ages 45–54 for US White non-Hispanics (USW), US Hispanics (USH), and six comparison countries: France (FRA), Germany (GER), the United Kingdom (UK), Canada (CAN), Australia (AUS), and Sweden (SWE).

2. **Causes of death?**

   Mortality by cause, white non-Hispanics ages 45–54.

Case, A.; Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. Proceedings of the National Academy of Sciences (2015) 112

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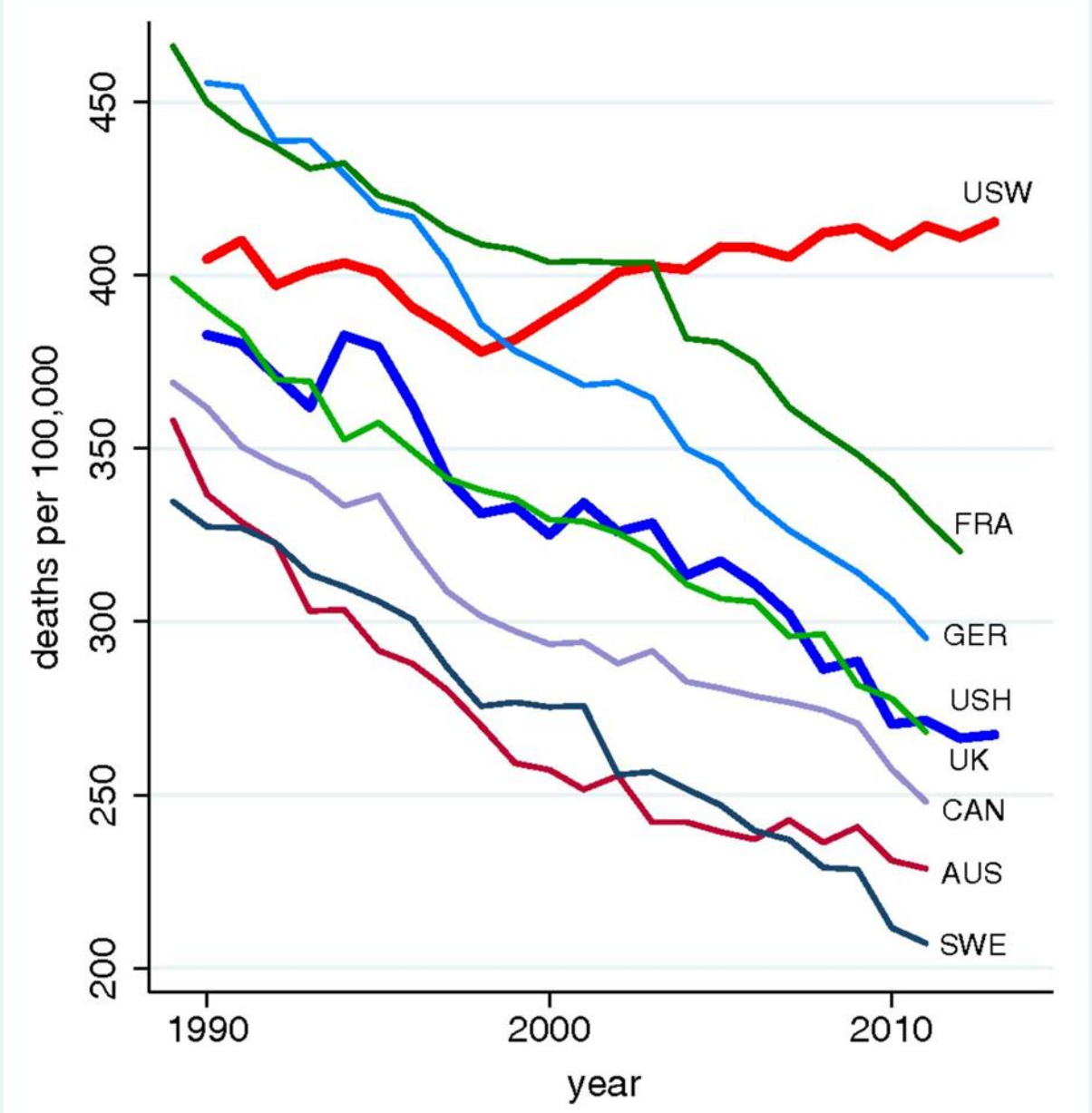

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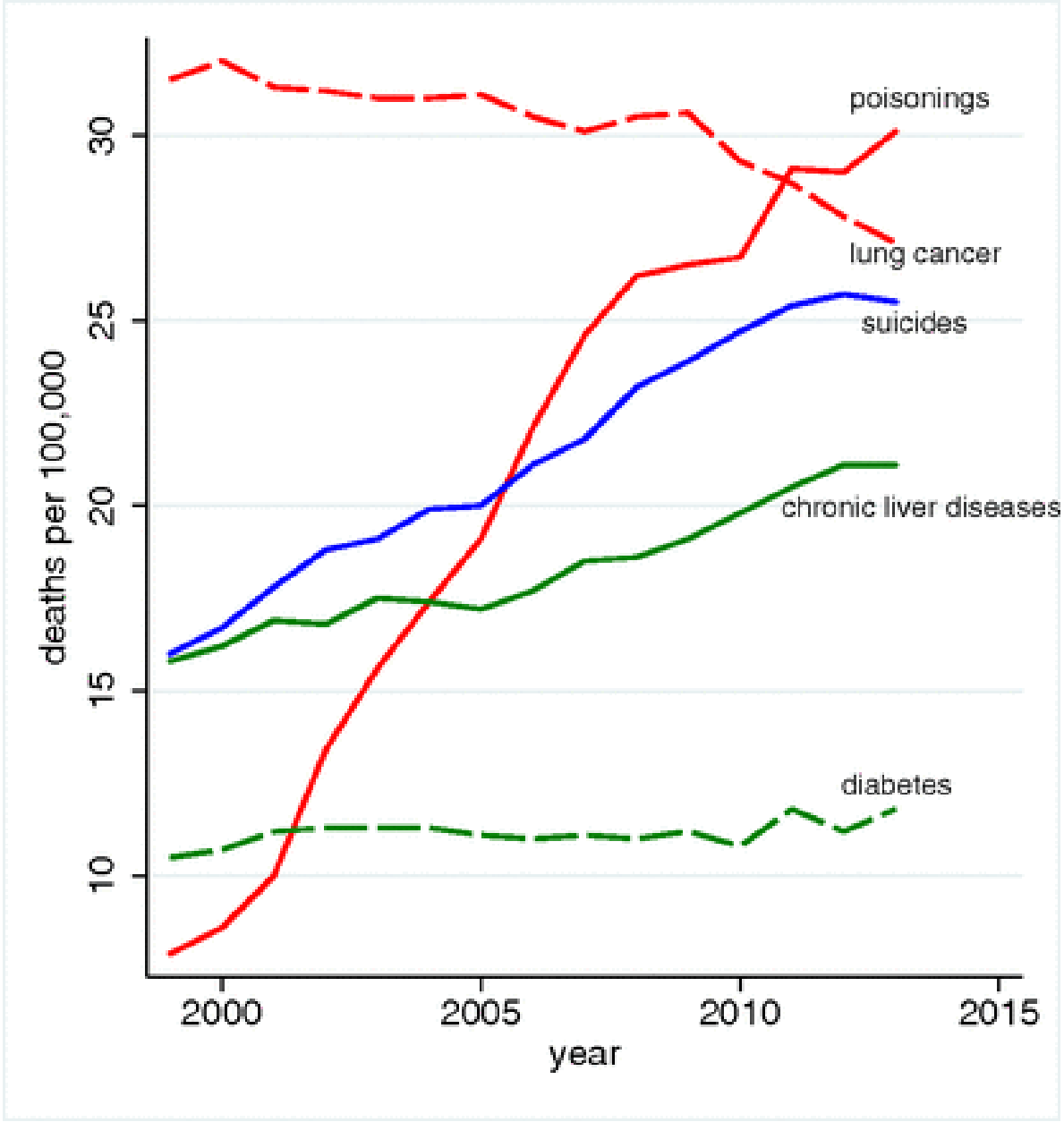

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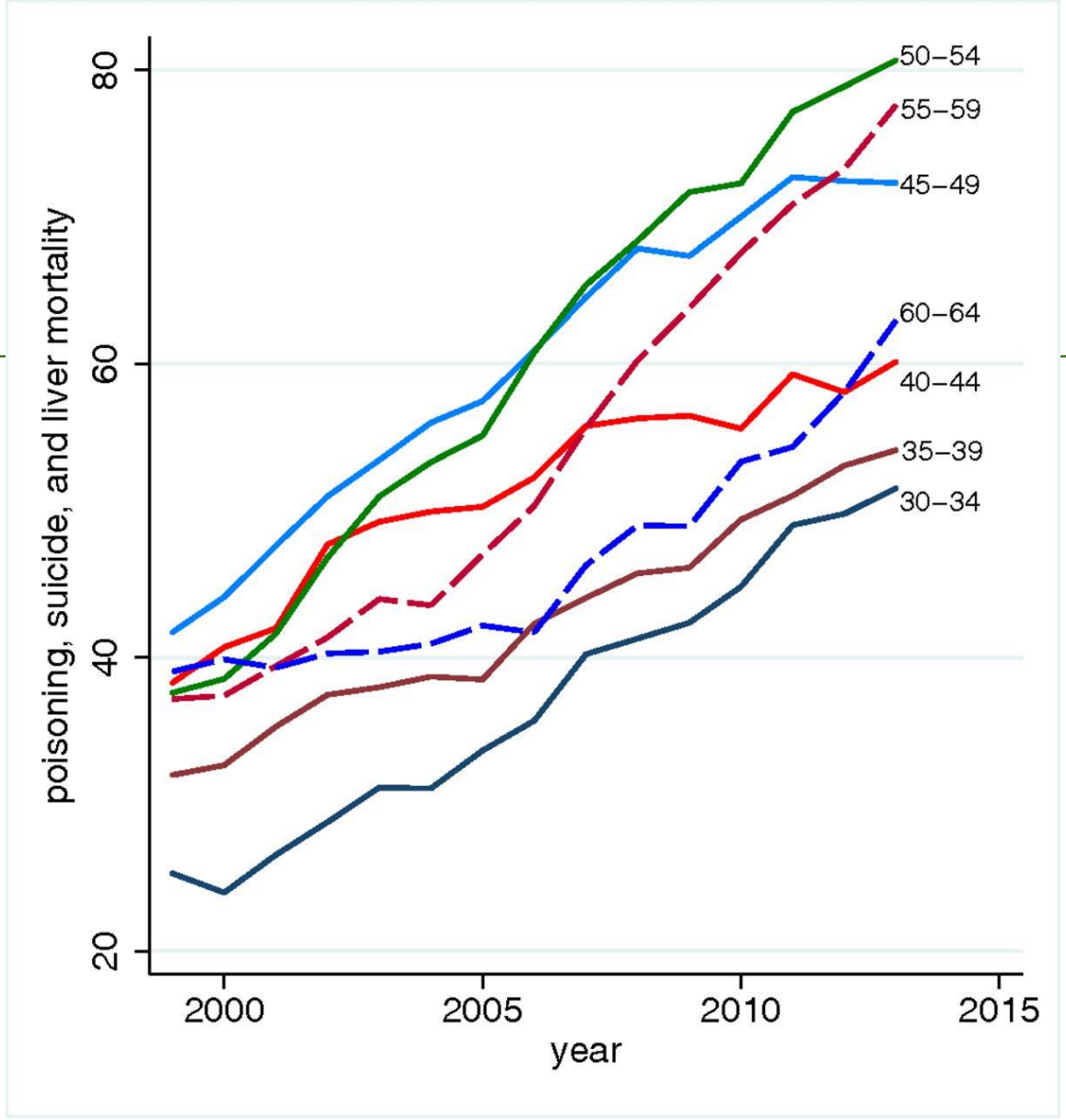
Is it a trend? U.S.

Rising mortality for US White non-Hispanics

So: The change in all-cause mortality for white non-Hispanics 45–54 is largely accounted for by an increasing death rate from external causes, mostly increases in drug and alcohol poisonings and in suicide.

And: **all 5-y age groups between 30–34 and 60–64** have witnessed marked and similar increases in mortality from the sum of drug and alcohol poisoning, suicide, and chronic liver disease and cirrhosis over the period 1999–2013 That's not a blip

Case, A.; Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. Proceedings of the National Academy of Sciences (2015) 112



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That's not a blip!

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So, why have longevity improvements reduced?

Is it a trend?

Underfunded public health and care services - UK

Social change – US

And what are actuaries doing about it?

UK

Flawed longevity assumptions could be adding extra £25bn to DB pension deficits

" … assuming people will live four months longer than they actually will,…." Club Vita

Slowdown in improving life expectancy could cut pension deficit by £28bn

Mercer.

High mortality rates challenge the way life insurers project longevity

.. survey results on what insurers are currently projecting for long-term improvements in the UK – Willis Towers Watson – Nov 2016

UK

Schemes should be cautious of longevity mispricing - Aon Hewitt Pensions Age Feb 2017

"Pension schemes should review lower rates of UK mortality improvement to ensure fair pricing of longevity insurance transactions, Aon Hewitt has reiterated."

Medical science boosts longevity predictions, improving pricing accuracy WillisTowersWatson April 2016

Willis Towers Watson has developed the first widely-available mortality model to use medical science and the views of medical experts to improve predictiveness. The model, called PulseModel, incorporates the impact of medical conditions, such as diabetes, to inform future mortality patterns and is designed to help insurance companies and pension funds accurately price insurance cover, calculate liabilities and manage risk.

UK CMI: Continuous Mortality Investigation

Mortality Projections

New CMI Model 2016

- CMI_2016 (published March 2017)
  - Essentially similar to previous version of the model, although …
    - … faster, simpler, more transparent, more useable, pure Excel/VBA
  - The Core model is slightly less responsive than before, but …
    - … responsiveness can now be adjusted explicitly by users

Impact of CMI_2016

Impact on life expectancy *projections* of moving to CMI_2016

	Projection	Age					
		35	45	55	65	75	85
Male	CMI_2014	−2.25%	−2.52%	−2.72%	−2.54%	−2.33%	−4.38%
	CMI_2015	−1.73%	−1.86%	−1.88%	−1.31%	−0.49%	−2.46%
Female	CMI_2014	−2.98%	−3.12%	−3.19%	−3.35%	−3.39%	−5.76%
	CMI_2015	−2.40%	−2.41%	−2.27%	−2.00%	−1.47%	−3.78%

Life expectancies are based on the Core model using an illustrative long-term rate of 1.5% p.a. applied to S2PMA / S2PFA base.
Source: CMI Working Paper 97.
Courtesy Jon Palin, CMI

US

How long can mortality improvement continue?

Fenton et al, WillisTowersWatson June 2016

Historical mortality improvement

Mortality improvement from 2000 to 2010, and from 2010 to 2014. The difference shown is calculated as the most recent range less the previous decade, 2000 to 2010.

Historical mortality improvement								
Period	**Gender**	**25 – 34**	**35 – 44**	**45 – 54**	**55 – 64**	**65 – 74**	**75 – 84**	**85+**
2000–2010	Male	–0.2%	1.8%	0.7%	1.3%	2.7%	2.0%	1.3%
	Female	–0.1%	1.0%	0.0%	1.8%	2.3%	1.5%	1.1%
2010–2014	Male	–1.3%	–0.5%	0.5%	–0.5%	1.1%	1.5%	1.3%
	Female	–1.2%	–1.0%	–0.3%	–0.6%	1.4%	1.1%	0.9%
Difference	Male	–1.1%	–2.3%	–0.2%	–1.9%	–1.5%	–0.5%	0.0%
	Female	–1.2%	–2.0%	–0.4%	–2.4%	–0.9%	–0.4%	–0.2%

Fenton et al, WillisTowersWatson June 2016

US

Updated views on future mortality improvement

Fenton et al, WillisTowersWatson June 2016

Projected mortality improvement

".. projected future mortality improvement rates using our COD model to reflect recent historical experience"

Projected Mortality Improvement on Age-Based Approach								
Period	**Gender**	**25 – 34**	**35 – 44**	**45 – 54**	**55 – 64**	**65 – 74**	**75 – 84**	**85+**
2000–2014	Male	–0.5%	1.2%	0.6%	0.8%	2.2%	1.8%	1.3%
(Actual)	Female	–0.4%	0.5%	–0.1%	1.1%	2.0%	1.4%	1.0%
2014–2024	Male	–0.3%	0.8%	0.6%	0.7%	1.7%	1.3%	0.6%
(Projected)	Female	–0.5%	0.2%	–0.1%	0.8%	1.3%	0.7%	0.2%

Future mortality rates are projected to continue to show a decline in improvement levels and, in a few cases, deterioration.

Fenton et al, WillisTowersWatson June 2016

Is longevity *still* improving?

Conclusions

There are Winter Excess Mortality effects but:

Longevity improvements faltering in some countries

Effects differ by: age group, gender, socio-economic group, location

Underlying causes unlikely to disappear

Impact on insured and pensioner populations differ:

- different subsets of the population
- exposure by “amounts” higher for higher socio-economic groups

And need separate consideration

Is longevity *still* improving?

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