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# Mortality trends from an International Perspective

Adrian Gallop



15 June 2018

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## International mortality trends

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*This presentation covers published and unpublished material from a variety of sources and countries. The findings do not necessarily reflect the position of the authors' employers*

**With thanks to:**  
Sophie Sanders, Marina Habart, Jon Palin, Richard Willets, Magali Barbieri, Assia Billig, Al Klein, Sam Guterman, Dale Hall, Madhavi Bajecai, Michael Sherris, Rikard Bergstrom, David Raymont, Lars Pralle, Jari Nittuimperä, Luis Alfonso Jiménez Muñoz, Hans de Mik and many others



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## Framework for presentation

- Introduction
- Longevity and death rates, country by country
  - We know the UK and US are seeing a slowdown: Where else – and why?
- Analysis: groupings, causes and drivers
  - What do we know about the causes and drivers of change?
  - Are these indications a blip or a trend?
  - Are there similarities internationally?
- What are actuaries, demographers and others doing?



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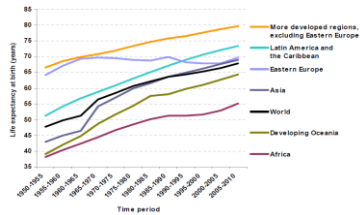
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## Life expectancy a birth - Past 70 years



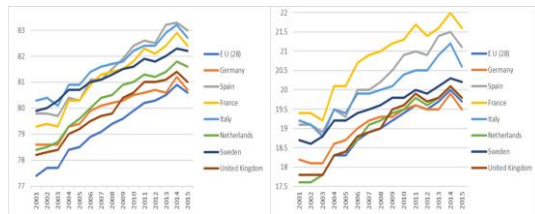
Source World Health Statistics. Accessed on 8 March 2018 <https://healthstatistics.worldbank.org/world-health-statistics/>



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## Europe: Combined Life Expectancy from birth and age 65



Source: Eurostat



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## Methodology for comparisons

- The problem: how to show and compare progress in different countries when we have figures from some to 2016, others to 2015 (the "bad" year) and some only to 2014
- Wishing to compare annual improvement rates against a common base we chose to use the period [2011-most recent year] against a base of [2001-2011].
- Method fits trend lines to 2001-11 and 2011 onwards using linear regression. Numbers above reflect differences in gradients of fitted line.
- In the selection of high-income countries in Europe we considered population size and availability of recent data.
  - Comparing rate of increase in longevity:

Green = increase Red = decrease



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### Selected high-income countries

Where are there signs of a fallback – and why?

- UK
- Other European countries
- US
- Canada
- Australia
- Japan



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### Life expectancy at birth: Months gained per year elapsed

Average trend annual increase in period life expectancy at birth - Months

Country	Last	Male		Female		Difference	
		2011+	2001-11	2011+	2001-11	M	M
	year						
Australia	2016	1.7	3.1	1.2	2.2	-1.6	-0.9
Austria	2016	2.4	3.0	1.3	2.3	-0.6	-1.0
Belgium	2015	3.0	3.4	1.5	2.1	-0.3	-0.6
Canada	2013/15	1.6	2.9	1.2	2.1	-1.4	-0.9
Czech Republic	2016	3.6	3.5	3.0	3.0	0.1	0.0
Denmark	2015	3.0	3.5	2.8	2.9	-0.4	-0.1
Finland	2016	3.5	2.9	1.9	2.5	0.6	-0.6
France	2015	2.4	3.6	1.1	2.5	-1.2	-1.4
Germany	2015	1.4	3.1	0.8	2.0	-1.7	-1.1
Italy	2014	3.4	3.6	2.6	2.2	-0.1	0.4
Japan	2016	3.6	1.9	2.9	1.5	1.7	1.3
Netherlands	2016	2.0	4.2	0.9	2.9	-2.2	-2.0
Norway	2016	3.9	3.3	2.2	2.3	0.6	-0.1
Poland	2016	3.7	2.4	2.5	2.7	1.3	-0.2
Portugal	2015	2.8	4.3	2.2	3.4	-1.5	-1.2
Spain	2016	2.4	3.9	1.6	2.7	-1.5	-1.2
Sweden	2016	1.9	2.7	1.3	1.9	-0.8	-0.6
UK	2016	0.9	3.7	0.4	2.8	-2.8	-2.4
USA	2015	2015	0.2	2.8	0.4	-2.6	-1.8



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Green = better  
Red = worse

### Life expectancy at age 65: Months gained per year elapsed

Average trend annual increase in period life expectancy at birth - Months

Country	Last	Male		Female		Difference	
		2011+	2001-11	2011+	2001-11	M	M
	year						
Australia	2016	1.5	2.3	1.0	1.6	-0.7	-0.6
Austria	2016	0.9	2.0	0.8	1.8	-1.1	-1.0
Belgium	2015	1.5	2.3	0.8	1.7	-0.8	-0.9
Canada	2013/15	1.6	2.2	0.8	1.6	-0.6	-1.0
Czech Republic	2016	2.0	2.1	2.4	2.3	-0.2	0.2
Denmark	2015	2.3	2.3	2.1	2.0	0.0	0.1
Finland	2016	1.5	2.2	0.8	2.2	-0.7	-1.4
France	2015	1.3	2.4	0.6	2.0	-1.2	-1.4
Germany	2015	0.7	2.0	0.4	1.5	-1.3	-1.1
Italy	2014	2.4	2.1	2.0	1.6	0.2	-0.4
Japan	2016	2.1	1.3	1.9	1.4	0.8	0.5
Netherlands	2014	2.2	3.0	1.3	2.1	-0.8	-0.9
Norway	2016	2.4	2.2	1.3	1.6	0.2	-0.3
Poland	2016	1.6	1.6	1.7	2.2	0.1	-0.5
Portugal	2015	1.4	2.4	1.2	2.4	-1.0	-1.1
Spain	2016	1.1	2.3	1.4	2.2	-1.1	-0.9
Sweden	2016	1.6	1.9	1.0	1.4	-0.3	-0.3
UK	2016	0.8	2.8	0.3	2.3	-2.0	-1.9
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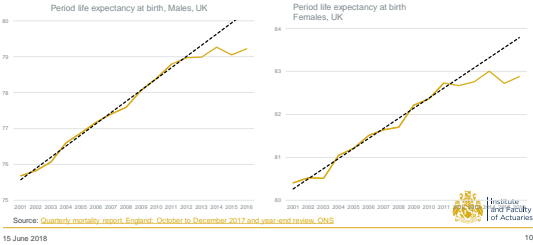


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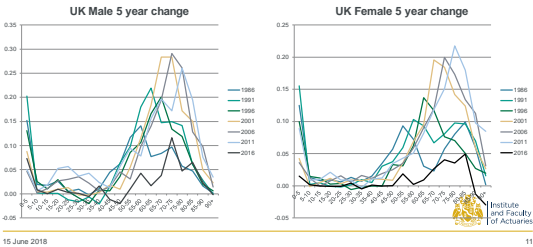
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Green = better  
Red = worse

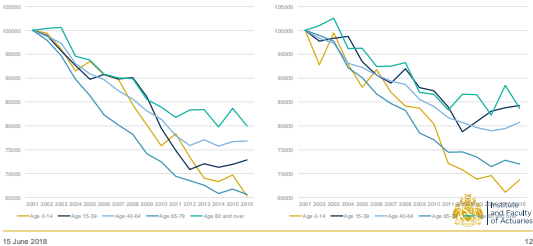
UK: Period life expectancy at birth 2001-2016



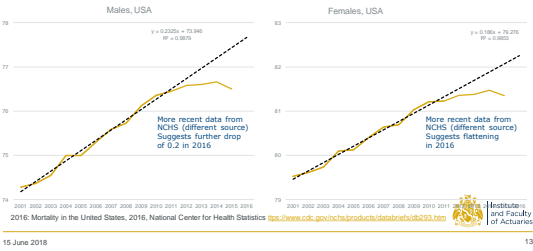
UK increase in partial life expectancy by 5-year age bands, for 5-year periods ending 1986 to 2016



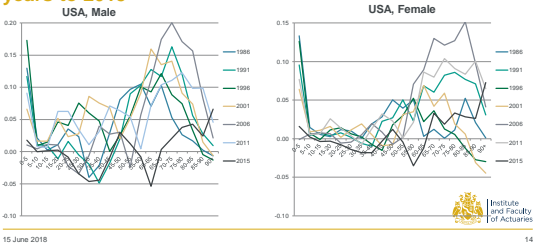
UK: Standardised deaths by age group indexed to 100,000 in 2001



US: Period life expectancy 2001 to 2015



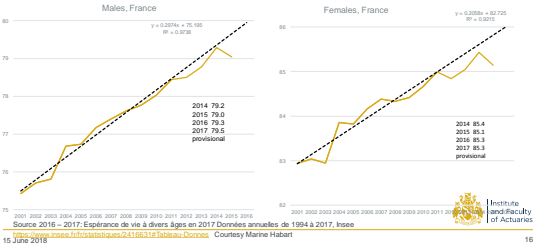
US increase in partial life expectancy by 5-year age bands, for 5-year periods ending 1986 to 2011 and 4 years to 2015



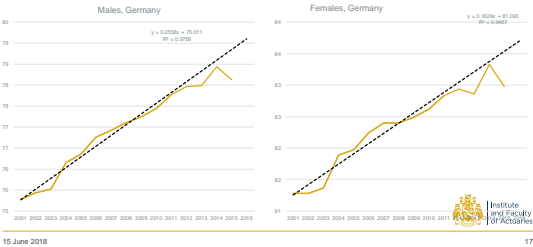
US: Standardised deaths by age group indexed to 100,000 in 2001



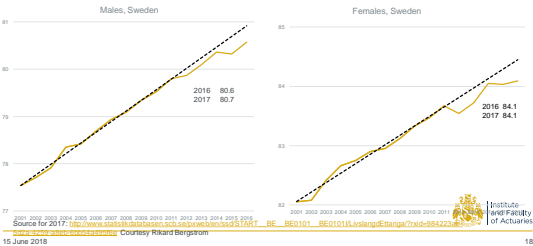
France: Period life expectancy at birth 2001 to 2015



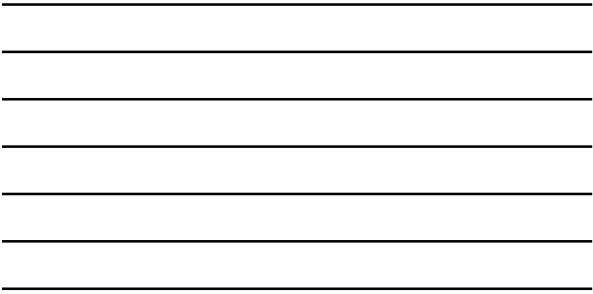
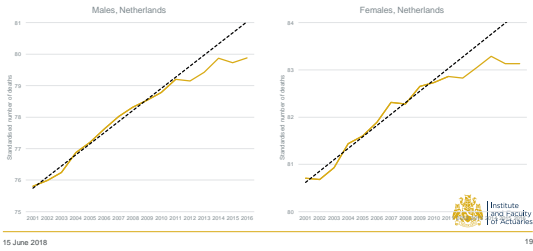
Germany: Period life expectancy at birth 2001 to 2015



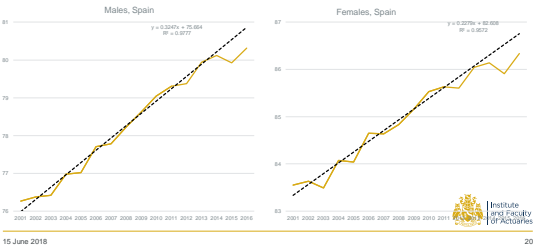
Sweden: Period life expectancy at birth 2001 to 2016



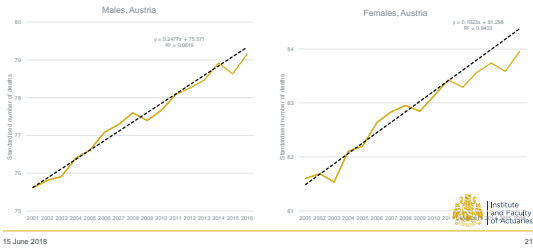
The Netherlands: Period life expectancy 2001 to 16



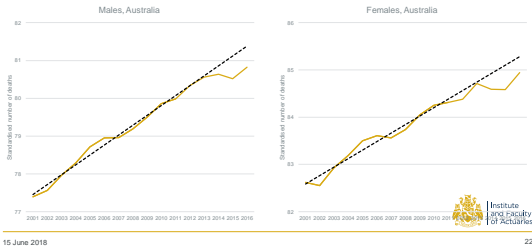
Spain: Period life expectancy at birth 2001 to 2016



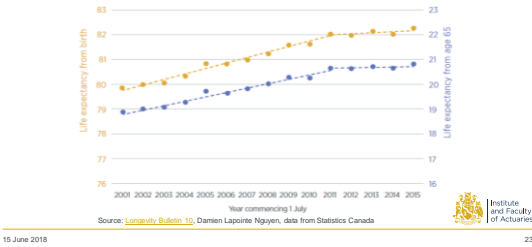
Austria: Period life expectancy at birth 2001 to 2016



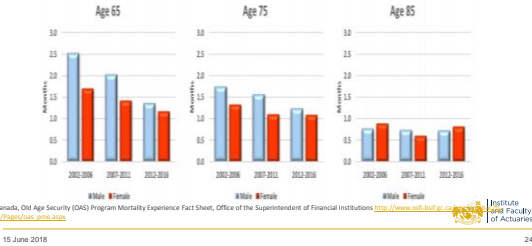
Australia: Period life expectancy at birth 2001 to 2016



Canada period life expectancy at birth and age 65, males and females combined, 2001/2 to 2015/16

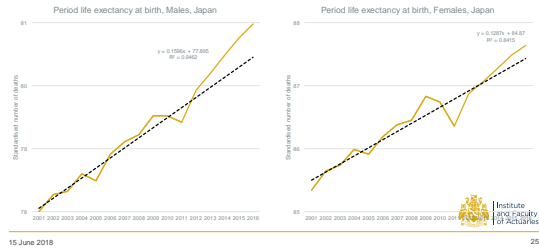


Canada Old Age Security (OAS) Program Mortality Experience  
Average Annual Increase in Life Expectancy of OAS Beneficiaries (in months)

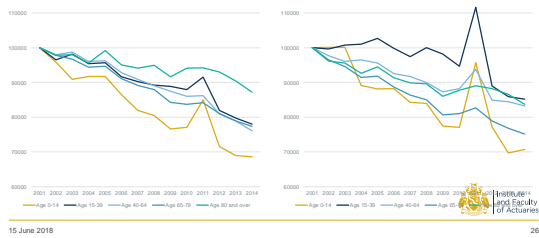




### Japan: Period life expectancy at birth 2001 to 2016



### Japan by age group. Standardised deaths indexed to 100k in 2001



### Selected high-income countries

Where are there signs of a fallback – and why?

- US 😞😞😞
- UK 😞😞
- Other European countries 😞
- Canada 😞😞
- Australia 😞
- Japan – the exception 😊😊

Now, what about causes and drivers? – evidence of a “blip” or a trend?

## Groupings, Causes and drivers

Looking at a few of the causes and drivers

Seasonal factors (eg winter mortality)

Causes of death

15-64

cardiovascular/circulatory/stroke

dementia

Drivers Smoking – obesity – diabetes – behaviours

Socio-economic groups and deprivation

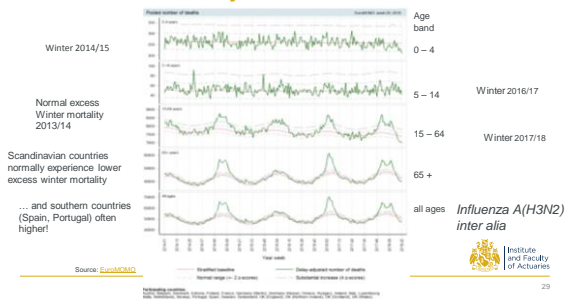
Austerity

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## Seasonal mortality – Europe excess winter mortality



## Causes of death

- 15-64
- Cardiovascular/circulatory/stroke
- Dementia



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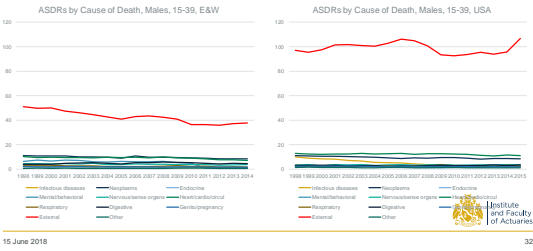
US Standardised deaths indexed to 100k in 2001



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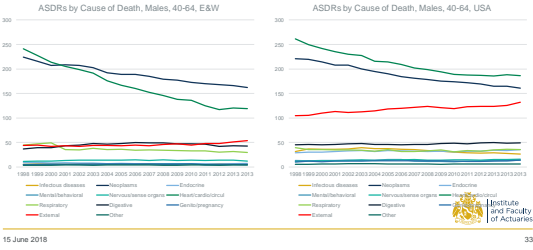
ASDRs by cause of Death, EW v US, Males 15-39



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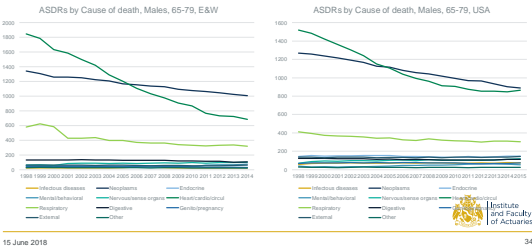
ASDRs by cause of Death, EW v US, Males 40-64



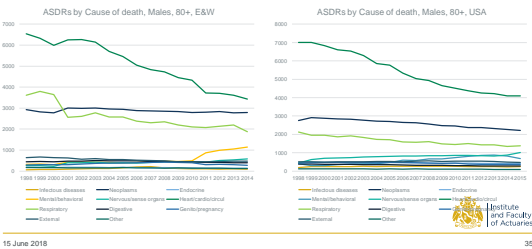
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ASDRs by cause of Death, EW v US, Males 65-79

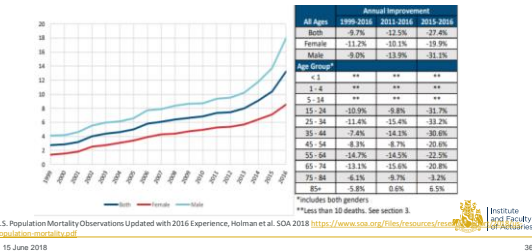


ASDRs by cause of Death, EW v US, Males 80+

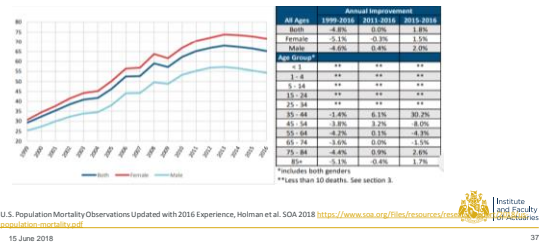


US Opioids: Age adjusted mortality 1999-2016

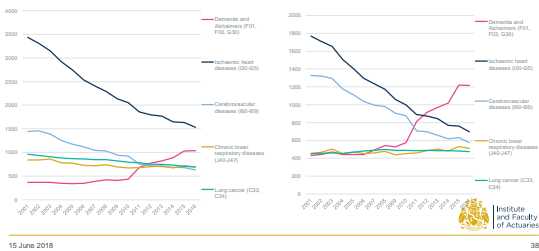
Deaths per 100,000



## US Alzheimer's/Dementia, age adjusted mortality 1999-2016



## E&W: Age standardised mortality rates for top five leading causes of death M, F (per 100,000)

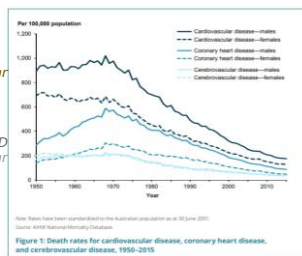


## Australia

### Cardiovascular

### CHD

### Cerebrovascular



"As the death rate from cardiovascular disease fell, rates from other diseases, such as dementia rose. Dementia might soon overtake coronary heart disease as the single leading cause of death in Australia (ABS 2016).

There are close associations between dementia and cardiovascular disease—cardiovascular disease itself is a major cause of dementia, and it is often listed as an associated cause when dementia is the underlying cause of death."

## Drivers

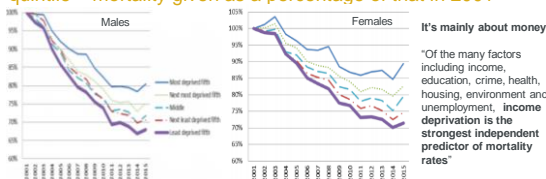
- Smoking: Effect of past generations quitting smoking – is it now fading out?
- Obesity and diabetes – effect increasing?
- Behaviours: eg US deaths from drug and alcohol poisoning, suicide, and chronic liver disease and cirrhosis
- Socio-economic factors

WHAT'S HAPPENING TO U.S. MORTALITY RATES? Chen et al, Center for retirement research, Boston College.  
[http://cit.rrc.bc.edu/wp-content/uploads/2017/08/16\\_17-17.pdf](http://cit.rrc.bc.edu/wp-content/uploads/2017/08/16_17-17.pdf)

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**England: Socio-economic gap. Progression of death rates for those aged 60-89 of each socioeconomic circumstances quintile – mortality given as a percentage of that in 2001**



Life expectancy: Is the socioeconomic gap narrowing? Longevity Science Panel Feb 2018  
[http://www.longevitypanel.co.uk/\\_files/LSP\\_Report.pdf](http://www.longevitypanel.co.uk/_files/LSP_Report.pdf)

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**US: Compares age-standardized deaths for counties with average household income in top 30% against all counties**

TOP 30% VS. ALL COUNTIES BY INCOME AGE ADJUSTED MORTALITY 1999-2016



U.S. Population Mortality Observations Updated with 2016 Experience, Holman et al. SOA 2018  
[https://www.soa.org/files/resources/research/population\\_mortality.pdf](https://www.soa.org/files/resources/research/population_mortality.pdf)

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Austerity – mixed messages

- **Europe: The slowing down of life expectancy, correlated to the level of austerity**, raises uncomfortable questions as to whether we are beginning to transition from the era of consistently improving population health to **a new age characterised by an instability in population health largely dictated by the social and political determinants of health.**
- "While income inequality has increased in both the United States and France, inequality in mortality in France remained remarkably low and stable"

Source: *Austerity and the new age of population health?* Mark A Green, Scandinavian Journal of Public Health  
Source: Mortality (inequality in France and the United States, J Currie et al National Bureau of Economic Research, Cambridge, MA

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Framework for presentation

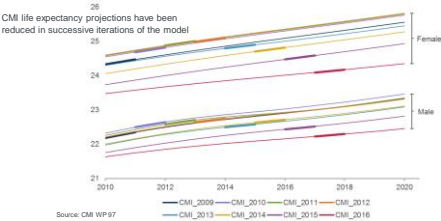
- Introduction
- Longevity and death rates, country by country
- Analysis: groupings, causes and drivers
- What are actuaries, demographers and others doing?

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The CMI Model – Life expectancy age 65



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US

Updated views on future mortality improvement

Fenton et al, WBS/TowersWatson June 2016

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

Historical mortality improvement								
Period	Gender	25-34	35-44	45-54	55-64	65-74	75-84	85+
2000-10	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%
2010-14	Male	-1.3%	-0.5%	0.5%	-0.5%	12.1%	1.5%	1.3%
	Female	-1.2%	-1.0%	-0.3%	-0.6%	1.4%	1.1%	0.9%
2010-24	Male	-0.3%	0.8%	0.6%	0.7%	1.7%	1.3%	0.6%
	Female	-0.5%	0.2%	-0.1%	0.8%	1.3%	0.7%	0.2%

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Germany

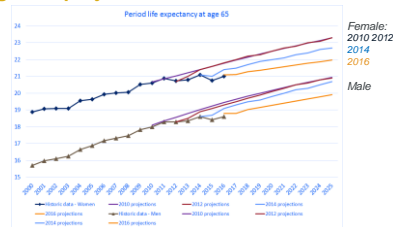
- The Life Insurance Committee of die Deutsche Aktuarvereinigung e.V. (DAV) reviewed reserving guidelines for pensions insurance in Jan 2018. Reserves based on DAV2016UR are slightly lower than those based on DAV2004R but within the range of expected fluctuations. Projections work on base mortality plus trend, and the reviewers found no need to change the guidelines.

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UK: Office for National Statistics: period life expectancy at age 65 - projections 2010 to 2016



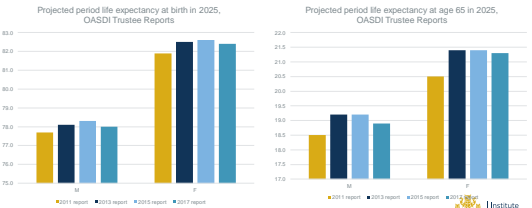
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**US OASDI:  
Successive projected period life expectancies in 2025**



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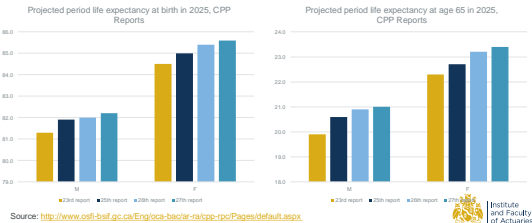
**Ultimate annual percent reductions in age-sex adjusted death rates, USA, OASDI Trustee reports**

	2008	2009	2011	2013	2015	2017
0-14	1.57	1.55	1.56	1.57	1.57	1.06
15-64	1.00	0.99	0.96	0.98	1.00	1.01
65+	0.65	0.71	0.66	0.64	0.63	0.62

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**Canada Pension Plan:  
Successive projected period life expectancies in 2025**

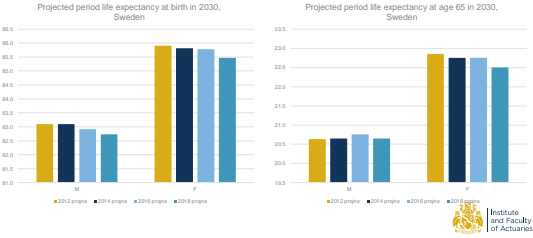


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Sweden:

Successful projected period life expectancies in 2025



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Conclusions

Longevity improvements have slowed down in most countries

Underlying causes unlikely to disappear

- Excess winter mortality
- "External causes"
- Opioids
- Cardiovascular/circulatory/stroke gains slackening
- Dementia and Alzheimer's mixed
- Poverty and the widening socio-economic gap
- Austerity

Impact on insured and pensioner populations differ:  
different subsets of the population  
exposure by "amounts" higher for higher socio-economic groups



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Questions

Comments

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