

TRENDS IN UNDERWRITING & U.S. LIFE EXPECTANCY

- Munich, September 2018
- Mike Fasano (Fasano Associates) and Jochen Ruß (ifa)



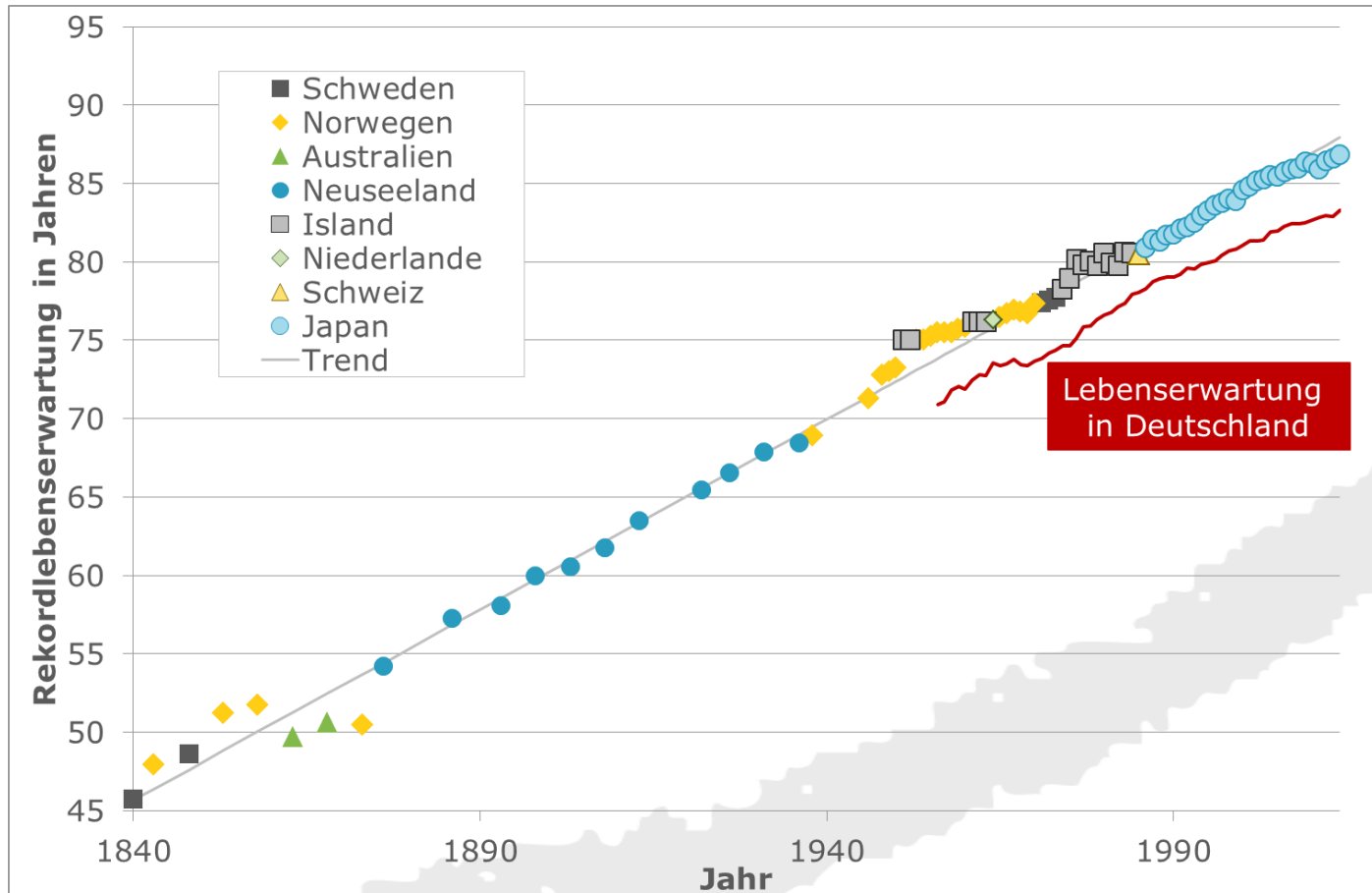
Part 1

The 20th Century: Life Expectancy went straight up!

Selected Research on Mortality Improvement and Longevity

Vaupel's Trend

Increase in global life expectancy has been extremely stable...



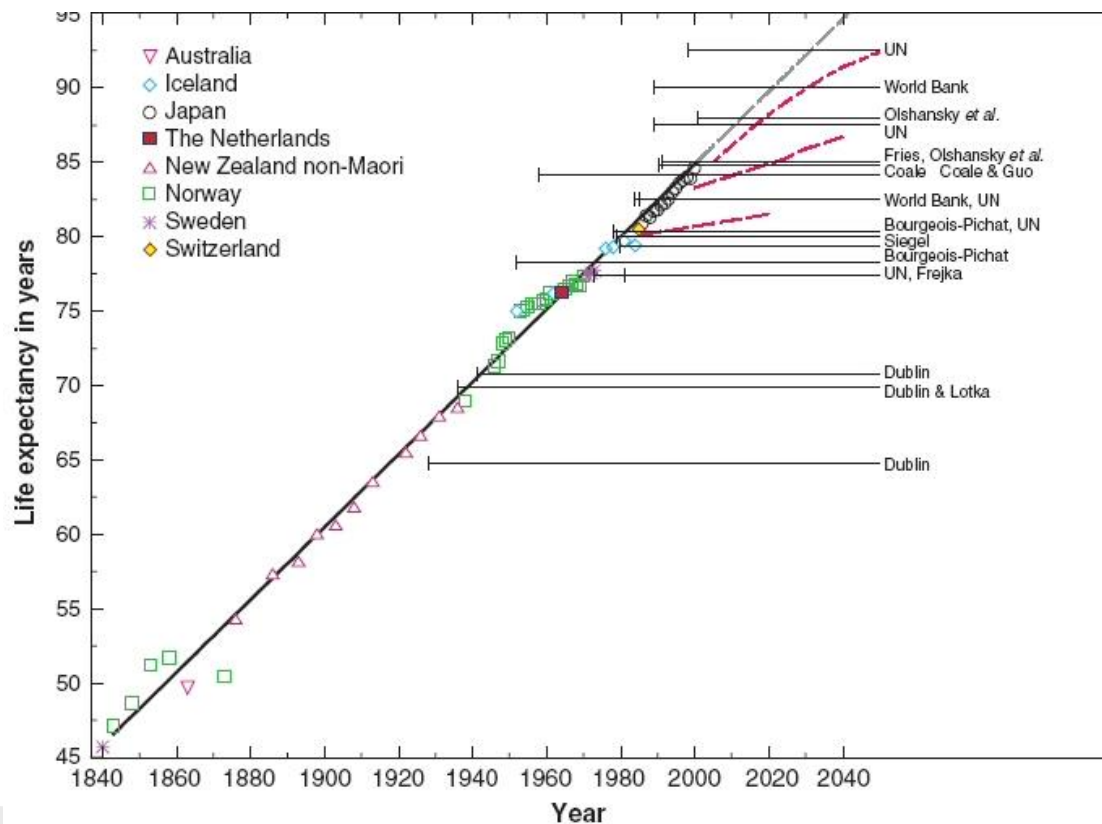
Source: Results from Oeppen and Vaupel (Science, 2002) supplemented by own calculations for the years 2001-2014.

Selected Research on Mortality Improvement and Longevity

Vaupel's Trend

... but experts always thought that it would end soon.

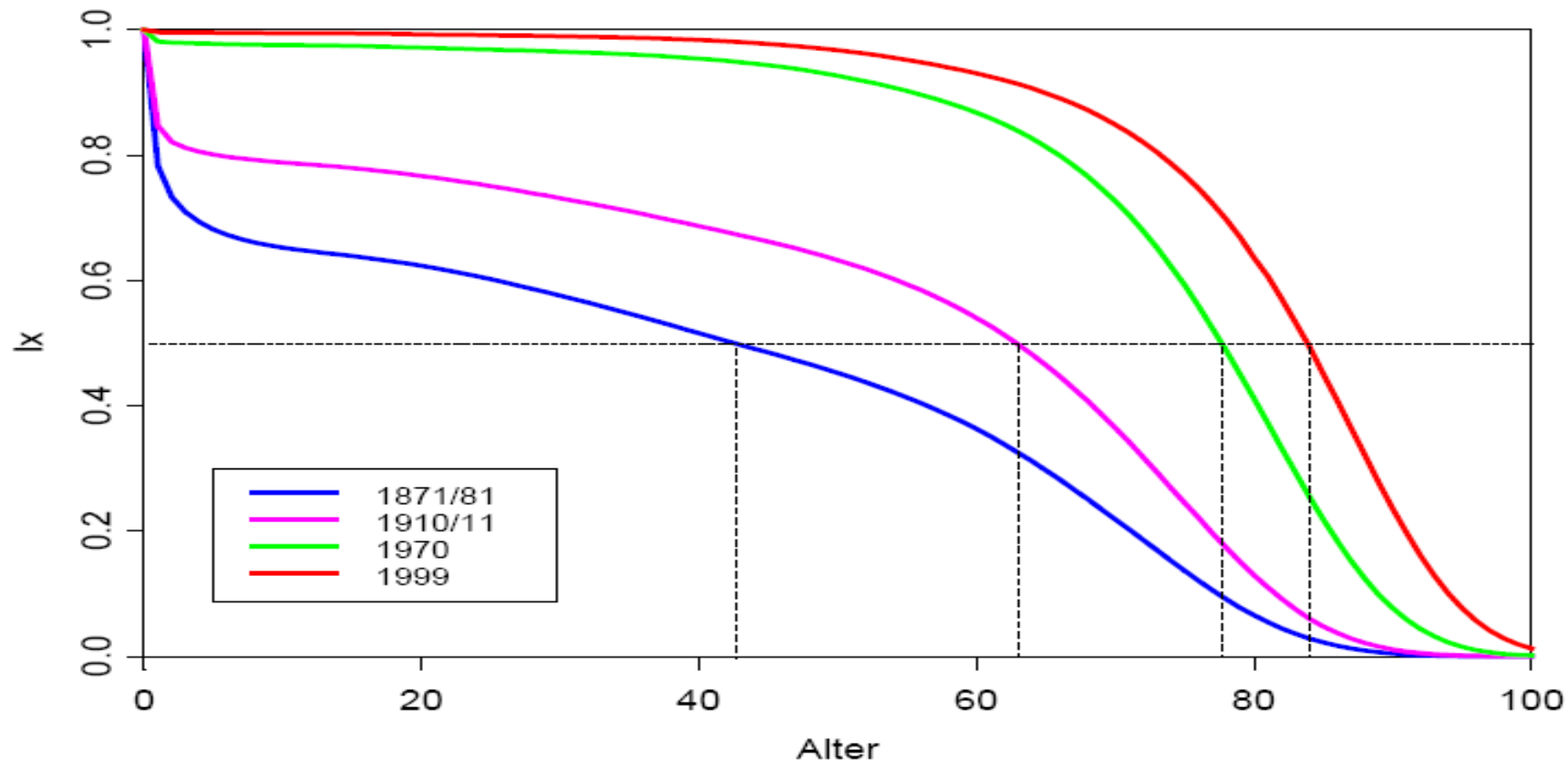
- The chart shows the trend from the previous slide compared with experts' estimates for maximum life expectancy (Source: Oeppen and Vaupel, Science, 2002)



Selected Research on Mortality Improvement and Longevity

Vaupel's Trend

- The increase has not been 'uniformly over the mortality curve'
- Currently, life expectancy increases mainly due to mortality improvements for ages 70+

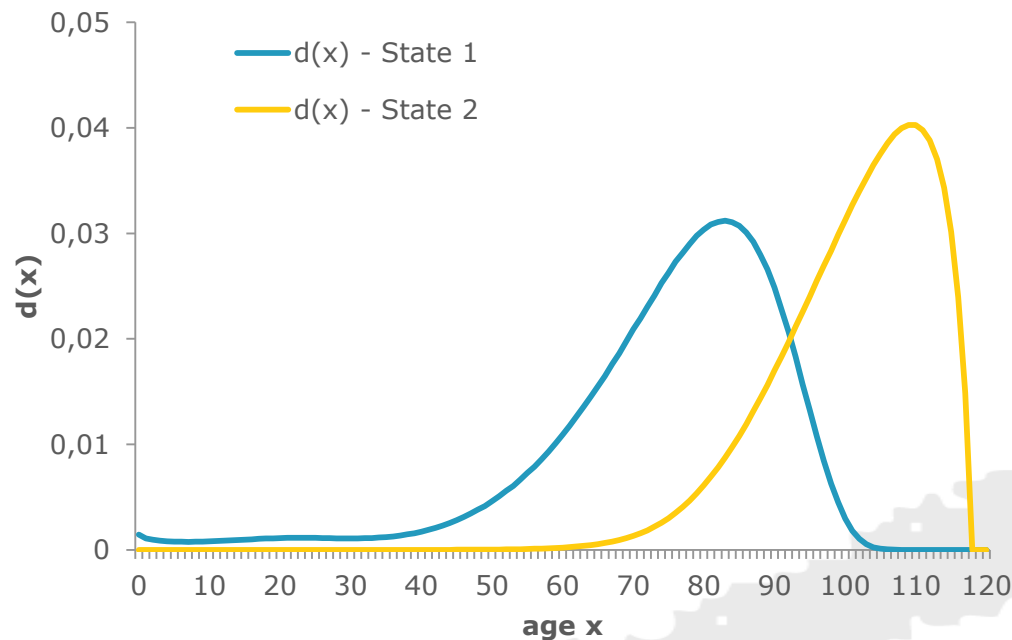


Source: Oeppen and Vaupel, Science, 2002

Selected Research on Mortality Improvement and Longevity

Extension, Compression, and beyond

- This raises the question, **how** mortality curves change, when life expectancy increases.
- This has not been uniformly!
- A change in the distribution of deaths over ages might look like this.



We* have recently proposed to consider 4 types of changes:

- right shift / left shift
 - Entire curve moves
- extension / contraction
 - Maximum attainable age moves
- compression / decompression
 - More (less) deaths around the peak of the curve
- concentration / diffusion
 - Deaths are less (more) evenly distributed over the whole curve

* M Börger, M Genz, J Ruß (2018): Extension, Compression, and Beyond: A Unique Classification System for Mortality Evolution Patterns. *Demography*, 55(4): 1343–1361.

Selected Research on Mortality Improvement and Longevity

Extension, Compression, and beyond

Example: US-Females


starting age	component	1933	1940	1950	1960	1970	1980	1990	2000	2010
10	M	+	↑ 0	+	+	↓	+	+	+	0
	UB	0	↑	+	+	+	-	↑	-	+
	DoI	+	+	+	0	↑	+	+	+	+
	d(M)	+	↓	+	-	↑	+	0	+	-
60	M	+	↑ 0	+	+	↓	+	↑	+	0
	UB	0	↑	+	+	+	-	↑	-	+
	DoI	0	↓	+	+	0	+	+	+	+
	d(M)	+	-	+	-	-	-	+	-	-

+	increasing trend
0	neutral trend
-	decreasing trend
↑	change in slope
↑	upward jump
↓	downward jump

- right shift / left shift – measured by a variable called M
- extension / contraction – measured by a variable called UB
- compression / decompression – measured by a variable called DoI
- concentration / diffusion – measured by a variable called d(M)

Source: M Börger, M Genz, J Ruß (2018): Extension, Compression, and Beyond: A Unique Classification System for Mortality Evolution Patterns. Demography, 55(4): 1343–1361.

Outlook: It is possible to use the most recent trend of these four variables to get a prediction for future mortality curves that is consistent with recent changes. (M Börger, M Genz, J Ruß (2018): The Future of Mortality – Mortality Forecasting by Extrapolations of Deaths Curve Evolution Patterns)



Part 2

The 21st Century – Changes

Part 2 and Part 3 of this presentation were held by Mike Fasano of Fasano Associates. The corresponding slides can be requested from the author at mfasano@fasanoassociates.com

Part 3

From Macro to Micro: Measuring Biologic Age

Part 2 and Part 3 of this presentation were held by Mike Fasano of Fasano Associates. The corresponding slides can be requested from the author at mfasano@fasanoassociates.com

Part 4

The Future: The
only certain thing
is uncertainty!

Development of life expectancy

What will the future bring?

For the future, there are (simplified) four different approaches:

- the pessimists
- the traditionalists
- the pragmatists
- the optimists

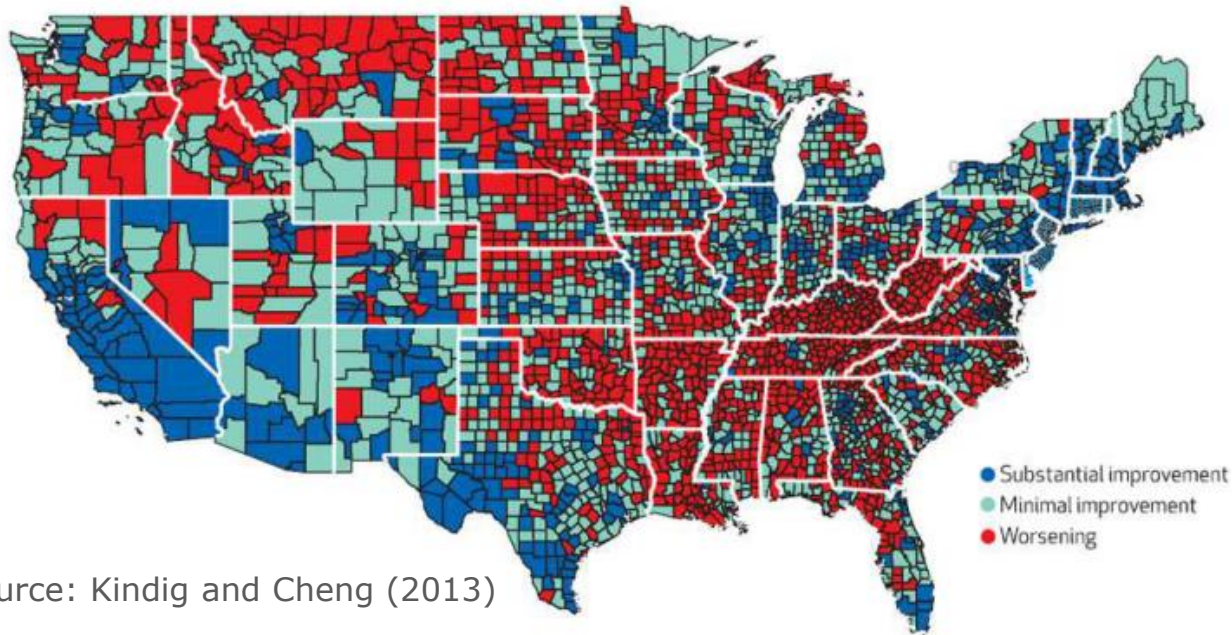


Development of life expectancy

What will the future bring?

The pessimists: In the near future, the life expectancy will stabilize or even decrease.

- The picture shows the development of the mortality of women in the USA from 1992 to 2006.
- In most counties, the life expectancy decreased (in the entire USA, it increased).



Source: Kindig and Cheng (2013)

- Possible reasons: obesity, poor medical care, ...

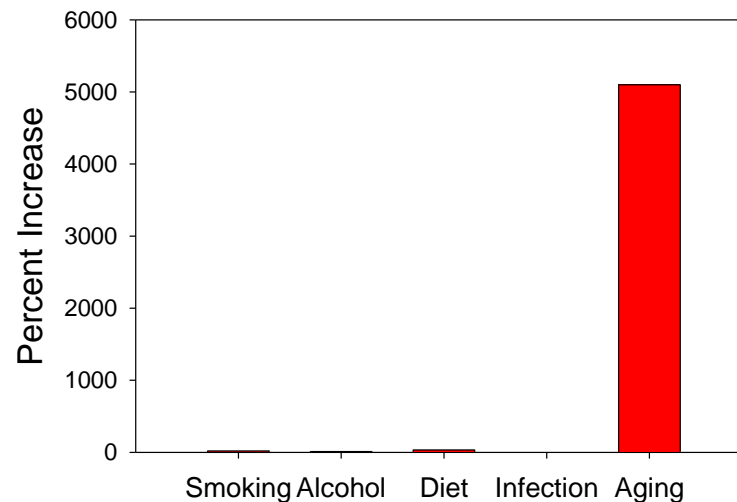
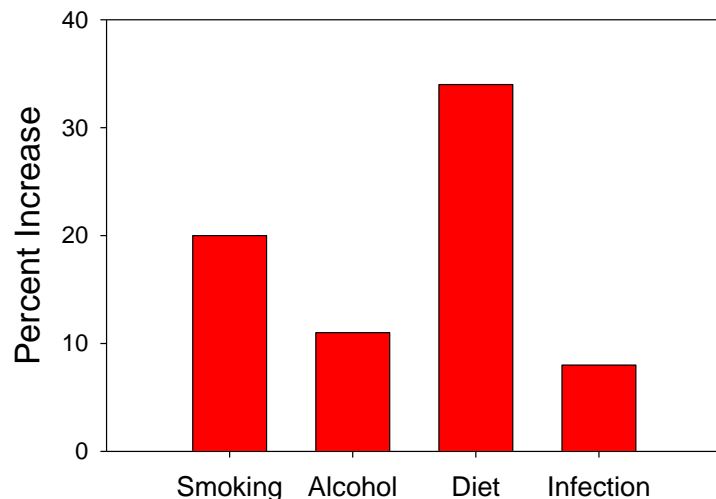
**But: The medical progress does not stop. Not everybody will profit from the progress.
→ More heterogeneity in the population!**

Development of life expectancy

What will the future bring?

The traditionalists: The life expectancy will further rise, but the increase will weaken.

- In the past, we had a strong reduction of mortality in young ages and therefore a significant gain of lifetime
 - If the mortality of older people is reduced, this results in fewer (additional) lifetime
 - The reduction of „usual“ disease triggers has only limited potential
 - **More potential only if the aging process can be slowed down**



Source: S. Jay Olshansky (2016), talk at the Longevity 12 Conference, Cicago, IL
The chart shows risk factors for cancer. In the talk of Olshanski, similar pictures were shown for heart diseases and Alzheimer's disease.



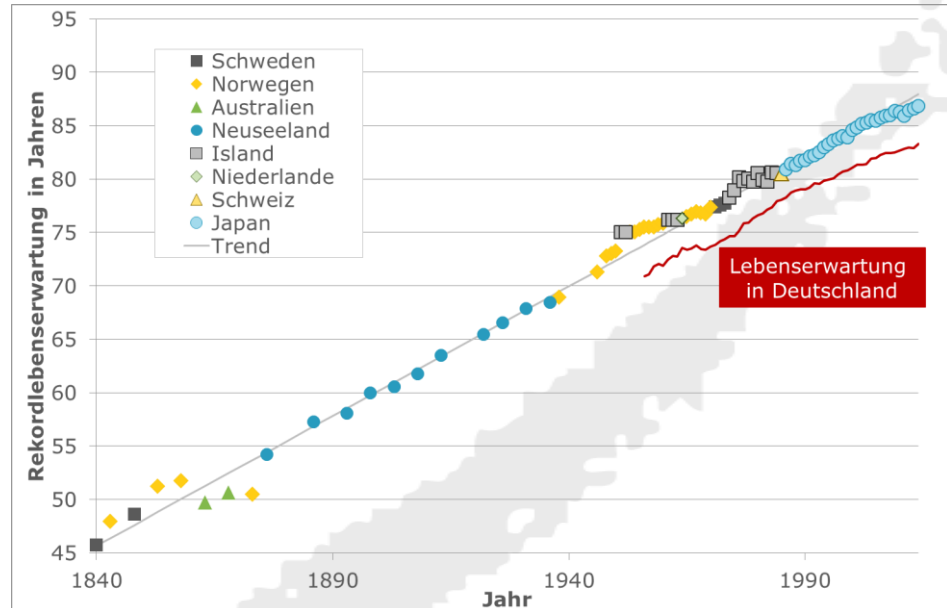
Development of life expectancy

What will the future bring?

The pragmatists: The life expectancy has risen in the past; it will further rise in the future.

- The reasons for the increase of the life expectancy have continuously changed, but the increase itself was rather steady.
- There will be reasons for an increase of the life expectancy in the future as well.
 - Genetic engineering?
 - Stem cells?
 - Telomeres?
 - Metformin?
 - „Young blood“?
- Alternative explanation:
If we don't know what the future will bring, the continuation of historic trends should be our best estimate.

Source: Own illustration of results from Oeppen and Vaupel (2002), supplemented by own calculations for the years 2001-2014.



Metformin as a Tool to Target Aging

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<http://dx.doi.org/10.1016/j.cmet.2016.05.011>

Aging has been targeted by genetic and dietary manipulation and by drugs in order to increase lifespan and health span in numerous models. Metformin, which has demonstrated protective effects against several age-related diseases in humans, will be tested in the TAME (Targeting Aging with Metformin) trial, as the initial step in the development of increasingly effective next-generation drugs.

Development of life expectancy

What will the future bring?

The optimists: The increase in life expectancy will even rise (dramatically).

- So far: focus on healing diseases once people got them
In the future: regular „maintenance“ of the human body before diseases emerge.
- This will result in ever stronger and faster increases of life expectancy.
 - Is the first person who will survive to age 200 years old already alive?
 - Most important (and most interesting) proponent of this theory: *Aubrey D.N.J. de Grey*



The seven approaches for the „maintenance“ of the human body

Source: *Aubrey de Grey*, talk at the Longevity 12 Conference, Cicago, IL

The “seven deadly things” & their fixes

Damage type	The maintenance approach
Cell loss, cell atrophy	Replace, using stem cells
Division-obsessed cells	Reinforce, using telomere control
Death-resistant cells	Remove, using suicide genes etc
Mitochondrial mutations	Reinforce, using backup copies
Intracellular waste products	Remove, using foreign enzymes
Extracellular waste products	Remove, using immune system
Extracellular matrix stiffening	Repair, using crosslink-breakers

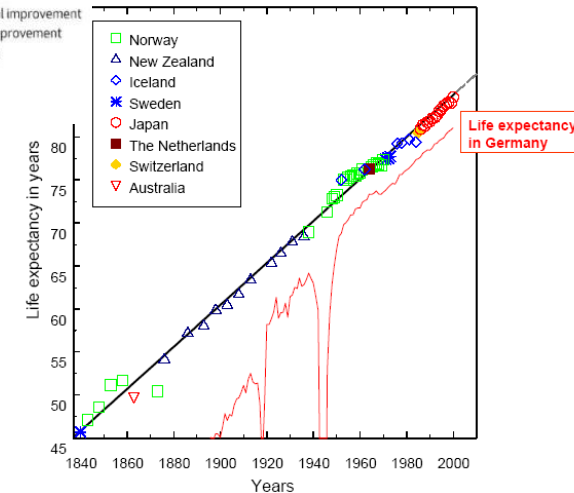
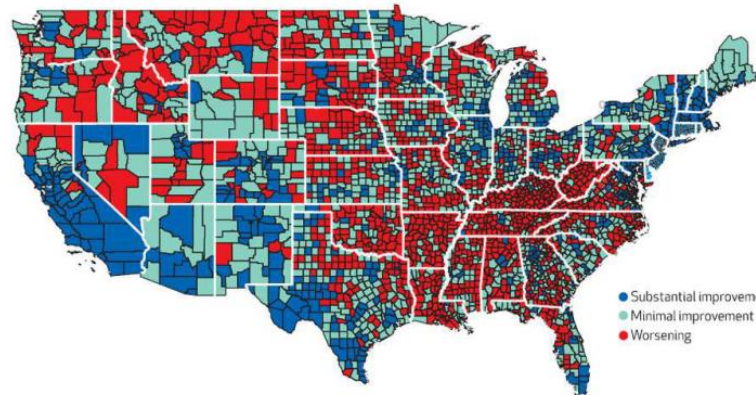
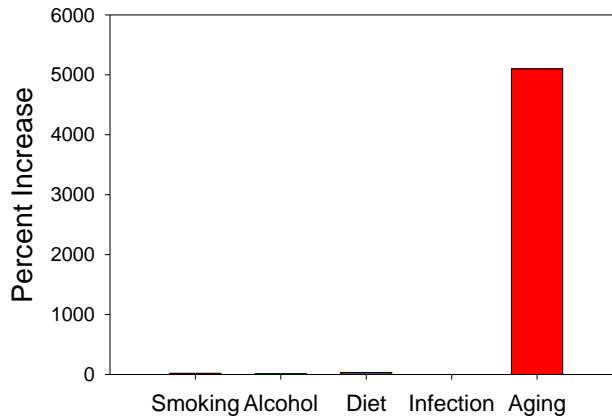
Existence of any 8th is looking increasingly unlikely

Development of life expectancy

What will the future bring?

Expert opinions strongly differ!

- However, there is no reason to assume that the medical progress stops.
- The extent on the other hand is extremely uncertain!



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November 5, 2018 • Washington D.C.

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