

# TRENDS IN UNDERWRITING & U.S. LIFE EXPECTANCY

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



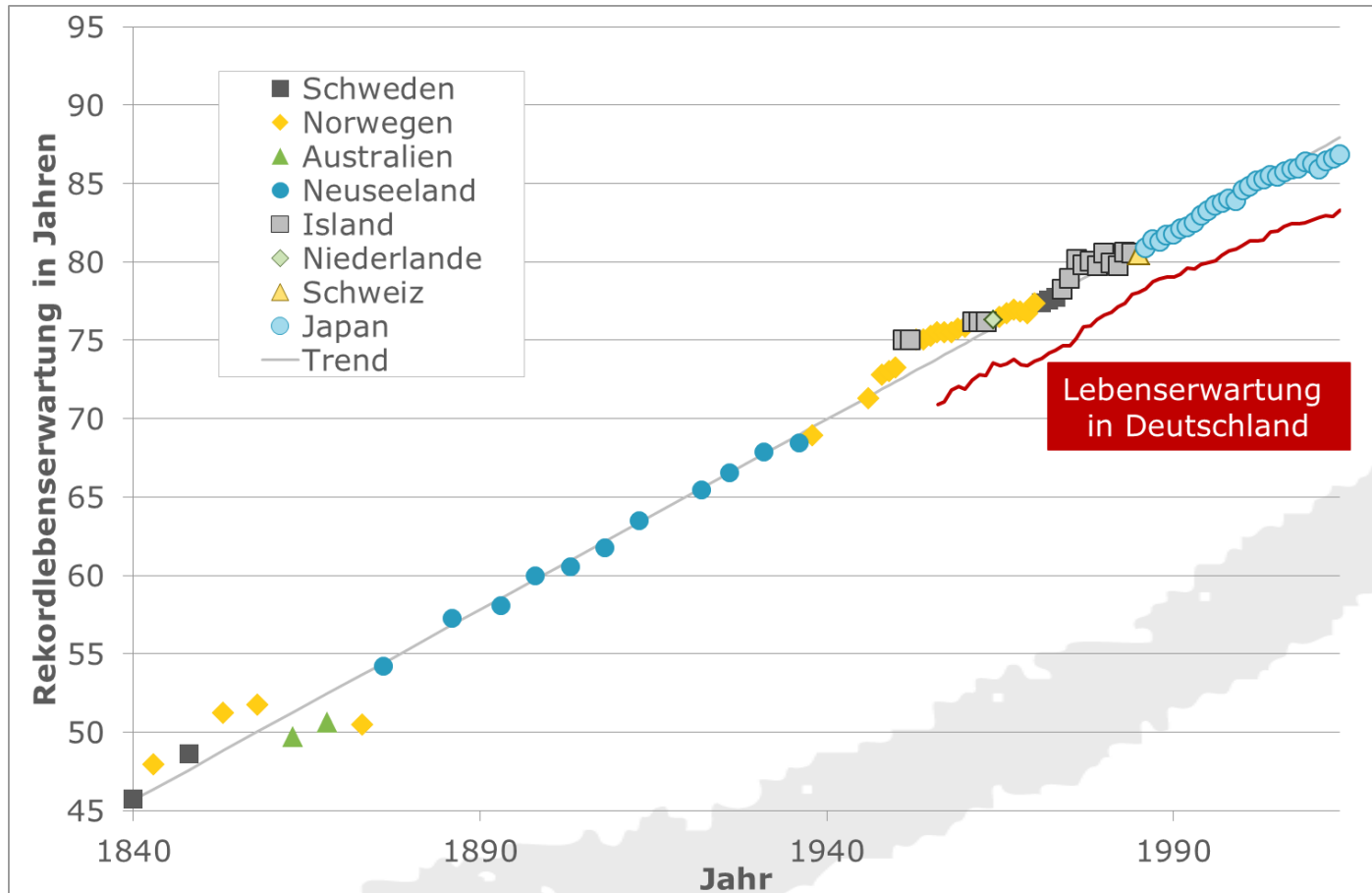
# Part 1

## 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...



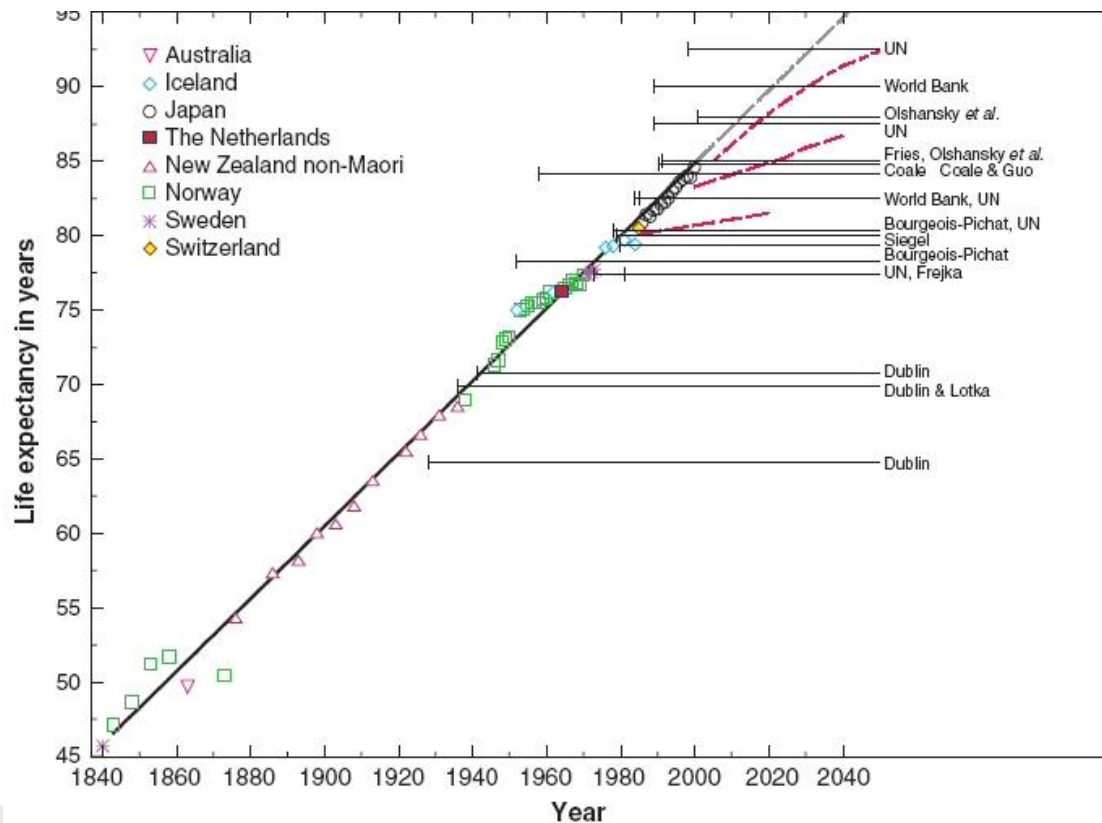
Source: Results from Oeppen and Vaupel (Science, 2002) supplemented by own calculations for the years 2001-2014.

# Selected Research on Mortality Improvement and Longevity

## Vaupel's Trend

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

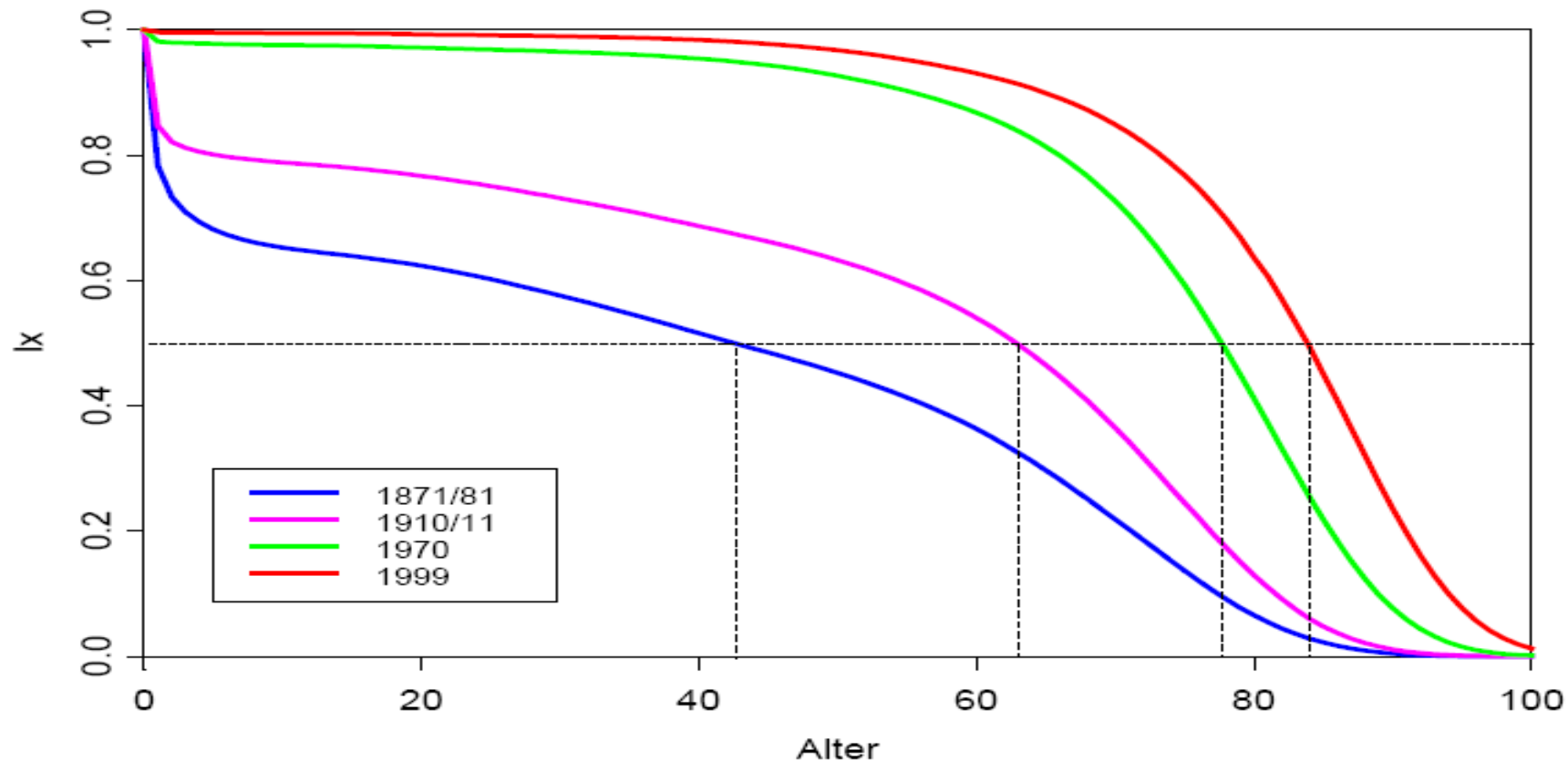
- The chart shows the trend from the previous slide compared with experts' estimates for maximum life expectancy (Source: Oeppen and Vaupel, Science, 2002)



# 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+

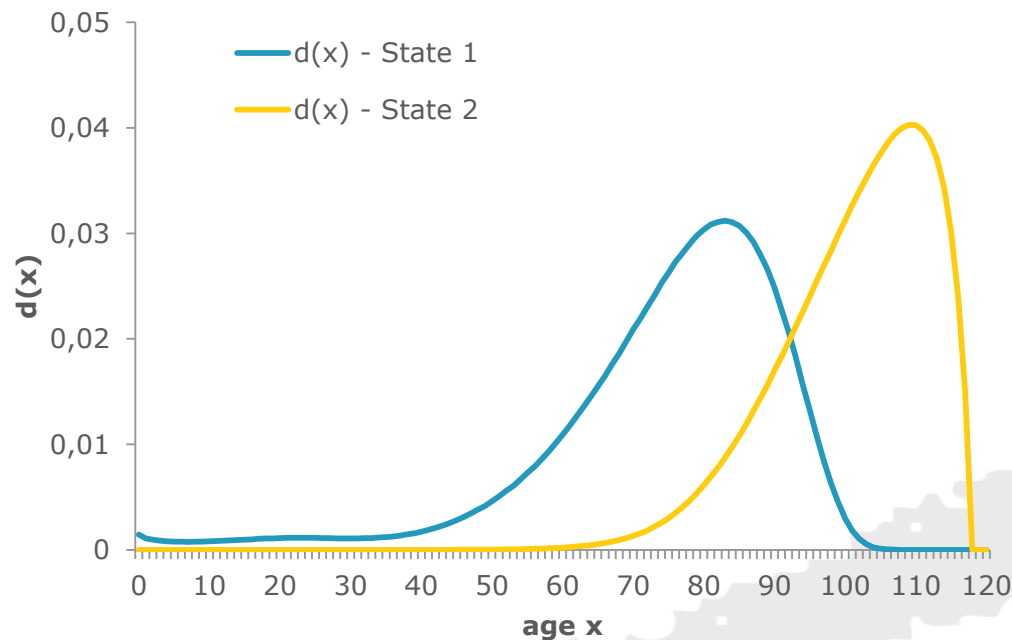


Source: Oeppen and Vaupel, Science, 2002

# 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 21<sup>st</sup> 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](mailto: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](mailto: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

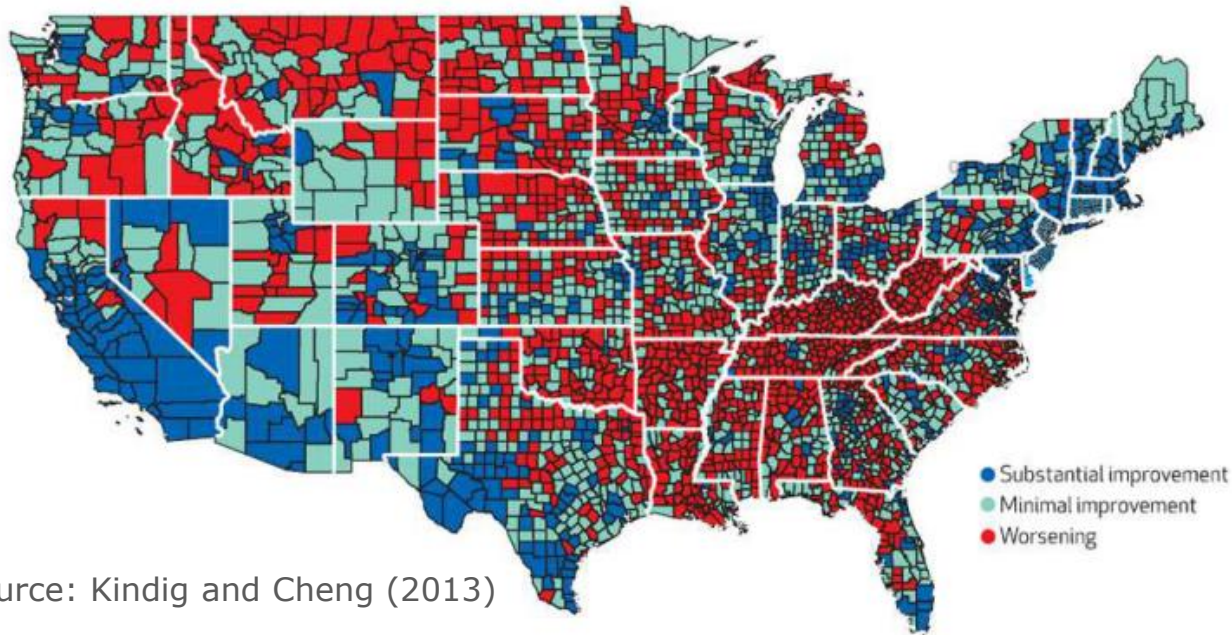


# Development of life expectancy

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, ...

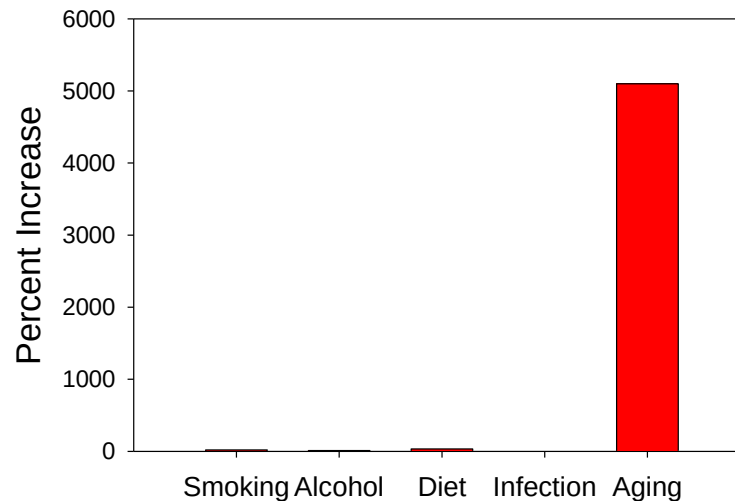
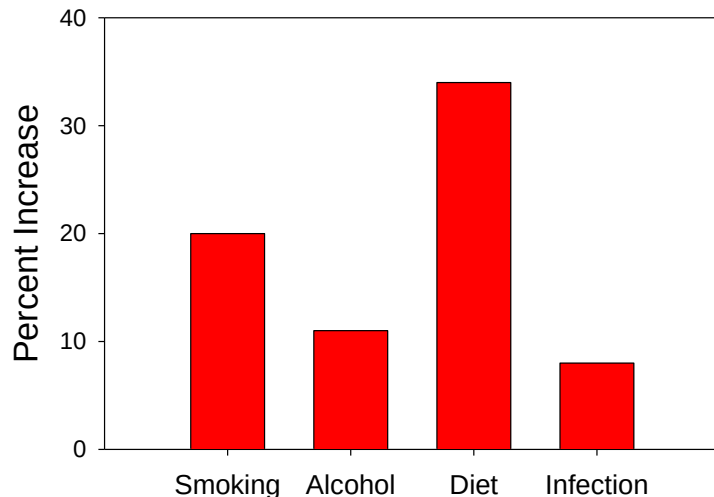
**But: The medical progress does not stop. Not everybody will profit from the progress.  
→ More heterogeneity in the population!**

# 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.



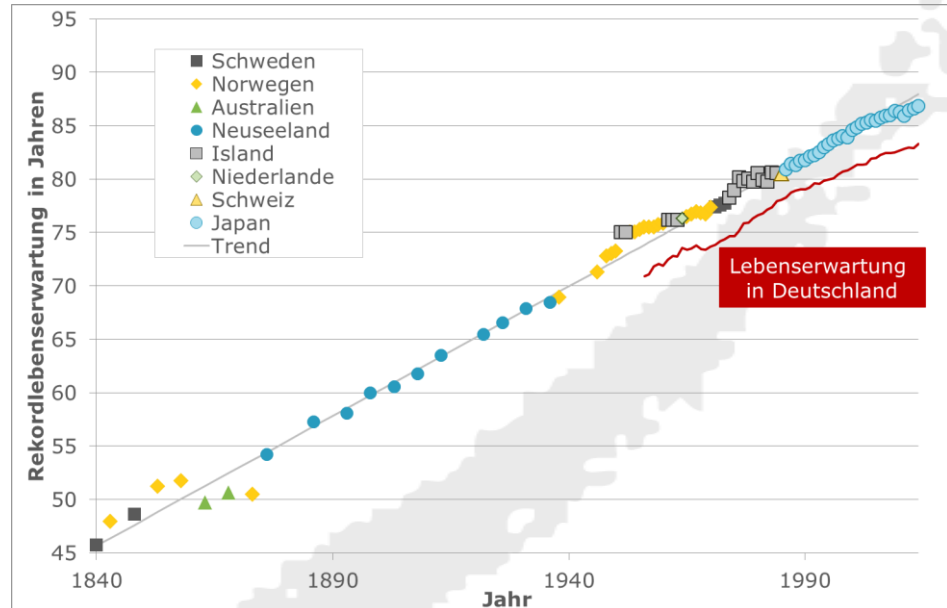
# Development of life expectancy

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

Nir Barzilai,<sup>1,\*</sup> Jill P. Crandall,<sup>1</sup> Stephen B. Kritchevsky,<sup>2</sup> and Mark A. Espeland<sup>2</sup>

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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 8<sup>th</sup> is looking increasingly unlikely**

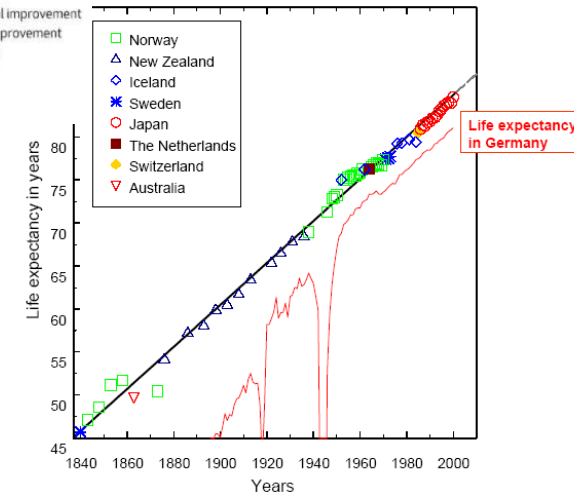
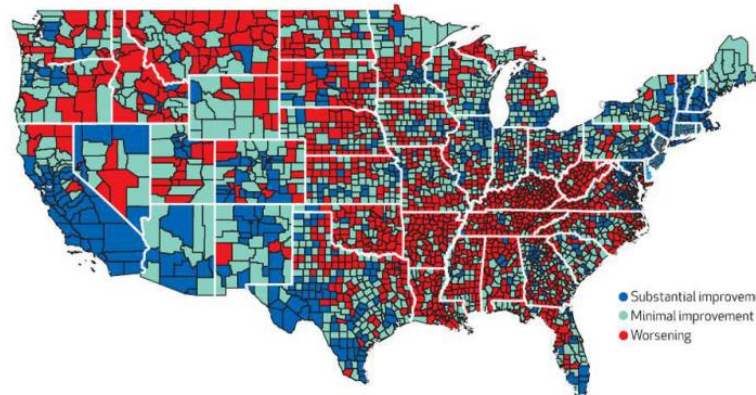
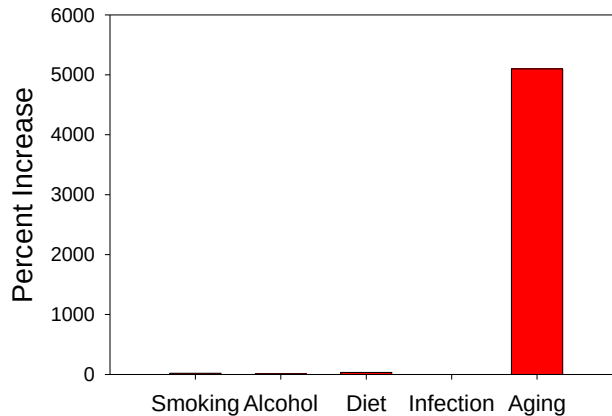


# Development of life expectancy

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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# FASANO 15<sup>th</sup> ANNUAL LONGEVITY CONFERENCE

November 5, 2018 • Washington D.C.

## PLEASE JOIN US!

### NOVEMBER 5<sup>TH</sup>, 2018

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