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Long Term Mortality Improvements

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14 September 2023

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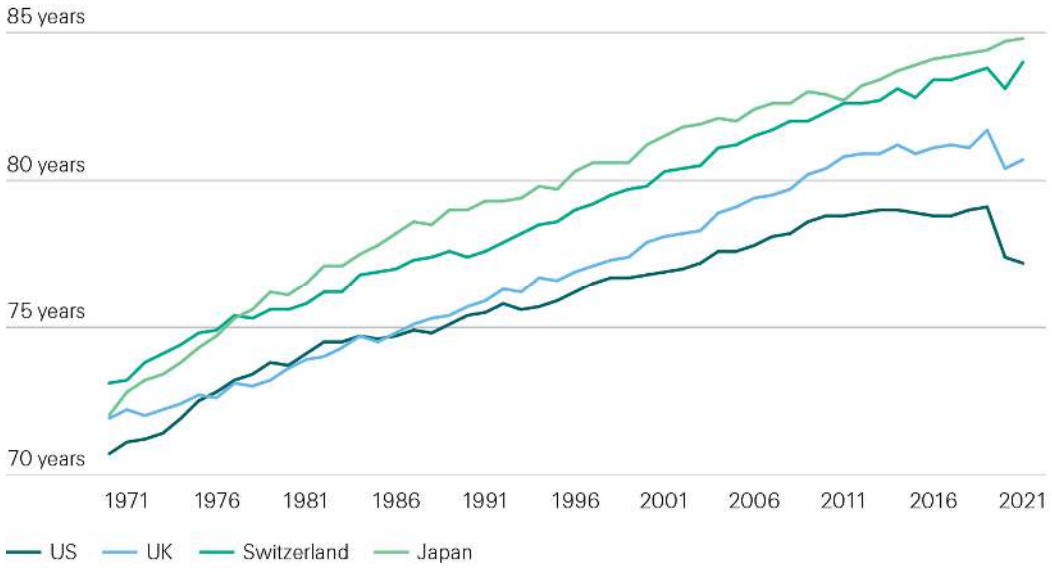
14 September 2023

UK mostly in line with high income nations, pandemic exacerbated global differences

Area	2019	2021
Japan	84.4	84.8
Switzerland	83.8	84
UK	81.7	80.7
US	79.1	77.2
China	78	78.2
High income	81.2	80.3
Less developed	71.3	69.6
World	72.8	71
Africa	62.7	61.7
Asia	74.2	72.5
Europe	79.1	77
LatAm	75.1	72.2



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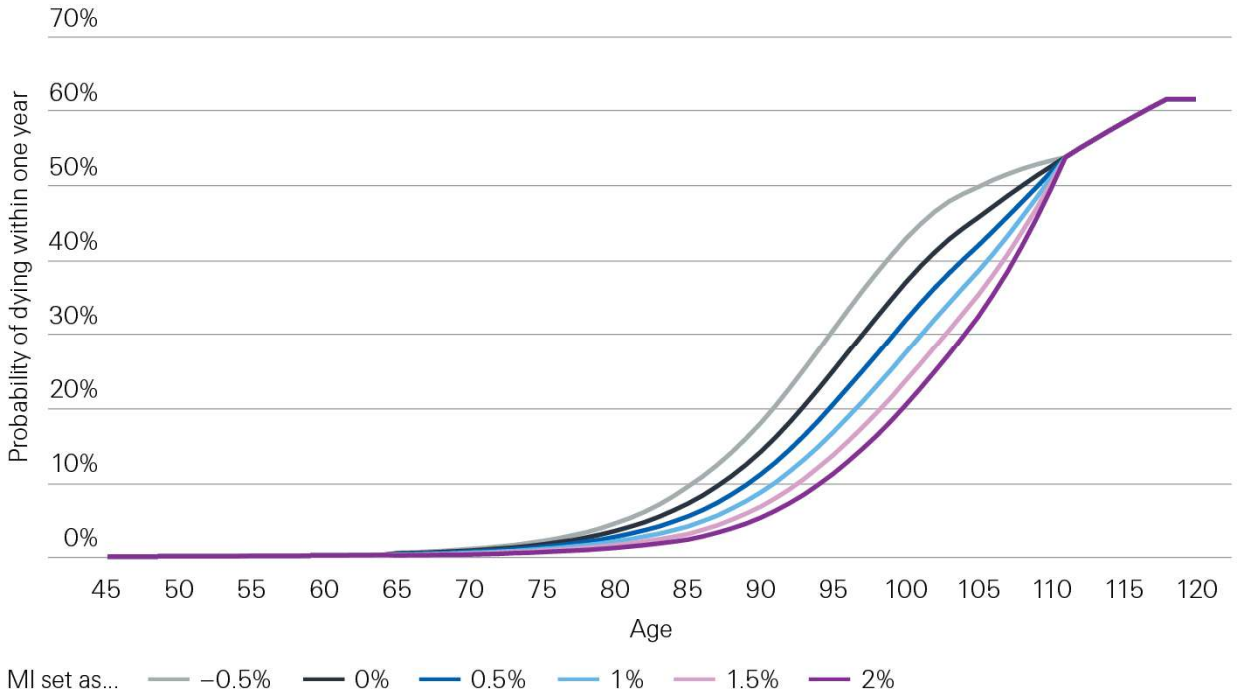
Small deviations in mortality can have significant impacts on an insurers' results



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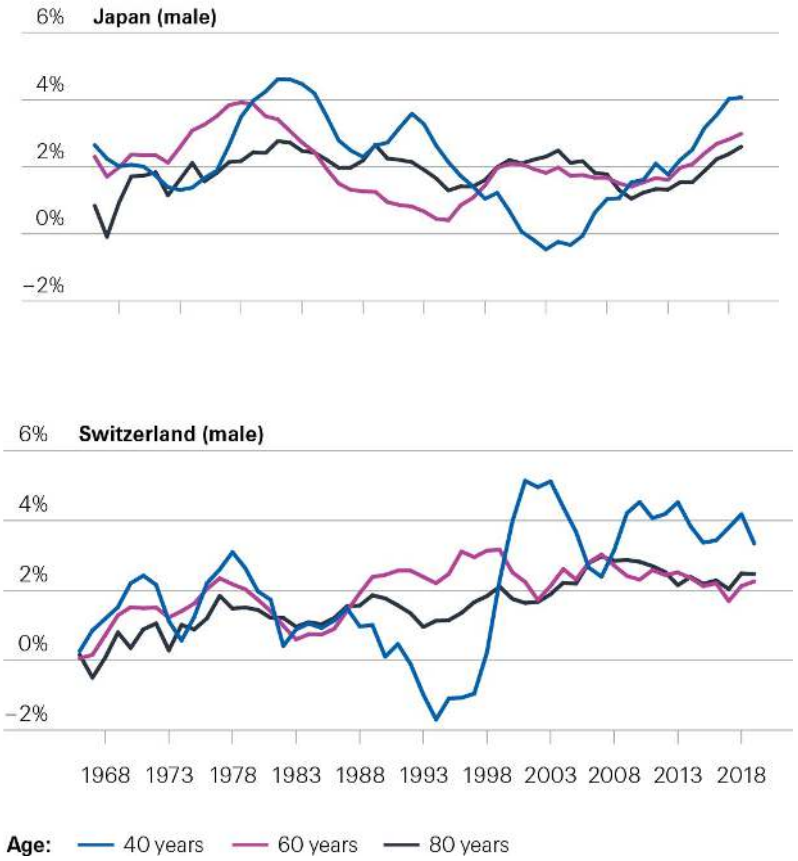
Longevity Champions: Japan and Switzerland



- Highest life expectancies in the world
  - Explained by medical developments over decades this can be explained through physical activity and diet
- Japan
  - Leader in the G7 for life expectancy due to improvements in CVD survival rates
  - Turnaround to increasing mortality improvements
- Switzerland
  - Average health status is one of the highest of all OECD countries.

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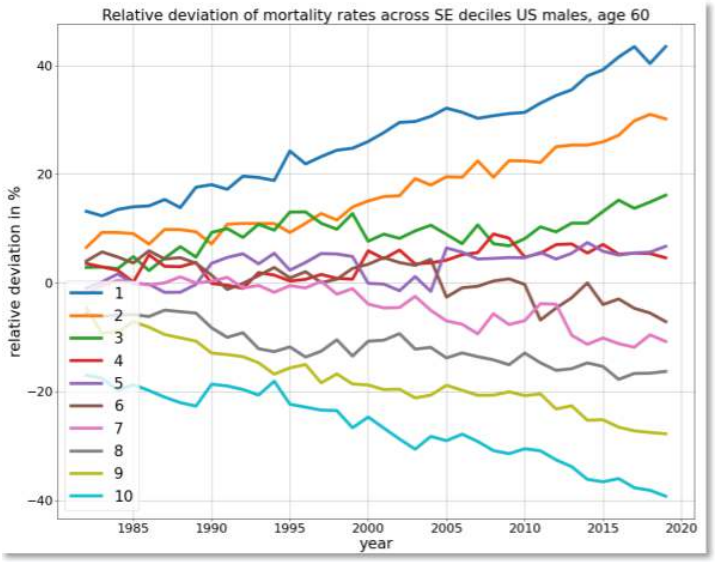
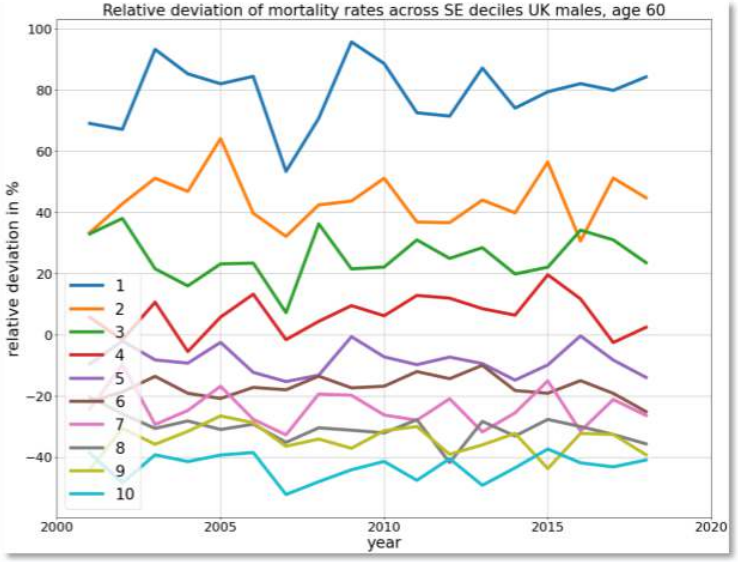
Mortality differences and divergence across socio-economic deciles





- UK and US

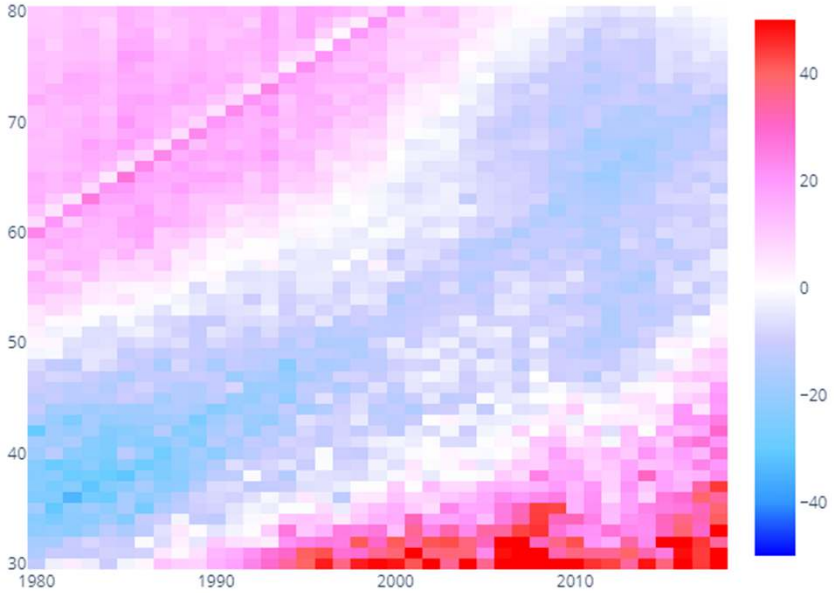
How will the long-term evolution look like?

Continued divergence, saturation, convergence?

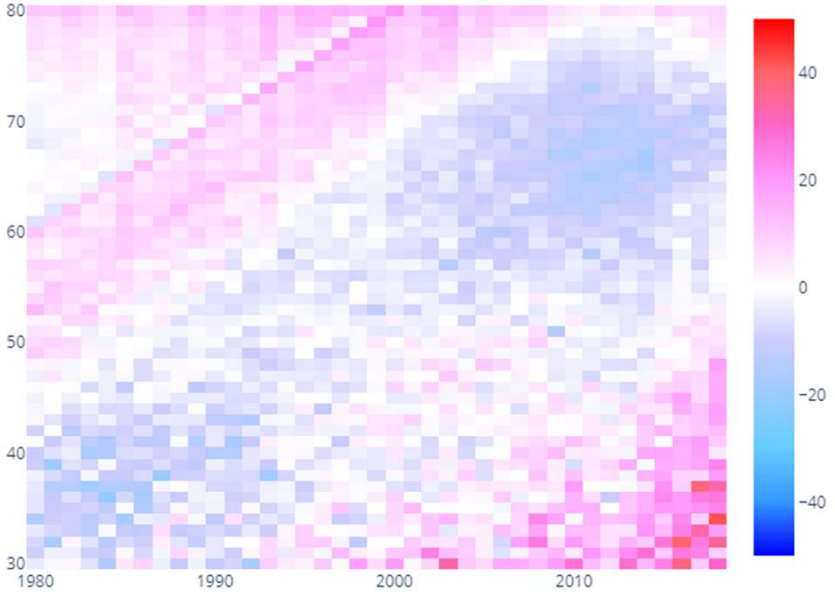
Sources: SOA study 2020, ONS

Historical Mortality Improvements 1980-2019, UK

Showing deviations from fitted plane to log-mortality rates in percent



UK males, 1980-2019, ages 30-80, avg. MI **1.86%**



UK females, 1980-2019, ages 30-80, avg. MI **1.63%**

Data source: Human Mortality Database

Strong overall mortality improvements over past decades.
Slow down of improvements since ~2010 in particular by younger cohorts born 1975+, which presumably will carry **worse mortality to higher ages.**

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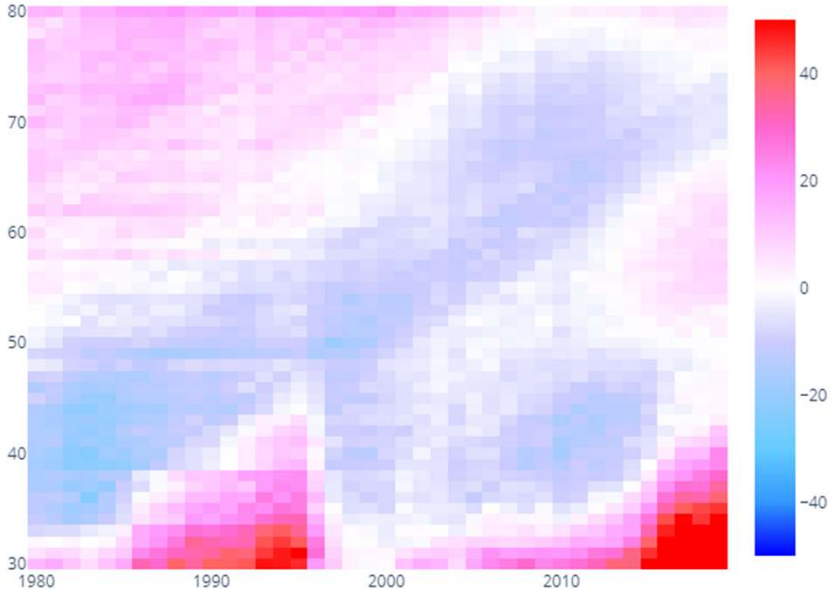
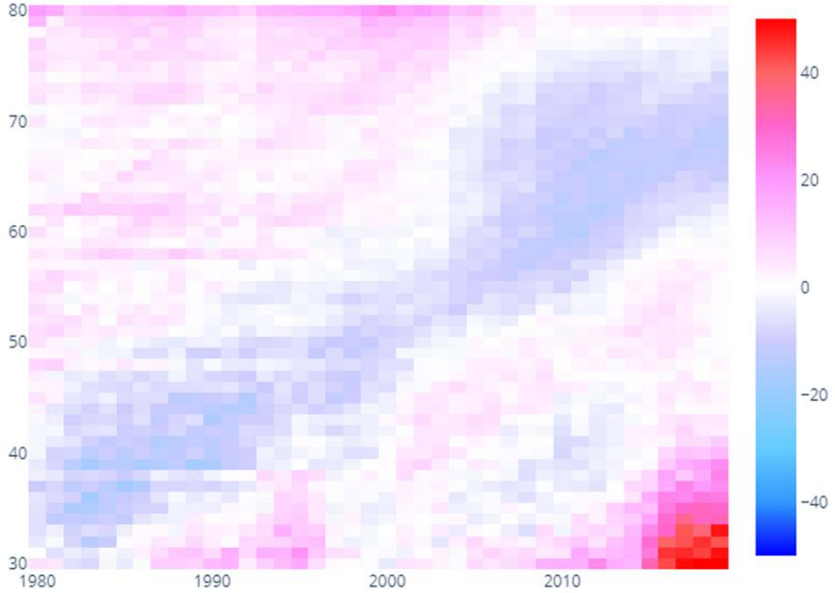
Historical Mortality Improvements 1980-2019, US

Showing deviations from fitted plane to log-mortality rates in percent



US males, 1980-2019, ages 30-80, avg. MI **1.29%**



US females, 1980-2019, ages 30-80, avg. MI **0.73%**

Data source: Human Mortality Database

Strong overall mortality improvements over past decades.
Slow down of improvements since ~2010 in particular by younger cohorts born 1975+, which presumably will carry **worse mortality to higher ages.**

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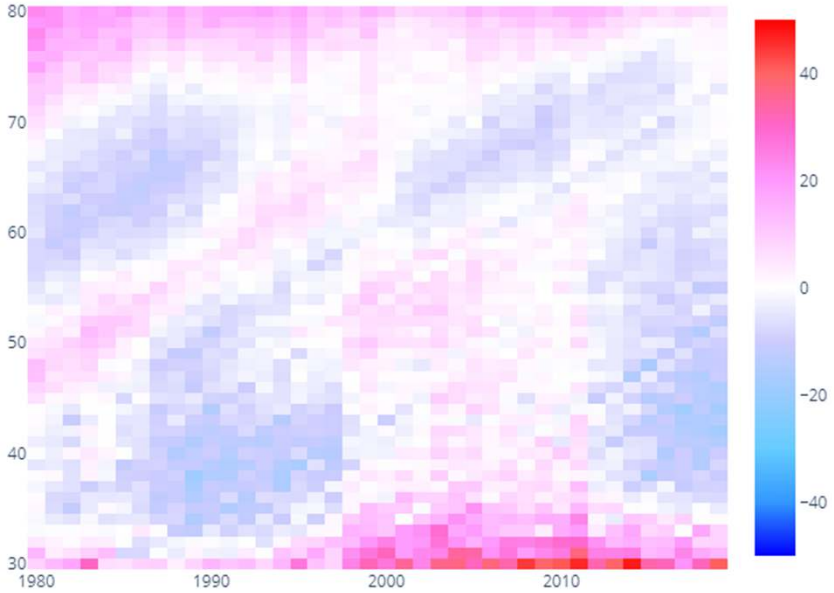
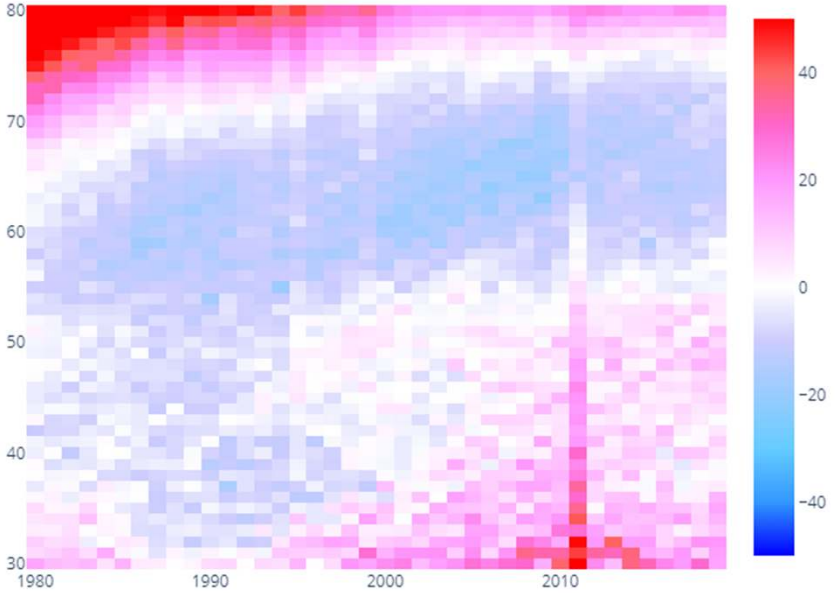
Historical Mortality Improvements 1980-2019, Japan
Showing deviations from fitted plane to log-mortality rates in percent



Japanese males, 1980-2019, ages 30-80, avg. MI **1.71%**



Japanese females, 1980-2019, ages 30-80, avg. MI **1.93%**

Strong overall mortality improvements over past decades.
Turnaround to increasing mortality improvements.

Data source: Human Mortality Database

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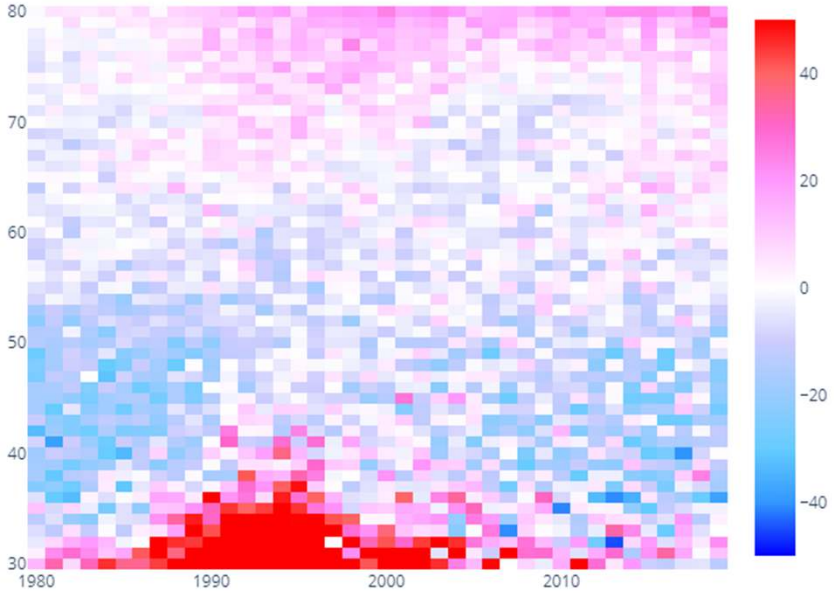
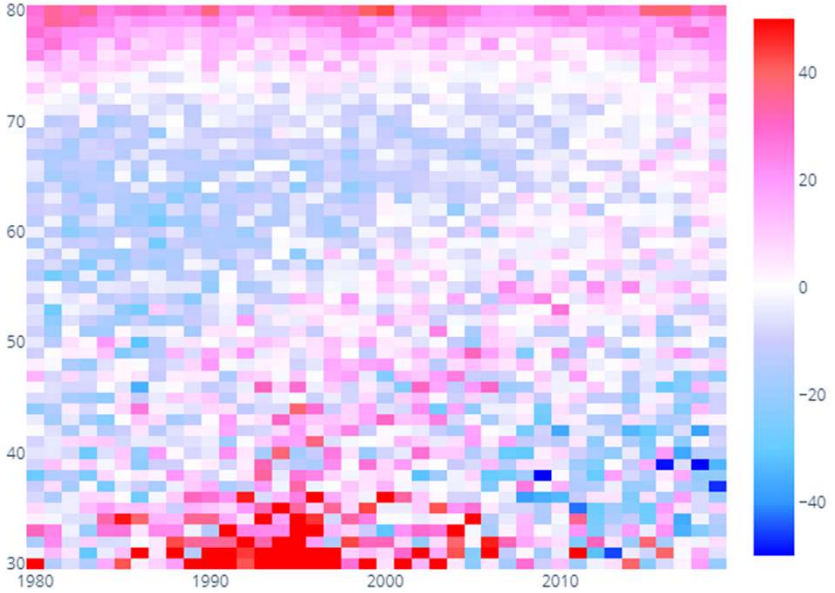
Historical Mortality Improvements 1980-2019, Switzerland

Showing deviations from fitted plane to log-mortality rates in percent



Swiss males, 1980-2019, ages 30-80, avg. MI **2.61%**



Swiss females, 1980-2019, ages 30-80, avg. MI **2.05%**

Strong overall mortality improvements over past decades.
Positive contributions also from migration.

Data source: Human Mortality Database

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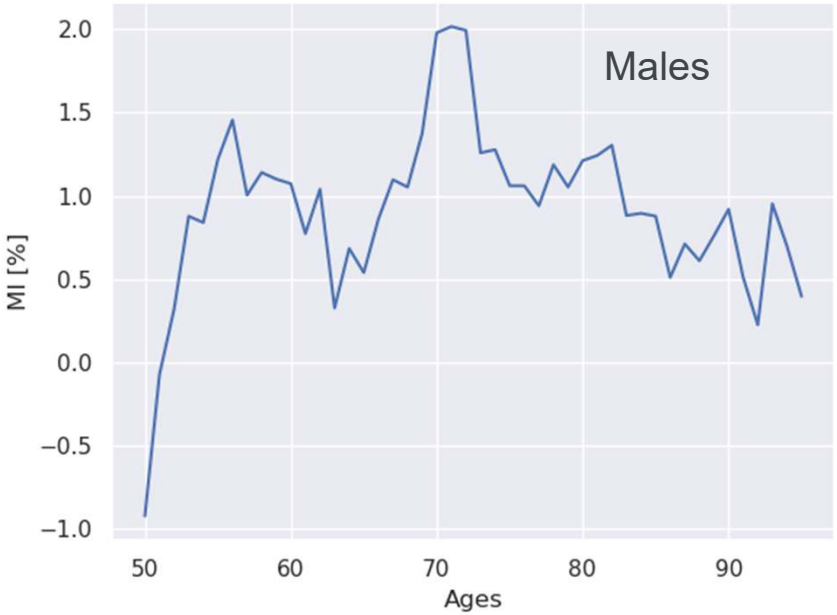
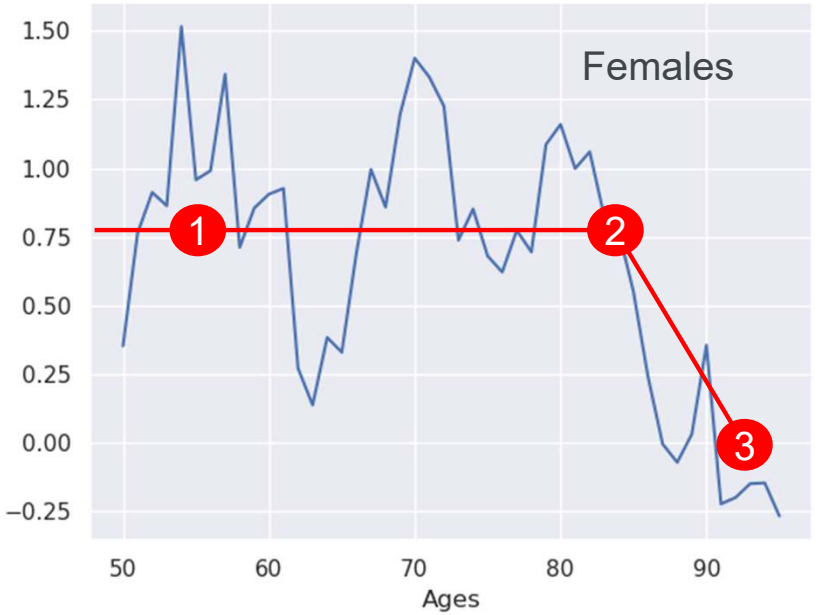
Historical Mortality Improvements, UK, 2000-2019





UK females currently confirm the commonly applied long-term pattern (red line, illustration), defined by 1. a flat mortality improvement rate, 2. start age and, 3. end age of age grading.
The Lee-Carter model is a good choice for analysing historical trends.

Data source: Human Mortality Database

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Mortality assumptions benchmarks

Benchmark	1. Mortality improvement	2. Grading start age	3. Grading end age	Time
US SOA 2019 Survey	0.73%	75+	100+	Conducted 2019
US SOA 2022 Survey	0.76%	75+	100+	Conducted 2022
Canada SS	0.80%	90	100+	Data up to 2015
US SSA	0.85%	65+	100+	Data up to 2019
Canada CIA	1.00%	90	105	Data up to 2013
UK ONS	1.20%	90	110	Data up to 2019
US Technical Panel	1.30%	65+	100+	Data up to 2019
US SOA MIM 2021	1.35%	65+	110	Data up to 2019
Netherlands AG2020	1.70%	75	120	Data up to 2019

The table shows our interpretation of publicly available information

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Poll questions 1 (UK) and 2 (US)

For the long-term future, until 2100, would you expect … with respect to mortality across socio-economic levels?

- Accelerated divergence
- Similar divergence as currently observed
- Slowing down divergence
- No divergence/convergence
- Slow convergence
- Fast convergence

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Poll questions 3 (UK) and 4 (US)

For the long-term future, until 2100, what average annual mortality improvement rate would you expect for ages 30 to 80, both genders, in general population?

- Below 0%
- 0% to 0.25%
- 0.25% to 0.5%
- 0.5% to 0.75%
- 0.75% to 1%
- 1% to 1.25%
- 1.25% to 1.5%
- 1.5% to 1.75%
- 1.75% to 2%
- Above 2%

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Poll question 5

Is there a minimum age from which on mortality improvements essentially remain 0% until 2100?

- Yes, around age 90
- Around age 95
- Around age 100
- Around age 105
- Around age 110
- Around age 115
- Around age 120
- Around age 125
- Around age 130
- No

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Progress in waves

- Lifespans are increasing
  - Life spans are increasing in most of the world with progress in uneven waves
  - Biggest waves of improvements are followed by outbreaks of communicable diseases
- Rapid Improvement
  - Mortality improvements in countries occurs in waves with periods of high and rapid improvement
  - Cyclical pattern signals the possibility of more improvements in the future
- Public Health
  - Some of the factors changing the pace of improvement affect multiple generations at once such as vaccinations and screening programmes
  - Countries have seen great shifts in mortality trends often undergoing significant trend reversals.

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Socioeconomic disparities – the need for change

- Higher SE groups historically linked to higher MI
  - Risk of mortality is associated with SE status
- US MI on the decline
  - Mortality improvements in higher socioeconomic groups in the US are on the decline
  - The difference between the life expectancy between the highest and lowest decile was 7.2 years for men and 5.7 years for women.
- Narrowing the protection gap
  - Individuals' ability to access and benefit from L&H products is related to their SE status
  - Limited access to healthcare has had clear implications on health

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Lifestyle factors for improving long-term health

Detractors of Health

- Smoking rates have generally been on the decline
- Vaping has become a popular alternative
- Opioid epidemic continues in certain strata of US society

Personal health monitoring

Focus is shifting to the role physical health and nutrition

Tech developments expected to influence a positive attitude to health

These tech developments include wearables monitoring sleep activity and physical activity

Metabolic Health

- Inclusive term for obesity, high cholesterol and high blood sugar
- Obesity and diabetes are on the rise
- Major contributors premature mortality

Physical Activity

- Sedentary lifestyles are the norm
- Collaboration with University of Oxford – using wearables data to forecast health trends
- 3 short bouts of vigorous activity led to a 40% reduction in all cause mortality

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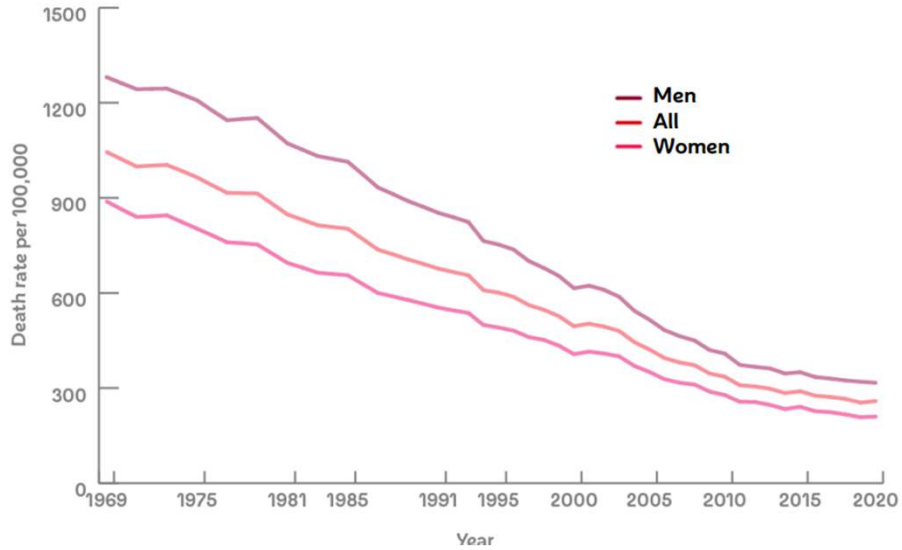
Cardiovascular disease: Gains of the Past

- Major cause of death
  - Heart disease related deaths have been a on a steady decline since 1970s
- Risk factors
  - Management and prevention of risk factors contribute to mortality improvements
- Smoking cessation
  - Boosted longevity as a single greatest lifestyle factor change of the 20th century

Death rates from heart and circulatory diseases (CVD), UK, 1969 to 2020



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Source: *British Heart Foundation factsheet, April 2023*

Obesity and Type 2 Diabetes- Trends To Watch

- Obesity rates are on the rise
  - Obesity rates have continued to steadily increase yearly over the past 50 years
  - Key drivers are processed foods and sedentary lifestyles
- Obesity increases risk of Type 2 diabetes
  - Obesity contributes 80-85% of the risk of developing Type 2 diabetes
  - 95% Type 2 Diabetes linked to behavioural choices
- Western nations are on an upward trend
  - Few effective public health measures are proposed
  - US will continue to be globally dominant

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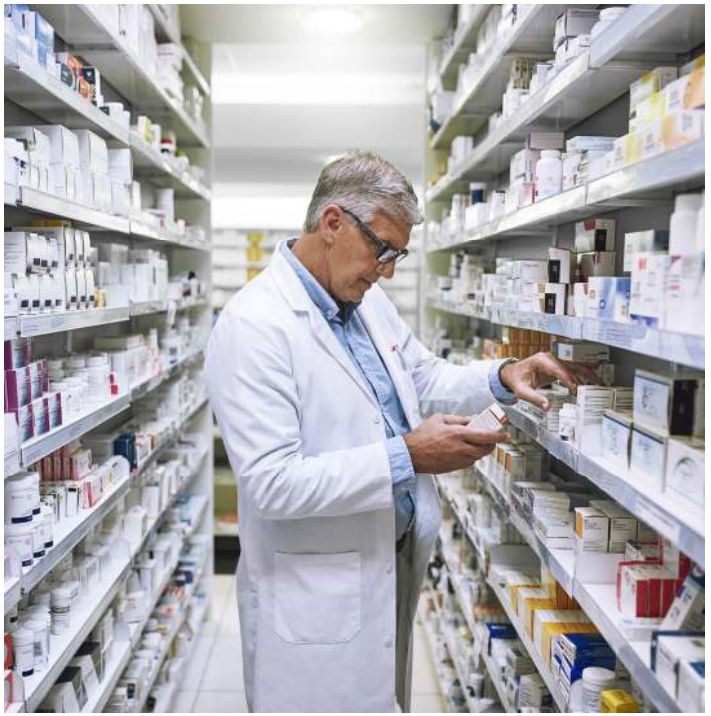
Obesity Management – therapeutic interventions

- New therapies on the rise
  - Medication developed for diabetes has now been used in weight management therapy
  - Injectable weekly medications (GLP-1 agonists) – Ozempic etc may help with weight loss over several years
  - Early evidence shows 20% reduction in heart attacks and strokes
- Surgeries
  - Strong history of use, now being used as a last resort option for some
- Therapies supplement lifestyles
  - Any intervention should also come alongside an increase activity levels and improvement in diet



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Cardiovascular disease – Prevention and Treatment

- Statins and anti-hypertensives
  - Help to lower cholesterol and blood pressure, reducing the risk of cardiovascular events.
  - Both are widely prescribed by general practitioners
- Anti-cholesterol vaccine
  - Administered 2x a year in primary care.
  - Combined with statins to reduce cardiovascular events while also increasing medication adherence.
- Family tracing for inherited disorders
  - Cascade testing of inherited lipid disorders

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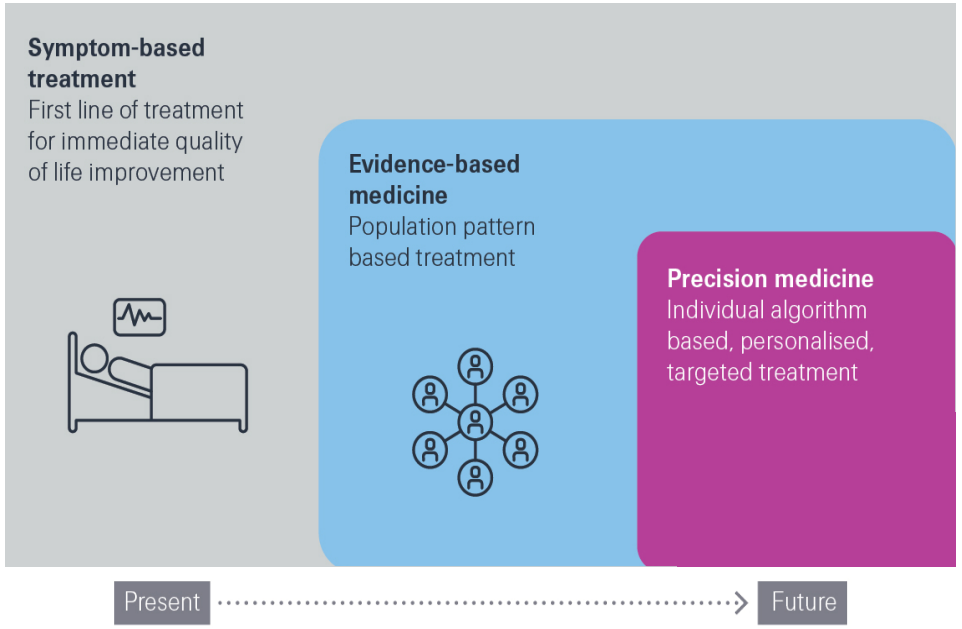
Cancer: Shifting towards precision medicine

- Current treatments
  - Focus on limiting progression of cancers at the cost of damaging healthy cells
- Treatments/therapies
  - Key avenues for personalised medicine in cancer therapies – mRNA vaccines & immunotherapies (T-cell strategies)

Public screening programmes promote high survival rates, particularly in breast, cervical and colorectal cancer.



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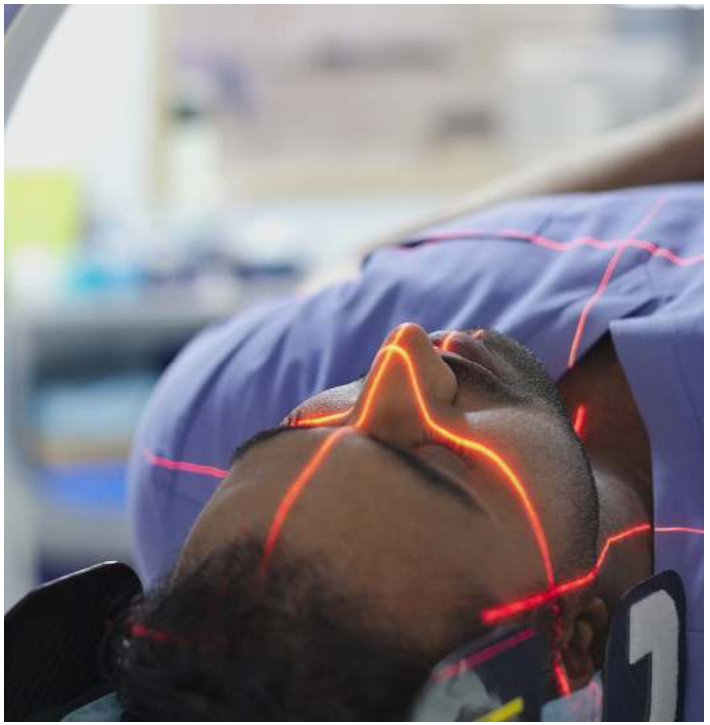
Cancer: Improvements in diagnostic methods leading to early detection

- Liquid biopsies
  - A less invasive, novel blood test for cancer detection
  - Early stages of its development, the sensitivity and specificity is lower than that of a traditional biopsy.
- AI: Screening & Drug discovery
  - Analysis of imaging data to supplement diagnostics for earlier and faster detection
  - Can aid identification of patients who are at risk of relapsing
  - Rapid review of literature and data to identify new targets



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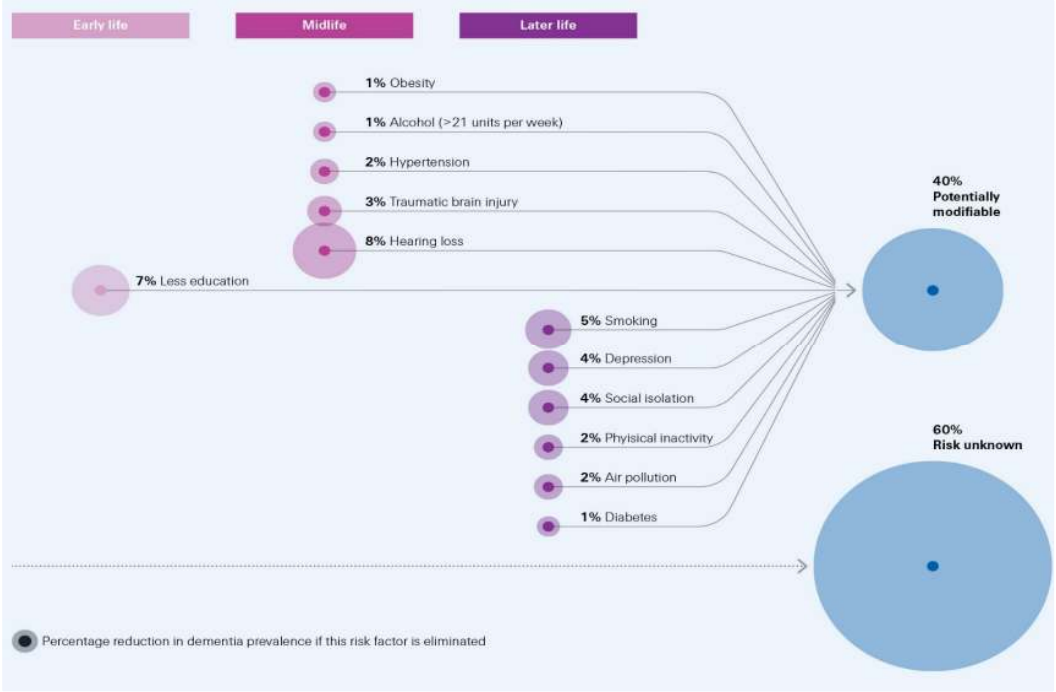
Neurodegenerative Disease: New ageing challenges

- Alzheimer's disease
  - Remains the leading cause of dementia
- Dementia – a modifiable risk?
  - 40% are potentially modifiable or avoidable behaviours and activities throughout life
- New drugs on the horizon
  - Current medications focus on treating symptoms not the root cause (amyloid plaque build up)
  - Lecanemab and donanemab released this year as fortnightly IV infusions
  - Both show modest reversal in cognitive decline with serious side effects (aducanumab pulled from the market).



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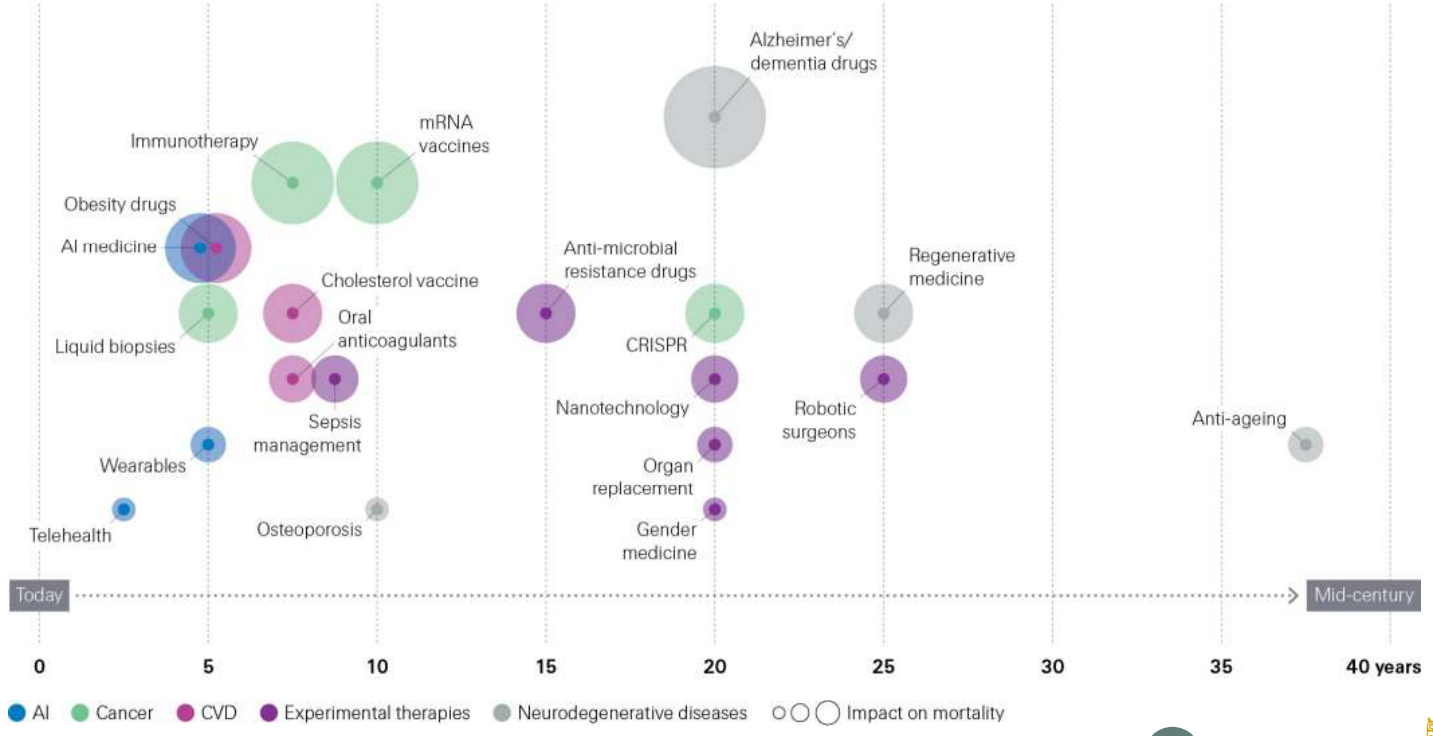
Source: *Dementia prevention, intervention, and care: 2020 report of the Lancet Commission* - The Lancet, reproduced by Swiss Re

Future medical advancements: many promising technologies but timing & uncertainty is high



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Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.