Mortality improvement: understanding the past and future trends

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Agenda

- Recent trends in mortality
- Drivers of slowing mortality improvements
- Genomic technology

Open discussion
Recent trends in mortality
We have had a long-run of increases in life expectancy

Life expectancy has risen since the early 20th century driven by advances in living conditions, medicine and technology.

Notes: Life expectancy (in 2016 or latest available) shown in the legend. Grey areas indicate periods of war.
Mortality improvements slowed recently

There are signs that mortality improvements have slowed recently in many countries... but not everywhere

5-year backward-looking moving averages of annual improvements in mortality rates

In percent, age-standardised rates

Notes: Coloured lines are 5-year backward-looking moving averages. Grey lines show the high volatility of annual rates of improvement. Rates were standardised using the US population in 2016.

Sources: Swiss Re Institute, Human Mortality Database
Overdose deaths involving opioids in the US

Standardised mortality rates, per 100 000

The US is in the midst of an opioid crisis with deaths from misuse of opioids rising sharply since 2000

Notes: * Natural and semi-synthetic opioids and methadone. ** Excluding methadone.

Source: Centers for Disease Control and Prevention (CDC): [www.cdc.gov/drugoverdose/data/analysis.html](http://www.cdc.gov/drugoverdose/data/analysis.html)
Change in trend of just volatility?

Annual mortality rates are highly volatile and developments need to be assessed over a long time period

**US all-cause mortality rates**
Short-term and long-term perspectives

**Note:** Vertical lines indicate possible structural breaks in the piecewise linear relationship.
**Sources:** Swiss Re Institute, Human Mortality Database
Drivers of slowing mortality improvement
Leading contributory causes of the recent slowdown

Developments in cerebrovascular disease, diabetes mellitus and ischaemic heart disease were key drivers

**Average annual change in mortality rates**

*2005-10 vs 2010-15*

**Change: 2010–15 (in percent)**

<table>
<thead>
<tr>
<th>Change</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Hypertensive HD</td>
</tr>
<tr>
<td>3</td>
<td>Chronic liver disease and cirrhosis</td>
</tr>
<tr>
<td>0</td>
<td>Chronic lower respiratory diseases, Urinary tract cancer, Diabetes mellitus</td>
</tr>
<tr>
<td>-3</td>
<td>Motor vehicle accidents, Stomach cancer, Cerebrovascular diseases</td>
</tr>
<tr>
<td>-5</td>
<td>Atherosclerosis</td>
</tr>
<tr>
<td>-8</td>
<td></td>
</tr>
<tr>
<td>-10</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Based on 11 countries that experienced a recent slowdown in mortality improvement.

**Sources:** Swiss Re Institute, WHO (mortality) and UNDP (vital) data
Underlying risk factors can be complex

A risk factor is anything that affects the chance of a disease/injury causing death, but does not necessarily cause death

<table>
<thead>
<tr>
<th>Example of a causal chain of risk factors leading to death from heart failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic risk factors</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Ethnicity</td>
</tr>
<tr>
<td>Chromosomal abnormalities</td>
</tr>
</tbody>
</table>

Non-modifiable | Modifiable

Note: Lines indicate some of the (dual-directional) interactions between risk factors that may lead to death.
Explaining mortality improvement slowdown

Lifestyle choices over diet and physical exercise are more likely explanations rather than smoking or alcohol

Changes in shares of total deaths linked to major risk factors
High-income countries, indexed: 1990=100

Sources: Institute for Health Metrics and Evaluation (IHME), Swiss Re Institute calculations
Socio-economic risks play crucial role too

Biomedical and behavioural risk factors alone do not fully explain different mortality experience

**Socio-economic risks**

- **Reduction in healthcare spending**
  - Quality of healthcare
  - eg, compromise of service provision
- **Economic and social inequality**
  - Access to healthcare
  - eg, introduction of Medicare/Medicaid
  - Financial troubles
  - eg, increased incidents of intentional self-harm, deaths of despair in the US
  - Others
  - eg, lower education

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**Life expectancy at birth (in years)**

at different levels of total healthcare spending per capita

Note: Based on 31 countries (United States is an outlier and was not considered).

Source: Swiss Re Institute estimates combining Human Mortality Database and OECD data
Framing the future: genomic technology
What is Genetic Testing?

“Genetic testing looks for alterations in a person's genes or chromosomes to identify heritable or acquired mutations related to disease and health.”

**Diagnostic / confirmatory genetic testing**
Identifies or confirms a specific genetic condition in a symptomatic individual

**Pharmacogenomic testing**
Guides individual drug dosage, selection and response

**Direct-to-consumer (DTC) genetic testing**
Genetic tests marketed directly to consumers without involving healthcare professionals

**New-born screening**
Identifies highly penetrant genetic disorders that can be treated early in life

**Predictive and pre-symptomatic genetic testing**
Estimates the risk of developing adult-onset disease or predicting future disease onset

**Nutrigenomic testing**
Studies the effect of genetic variations in relation to the interaction between diet/nutrition and health

**Liquid biopsy testing**
Detects molecular biomarkers in blood & other body fluids for diagnosis, prognosis and treatment
Trends and prospects in genetic testing

Over the past year, personal genetic testing has gone mainstream with exponential growth driven by affordability, accessibility and consumer curiosity.

Cost massively decreasing

Declining sequencing costs and advances in computing capability in the last decade have massively increased the availability and affordability of genetic testing.

Clinical utility increasing

Increasing use of medical genetic testing provides health-care professionals a valuable tool in prevention, diagnosis & treatment of disease, which improves health outcomes and increase life expectancy.

Demand for lifestyle advice increasing

A rapid growth of a direct-to-consumer (DTC) genetic testing market provides individuals with a broad range of health, ancestry, and lifestyle information.
Genetic testing consumer survey

Surveyed markets

USA  Australia  Canada  China  UK

Survey objectives

Who undergoes genetic testing and why?

How consumers use their genetic information?

How genetic testing affects life insurance?

23,000 US citizens aged 18 and over and another 13,000 in four additional markets

3,000* US individuals who underwent genetic testing completed an extensive consumer research survey to explore their insurance and health behaviours

Note: *500 individuals for other markets
Genetic testing categories and consumer adoption rates

Medically prescribed tests with clinical validity and utility to diagnose or predict disease

Direct-to-consumer (DTC) kits purchased online or in stores by those who want to learn more about their ancestry and health

Share of 20-60 year old population with a genetic test

<table>
<thead>
<tr>
<th>Country</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>20%</td>
</tr>
<tr>
<td>China</td>
<td>16%</td>
</tr>
<tr>
<td>Canada</td>
<td>8%</td>
</tr>
<tr>
<td>UK</td>
<td>7%</td>
</tr>
<tr>
<td>Australia</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: Can life insurance pass the genetic test? SRI 2019
US genetic testing rates and consumer demographics

US testing rates

80% No test

20% of the survey respondents have taken a genetic test

- Medical: 13%
- DTC: 6%
- Medical + DTC: 1%

When tested?

- More than 10 years ago: 9%
- 6-10 years ago: 10%
- 2-5 years ago: 43%
- Last year: 38%
- Total: 56%

Source: Can life insurance pass the genetic test? SRI 2019
US genetic testing rates and consumer demographics

Who gets tested?

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male (20-39y)</th>
<th>Male (40-60y)</th>
<th>Female (20-39y)</th>
<th>Female (40-60y)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>25%</td>
<td>16%</td>
<td>16%</td>
<td>14%</td>
<td>20%</td>
</tr>
<tr>
<td>Age</td>
<td>26%</td>
<td>14%</td>
<td>17%</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>Salary</td>
<td>17%</td>
<td>26%</td>
<td>16%</td>
<td>25%</td>
<td>18%</td>
</tr>
<tr>
<td>Education</td>
<td>16%</td>
<td>25%</td>
<td>16%</td>
<td>25%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Genetic test consumers tend to be highly educated and well-to-do men between age 20 to 40.

Source: Can life insurance pass the genetic test? SRI 2019
Genetic testing motivates people to be healthier

Source: Can life insurance pass the genetic test? SRI 2019
Open discussion
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