Health risk factor time trends and risk prevention

Daniel Ryan, Head of R&D – Life & Health & Big Data
Seeing the benefits of trends in risk factors
Rapid pace of improvements in life expectancy

Source: Global Burden of Disease 2010

UK standardised myocardial infarction death rate per 100,000 population (41) is twice that of France (19) - but UK death rates fell faster than any other European country between 1980 and 2006.

Source: OECD data
# Leading risks factors

## Analysis by region from Global Burden of Disease 2010

| Risk factor                              | Global | High-income Asia Pacific | Western Europe | Americas | High-income Northern Europe | Global North | Southern Europe | Eastern Europe | South Asia | East Asia | South East Asia | Southeast Asia | South Asia | South Asia | North Africa | Middle East | Central Asia | Central Asia | Western Europe | Sub-Saharan Africa | Sub-Saharan Africa | Sub-Saharan Africa | Sub-Saharan Africa | Sub-Saharan Africa | Sub-Saharan Africa | Sub-Saharan Africa |
|------------------------------------------|--------|-------------------------|----------------|----------|-----------------------------|--------------|-------------------|----------------|------------|-----------|----------------|----------------|-----------|-----------|--------------|-------------|----------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| High blood pressure                     | 1      | 2                       | 2              | 2        | 2                           | 2            | 2                 | 2              | 2          | 2         | 2              | 2              | 2         | 2         | 2            | 2            | 2               | 2               | 2                | 2                | 2                | 2                | 2                | 2                |
| Tobacco smoking, including second-hand smoke | 3      | 3                       | 4              | 4        | 4                           | 4            | 4                 | 4              | 4          | 4         | 4              | 4              | 4         | 4         | 4            | 4            | 4               | 4               | 4                | 4                | 4                | 4                | 4                | 4                |
| Alcohol use                              | -5     | -5                      | 0              | 0        | 0                           | 0            | 0                 | 0              | 0          | 0         | 0              | 0              | 0         | 0         | 0            | 0            | 0               | 0               | 0                | 0                | 0                | 0                | 0                | 0                |
| Household air pollution from solid fuels | -12    | -12                     | -7             | -7       | -7                          | -7           | -7                | -7             | -7         | -7        | -7              | -7             | -7         | -7         | -7            | -7           | -7              | -7              | -7               | -7               | -7               | -7               | -7               | -7               |
| Diet low in fruits                       | 5      | 5                       | 7              | 7        | 7                           | 7            | 7                 | 7              | 7          | 7         | 7              | 7              | 7         | 7         | 7            | 7            | 7               | 7               | 7                | 7                | 7                | 7                | 7                | 7                |
| High body mass index                     | 6      | 6                       | 8              | 8        | 8                           | 8            | 8                 | 8              | 8          | 8         | 8              | 8              | 8         | 8         | 8            | 8            | 8               | 8               | 8                | 8                | 8                | 8                | 8                | 8                |
| High fasting plasma glucose              | 7      | 7                       | 6              | 6        | 6                           | 6            | 6                 | 6              | 6          | 6         | 6              | 6              | 6         | 6         | 6            | 6            | 6               | 6               | 6                | 6                | 6                | 6                | 6                | 6                |
| Childhood overweight                     | 8      | 8                       | 9              | 9        | 9                           | 9            | 9                 | 9              | 9          | 9         | 9              | 9              | 9         | 9         | 9            | 9            | 9               | 9               | 9                | 9                | 9                | 9                | 9                | 9                |
| Physical inactivity and low physical activity | 10     | 10                      | 9              | 9        | 9                           | 9            | 9                 | 9              | 9          | 9         | 9              | 9              | 9         | 9         | 9            | 9            | 9               | 9               | 9                | 9                | 9                | 9                | 9                | 9                |
| Diet high in sodium                     | 11     | 11                      | 10             | 10       | 10                          | 10           | 10                | 10             | 10         | 10        | 10              | 10             | 10         | 10         | 10            | 10           | 10              | 10              | 10               | 10               | 10               | 10               | 10               | 10               |
| Diet low in nuts and seeds              | -12    | -12                     | 0              | 0        | 0                           | 0            | 0                 | 0              | 0          | 0         | 0              | 0              | 0         | 0         | 0            | 0            | 0               | 0               | 0                | 0                | 0                | 0                | 0                | 0                |
| Iron deficiency                          | 13     | 13                      | 12             | 12       | 12                          | 12           | 12                | 12             | 12         | 12        | 12              | 12             | 12         | 12         | 12            | 12           | 12              | 12              | 12               | 12               | 12               | 12               | 12               | 12               |
| Suboptimal breastfeeding                  | 14     | 14                      | -              | -        | -                           | -            | -                 | -              | -          | -         | -              | -              | -         | -         | -            | -            | -               | -               | -                | -                | -                | -                | -                | -                |
| High total cholesterol                   | 15     | 15                      | 12             | 12       | 12                          | 12           | 12                | 12             | 12         | 12        | 12              | 12             | 12         | 12         | 12            | 12           | 12              | 12              | 12               | 12               | 12               | 12               | 12               | 12               |
| Diet low in whole grains                 | 16     | 16                      | 16              | 16       | 16                          | 16           | 16                | 16             | 16         | 16        | 16              | 16             | 16         | 16         | 16            | 16           | 16              | 16              | 16               | 16               | 16               | 16               | 16               | 16               |
| Diet low in vegetables                   | 17     | 17                      | 14             | 14       | 14                          | 14           | 14                | 14             | 14         | 14        | 14              | 14             | 14         | 14         | 14            | 14           | 14              | 14              | 14               | 14               | 14               | 14               | 14               | 14               |
| Diet low in essential omega-3 fatty acids | 18     | 18                      | 15             | 15       | 15                          | 15           | 15                | 15             | 15         | 15        | 15              | 15             | 15         | 15         | 15            | 15           | 15              | 15              | 15               | 15               | 15               | 15               | 15               | 15               |
| Drug use                                  | 19     | 19                      | 19              | 19       | 19                          | 19           | 19                | 19             | 19         | 19        | 19              | 19             | 19         | 19         | 19            | 19           | 19              | 19              | 19               | 19               | 19               | 19               | 19               | 19               |
| Occupational risk factors for injuries   | 20     | 20                      | 20              | 20       | 20                          | 20           | 20                | 20             | 20         | 20        | 20              | 20             | 20         | 20         | 20            | 20           | 20              | 20              | 20               | 20               | 20               | 20               | 20               | 20               |
Pioneers in assessing importance of risk factors

- Capewell & Critchley explained historical changes in CHD mortality through observed changes in risk factors and treatments
- Initial studies in UK, USA and other developed countries, but more recently focusing on former East European countries and Beijing in China
- For given study period, comparisons focus on difference between projected and actual number of deaths
- Relatively simple population model without disease-transitions hosted in EXCEL
- Widely used to test "What if" scenarios based on policy intervention or changes in risk behaviour
Country differences in explanatory studies
% reduction in CHD mortality

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatments</th>
<th>Risk factors</th>
<th>Unexplained</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States, 1968-76 [14]</td>
<td>40%</td>
<td>54%</td>
<td>6%</td>
</tr>
<tr>
<td>New Zealand, 1974-81 [15]*</td>
<td>40%</td>
<td>60%</td>
<td>10%</td>
</tr>
<tr>
<td>Holland, 1978-85 [17]</td>
<td>46%</td>
<td>44%</td>
<td>10%</td>
</tr>
<tr>
<td>United States, 1980-90 [13]</td>
<td>53%</td>
<td>50%</td>
<td>7%</td>
</tr>
<tr>
<td>IMPACT Scotland, 1975-94 [18]</td>
<td>55%</td>
<td>55%</td>
<td>10%</td>
</tr>
<tr>
<td>IMPACT New Zealand, 1982-93 [19]</td>
<td>53%</td>
<td>60%</td>
<td>5%</td>
</tr>
<tr>
<td>IMPACT United States, 1980-2000 (this study)</td>
<td>37%</td>
<td>44%</td>
<td>9%</td>
</tr>
<tr>
<td>Finland, 1972-92 [16]†</td>
<td>24%</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>IMPACT Finland, 1982-97 [22]</td>
<td>24%</td>
<td>53%</td>
<td>24%</td>
</tr>
</tbody>
</table>
Explaining increase in CHD deaths in Beijing

Figure 1. CHD mortality trends in Beijing 1984 to 1999: additional deaths attributable to risk factor changes and deaths prevented or postponed by treatments.


Copyright © American Heart Association, Inc. All rights reserved.
Understanding the drivers to future longevity

GENETICS

ENVIRONMENT

HEALTHCARE

INTERACTIONS

BEHAVIOUR
Healthcare in the future
## Current cost of pharmaceutical research

<table>
<thead>
<tr>
<th>Company</th>
<th>Ticker</th>
<th>Number of drugs approved</th>
<th>R&amp;D Spending Per Drug ($Mil)</th>
<th>Total R&amp;D Spending 1997-2011 ($Mil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca</td>
<td>AZN</td>
<td>5</td>
<td>11,790.93</td>
<td>58,955</td>
</tr>
<tr>
<td>GlaxoSmithKline</td>
<td>GSK</td>
<td>10</td>
<td>8,170.81</td>
<td>81,708</td>
</tr>
<tr>
<td>Sanofi</td>
<td>SNY</td>
<td>8</td>
<td>7,909.26</td>
<td>63,274</td>
</tr>
<tr>
<td>Roche Holding AG</td>
<td>RHHBY</td>
<td>11</td>
<td>7,803.77</td>
<td>85,841</td>
</tr>
<tr>
<td>Pfizer Inc.</td>
<td>PFE</td>
<td>14</td>
<td>7,727.03</td>
<td>108,178</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>JNJ</td>
<td>15</td>
<td>5,885.65</td>
<td>88,285</td>
</tr>
<tr>
<td>Eli Lilly &amp; Co.</td>
<td>LLY</td>
<td>11</td>
<td>4,577.04</td>
<td>50,347</td>
</tr>
<tr>
<td>Abbott Laboratories</td>
<td>ABT</td>
<td>8</td>
<td>4,496.21</td>
<td>35,970</td>
</tr>
<tr>
<td>Merck &amp; Co Inc</td>
<td>MRK</td>
<td>16</td>
<td>4,209.99</td>
<td>67,360</td>
</tr>
<tr>
<td>Bristol-Myers Squibb Co.</td>
<td>BMY</td>
<td>11</td>
<td>4,152.26</td>
<td>45,675</td>
</tr>
<tr>
<td>Novartis AG</td>
<td>NVS</td>
<td>21</td>
<td>3,983.13</td>
<td>83,646</td>
</tr>
<tr>
<td>Amgen Inc.</td>
<td>AMGN</td>
<td>9</td>
<td>3,692.14</td>
<td>33,229</td>
</tr>
</tbody>
</table>

Sources: InnoThink Center For Research In Biomedical Innovation; Thomson Reuters Fundamentals via FactSet Research Systems
The contribution of robots to our future
New possibilities for healthcare delivery & support

Source: Cyberdyne & Tsukuba University

Source: Toyota
The rediscovery of regenerative medicine

Induced Pluripotent Stem Cell (iPSC)
Potential to make ‘all’ cell types

Nobel Prize October 2012
John Gurdon & Shinya Yamanaka

High capacity self-renewal

Adult cells e.g. bone, cartilage
New horizons in curative healthcare

**Remedial**
- **Control Symptoms**
  - Caused by: Organ Dysfunction
  - Shown by: Blood tests and Imaging
  - Aims: Avoid symptoms drugs, surgery, radiotherapy

**Preventive**
- **Prevent Symptoms**
  - Plus markers: eg: CA125
  - + genome = personal medicine

**Curative & Prophylactic Cure**
- **Influence Cellular Networks** at “pre-disease” level
- **Target Cell Networks in nucleus & cytoplasm**
  - to influence structure & patterns of: genes, proteins & Cell Organelles (mitochondria, ribosome)

**Aims:**
- Avoid symptoms drugs, surgery, radiotherapy

*Daniel Ryan | Expert Forum on health risk factors | 15 October 2014*
Individual choices in the future
1 billion will die from smoking in 21st century

Source: Tobacco Cancer Atlas
Promoting healthy behaviour

Salience

Yellow tape was placed across a shopping cart indicating where fruit and vegetables should be placed. Result: 102% increase in sales of fruit and vegetables.

Incentives

Google cafeteria hid unhealthy food out of sight and out of reach and placed healthy food more centrally. Result: fat consumption from chocolate decreased by 11%.

Norms

At Google's cafeteria, junk food is out of sight and zone is (cropped) out of reach. (Credit: Alastair McGeachie)
What we share with one another every minute

[Image of a circular infographic showing various statistics and numbers related to digital and social media activities.]
Our ability to influence risk factors in the future

- Wearable sensors
- Smart lenses
- Smart garments
- Handheld medical scanner
- Smart Pill
Towards a better understanding of the future
Developing our disease-centred view of longevity

General drivers

Individual Risk Factors
Healthcare Funding
Doctor-Patient Interaction
Research & Development

Disease type & progression

Healthy
Circulatory
Respiratory
Multiple diseases
Death

Risk factors
Cancer
Neurological

Disease-specific factors

Early detection
Breast cancer
Medical innovation

Current treatments
Clinical trials pipeline
SEARCH – raising our ambition for better predictions of future mortality & longevity

- Complementary to actuarial/demographic approaches
  - stochastic mortality models
  - blending between current mortality improvements and long-term assumptions over defined horizons

- Bringing together:
  - Annual assessment of changes in key risk factors and their impact
  - Large cohort databases in different countries
  - Networks of engaged expert opinion – forward-looking scenarios

- Causal-based mortality predictions, evaluating factors such as:
  - Promotion and adoption of healthy lifestyle choices
  - Advances in screening and diagnostic technology
  - Pharmaceutical pipeline and its likely impact
Thank you
Legal notice

©2014 Swiss Re. All rights reserved. You are not permitted to create any modifications or derivative works of this presentation or to use it for commercial or other public purposes without the prior written permission of Swiss Re.

The information and opinions contained in the presentation are provided as at the date of the presentation and are subject to change without notice. Although the information used was taken from reliable sources, Swiss Re does not accept any responsibility for the accuracy or comprehensiveness of the details given. All liability for the accuracy and completeness thereof or for any damage or loss resulting from the use of the information contained in this presentation is expressly excluded. Under no circumstances shall Swiss Re or its Group companies be liable for any financial or consequential loss relating to this presentation.