Living to 100: Challenges and Opportunities of Longevity

Tim Harris, 2017 Chairperson
Living to 100 Committee

June 22, 2017
Living to 100

• Research Initiative of the Society of Actuaries

• Triennial Call For Papers resulting in Symposium and online monograph

• Researchers, Economists, Retirement Professionals, Policy Makers, Actuaries and other professionals converge to share insights on longevity.

• Latest research to help actuaries review and update longevity assumptions.

• Identification and discussion of the challenges and opportunities in the public and private sectors created by aging populations across the world
Today’s Topics

• Increasing Life Expectancy
• Is there an End in Sight?
• Projecting Longevity
• Healthy Longevity
• Technology and Aging
• Proper Lifestyles for Longer Lives
• Affordability of Longevity
• Business Opportunities
Today’s Topics (Cont’d)

• Genetics/Heredity
• Can We Afford to Live Longer?
• What Will Life be Like at Higher Ages?
• Implications for Social Insurance Systems
• Implications for Healthcare Delivery Systems
• Implications/Opportunities for Businesses
Increasing Life Expectancies

• Life expectancies have been increasing in recent history.
  • What are the reasons?
  • Will they continue to increase?
Increasing Life Expectancies (Cont’d)

• Life spans have followed a pattern of almost continual increase since the existence of man (except for the Middle Ages) and the recent past is no exception. These increases in life span have at times followed changes in societies’ hygiene and more recently have been the result of improvements in medical treatments, sanitation and modification of lifestyles.
<table>
<thead>
<tr>
<th>Age</th>
<th>Ratio of Male to Female Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the womb</td>
<td>1.43</td>
</tr>
<tr>
<td>Age 1</td>
<td>1.23</td>
</tr>
<tr>
<td>Age 2</td>
<td>1.24</td>
</tr>
<tr>
<td>Age 12</td>
<td>1.50</td>
</tr>
<tr>
<td>Age 22</td>
<td>3.17</td>
</tr>
<tr>
<td>Age 50</td>
<td>1.75</td>
</tr>
<tr>
<td>Age 112</td>
<td>1.00</td>
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</table>
Life Expectancy by Gender from Early Times to the Present - Expected Additional Years of Life Measured From Age 20

<table>
<thead>
<tr>
<th>Era</th>
<th>Male</th>
<th>Female</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neolithic Period (4000 BC)</td>
<td>21.0</td>
<td>14.0</td>
<td>Acsadi</td>
</tr>
<tr>
<td>Roman Empire</td>
<td>20.6</td>
<td>14.5</td>
<td>Hishinuma</td>
</tr>
<tr>
<td>Medieval (1200 )</td>
<td>29.8</td>
<td>25.4</td>
<td>Hishinuma</td>
</tr>
<tr>
<td>1700s</td>
<td>28.0</td>
<td>28.4</td>
<td>Deprez</td>
</tr>
<tr>
<td>Current (2003)</td>
<td>55.8</td>
<td>60.8</td>
<td>US CDC/NHI</td>
</tr>
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</table>
# U.S. Remaining Life Expectancy at Ages 0, 65 and 75

<table>
<thead>
<tr>
<th>Age and year</th>
<th>All</th>
<th>Male</th>
<th>Female</th>
<th>Female Advantage</th>
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<tbody>
<tr>
<td>At birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>47.3</td>
<td>46.3</td>
<td>48.3</td>
<td>2.0</td>
</tr>
<tr>
<td>2000</td>
<td>76.8</td>
<td>74.1</td>
<td>79.3</td>
<td>5.2</td>
</tr>
<tr>
<td>2014</td>
<td>78.8</td>
<td>76.4</td>
<td>81.2</td>
<td>4.8</td>
</tr>
<tr>
<td>At 65 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>11.9</td>
<td>11.5</td>
<td>12.2</td>
<td>0.7</td>
</tr>
<tr>
<td>2000</td>
<td>17.6</td>
<td>16.0</td>
<td>19.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2014</td>
<td>19.3</td>
<td>18.0</td>
<td>20.5</td>
<td>2.5</td>
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<tr>
<td>At 75 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>7.1</td>
<td>6.8</td>
<td>7.3</td>
<td>0.5</td>
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<tr>
<td>2000</td>
<td>11.0</td>
<td>9.8</td>
<td>11.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2014</td>
<td>12.2</td>
<td>11.2</td>
<td>13.0</td>
<td>1.8</td>
</tr>
</tbody>
</table>
U.S. Life Expectancy

United States
Life Expectancy at Birth

Number of Years
45 50 55 60 65 70 75 80 85

Calendar Year

Male
Female

SOCIETY OF ACTUARIES
U.S. Life Expectancy

United States
Life Expectancy at Age 65

Number of years


Calendar Year

Male
Female
U.S. Life Expectancy

United States
Life Expectancy at Age 75

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Number of Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>6.5</td>
</tr>
<tr>
<td>1910</td>
<td>7.2</td>
</tr>
<tr>
<td>1920</td>
<td>7.9</td>
</tr>
<tr>
<td>1930</td>
<td>8.5</td>
</tr>
<tr>
<td>1940</td>
<td>9.1</td>
</tr>
<tr>
<td>1950</td>
<td>9.7</td>
</tr>
<tr>
<td>1960</td>
<td>10.2</td>
</tr>
<tr>
<td>1970</td>
<td>10.8</td>
</tr>
<tr>
<td>1980</td>
<td>11.4</td>
</tr>
<tr>
<td>1990</td>
<td>12.0</td>
</tr>
<tr>
<td>2000</td>
<td>12.6</td>
</tr>
<tr>
<td>2010</td>
<td>13.2</td>
</tr>
<tr>
<td>2014</td>
<td>13.6</td>
</tr>
</tbody>
</table>

- **Male**
- **Female**
Limits on Human Life Expectancy

• Debate: Are there limits on increases in human longevity?
  • Life Expectancy vs. Life Span
  • Are there fixed limits on life span regardless of biotechnology and health care?
  • Can medication or genetic modification eliminate the limits on life span?
Aging Theories

• Vitalism – Ancient Theory
• Cellular Mutation – Conflicting results using radiation.
• Reproduction Related Obsolescence – eg. Salmon and Squid
• Programmed Obsolescence
• Human Machine Theory – Reliability Theory
Human Life Span

120 or 115
Extending Life Span

- Caloric Restriction
- Resveratrol
- Genetic Manipulation
- Metformin
How to Die Young at a Very Old Age
Nir Barzilai

• Living to 100 is rare with only 1/10,000 individuals are 100 years old
• Aging itself is the strongest risk factor for all age-related diseases
• Healthy lifespan has been extended in numerous animal models
• Relevant drugs (e.g., Metformin and Rapamycin) have been used in humans
How to Die Young at a Very Old Age
Nir Barzilai

• TAME: Targeting Aging with Metformin
• Metformin has age-delaying effects on nematodes and mice
• Metformin is associated with less cancer in patients with type 2 diabetes
• Early support exists that metformin may delay cognitive decline
How to Die Young at a Very Old Age
Nir Barzilai

TAME Study

• To prove that aging can be targeted
• To change health-span of individuals
• To lead to development of better drugs and their combination
• To affect healthcare system and its costs
Technology

• Robotics
• Artificial intelligence
• Driverless cars
• Cell phones
• Electronic medical records
• Internet
• Wearables
<table>
<thead>
<tr>
<th>Choice</th>
<th>Loss in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>7</td>
</tr>
<tr>
<td>Obesity</td>
<td>4 to 8</td>
</tr>
<tr>
<td>Inactivity</td>
<td>4</td>
</tr>
<tr>
<td>Eating meat</td>
<td>2</td>
</tr>
<tr>
<td>Unmarried</td>
<td>10</td>
</tr>
<tr>
<td>Lack of education</td>
<td>3</td>
</tr>
</tbody>
</table>
Affordability

• Can you afford to live that long?
• Yes, if you are one of the few that has a paternal employer that provided a defined retirement benefit and post retirement health.
• Otherwise?
Affordability (Cont’d)

• Retirement Savings
  • Need 10 x desired after tax income in 401(k)
  • The average 401(k) balance at retirement is less than $200,000 according to Fidelity. Less than out of pocket healthcare costs for a retired couple.
Affordability (Cont’d)

• Fidelity Investments projects that a couple retiring at age 65 in 2016 will need $260,000 to fund Medicare Premiums and Out-of-Pocket expenses for healthcare (Excluding Nursing Home Costs)
Solutions

• Financial Planning
• Saving
• Consider spouse/partner
• Delayed Retirement (Converse is often the case)
• Use current assets to generate income – car and home – Uber, Airbnb
Expectations

What will life be like at higher ages?

- “Compression” of mortality and morbidity
- Increasing percentages of obesity, diabetes, and hypertension (7-10% from 1994-2004)
- Lower percentage of smokers
- Frailty/Increased risk of falling
- More people functioning with disabilities
- Health Expectancy
- Ageism
Implications for Social Insurance Systems

• Continued Stress on Social Security Systems
  • A number of possible solutions in the U.S.
  • Fixable

• Continued Stress on Healthcare Security Systems
  • Difficult choices will have to be made in the U.S.
Healthcare Delivery Systems

• Implications of healthcare delivery systems

• Modeled U.S. Healthcare Services – Results are highly sensitive to assumptions.
  
  • Future hospital capacity of the U.S. – Sufficient due to reduced lengths of stay and use of outpatient facilities
  
  • Supply of healthcare professionals – Shortages especially in nursing and certain physician specialties including gerontologists.
Healthcare Delivery Systems (Cont’d)

• Outpatient Facilities – Shortage due to increased utilization and shifting to outpatient from inpatient

• Nursing Homes – Sufficient with possible increase in staff qualifications
  • Compression of morbidity
  • Increased functionality
Implications for Business

• Implications for increasing longevity for:
  • Insurance companies
  • Annuity companies
  • HMOs and other insurers of the senior population in the U.S.
  • Health-care related corporations

• Effect of changing demographics on other corporations
  • Delayed retirement/Phased in retirement

• Longevity Bonds/Indices

• Reverse Mortgages
Conclusions

• Actuaries should understand latest developments influencing longevity in order to be leaders in finding solutions and shaping change
http://livingto100.soa.org/

Literature review of all five past symposia from 2002 to 2014 can be found at:

https://www.soa.org/Research/Research-Projects/Life-Insurance/soa-living-100.aspx