Declining Mortality (Increasing Longevity): At What Rate?

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Social Security Administration

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Perspective: “Aging” Not Mainly from Mortality

Aging (change in age distribution) mainly due to drop in birth rates

Aged Dependency Ratio 2016 TR
Population 65+/ (20-64)

- Actual and TR Intermediate
- TFR remain at 3.0 after 1964
- TFR remain at 3.3 after 1964
Various Alternative Projection Approaches Using Data

확록

Extrapolating past trends:

1) Age setback (*early method*)
2) Mortality rate by age and sex (*Lee/Carter*)
3) Life expectancy at birth (*Vaupel/Oeppen*)
4) Mortality rate by trend all ages (*2011 Technical Panel, CBO 2013-5*)

Or reflect changing conditions:

5) Improvement by cohort (*UK CMI, SOA*)
6) Mortality rate by age, sex, cause (*OCACT/TR, 2015 Technical Panel*)
2) Extrapolation by Age and Sex

- Example: Lee and Carter
- Fit the average trend of a selected period
- Future conditions must replicate the past—on average
- Age gradient never changes
- No deceleration in mortality decline
Mortality Decline \textit{Varies} Over Time

Conditions: Antibiotics/economy 1936-54; Medicare/Medicaid 1968-82
3) Will Life Expectancy Rise Linearly? Vaupel/Oeppen 2002; Best Nations

- Requires accelerating rate of decline in mortality rates if retain age gradient
- LE most affected by lowest ages—only so much gain possible
- Most disagree
  - Vallin/Meslé
4) Extrapolate All Ages the Same

- Ignores historical age gradient
- Result:
  - Substantial bias for population age distribution
- Thus, large bias for cost as % of payroll
  - Less mortality decline at young ages raises cost
  - More mortality decline at higher ages raises cost
Appropriate Data: by Age Critical

Age-gradient in past reduction is clear

Long-Term Historical Average Annual Rates of Reduction in Mortality 1929 to 2009

Recent Historical Average Annual Rates of Reduction in Mortality 1982 to 2009
5) Extrapolation by Cohort

- U.K. (& SOA-RPEC): “Phantoms never die” data issues
- Post-WW2 births: antibiotics young, statins later
- What does change up to age x say above age x?
  - Is cohort healthier at x if lower mortality up to x?
  - Or is cohort compromised by impaired survivors?
  - What does one cohort imply for the next cohort?
- Period effects from known changes in conditions are stronger—especially in the U.S.
6) Projection by Age, Sex, Cause

- SSA/OCACT/Trustees Reports (2015 Technical Panel)
- Requires selecting ultimate rates of decline
- Allows change in age gradient
- Results in deceleration in mortality decline

### Comparison of Historical, 2015 Trustees Report, and Ron Lee*

**Average Annual Rates of Decline in Age-Sex-Adjusted Death Rates**

<table>
<thead>
<tr>
<th>Historical (Dec 2015 data)</th>
<th>AGE</th>
<th>Ron Lee</th>
<th>2015TR Intermediate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.79</td>
<td>1.22</td>
<td>2.14</td>
<td>0-14</td>
</tr>
<tr>
<td>0.63</td>
<td>0.61</td>
<td>1.06</td>
<td>15-49</td>
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<tr>
<td>1.61</td>
<td>1.27</td>
<td>0.05</td>
<td>50-64</td>
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<tr>
<td>0.92</td>
<td>2.11</td>
<td>0.91</td>
<td>65-84</td>
</tr>
<tr>
<td>-0.18</td>
<td>1.30</td>
<td>-0.11</td>
<td>85+</td>
</tr>
<tr>
<td>0.51</td>
<td>1.78</td>
<td>0.48</td>
<td>65+</td>
</tr>
<tr>
<td>0.75</td>
<td>1.59</td>
<td>0.48</td>
<td>Total</td>
</tr>
</tbody>
</table>

* Fit 1950-2011, using Medicare-enrollment data for 65 and over, rather than HMD data

See Actuarial Note 158 https://www.ssa.gov/oact/NOTES/pdf_notes/note158.pdf
Age-adjusted Death Rates for Heart Disease, Cancer, Stroke, and Unintentional Injuries: United States, 1900-2015

(courtesy Robert Anderson, NCHS)

Rate per 100,000 standard population

NOTE: Data prior to 1933 contain death-registration States only. Data for 2015 is provisional.
Mortality Decline by *Cause* of Death:

*Rate of change from 1979 to 2013*

**FEMALE**

**MALE**

- Cardiovascular
- Cancer
- Violence
- Respiratory
- Other

Under 15 15-49 50-64 65-84 85+
Age-Sex Extrapolation vs. Age-Sex-Cause Projection

Lee maintaining full age-gradient offsets lack of deceleration
Result: OASDI actuarial deficit unchanged using Lee estimates

Mortality Rate Comparison Age 0-14 Unisex

Mortality Rate Comparison Age 65+ Unisex
Endorsed projections by cause with age-gradient

Suggested *average* age-adjusted 1% annual rate of decline

– To match average rate since 1950, overall
– Understood this incorporated deceleration

Chairperson Alicia Munnell, after TR 2016, said she was glad Trustees did not adopt the 1% rate of decline
Mortality Improvement: Slow Since 2009

Trustees Reports have overestimated reduction lately

Age-Sex-Adjusted Death Rates
(Total, All Ages)

Age-Sex-Adjusted Death Rates
(Ages 65 and Older)
Developing Assumptions by Cause

- Scientific approach reflecting biology
- Trustees and SSA/OCACT develop in consultation with other experts
- Johns Hopkins recent survey of medical researchers and clinicians came to very similar medium term expectations—individually
  - Trustees’ medium-term rates by cause had not been published
Cardiovascular: JHU Less Optimistic than Trustees over Age 50 for Next 30 Years

Cardiovascular Disease-Female
Average Annual Percent Reduction
JHU values are for the period 2009-2040

Cardiovascular Disease-Male
Average Annual Percent Reduction
JHU values are for the period 2009-2040
Respiratory: JHU More Optimistic under Age 50, Less Optimistic over Age 85

**Respiratory-Female**

*Average Annual Percent Reduction*

*JHU values are for the period 2009-2040*

- Under Age 15: JHU 1.7
- Ages 15-49: JHU 0.8
- Ages 50-64: JHU 0.5
- Ages 65-84: JHU 0.1
- Ages 85 and older: JHU
- Total:

**Respiratory-Male**

*Average Annual Percent Reduction*

*JHU values are for the period 2009-2040*

- Under Age 15: JHU 1.5
- Ages 15-49: JHU 0.8
- Ages 50-64: JHU 0.4
- Ages 65-84: JHU 0.4
- Ages 85 and older: JHU
- Total:
Cancer: JHU Very Similar to Trustees’ Expectations

Cancer-Female
Average Annual Percent Reduction
JHU values are for the period 2009-2040

- Under Age 15
- Ages 15 - 49
- Ages 50 - 64
- Ages 65 - 84
- Ages 85 and older
- Total

Cancer-Male
Average Annual Percent Reduction
JHU values are for the period 2009-2040

- Under Age 15
- Ages 15 - 49
- Ages 50 - 64
- Ages 65 - 84
- Ages 85 and older
- Total
How Future Conditions Might Change

- Smoking decline for women
  - Started and stopped later than men
- Obesity—sedentary lifestyle
- Difference by income/earnings
- Health spending—must decelerate
  - Advances help only if apply to all
- Human limits
  - Increasing understanding of deceleration

Sam Preston 2010—must consider cumulative effects
Increasing duration of obesity for aged in future
Death Rates Vary by Career Earnings Ranking

Difference has increased

Female 65-69 Retired-Worker
Relative Death Rates by AIME Quartile

1990
2010
Does Health Spending Affect Mortality?

*Note rise, at least through 2009*

![Graph showing national health expenditures with and without Medicare and Medicaid as a percent of GDP.](graph.png)
Health Spending Cannot Continue to Rise at Historical Rates

Note Trustees’ deceleration
Is There an Omega?

It appears we are rectangularizing the survival curve?
Death Rates Will Continue to Decline: But How Fast and for Whom?

- Must understand past and future conditions
  - Persistent historical “age gradient”
  - Avoid simple extrapolation of past periods
    » Cannot ignore changing conditions
      - “Limits” on longevity due to physiology
        - Latter half of 20th century was extraordinary
        » So deceleration seems likely
    » Cause-specific rates allow basis for assumptions
  - Results: in the 1982 TR, we projected LE65 in 2013 to be 19.0; actual was 19.1
For More Information…

http://www.ssa.gov/oact/

◆ Documentation of Trustees Report data & assumptions

◆ Historical and projected mortality rates
  https://www.ssa.gov/oact/HistEst/DeathHome.html

◆ Annual Trustees Reports
  https://www.ssa.gov/oact/TR/index.html