Declining Mortality (Increasing Longevity): At What Rate?

Steve Goss, Chief Actuary
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 2017 TR
Population 65+/(20-64)
Various Alternative Projection Approaches Using Data

- 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 *Varies* Over Time

Conditions: Antibiotics/economy 1936-54; Medicare/Medicaid 1968-82

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**Female Historical and Projected (2014 Trustees Report)**

Annual Percent Reduction in U.S. Mortality Rates

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**Male Historical and Projected (2014 Trustees Report)**

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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*

<table>
<thead>
<tr>
<th>Historical (Dec 2015 data)</th>
<th>AGE</th>
<th>Ron Lee</th>
<th>2015TR Intermediate</th>
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<tbody>
<tr>
<td>2.79</td>
<td>1.22</td>
<td>2.77</td>
<td>2.74</td>
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<td>0.63</td>
<td>0.61</td>
<td>1.07</td>
<td>1.06</td>
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<tr>
<td>1.61</td>
<td>1.27</td>
<td>1.34</td>
<td>1.34</td>
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<td>0.92</td>
<td>2.11</td>
<td>1.06</td>
<td>1.06</td>
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<td>-0.18</td>
<td>1.30</td>
<td>-0.11</td>
<td>0.65</td>
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<td>0.51</td>
<td>1.78</td>
<td>0.88</td>
<td>0.86</td>
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<td>0.75</td>
<td>1.59</td>
<td>0.99</td>
<td>0.96</td>
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* 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

Heart disease
Cancer
Stroke
Unintentional injuries

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

- Cardiovascular
- Cancer
- Violence
- Respiratory
- Other

**FEMALE**

**MALE**

[Graph showing mortality decline by cause of death for both genders, with rate of change from 1979 to 2013 for different age groups.]
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 Experience: All Ages
Reductions continue to fall short of expectations
Mortality Experience: Ages 65 and Older

Reductions since 2009 continue to fall short of expectations

Age-Sex-Adjusted Death Rates
(Ages 65 and Older)
Mortality Experience: Ages Under 65

*Actual increase since 2010*
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—indepedently
  - 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

**Respiratory-Male**
Average Annual Percent Reduction
JHU values are for the period 2009-2040
**Cancer: JHU Very Similar to Trustees’ Expectations**

### Cancer-Female

**Average Annual Percent Reduction**

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<tr>
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<td>1.8</td>
<td>0.9</td>
<td>0.4</td>
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<td>1.3</td>
<td>1.2</td>
<td>1.3</td>
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### Cancer-Male

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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

![Graph showing trends in obesity from 1971 to 2006 for different age groups.](image)
Death Rates Vary by Career Earnings Ranking

*Difference has increased*

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

- **1990**
- **2010**

<table>
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<tr>
<th>Quartile</th>
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<th>2010</th>
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<tr>
<td>1</td>
<td>1.2</td>
<td>1.6</td>
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<tr>
<td>2</td>
<td>1.1</td>
<td>1.4</td>
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<tr>
<td>3</td>
<td>1.0</td>
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<tr>
<td>4</td>
<td>0.9</td>
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Does Health Spending Affect Mortality?

*Note rise, at least through 2009*
Health Spending Cannot Continue to Rise at Historical Rates

*Note Trustees’ deceleration*

Annual Percent Change in Medicare Cost per Beneficiary Relative to GDP per Worker: 2015 TR

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<tr>
<td>Percent</td>
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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