Outline

• Our main focus today: approaches to projecting mortality and the inherent challenges
• Other topic 1: COVID-19
• Other topic 2: Dementia
Perspective: “Aging” Is Not Mainly from Mortality

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

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 older ages raises cost
Appropriate Data: by Age Critical

Age gradient in past reduction is clear
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

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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-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

Historical 2015TR Lee
Age-adjusted Death Rates Due to Selected Leading Causes of Deaths: United States, 1900-2019

(courtesy Robert Anderson, NCHS)
Mortality Decline by Cause of Death:
Rate of change from 1979 to 2018

FEMALE

MALE

Cardiovascular  Cancer  Violence  Respiratory  Other

Under 15  15-49  50-64  65-84  85+
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
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—indeed, independently
  - Trustees’ medium-term rates by cause had not been published
Cardiovascular: JHU Less Optimistic than Trustees over Age 50 for Next 30 Years
Respiratory: JHU More Optimistic under Age 50, Less Optimistic over Age 85
Cancer: JHU Very Similar to Trustees’ Expectations
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 and increasing duration of obesity for aged in future
Death Rates Vary by Career Average Earnings Quintile
Bosley, Morris, Glenn (2018): have the spreads stabilized? At ages 65-69:
Does Health Spending Affect Mortality?

*Note rise, at least through 2009*
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
Ultimately, the Changing Age Distribution of the Population Is the Main Factor for Social Security
1918: Three Waves

Figure 1. Death Rates of the Spanish Flu, June 1918 to May 1919


COVID-19: So Far

Source: https://covid.cdc.gov/covid-data-tracker
Change in Total Deaths by Age

Pneumonia/Influenza/COVID
Death Reporting Lags Date of Death

Estimated Complete—Rising
COVID-19 Longer-Term Implications

- Raised death rates in US 16% in 2020, similar in 2021?
- Second coronavirus in 20 years
  - Expect periodically in a now mobile world population?
- Reduced life expectancy for affected cohorts
  - But hopefully transient, not affecting future cohorts
  - Thus, possibly no implication for “trend rate” in mortality
- But, if deaths are raised by 16% in 2 of every 20 years:
  - Average level of mortality will be 1.6% above “trend”
Dementia

- Includes 4 categories of death (4 ICD-10 codes)
  - Vascular dementia (F01)
  - Unspecified dementia (F03)
  - Alzheimer’s disease (G30)
  - Other degenerative diseases of the nervous system not specified elsewhere (G31)
- Alzheimer’s disease was 46% of all dementia deaths in 2017
- Dementia has had an increasing share of all deaths, particularly in the past 20 years
Death Rates due to Dementia Have Been Rising Steadily for Men…
...And Even More So for Women
Similar Patterns Seen in the UK

Courtesy Adrian Gallop, UK Government Actuary’s Office

Mortality Projections: A US Perspective on Approaches and Challenges – September 13, 2021
Mortality Decline by Cause of Death: “Other” Only

Average rates of improvement

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Average rates of improvement
For More Information…

- 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
Thank you!