

# **Declining Mortality (Increasing Longevity): At What Rate?**

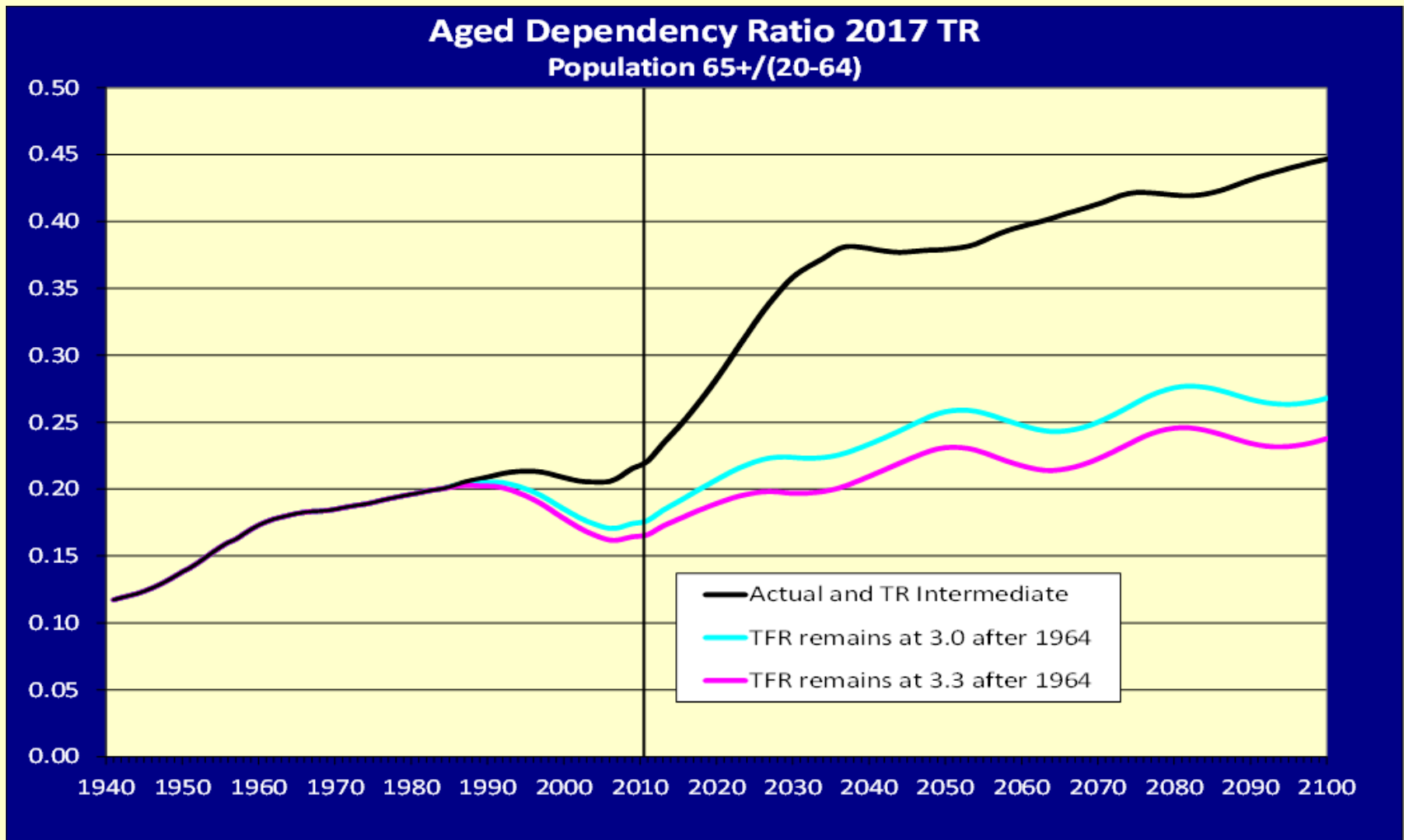
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**Steve Goss and Karen Glenn  
Office of the Chief Actuary  
Social Security Administration**

National Bureau of Economic Research  
July 26, 2017

# Perspective: “Aging” Not Mainly from Mortality

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



# Various Alternative Projection Approaches Using Data

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## ◆ 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*)

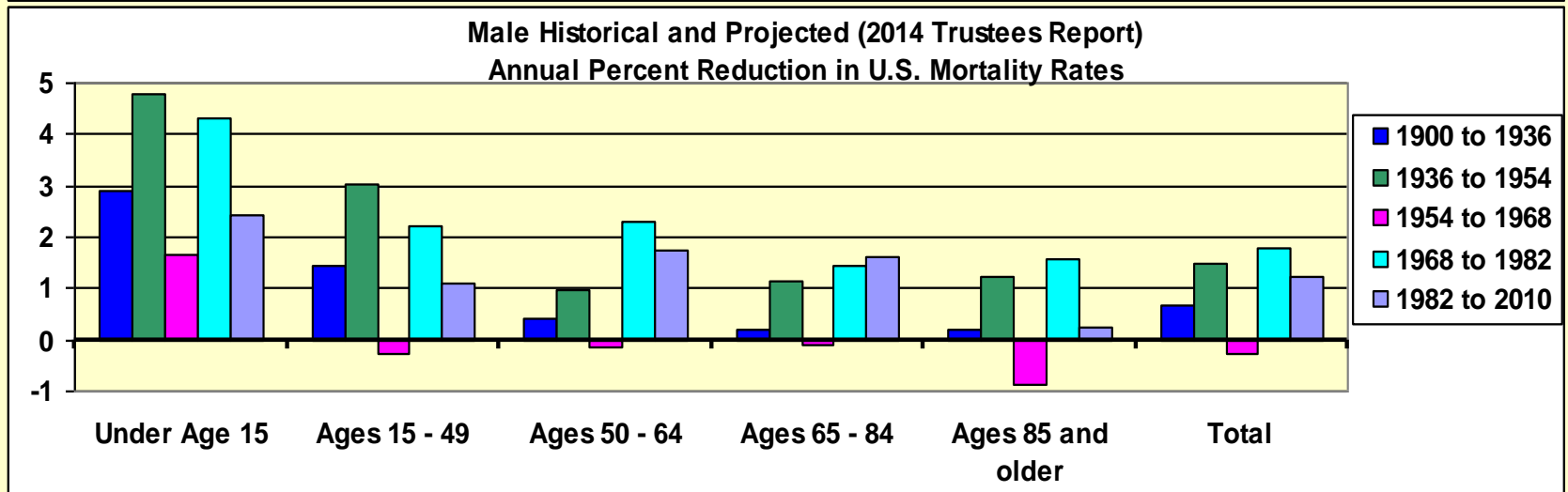
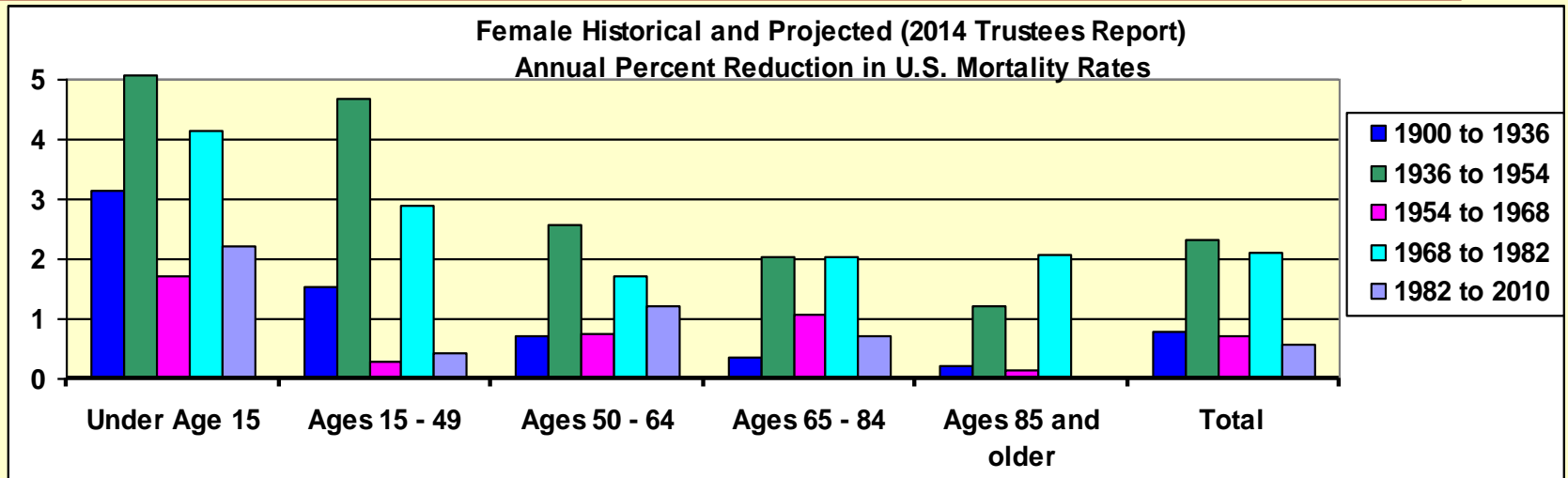
## 2) Extrapolation by Age and Sex

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- ◆ 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*



# 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

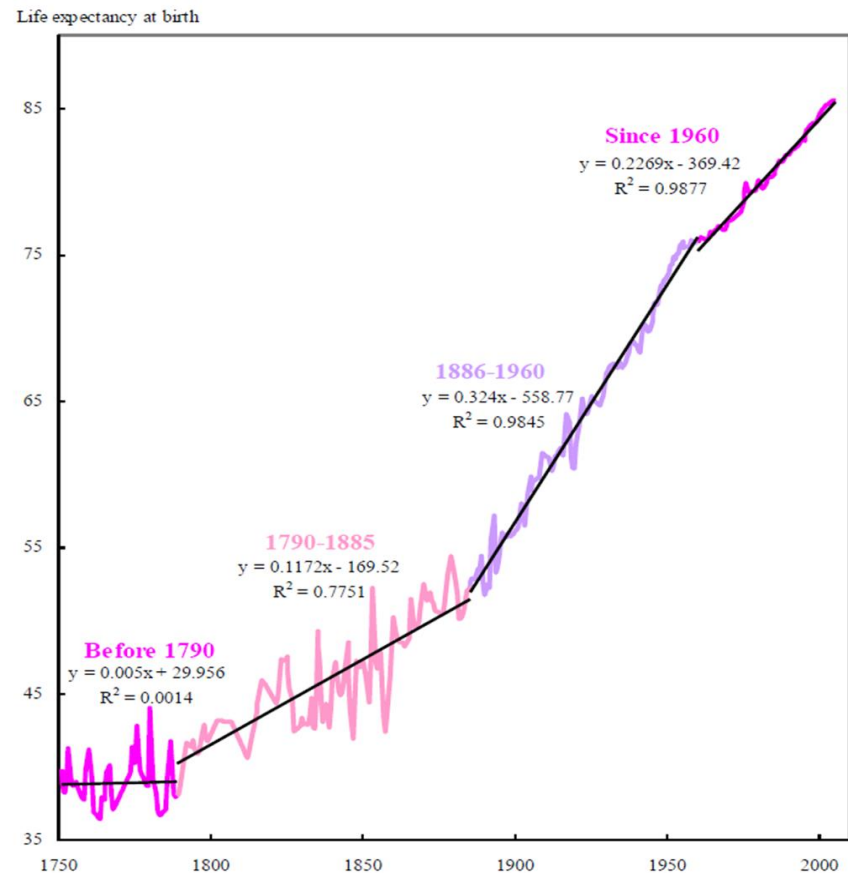


Figure 2. Maximum female life expectancy at birth since 1750 but excluding Norway (until 1866) and New Zealand  
Source: Vallin and Meslé 2008

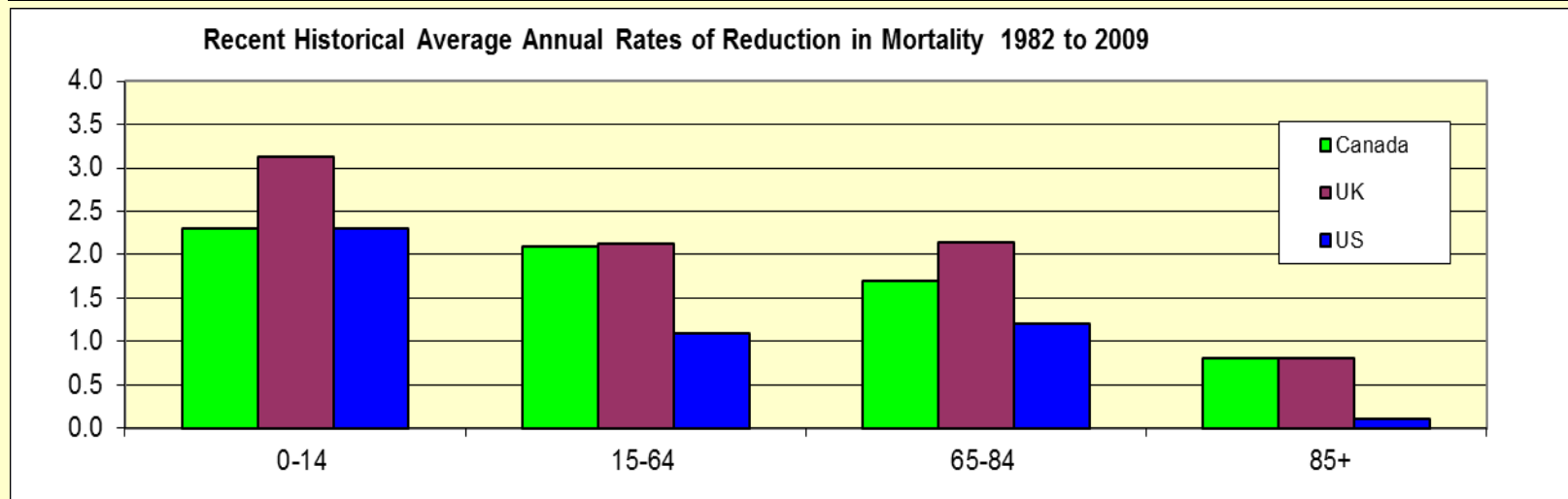
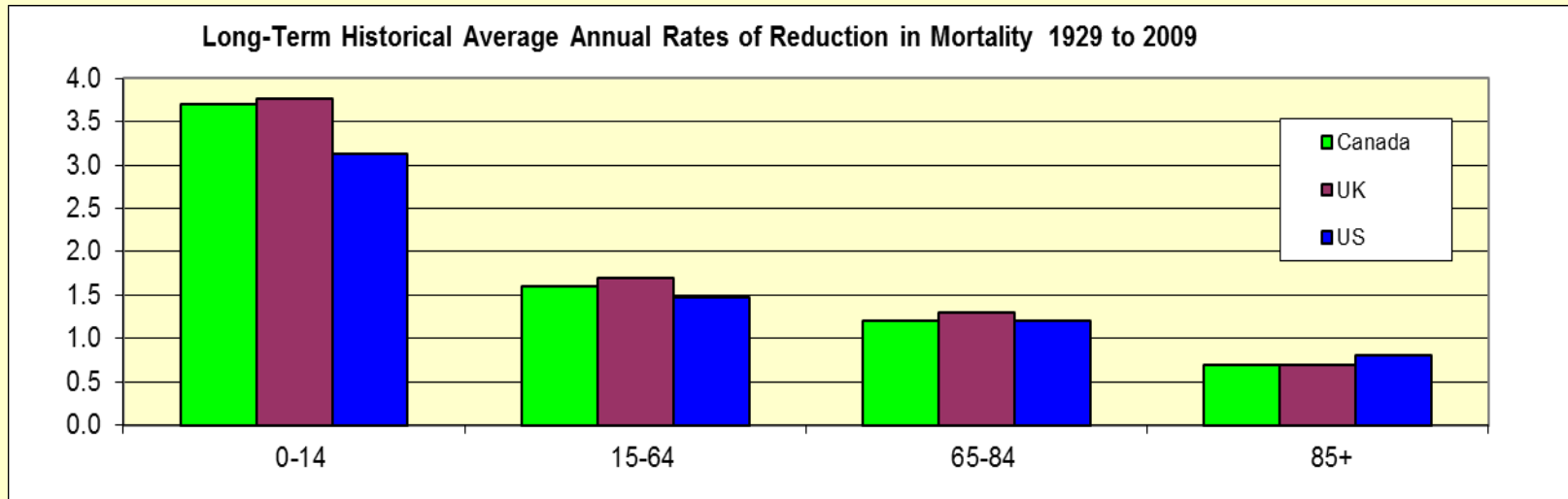
# 4) Extrapolate All Ages the Same

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- ◆ 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*





# 5) Extrapolation by Cohort

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- ❖ 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**

Historical (Dec 2015 data)			AGE	Ron Lee			2015TR Intermediate		
1982-99	1999-2009	2009-13		2011-39	2011-89	2039-89	2011-39	2011-89	2039-89
2.79	1.22	2.14	0-14	2.77	2.74	2.72	1.58	1.57	1.57
0.63	0.61	1.06	15-49	1.07	1.06	1.05	0.97	0.93	0.90
1.61	1.27	0.05	50-64	1.34	1.34	1.34	1.17	1.09	1.06
0.92	2.11	0.91	65-84	1.06	1.06	1.05	1.09	0.86	0.74
-0.18	1.30	-0.11	85+	0.65	0.64	0.63	0.64	0.53	0.48
0.51	1.78	0.48	65+	0.88	0.86	0.85	0.89	0.71	0.61
0.75	1.59	0.48	Total	0.99	0.96	0.94	0.95	0.80	0.71

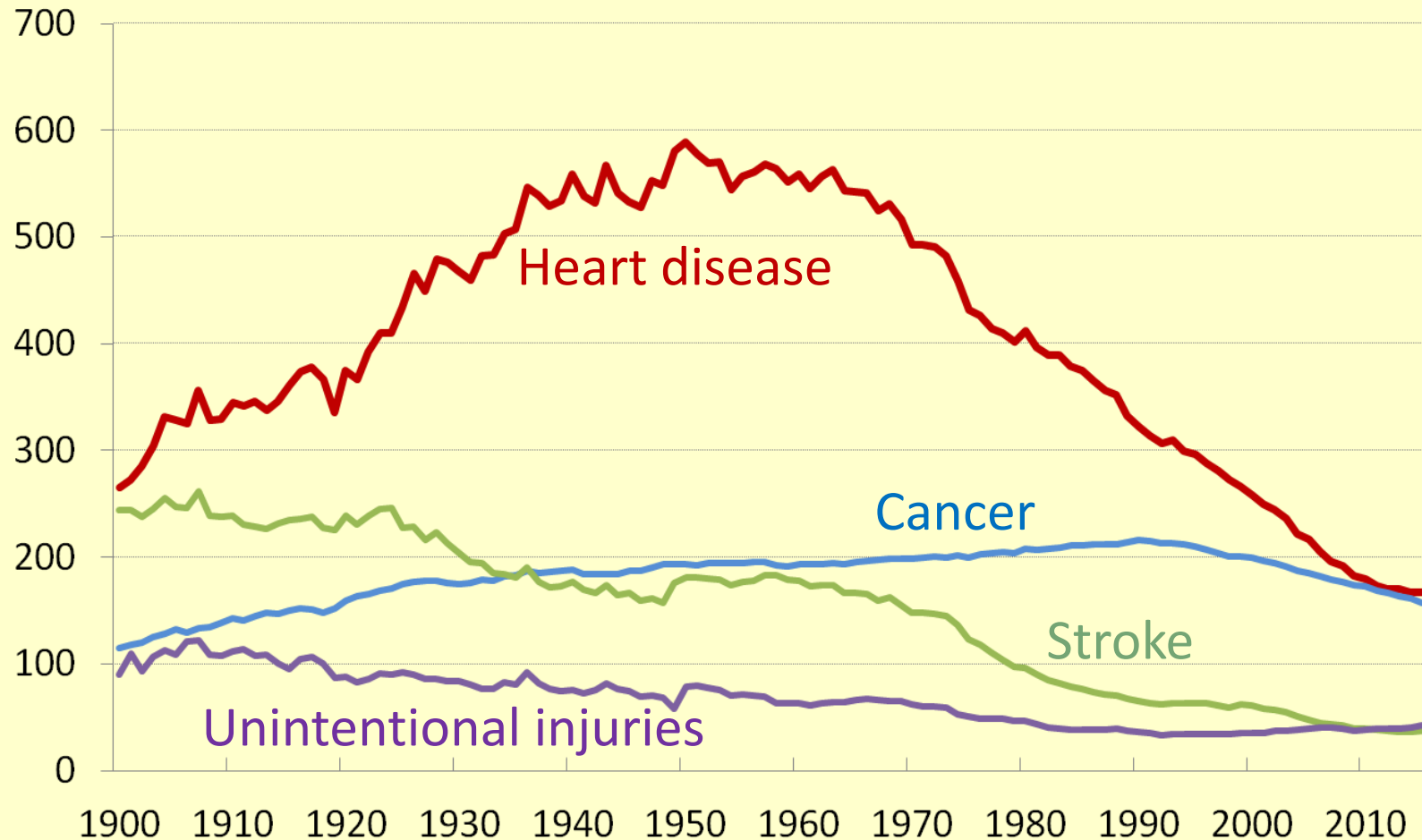
\* Fit 1950-2011, using Medicare-enrollment data for 65 and over, rather than HMD data

See Actuarial Note 158 [https://www.ssa.gov/oact/NOTES/pdf\\_notes/note158.pdf](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)

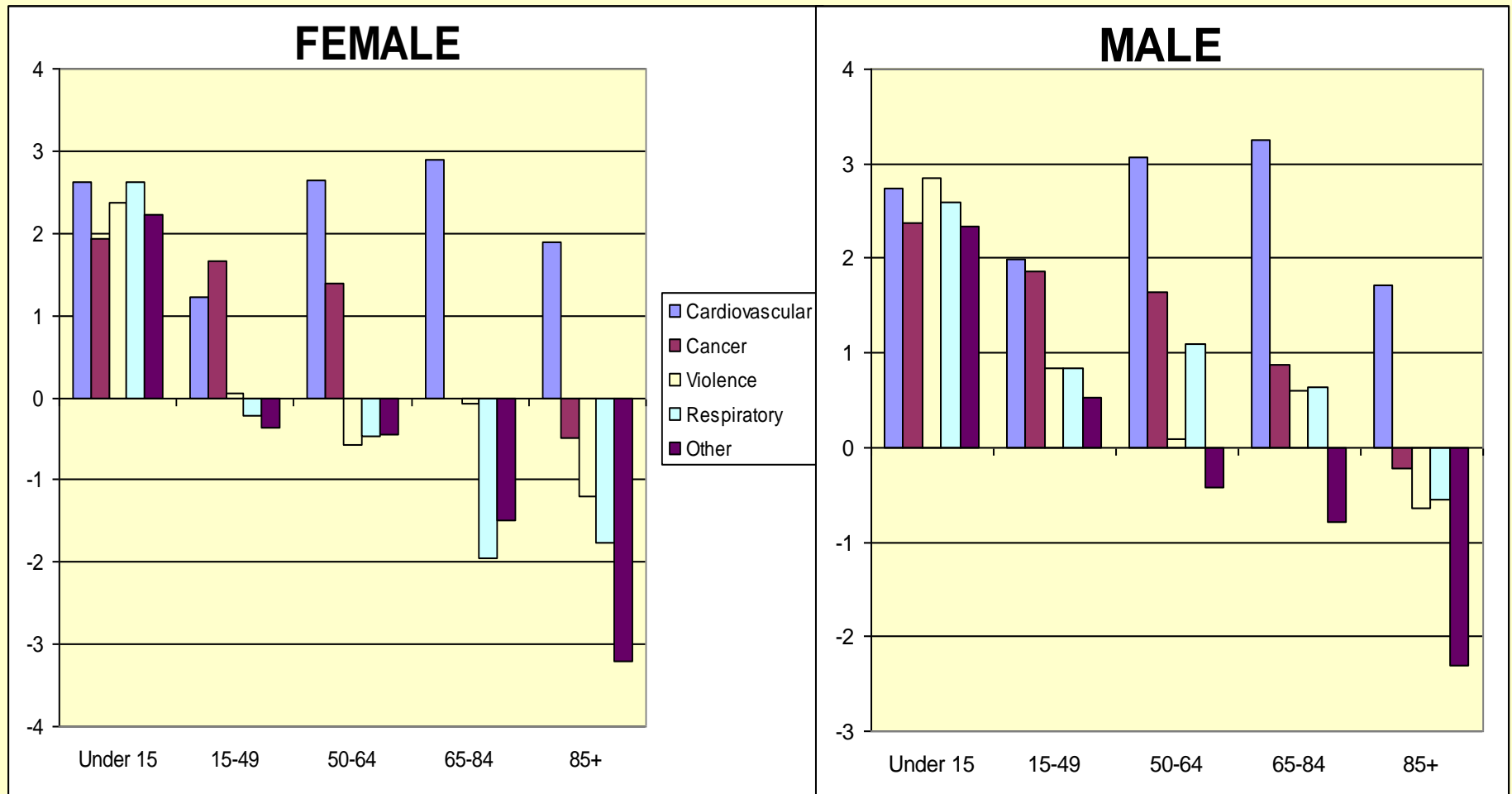
Rate per 100,000 standard population



NOTE: Data prior to 1933 contain death-registration States only. Data for 2015 is provisional.

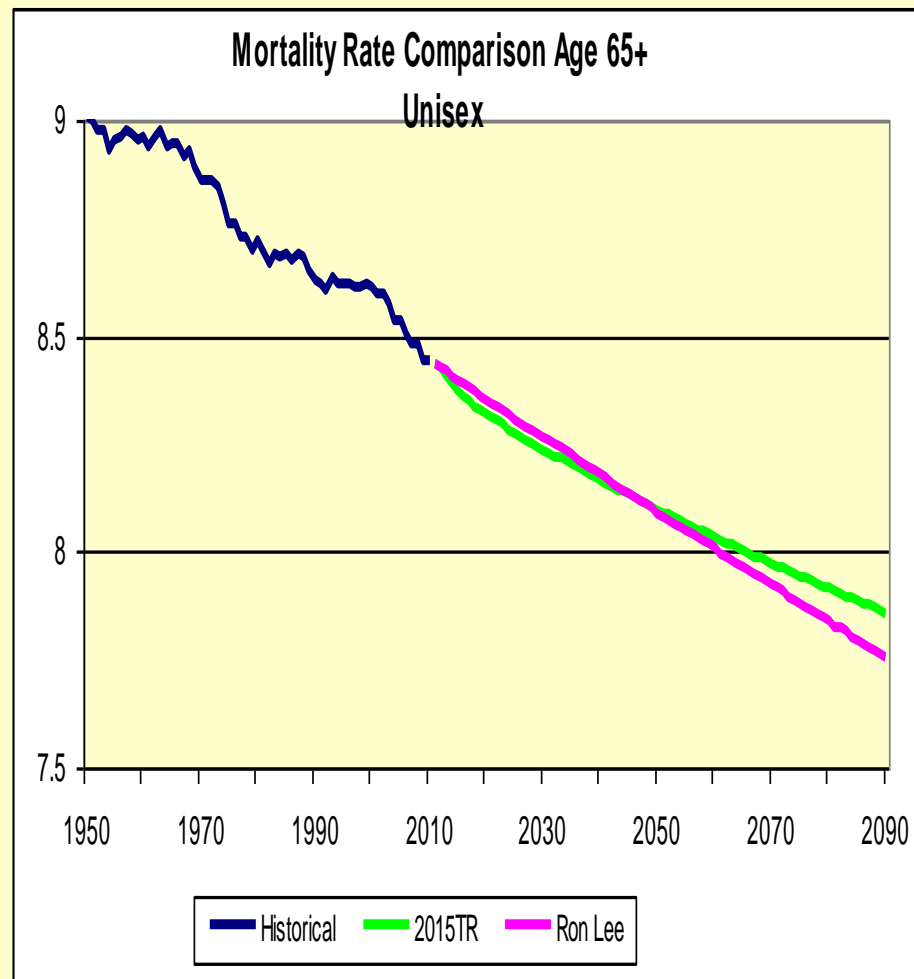
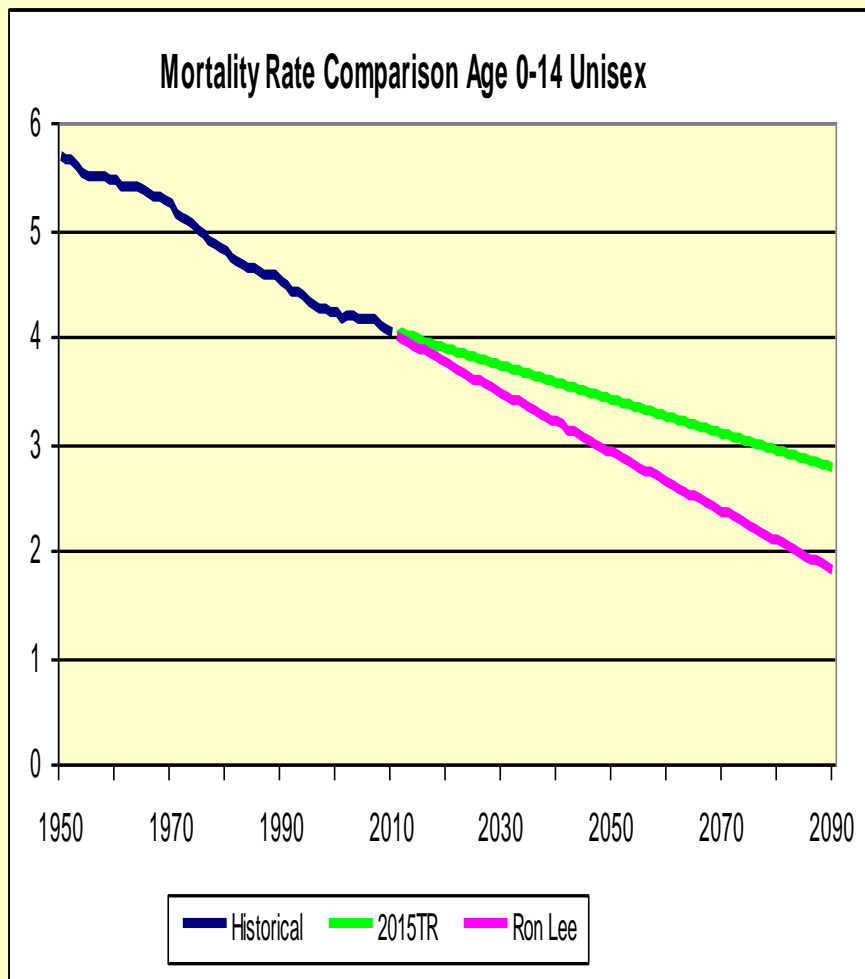
# Mortality Decline by *Cause of Death*:

*Rate of change from 1979 to 2013*



# 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*



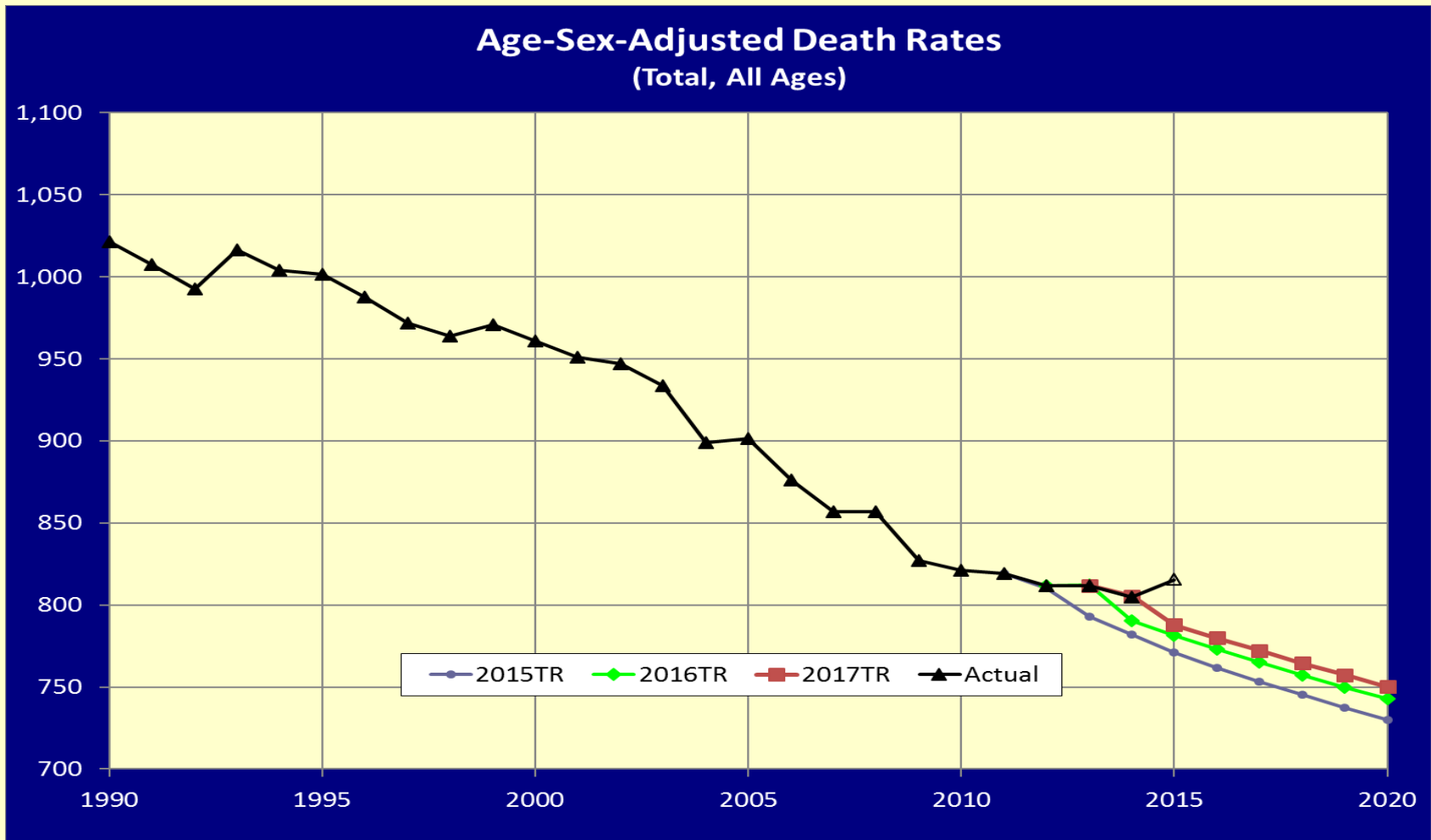
# 2015 Technical Panel

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- ◆ 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

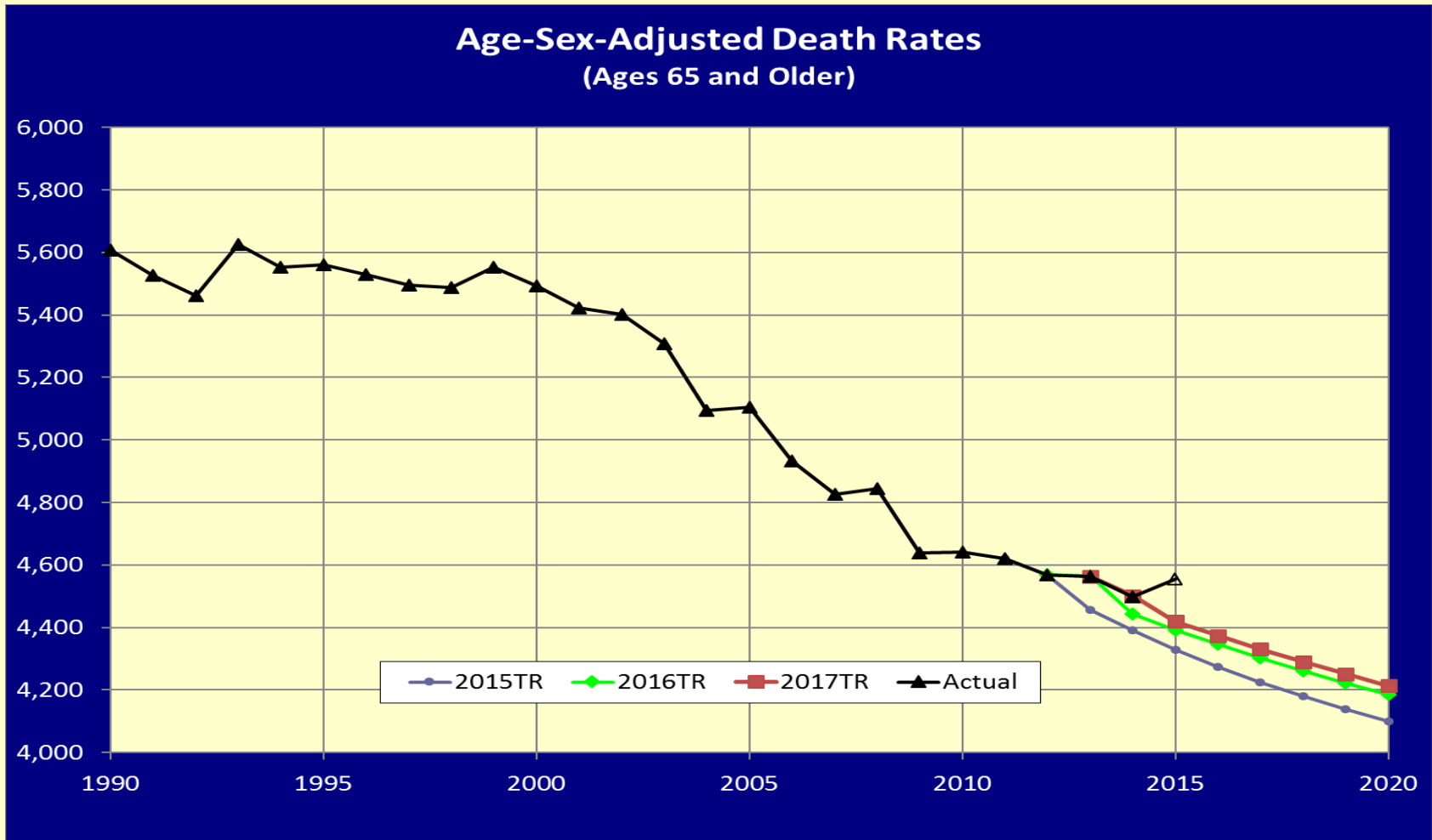
# Mortality Experience: All Ages

*Reductions continue to fall short of expectations*



# Mortality Experience: Ages 65 and Older

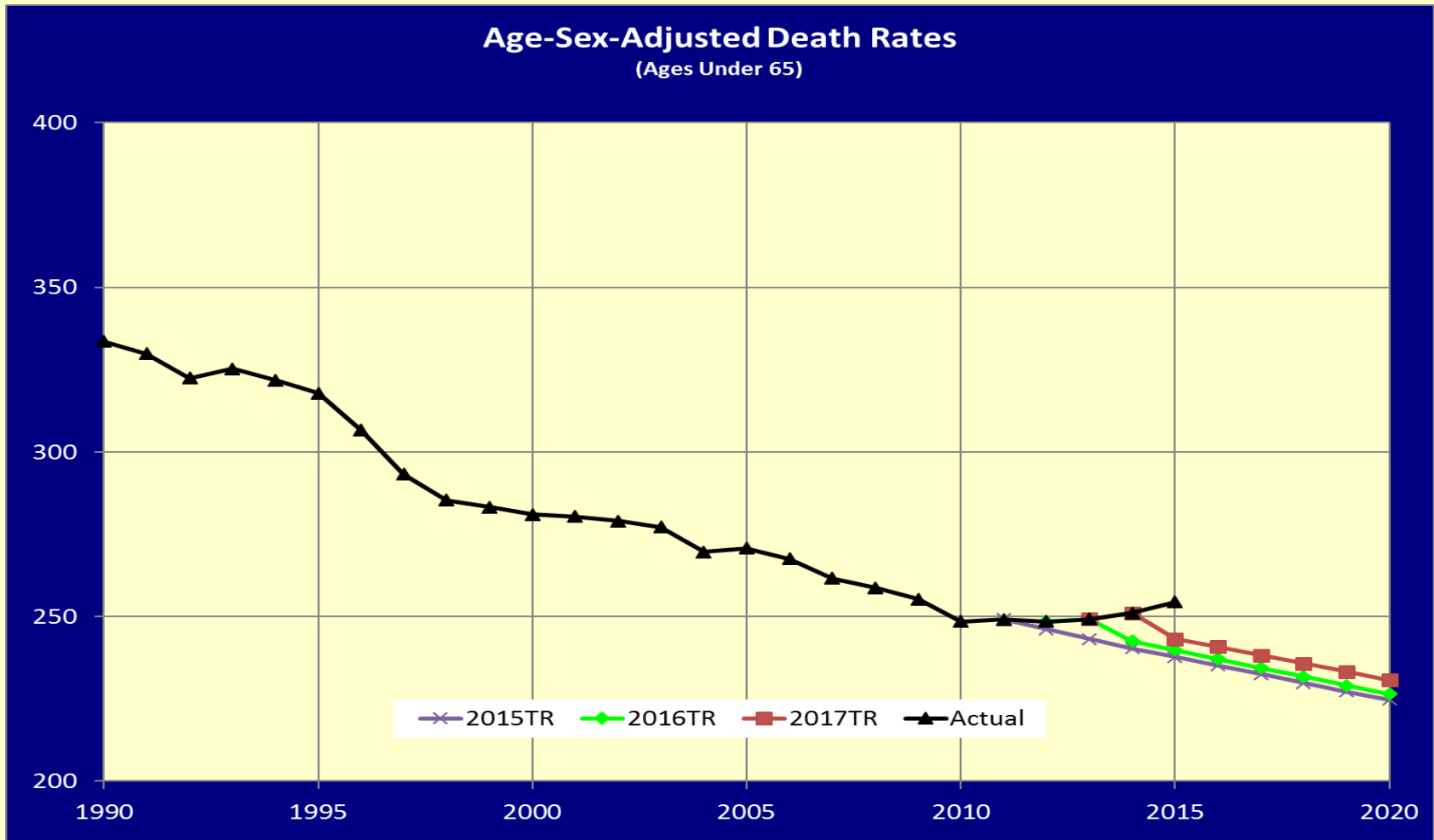
*Reductions since 2009 continue to fall short of expectations*





# Mortality Experience: Ages Under 65

*Actual increase since 2010*

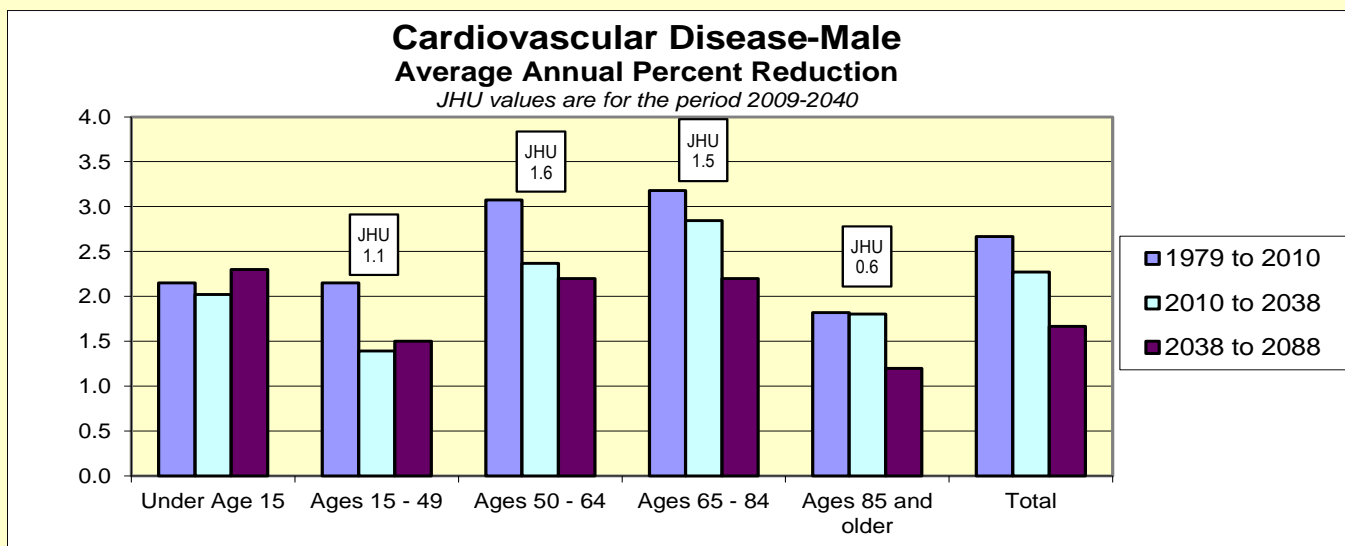
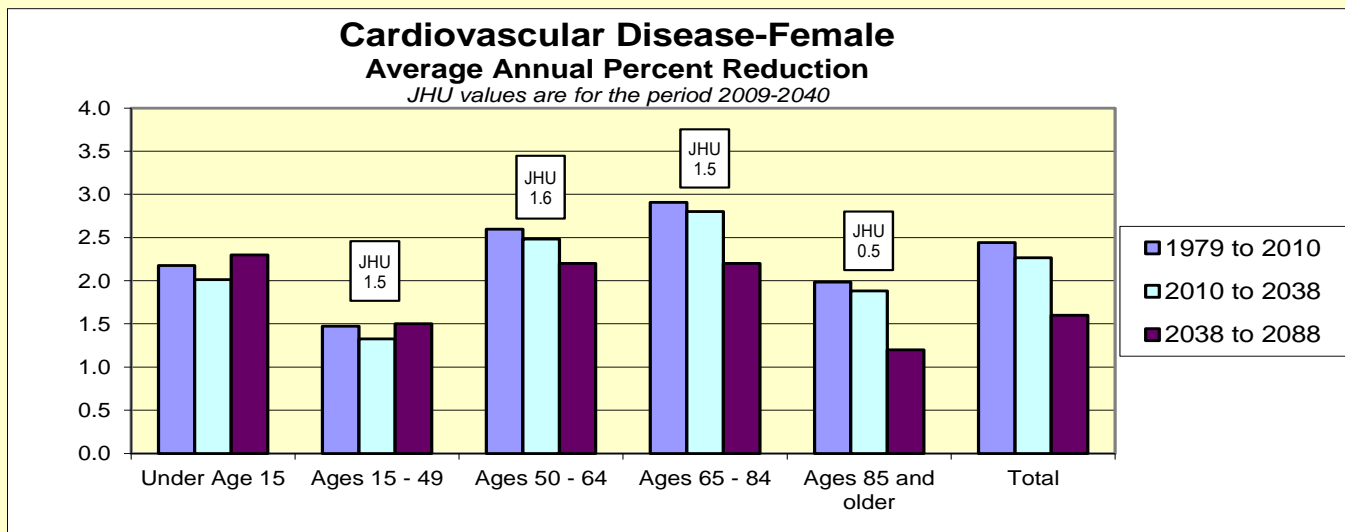


# Developing Assumptions by Cause

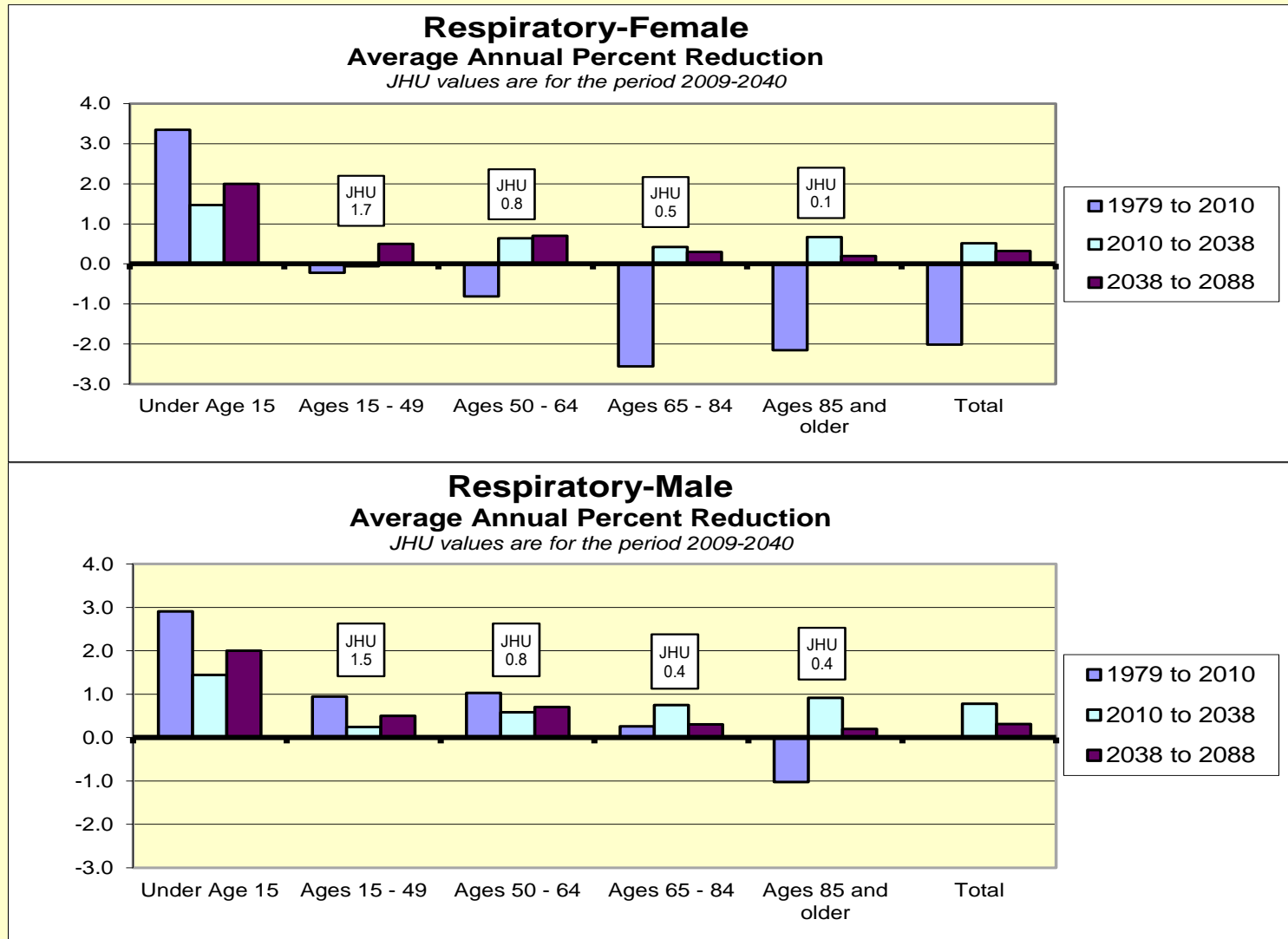
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- ◆ Scientific approach reflecting biology
- ◆ Trustees and SSA/OCACT develop in consultation with other experts
- ◆ Johns Hopkins recent survey of medical researchers and clinicians came to very similar medium term expectations—independently
  - Trustees’ medium-term rates by cause had not been published

# Cardiovascular: JHU Less Optimistic than Trustees over Age 50 for Next 30 Years

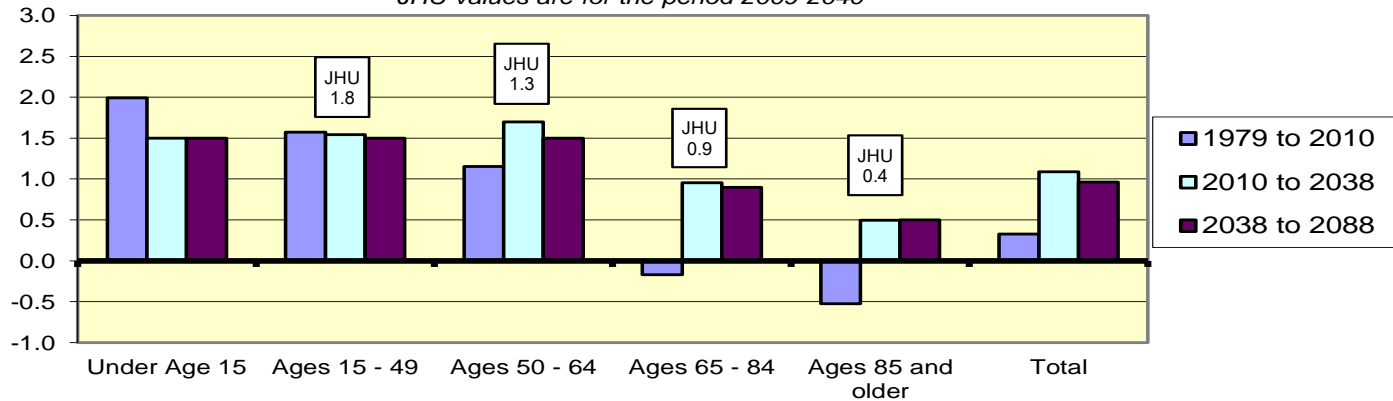


# Respiratory: JHU More Optimistic under Age 50, Less Optimistic over Age 85

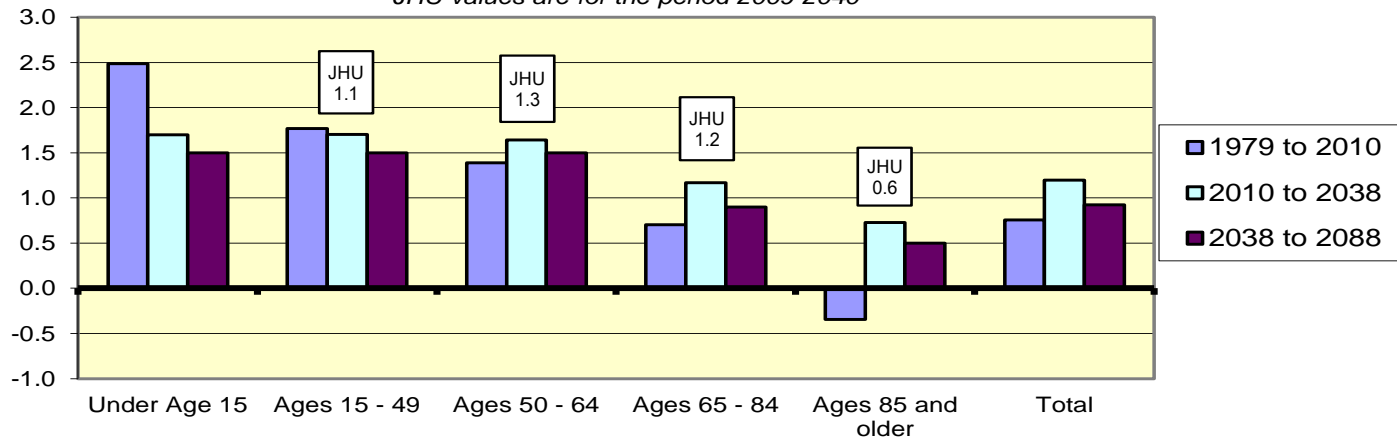


# Cancer: JHU Very Similar to Trustees' Expectations

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



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



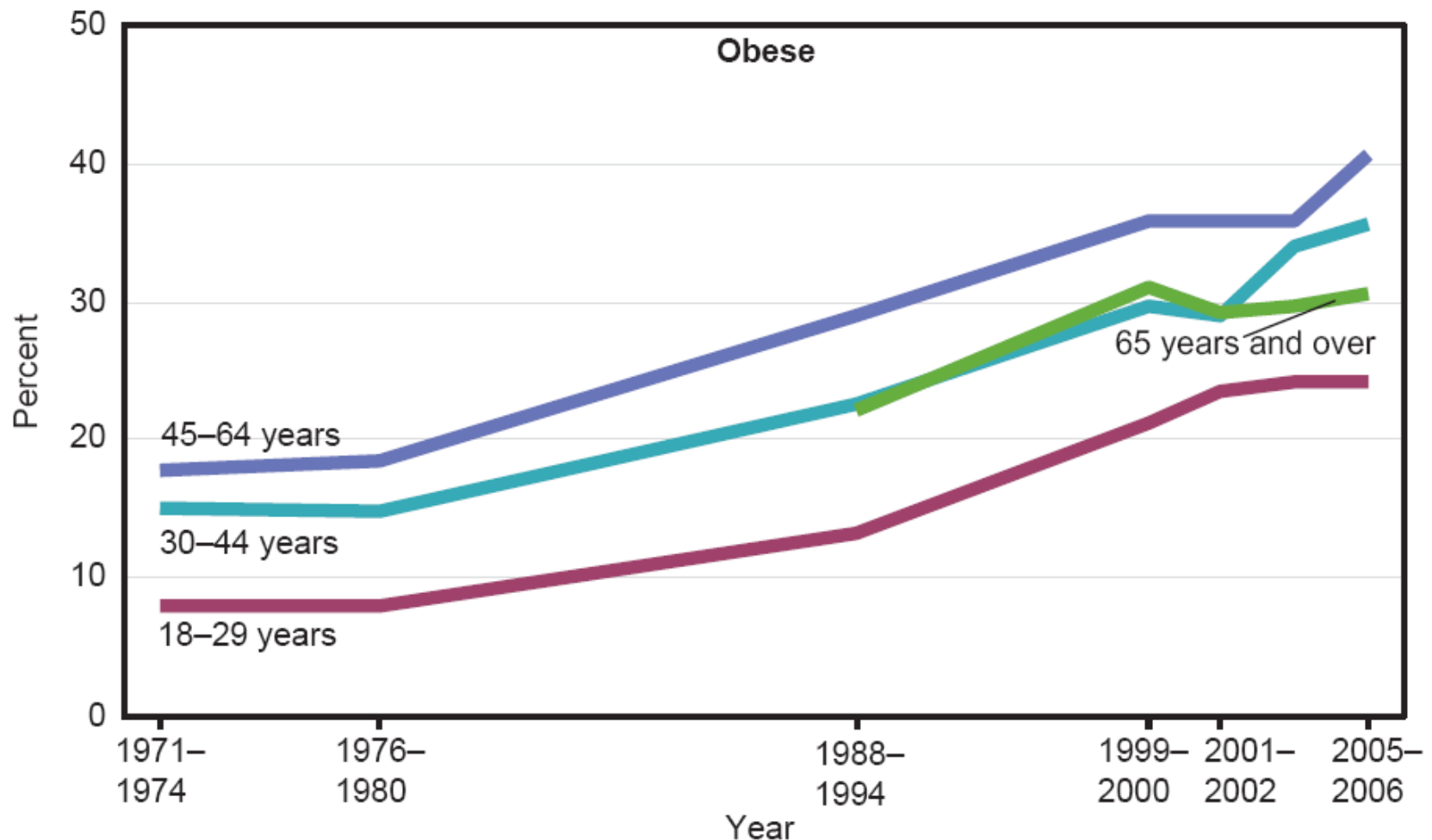
# How Future Conditions Might Change

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- ◆ 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

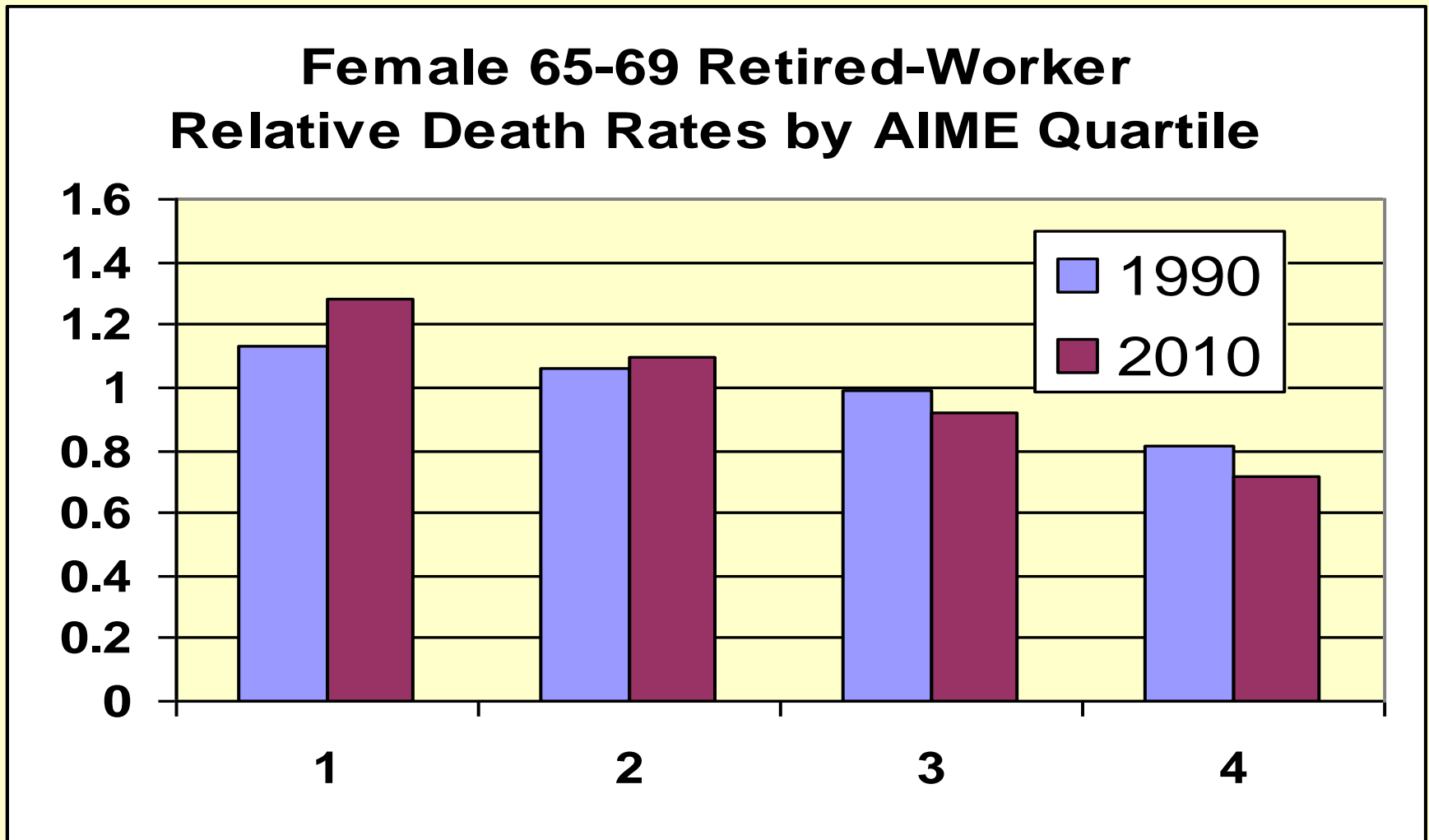
# Trends in Obesity: US 1971-2006

*Sam Preston 2010—must consider cumulative effects*  
*Increasing duration of obesity for aged in future*



# Death Rates Vary by Career Earnings Ranking

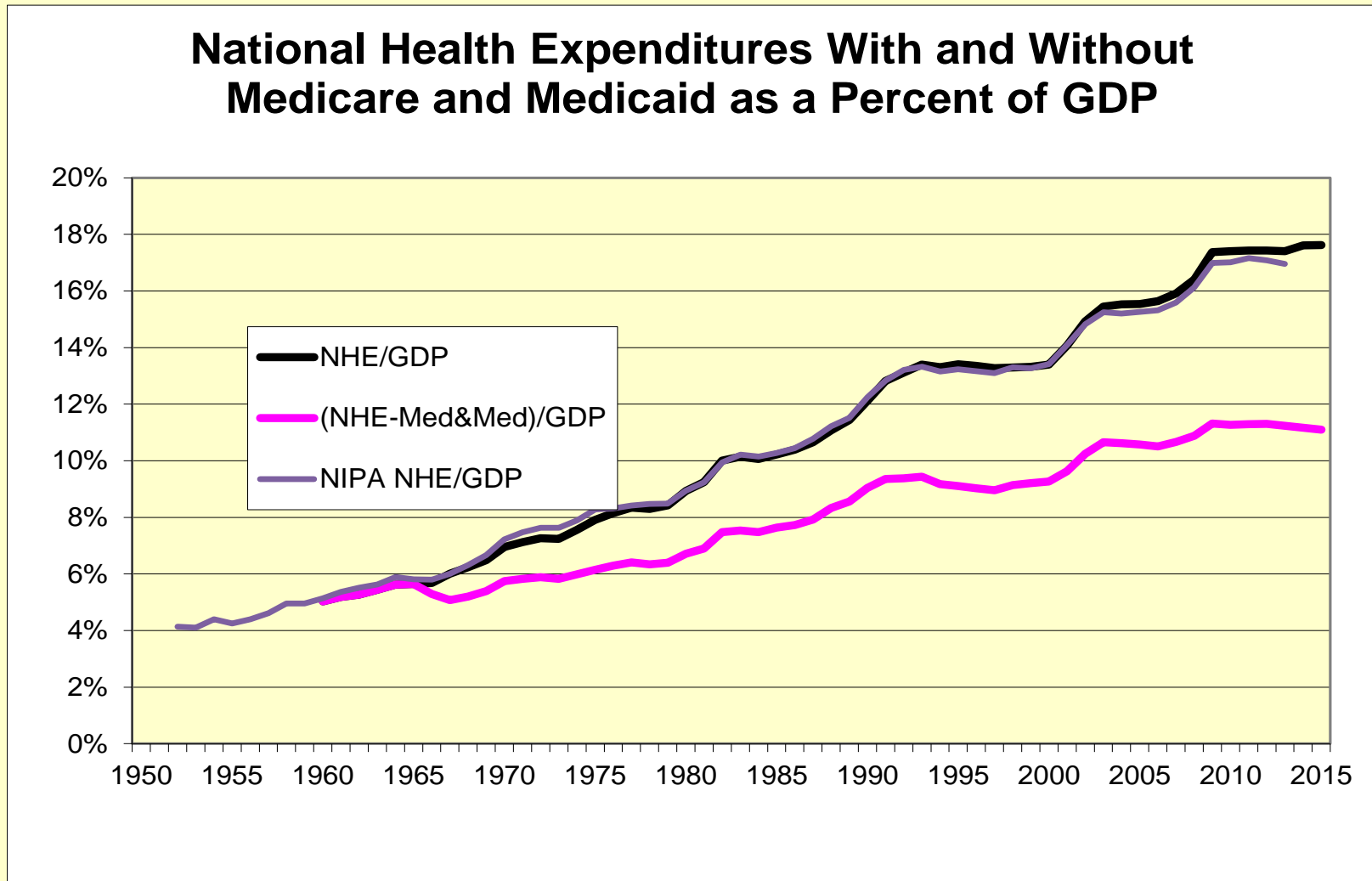
*Difference has increased*





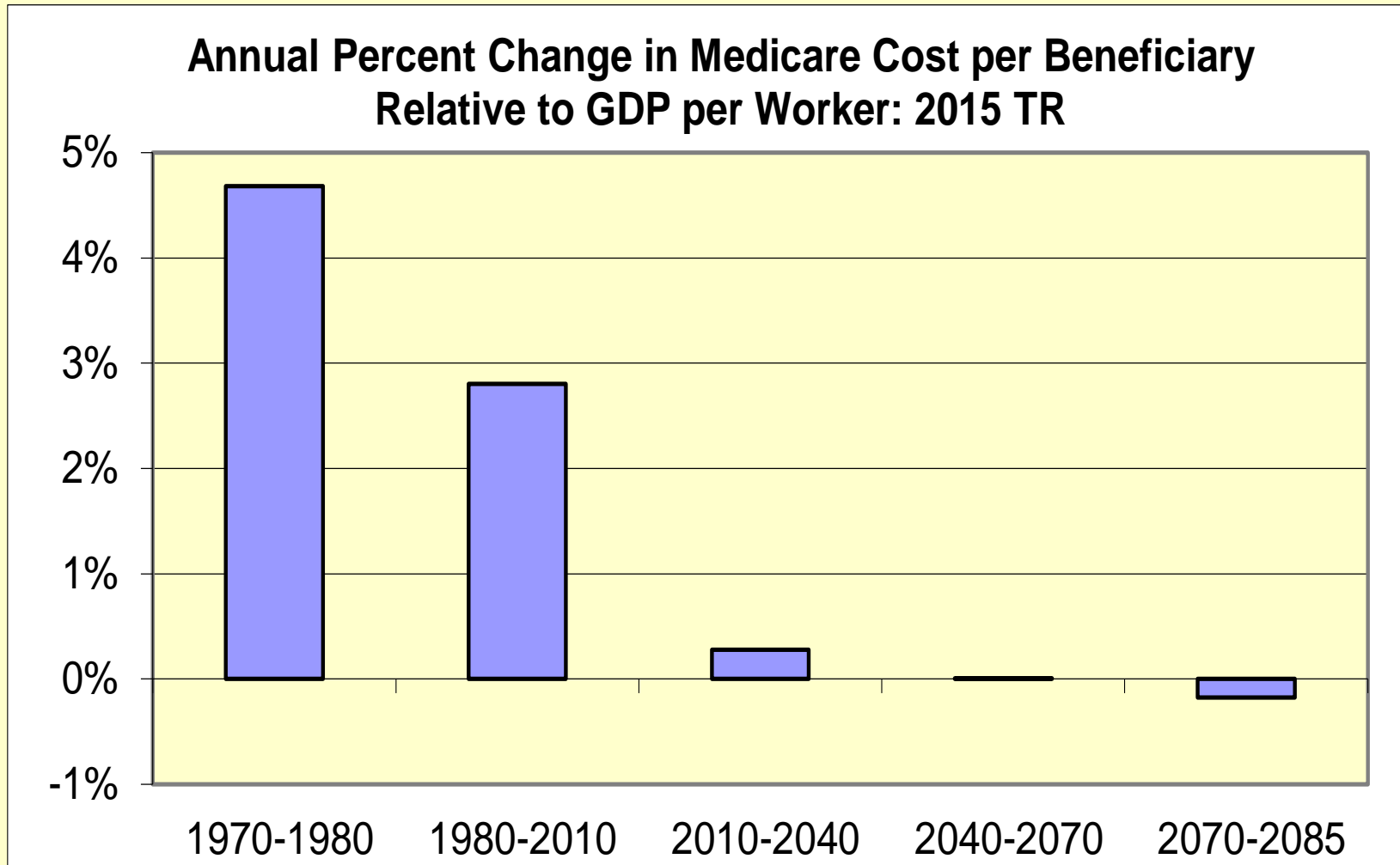
# Does Health Spending Affect Mortality?

*Note rise, at least through 2009*



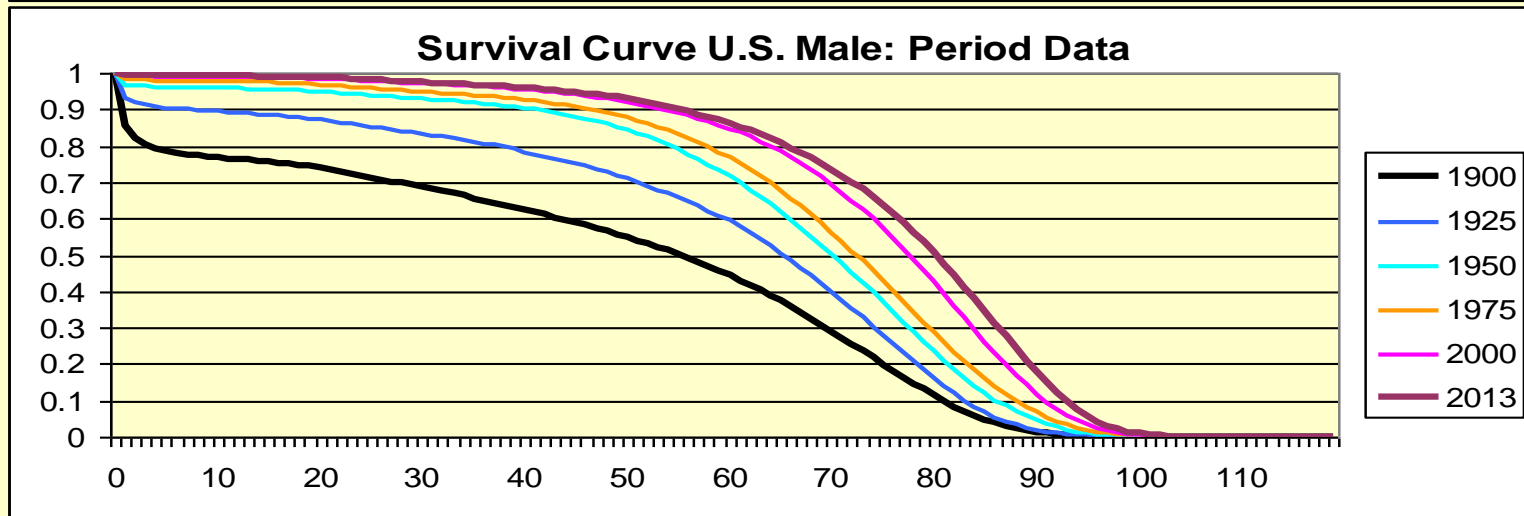
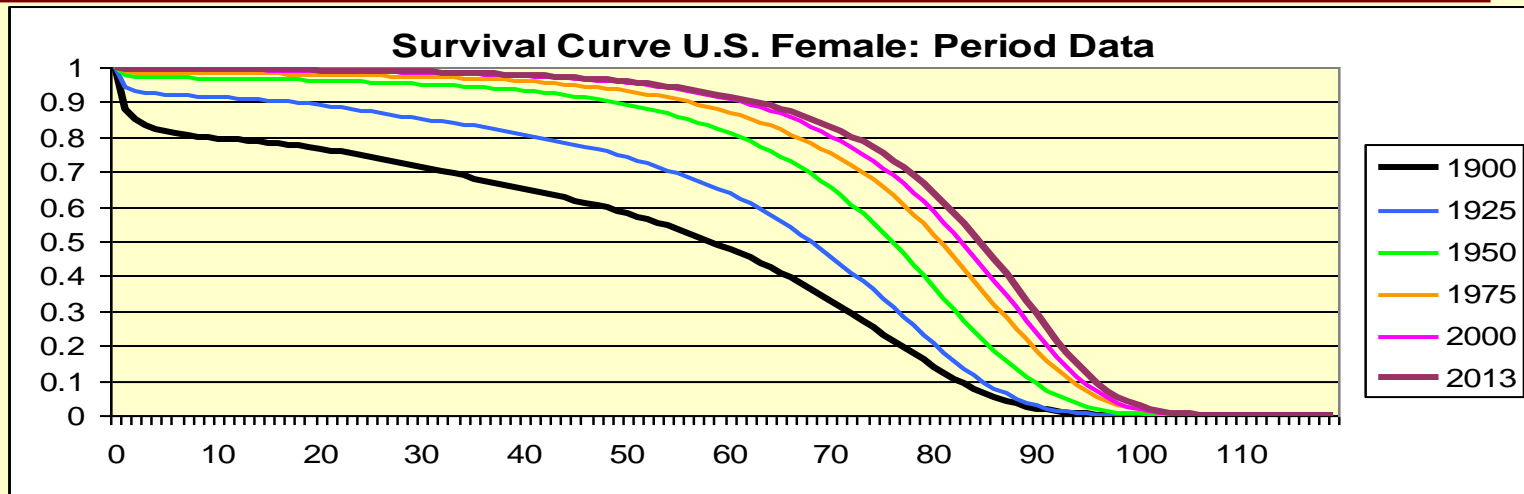
# Health Spending Cannot Continue to Rise at Historical Rates

*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?

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- ◆ 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 20<sup>th</sup> 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/>

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- ◆ Documentation of Trustees Report data & assumptions  
[https://www.ssa.gov/oact/TR/2017/2017\\_Long-Range\\_Demographic\\_Assumptions.pdf](https://www.ssa.gov/oact/TR/2017/2017_Long-Range_Demographic_Assumptions.pdf)
- ◆ Historical and projected mortality rates  
<https://www.ssa.gov/oact/HistEst/DeathHome.html>
- ◆ Annual Trustees Reports  
<https://www.ssa.gov/oact/TR/index.html>