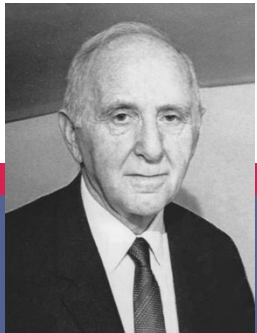


# A Satellite Account for Health in the United States

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November 2022



Simon Kuznets



Zvi Griliches

# Goal

- Talk about recent developments in satellite health account
- What is easy/hard for an org like BEA

## A Satellite Account for Health in the United States<sup>†</sup>

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*This paper develops a satellite account for the US health sector and measures productivity growth in health care for the elderly population between 1999 and 2012. We measure the change in medical spending and health outcomes for a comprehensive set of 80 conditions. Medical care has positive productivity growth over the time period, with aggregate productivity growth of 1.5 percent per year. However, there is significant heterogeneity in productivity growth. Care for cardiovascular disease has had very high productivity growth. In contrast, care for people with musculoskeletal conditions has been costly but has not led to improved outcomes. (JEL E01, H51, I10)*

*“The welfare of a nation can scarcely be inferred from a measure of national income.”*

—Simon Kuznets (1934, p. 7)



Estimating medical care productivity growth is a central economic challenge. The National Income and Product Accounts (NIPAs) report that multifactor productivity (MFP) in the health care and social assistance sector declined by 0.4 percent annually between 1987 and 2018,<sup>1</sup> in contrast to the 0.9 percent increase in the economy as a whole. Given the size of health care in the economy, about 18 percent of GDP,

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<sup>†</sup>Go to <https://doi.org/10.1257/aer.20201480> to visit the article page for additional materials and author disclosure statements.

<sup>1</sup>This includes health care and social assistance, although social assistance represents less than 10 percent of the total. Health care services includes inpatient and outpatient facilities but excludes pharmaceuticals and medical devices. Over the 1987–2016 time period, the reported MFP of the pharmaceutical industry was -1.7 percent annually and the reported productivity growth of the medical equipment and supplies industry was 0.7 percent annually.

# Measurement of productivity in medical care has been a longstanding challenge

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### THE CONSUMER PRICE INDEX AND TAX

Last December, a panel of five economists, headed by Michael Boskin, advised the Council of Economic Advisers (CEA) during the Bush Administration to revise the Consumer Price Index (CPI). The Boskin Commission report, *Toward the Cost of Living*, analyzes technical issues regarding the CPI and intended to lead to a more accurate measure of changes in the cost of living for legislative action to adjust indexing provisions.

The Commission found that the current CPI may overstate annual inflation from 0.8 to 1.6 percentage points. The Commission also concluded that the estimate of this overstatement is 1.1 percentage points per year. Although agreement among economists that the CPI probably overstates price changes, there is great uncertainty over the extent of this overstatement.

The Commission's report has proved controversial because a variety of programs, including Social Security and military retirement, are indexed to the CPI. This paper will focus on how a reduction in annual CPI adjustments would affect the tax system. A previous Joint Economic Committee (JEC) report<sup>1</sup> found that in 1996, middle class taxpayers, would comprise about 40 percent of a CPI revision. This paper takes no position on the policy issues raised by the report.

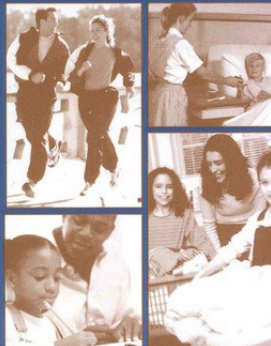
### THE CPI AND THE FEDERAL INCOME TAX

Under the provisions of the Economic Recovery Tax Act (ERTA) of 1981, the individual income tax was indexed to the CPI starting in 1985. This indexing eliminated the effects of inflation on the tax system, but it also exposed a smaller proportion of income to taxation and to tax a portion of income to higher tax rates. Conversely, a legislated cutback in annual CPI adjustments would result in a higher proportion of personal income would be taxable, and some higher tax rates. Over time, the cumulative effects of curtailing tax index-

<sup>1</sup>See JEC report, *The Consumer Price Index and Public Policy*, December 1996.

## BEYOND THE MARKET

Designing Nonmarket Accounts for the Unpaid Work of Women




NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

## ACCOUNTING FOR HEALTH AND HEALTHCARE

APPROACHES TO MEASURING THE SOURCES AND COSTS OF THEIR IMPROVEMENT

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

  
National Bureau of Economic Research

## Medical Care Output and Productivity

Studies in Income and Wealth  
Volume 62

Edited by  
David M. Cutler and  
Ernst R. Berndt

# Two basic difficulties with medical care productivity

- **We often get the industry wrong**
    - We focus on the name of the company providing the treatment (hospital, physician, pharma company). Consumers care about the condition being treated (heart disease, stroke, cancer)
    - BEA has made huge progress here.
  - **We are not good at measuring outcomes**
    - Improved health, relative to the counterfactual
    - There has been some progress. This is tough stuff.
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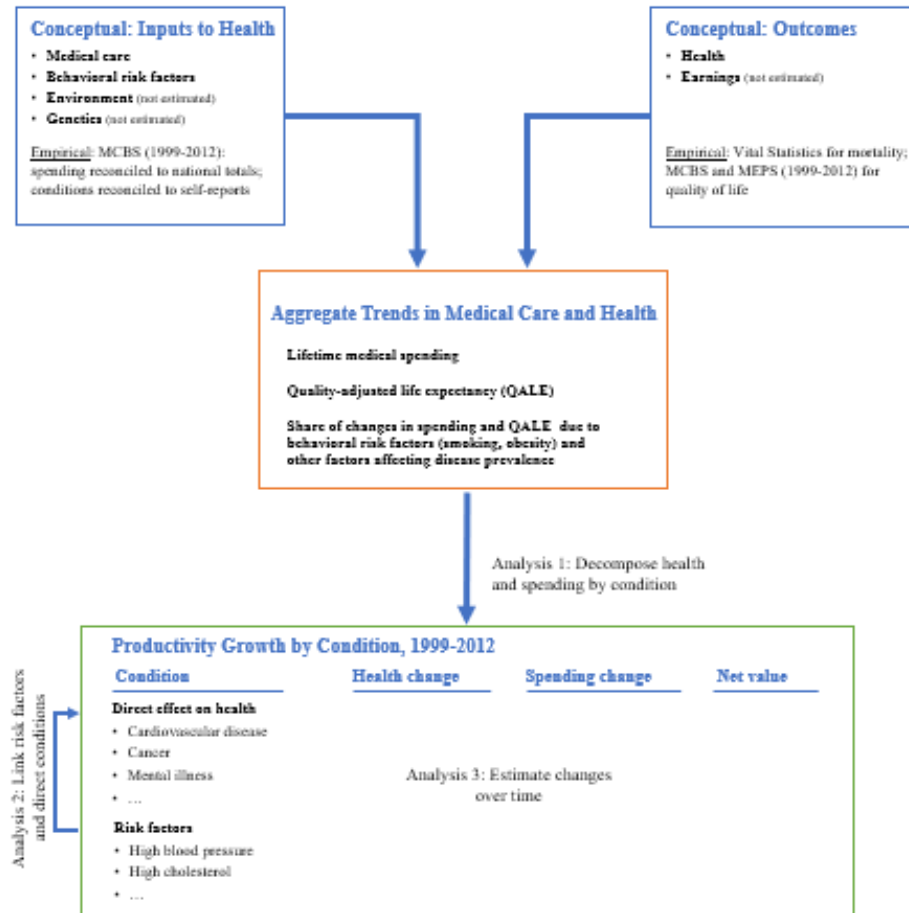
# Conceptual Underpinnings

Figure 1: Depiction of Satellite Health Account

Inputs

Aggregates

Conditions



Note: The top row shows the conceptual inputs to a satellite health account: the inputs and health outcomes. The middle row shows aggregate trends in medical care and health. The lower row shows the productivity analysis. Productivity growth is determined from changes in health and medical spending.

# First accounts are for the elderly\*

- Data are from Medicare Current Beneficiary Survey (MCBS), 1999-2012
- Total spending, not just Medicare
- Adjustments
  - Adjust weights in TM to match TM+MA population
    - Based on health info as well as demographics
  - Move spending across categories and adjust overall totals to match national health expenditure accounts
  - All spending in real (2010) dollars

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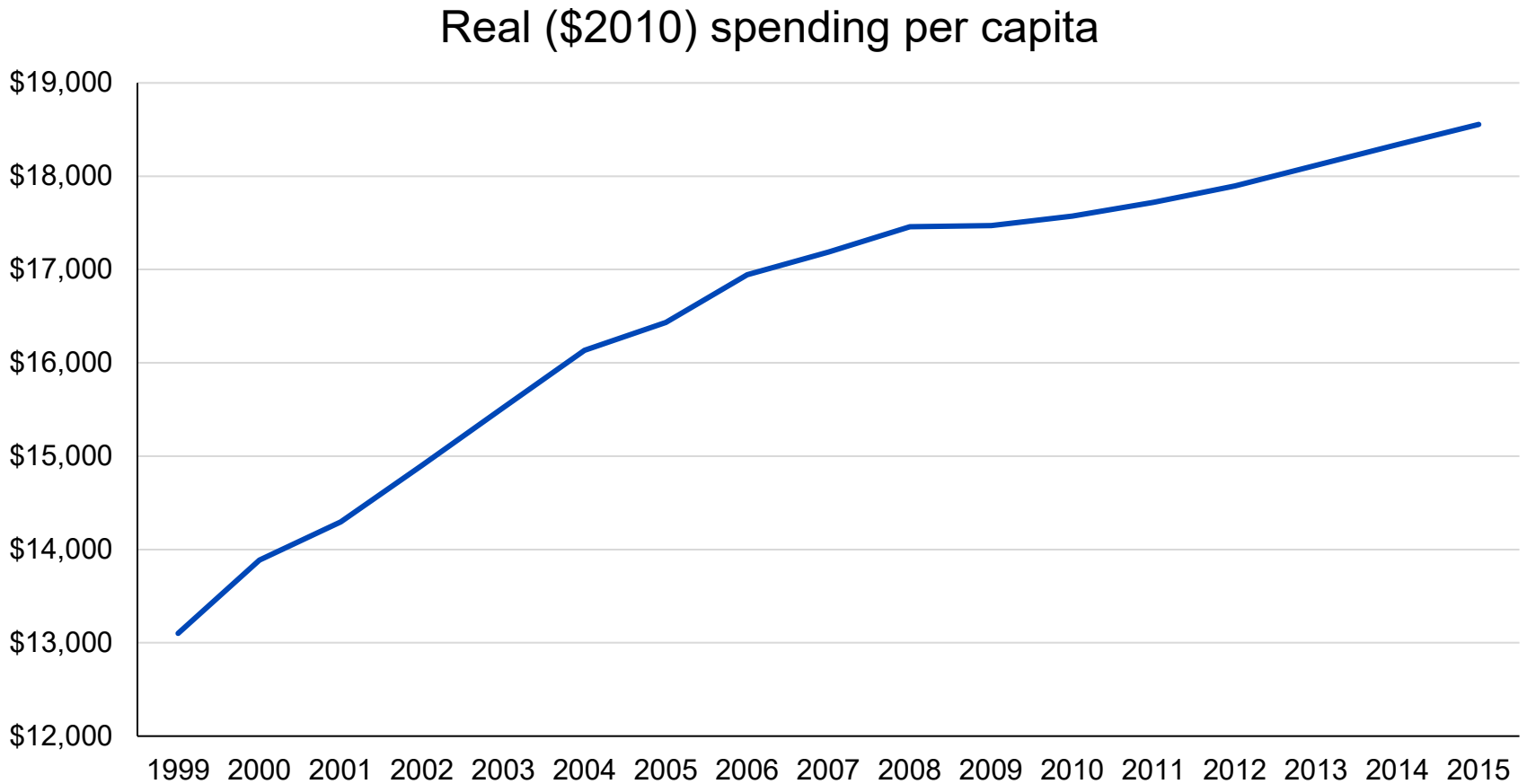
\* Working on the rest of the population.

# AGGREGATES

This is not too hard.

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# Real per capita medical spending increased \$4,800 annually over this time period



Data are age-adjusted to the 2010 population in 3 age groups.



# Measuring population health

$$QALE(t) = \sum_{k=0}^T \underbrace{\text{Survival}(t+k)} \cdot \underbrace{\text{QoL}(t+k)}$$

## Survival

Determined from life tables

## Quality of life

Specific impairments ( $X_{it}$ ):

- Any ADLs (/6) and IADLs (/6)
- Functional limitations (5)
- Trouble seeing, hearing
- Health limits social activity

Relate 0-100 health score to these impairments in 2000-2002 MEPS

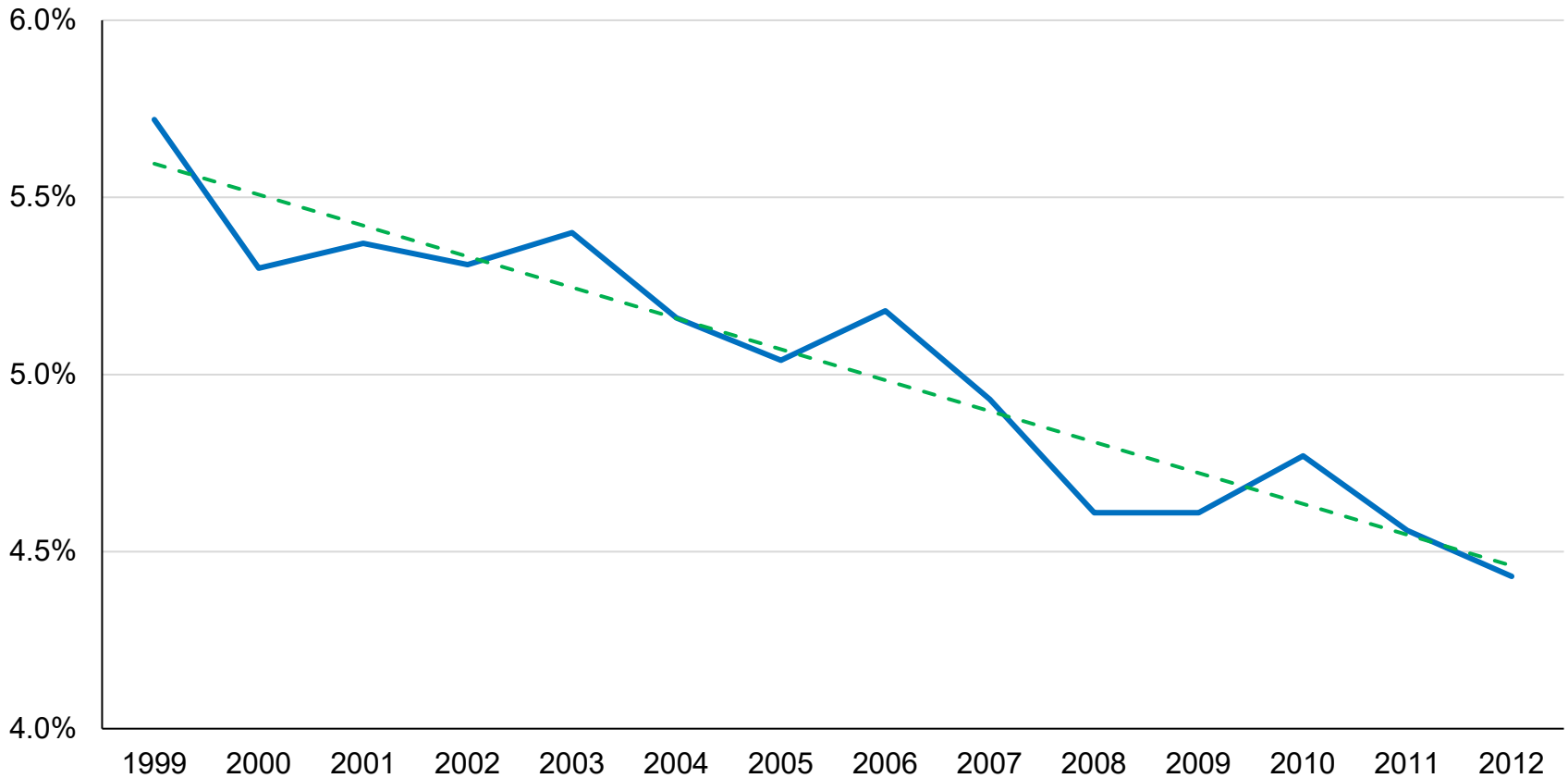
$$h_i = \beta_0 + \mathbf{X}_i\boldsymbol{\beta} + \varepsilon_i$$

Weight impairments over time ( $X_{it}\hat{\beta}$ )

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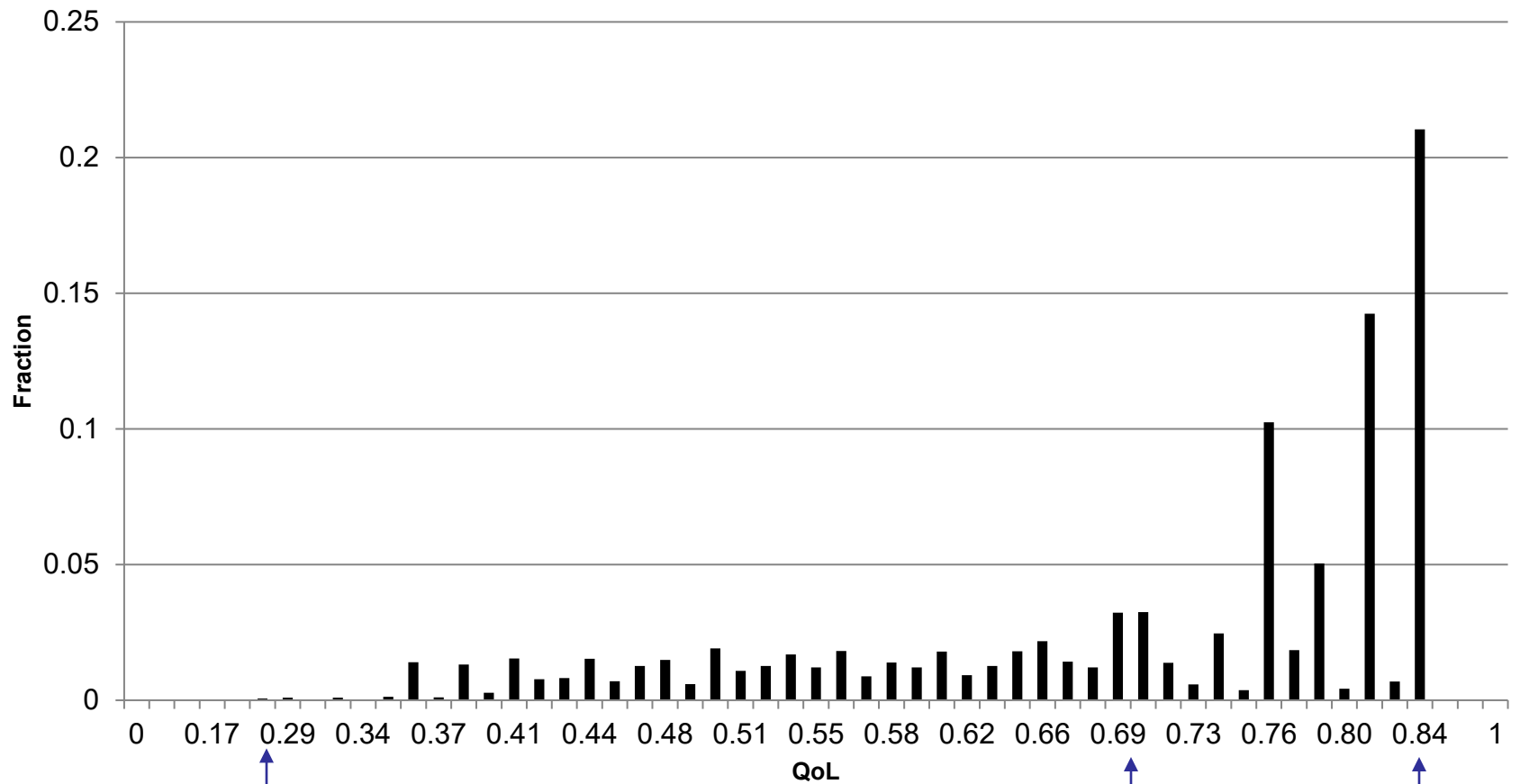
# Mortality in the elderly has been falling

Mortality Rate in the Elderly Population



Data are age-adjusted to the 2010 population in 3 age groups.

# Quality of life scores

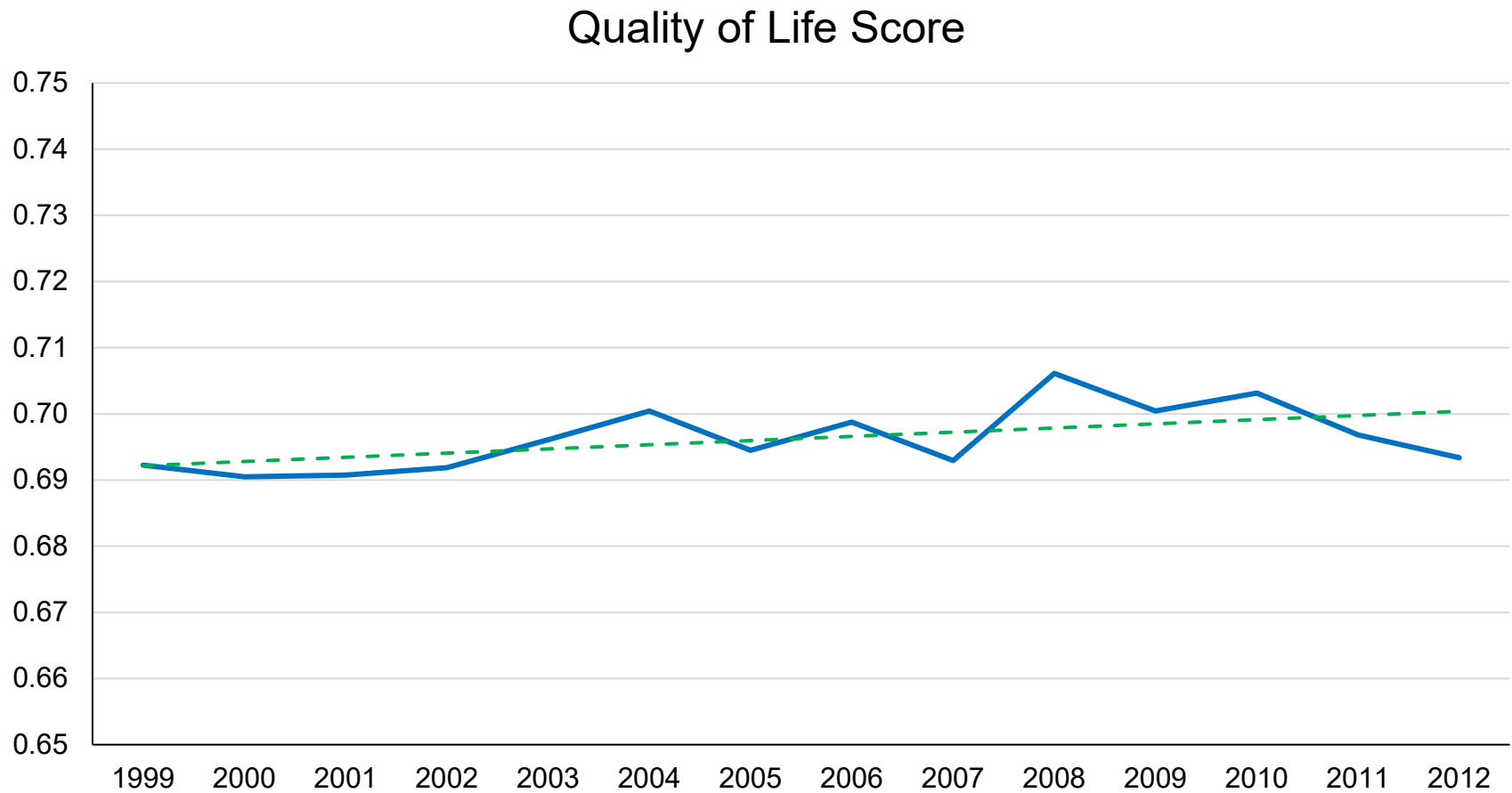


Lowest value ~ 0.26

Mean

Max value

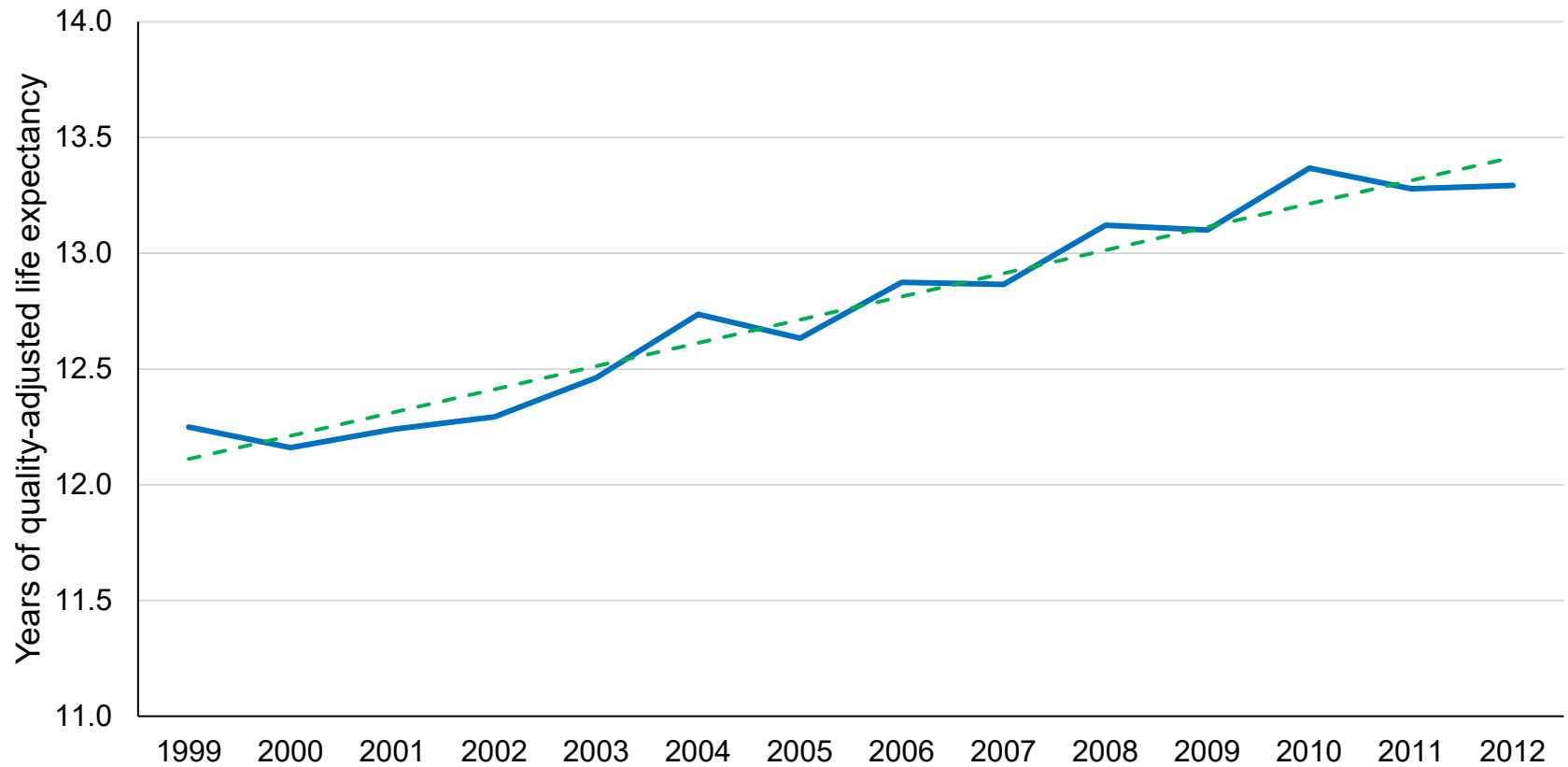
# Quality of life is relatively constant



Data are age-adjusted to the 2010 population in 3 age groups.

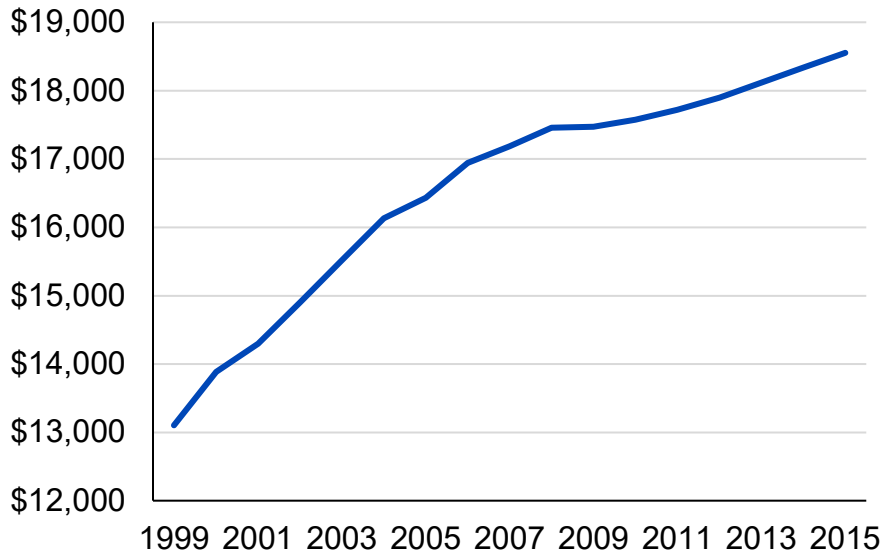
# Implication: quality-adjusted life expectancy is rising.

Quality-Adjusted Life Expectancy at age 65



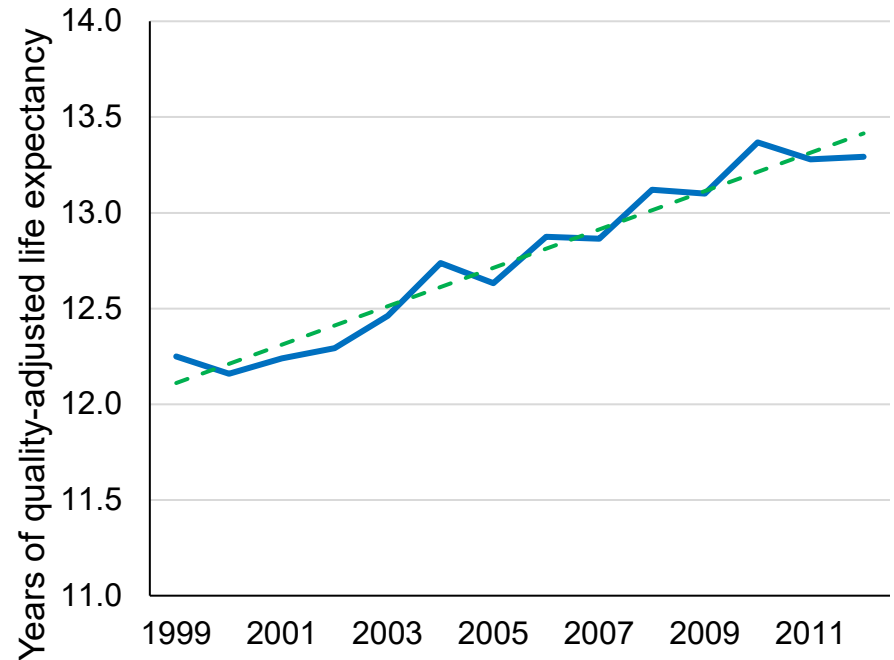
# Aggregate evaluation

## Real (\$2010) spending per capita



Note:  $\$4,800 \times 18 \text{ years} \approx \$85,000$

## Quality-Adjusted Life Expectancy at age 65



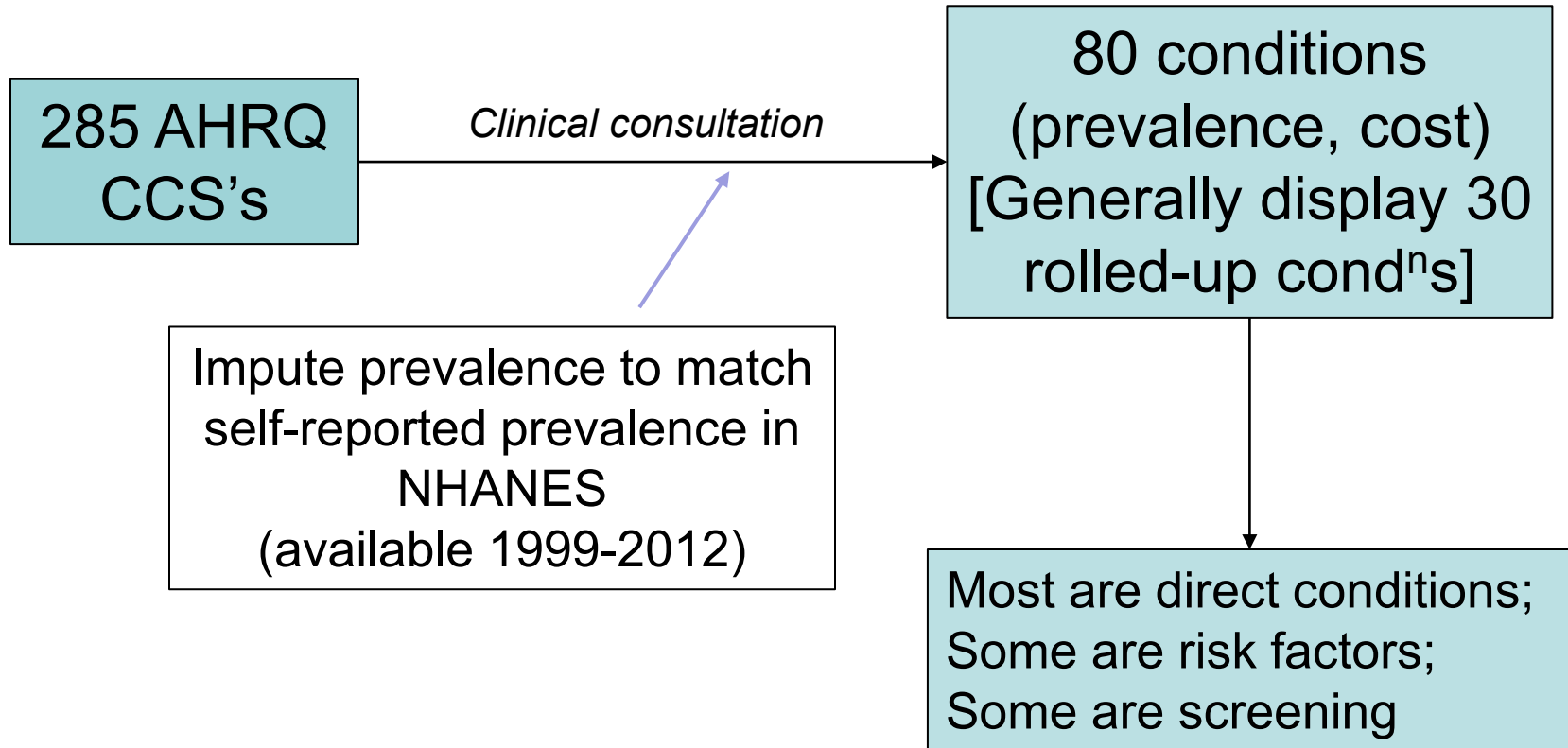
Note:  $1 \text{ year} \times \$100,000/\text{year} = \$100,000$

# **DISAGGREGATING TO CONDITIONS**

This is hard.

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# Conditions

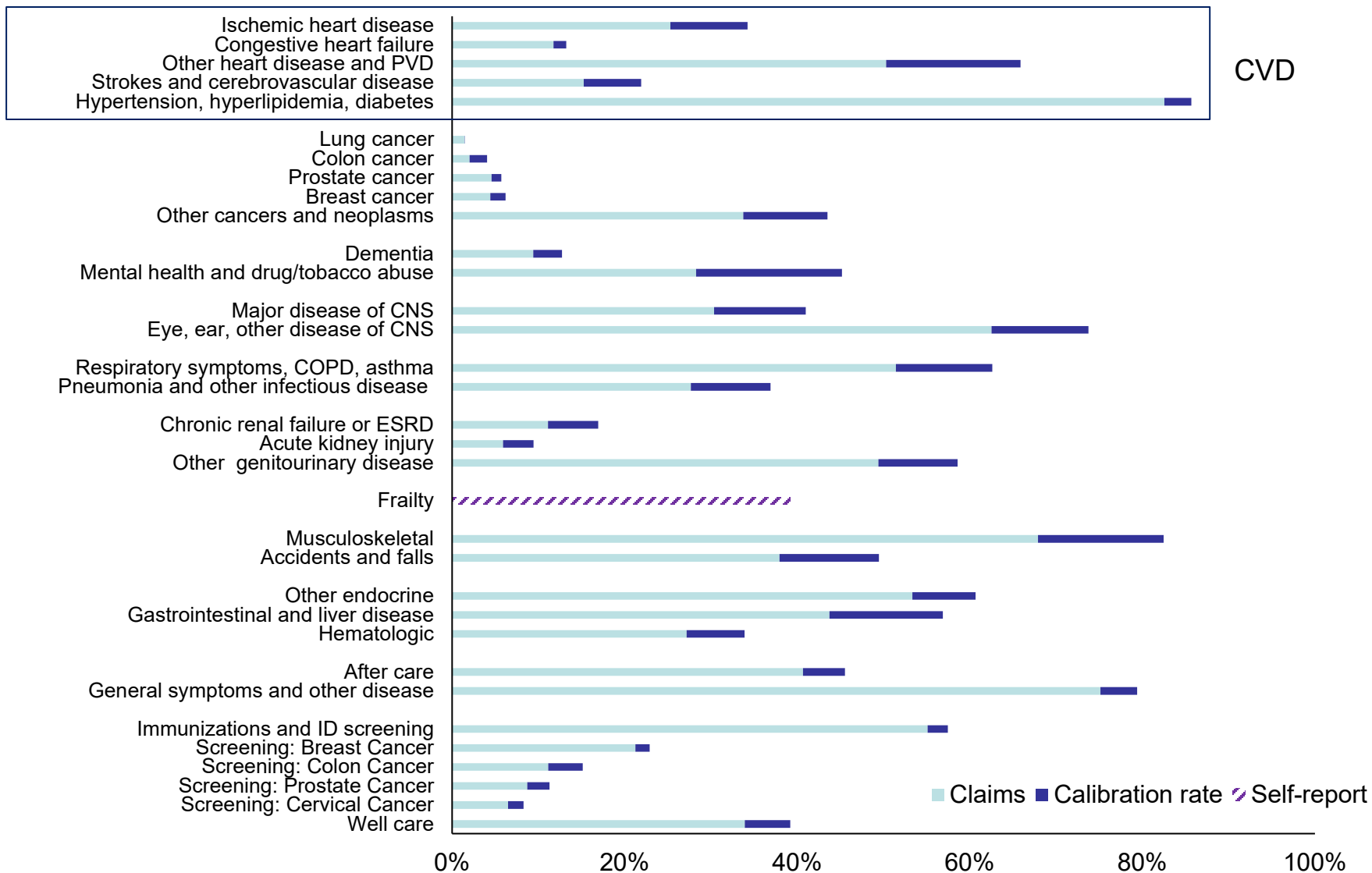


This will vary for different age groups.

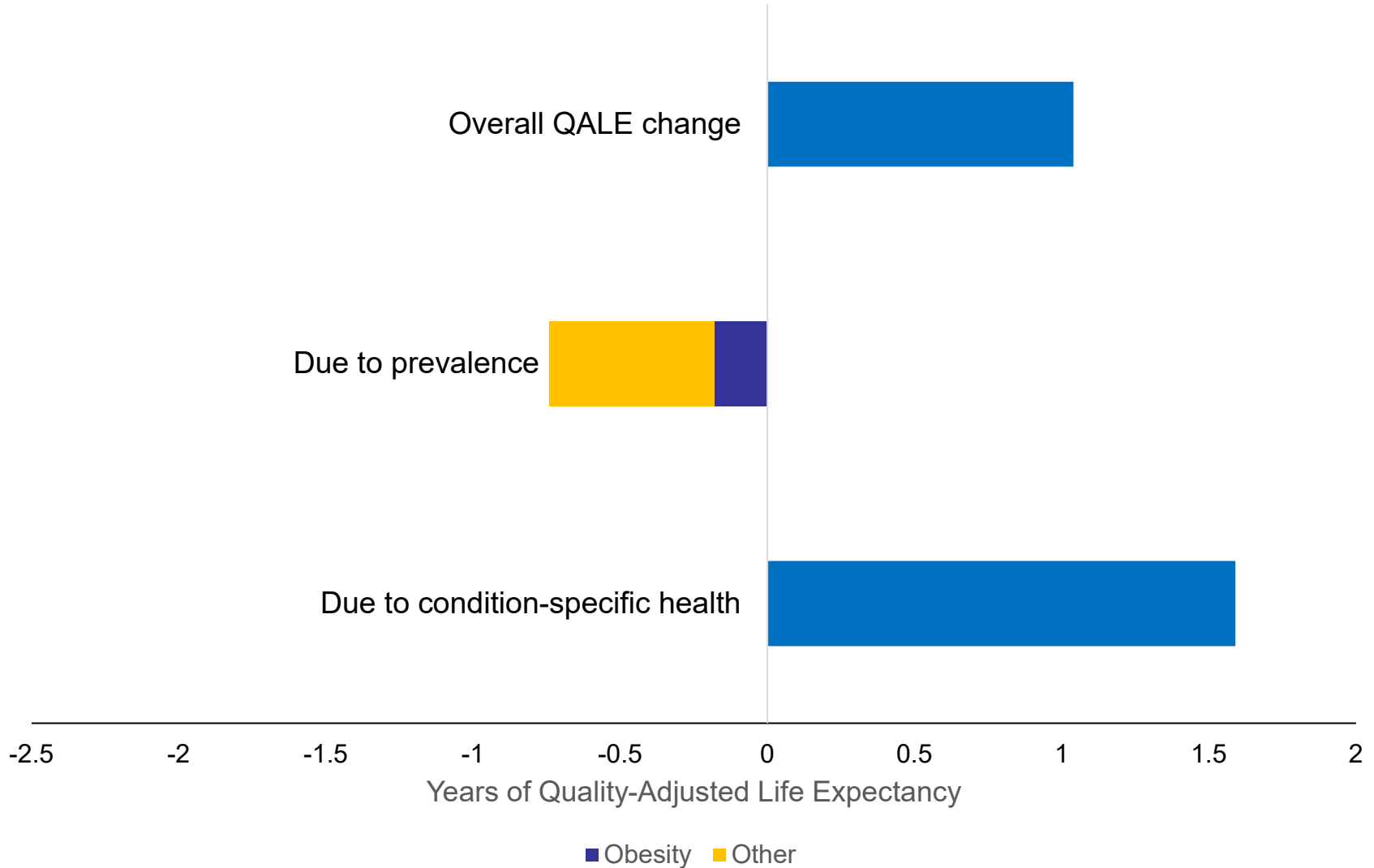
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# Conditions and Prevalence



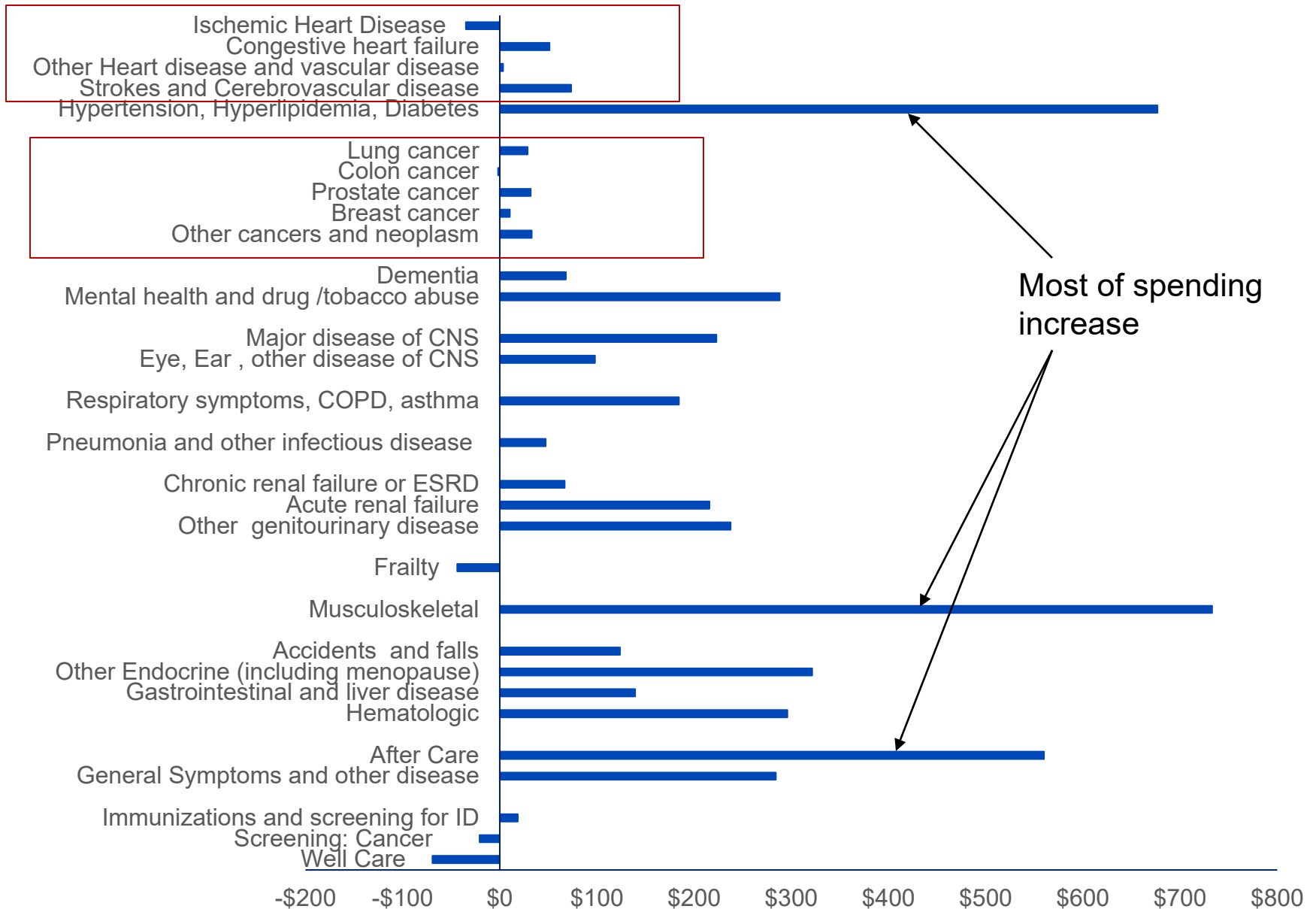
# The prevalence of most conditions is rising.



# Attributing spending and health outcomes (mortality + QOL) to conditions

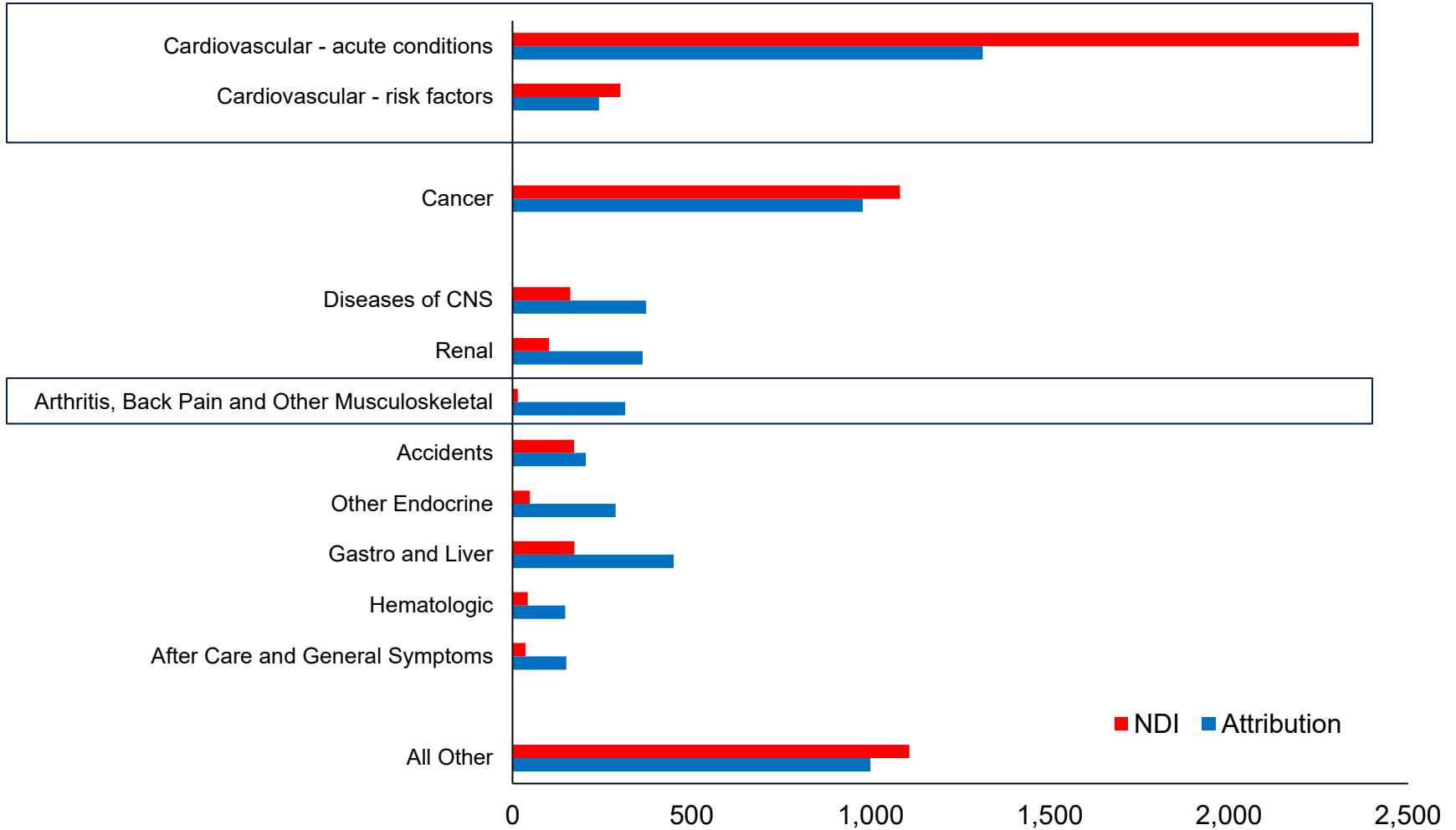
1. Use propensity score to find people with each condition and similar people without the condition
    - Difference between two groups is first pass.
  2. Adjust average and outliers to ensure spending matches national totals and fits wide distribution.
  3. Reallocate spending from final conditions to risk factors (e.g., heart disease → high cholesterol)
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# Increase in spending per capita



# Cause of death differs greatly between official data and our estimates

## Death Rate per 100,000



# **PRODUCTIVITY ANALYSIS**

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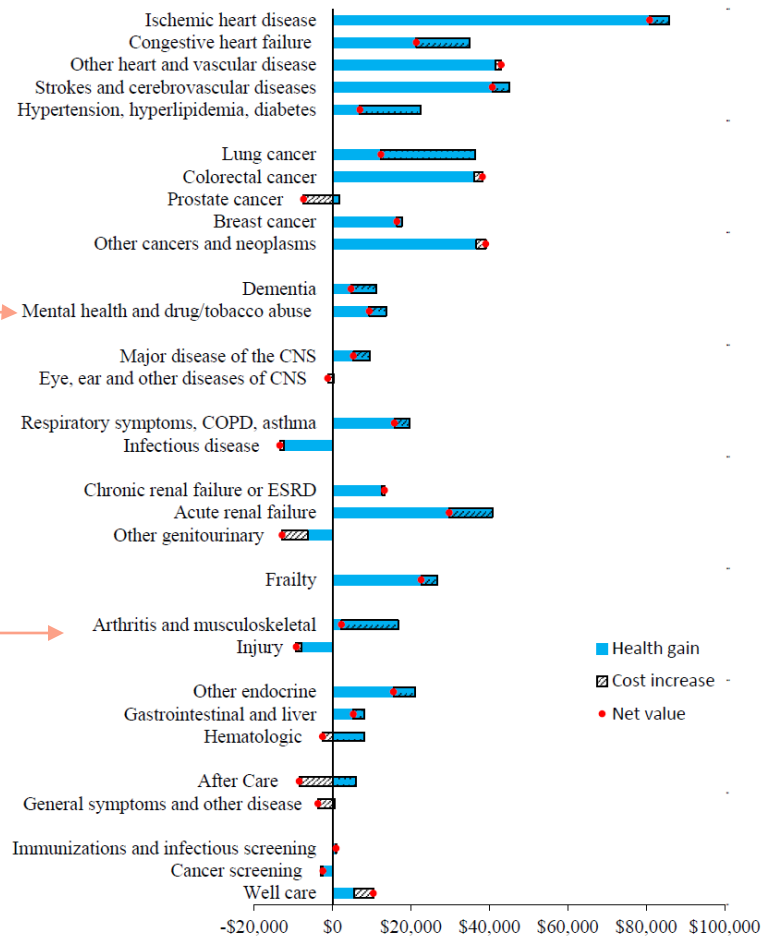
# Key productivity assumption

- Medical spending for people with a condition affects QALE for people with that condition but not prevalence of other conditions.
    - E.g. treatment for MI affects MI QALE but not cancer incidence
    - Other than identified risk factors
  - Compare estimates to simulation models
    - CVD: Ford et al.
    - Lung, colorectal cancer from SEER
    - Generally do well.
-

# Net value of health improvement

Figure 9: Net Value of Medical Spending Change by Condition, 1999–2012

- Overall benefit is positive ~\$110,000
  - 21%↑, 1.5%/yr
- Largest benefit for cardiovascular disease
- Other benefits in some types of cancers, kidney failure
- Notable failures are mental health and musculoskeletal.



Note: Data are from the Medicare Current Beneficiary Survey with totals matching estimated national spending on the elderly. Spending is in real (\$2010) dollars. The blue bar depicts improvement in health outcomes over the period, expressed in dollars. Health change is the change in QALE attributed to medical care and not changes in the prevalence of the condition. The hatched bar shows the change in medical spending. The red dot shows the net change in productivity estimate, defined as the dollar value of health improvement minus the increase in spending.



# Conclusions

- Satellite accounts hold a good deal of promise for understanding the value of medical care and other interventions that affect health.
  - The hardest issue for BEA is likely to be the health outcome part. There are several ways to do this:
    - Empirical measurement (like what is here)
    - Clinical trial estimates
    - Disease simulation models
    - All are worth utilizing
  - My thought: making assumptions isn't bad. Be clear about them.
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