

Are Medical Care Prices Still Declining? A Systematic Examination of Quality-Adjusted Price Index Alternatives for Medical Care



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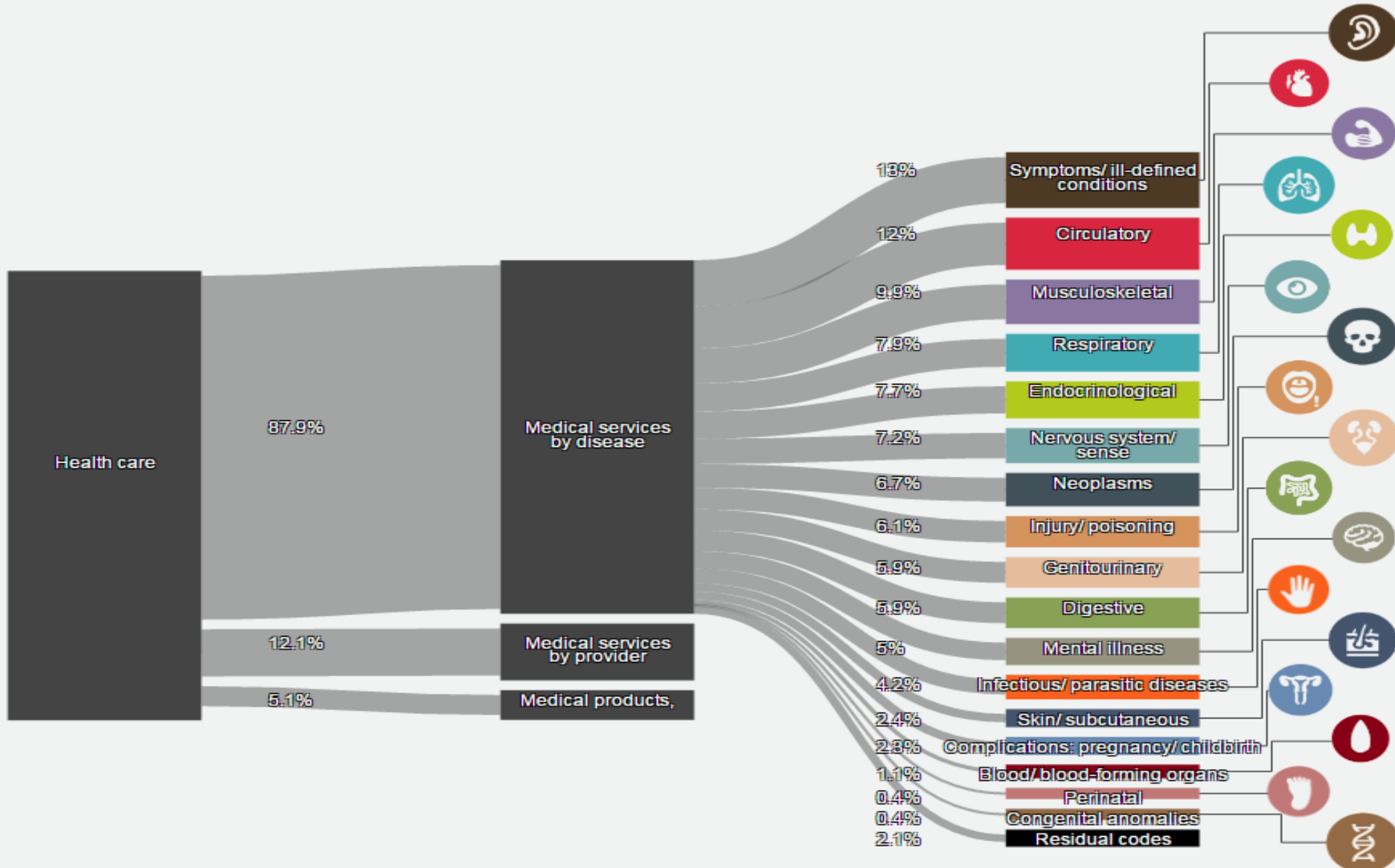
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- Health care is 17.8% of GDP in 2015
- Spending per capita in the U.S. is an outlier among advanced economies
- Is health care spending worth it?
- Divide question into two parts:
 1. How much are we paying for treatment?
 - Redefine the quantity / real output

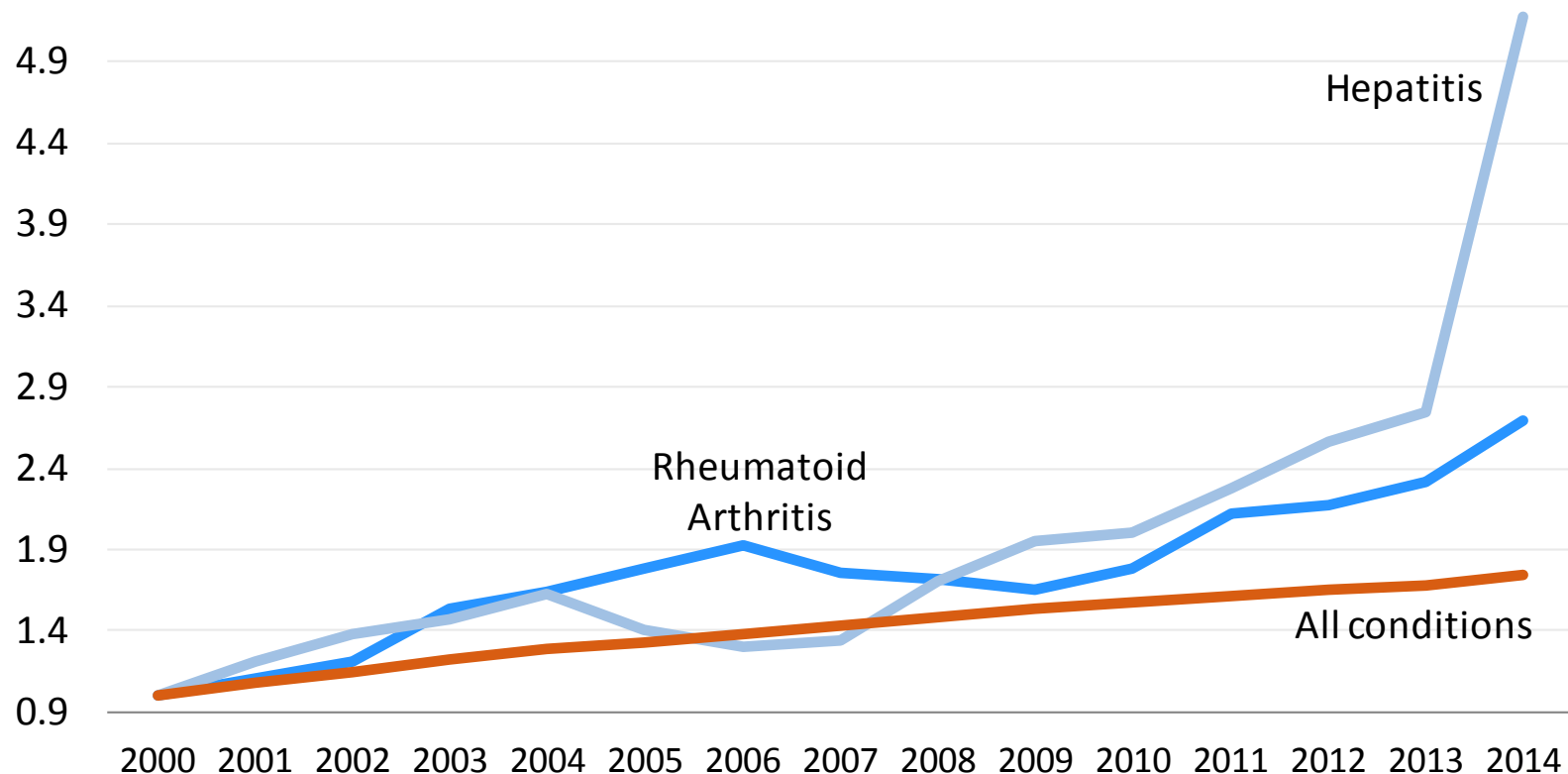
- Current definition: quantity/real output is the number of services provided
- Proposed redefinition: real output is the treatment of a condition
 - Example for heart attacks (AMI):
 - Nominal spending – total spending on heart attacks
 - Price index – expenditure per heart attack treatment
 - Quantity – the number of heart attacks
 - Better captures shifts in treatment
- Redefinition applied in **Health Care Satellite Account** at BEA
 - https://www.bea.gov/national/health_care_satellite_account.htm

Health Care Satellite Account



30 select conditions accounted for **17%** of spending in 2000, but over **40%** of spending growth per capita from 2000 to 2014

Trend in Price of Treatment (HCSA - Blended Account)



- Health care is 17.8% of GDP in 2015
- Spending per capita in the U.S. is an outlier among advanced U.S. economies
- Is health care spending worth it?
- Divide question into two parts:
 1. How much are we paying for treatment?
 - Redefine the quantity / real output
 2. How effective is the treatment?
 - Adjust for quality

- Real output also depends on the *quality* of the treatments
 - Cutler et al. (1998) – Heart Attacks; Berndt et al. (2000) – Depression; and Shapiro et al. (2001) – Cataracts
- Health care is nearly half of the overall bias for PCE
 - Groshen et al. (2017)
- Quality adjustment is challenging – Hall (2016) and Sheiner and Malinovskaya (2016)
 - How to measure quality changes?
 - Attributing quality changes to medical care?
 - **What method of quality adjustment to apply?**

- Analyze alternative methods of quality adjustment:
 - Theoretical differences
 - Empirical differences for three acute conditions from 2001-2011

- Quality adjustment has a significant impact on measured inflation
 - Conservative quality-adjusted inflation rates are 1 percent below the unadjusted estimates
- Large range of quality-adjusted estimates depending on method and assumptions
- Cost-of-living indexes lead to much lower price growth
 - Prices are declining relative to overall inflation for all three conditions

- Cost-of-living index (COLI)
 - Expenditures necessary to achieve a certain level of consumer utility given changing price levels
 - Adjusts based on the value of the good to the consumer
 - Common approach in health research literature
 - Value of consumer is often measured as the value of a life (e.g., Cutler et al. (1998))
 - Life expectancy (LE) index

- Resource cost adjustment
 - Standard method of quality adjustment for producer price indexes (PPI)
 - Similar to user value adjustment, but using cost to producer, not benefits to consumers
 - Practical difficulties in health care
 - Attributing costs to quality change is challenging
 - Approach applied by BLS
 - Hospital PPI
 - Nursing home PPI
 - Resource cost (RC) index

- Treatment endpoint adjustment
 - Berndt et al. (2002) – depression treatment
 - Expenditure to reach a treatment endpoint (i.e., remission), relative to no treatment at all
 - Treatment endpoint (TE) index

- Fixed treatment basket
 - Frank et al. (2004) – schizophrenia treatment
 - Regression used to fix treatment baskets for select technologies
 - Goal is to hold technology fixed, not “adjust” for quality
 - Basket price (BP) index

- Four methods to contrast with Unadjusted (UI) index
 - Life expectancy (LE) index – COLI based on value of a life
 - Resource cost (RC) index – similar to LE but adjusting for cost, not benefits
 - Treatment endpoint (TE) index – expenditure per effective treatment
 - Basket price (BP) index – measures the basket price of fixed technologies

- Shift to new technology, but no actual improvement in quality
 - LE and TE index have no quality adjustment
 - RC and BP potentially change
 - Example: Using proton beam therapy for prostate cancer

- Quality improves, but costs do not change
 - LE and TE have a quality adjustment
 - RC and BP show no change
 - Example: Use of beta blocker upon discharge after a heart attack

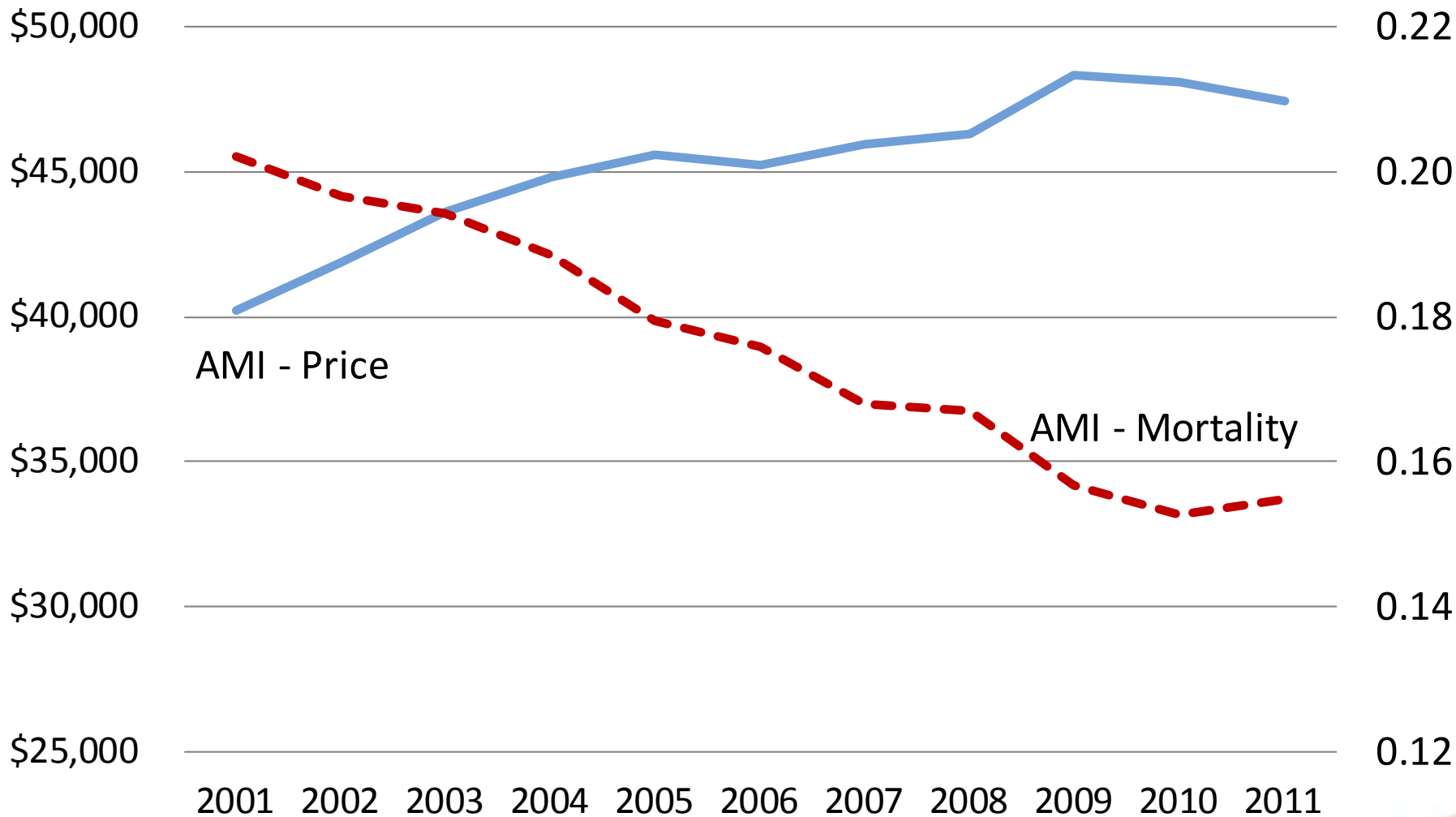
- LE index equals others when:
 - Monetized value of the quality change to consumer \approx change in the cost of the quality improvement
- Typically consumer value is larger than cost in markets for new and innovative goods (e.g., statin drugs to lower cholesterol)
 - Value to the infra-marginal consumer
 - Challenge for many industries (e.g., computers, smart phones, and minivans)
- Additional challenge in health care because of well-known market distortions
- BP, TE, and RC indexes – likely understate improvements for consumers
- Example: New hepatitis C treatments (e.g., Sovaldi)

- Medicare Fee-For-Service (FFS) Claims (5 percent sample)
- Following (Romley, Goldman, and Sood (2015)), sample includes patients with inpatient admission for:
 - Heart attack
 - Congestive heart failure
 - Pneumonia
- Additional selection rules:
 - Full year of FFS enrollment prior to the index admission (for risk adjustment based on diagnoses)
 - Full year after the admission or death within the year after the admission, to measure outcomes

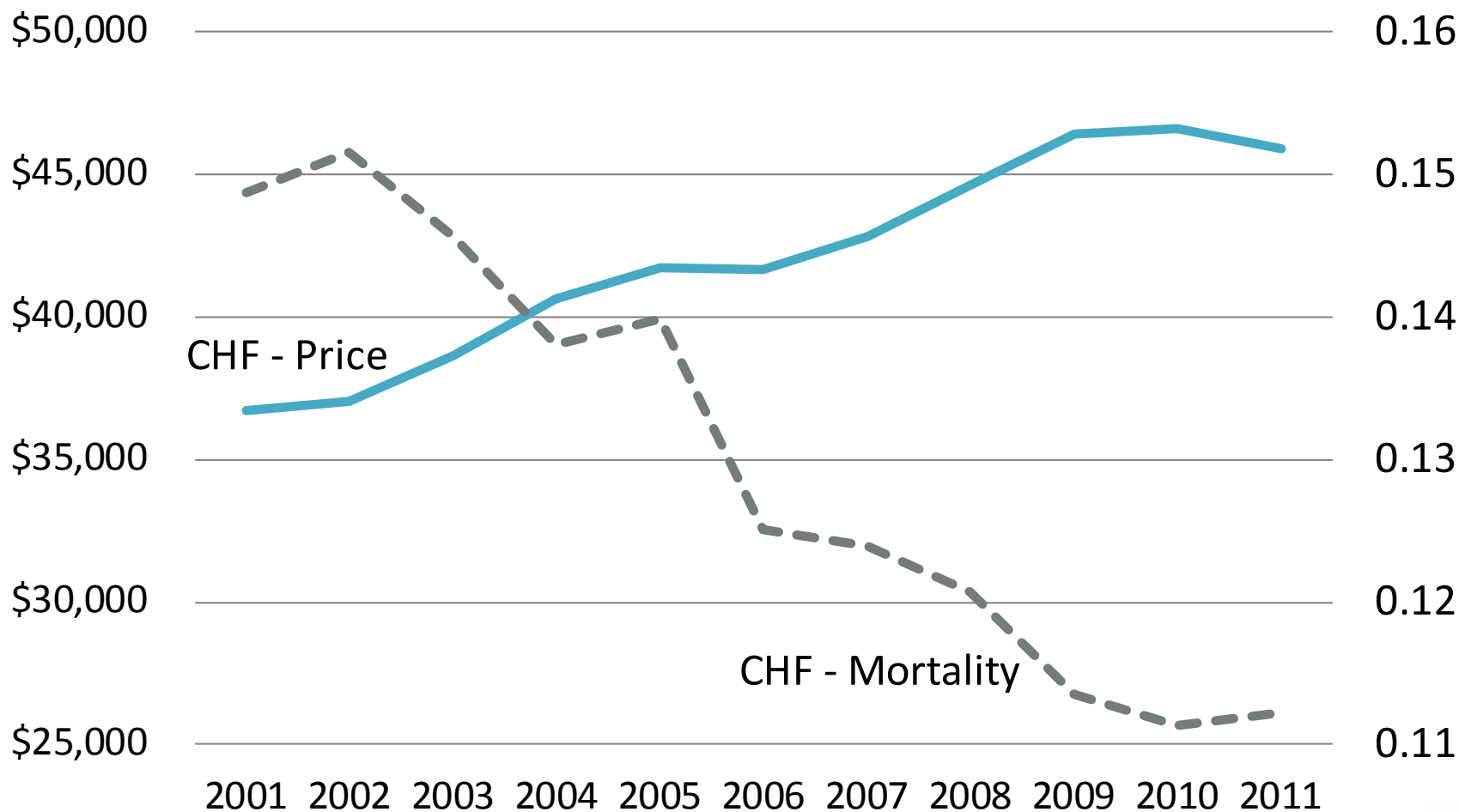
Distribution of Patients

	Heart attack	Heart failure	Pneumonia
Total Events	62,939	96,290	109,739
	<u>Proportion</u>	<u>Proportion</u>	<u>Proportion</u>
Male	43.5%	36.9%	38.6%
Age group:			
Age: 65-69	11.7%	8.2%	8.9%
Age: 70-74	17.1%	13.2%	14.3%
Age: 75-79	20.0%	18.1%	18.5%
Age: 80-84	20.9%	22.4%	21.8%
Age: 85-89	17.4%	21.0%	19.6%
Age: >=90	12.8%	17.2%	16.9%

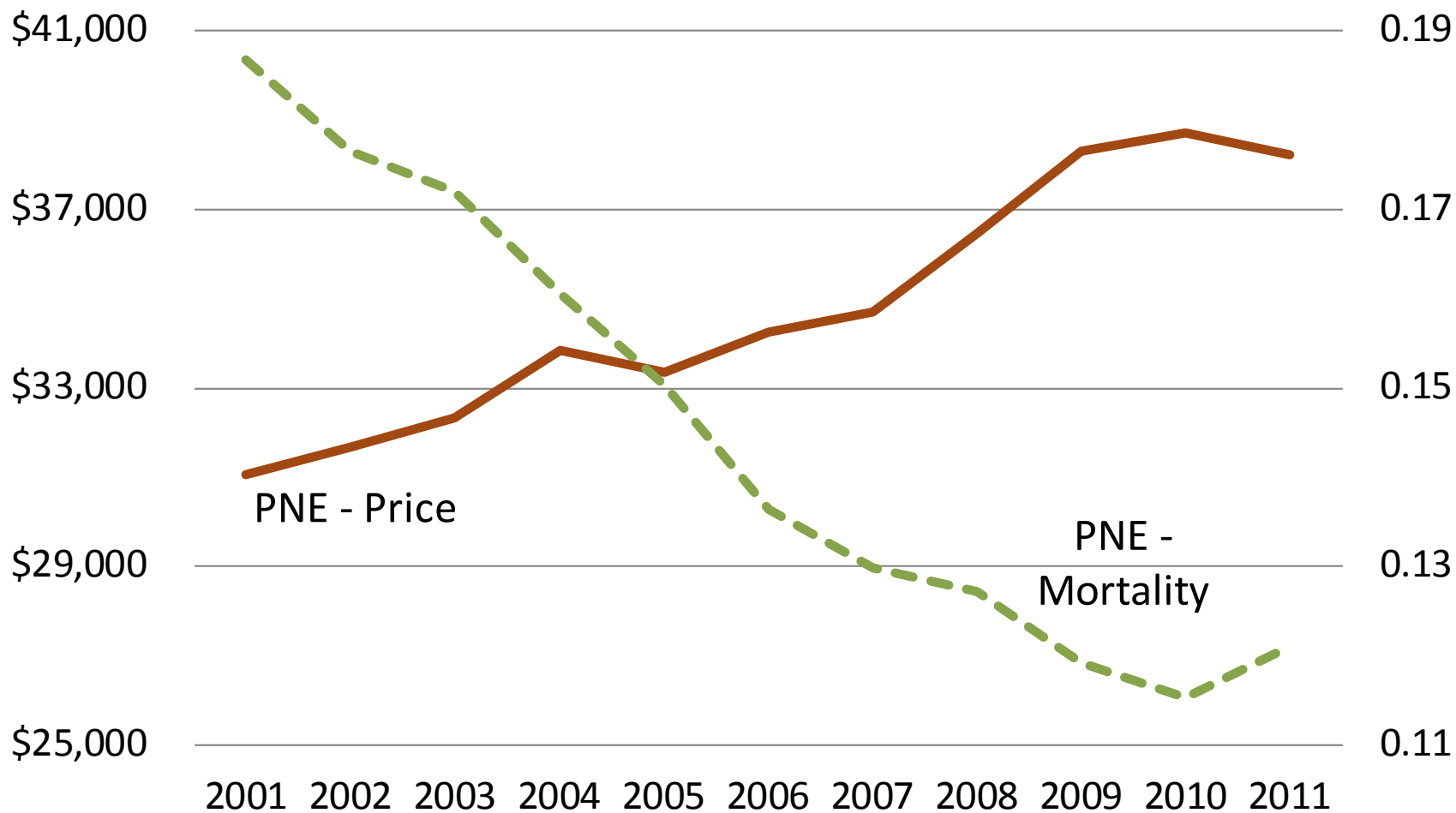
Heart Attack (AMI): Trends in Mortality and Unadjusted Price – Severity Adjusted



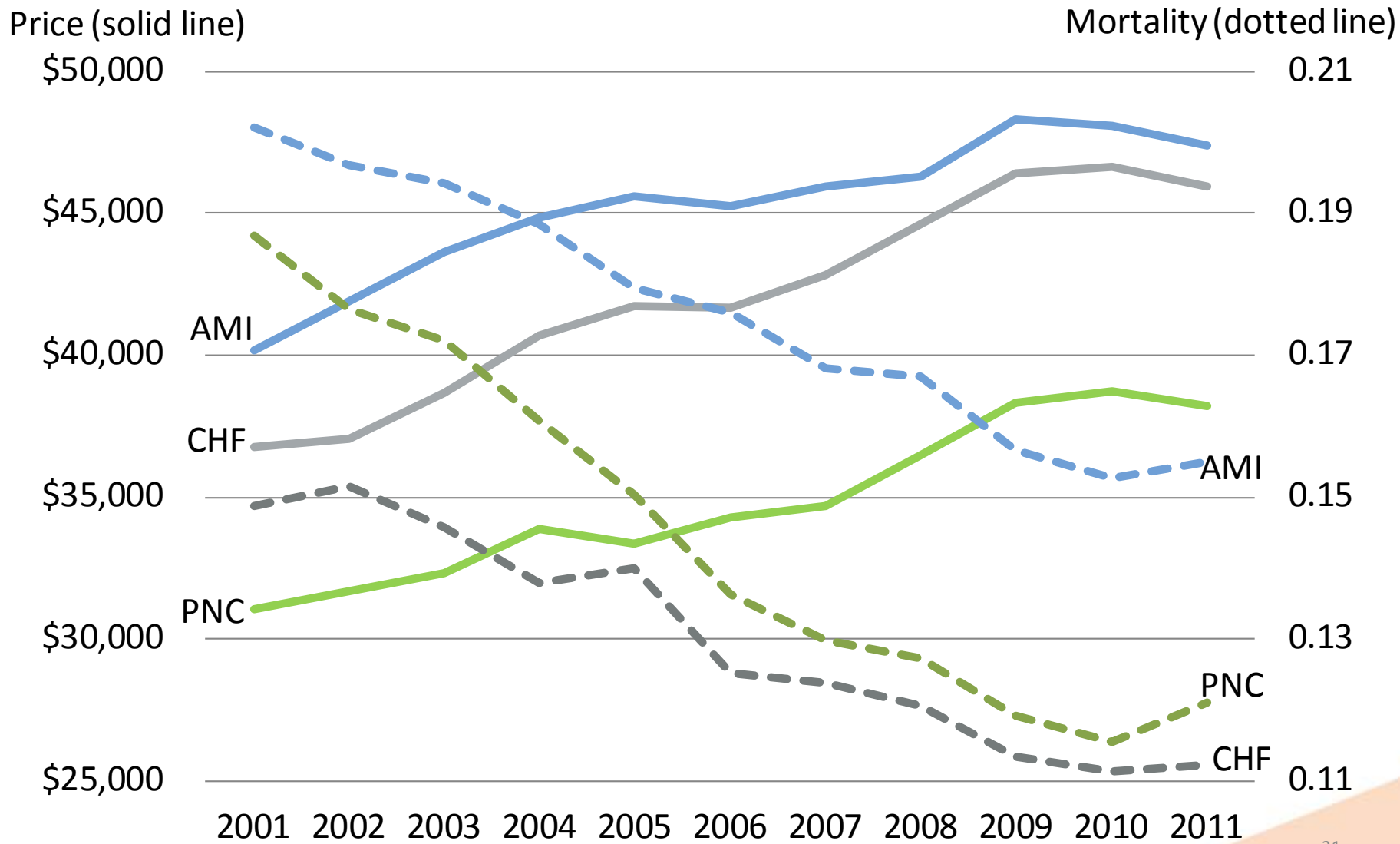
Congestive Heart Failure (CHF): Trends in Mortality and Unadjusted Price – Severity Adjusted



Pneumonia (PNE): Trends in Mortality and Unadjusted Price – Severity Adjusted



Trends in Mortality and Unadjusted Price – Severity Adjusted



- Quality adjustment is clearly important for these conditions
- Positive relationship between price and quality
- Main question: how important is the quality change?

- Unadjusted index + monetary change in benefit measure

$$COLI_{disease} = \left(\frac{\text{Price of Treatment}_1}{\text{Price of Treatment}_0} \right) - \left(\frac{\Delta B}{\text{Price of Treatment}_0} \right) = \frac{\text{Price of Treatment}_1 - \Delta B}{\text{Price of Treatment}_0}$$

- How to measure ΔB ?
- Two issues:
 - Value of a life assumption
 - Range around \$100,000 – Viscusi (2005)
 - Well studied, but controversial
 - Isolating contribution of treatment
 - Our approach: measure mortality in short windows in time around the event (e.g., 30, 60, or 90 days)

LE Index – Alternative Value of Life Estimates



Annual Value of A Life	<u>30 days</u>			<u>60 days</u>			<u>90 days</u>		
	\$50,000	\$100,000	\$150,000	\$50,000	\$100,000	\$150,000	\$50,000	\$100,000	\$150,000
<u>AMI</u>									
Unadjusted index	1.7%								
COLI	-0.7%	-3.1%	-5.6%	-1.1%	-3.9%	-6.8%	-1.3%	-4.3%	-7.4%
<u>Congestive heart failure</u>									
Unadjusted index	2.3%								
COLI	1.2%	0.1%	-1.1%	0.8%	-0.8%	-2.3%	0.5%	-1.3%	-3.1%
<u>Pneumonia</u>									
Unadjusted index	2.1%								
COLI	-0.7%	-3.6%	-6.5%	-1.6%	-5.4%	-9.3%	-2.1%	-6.5%	-11.0%

- Ratio unadjusted index to quality change

$$\text{TE} = \frac{\frac{\textit{Price of Treatment}_1}{\sigma_1}}{\frac{\textit{Price of Treatment}_0}{\sigma_0}}$$

- σ_t – fraction of treatments that reach a successful endpoint **relative to no treatment**
- Rate of successful endpoint without treatment is an unknown

TE Index – Alternative Rates of Success for Untreated Cases



	<u>Rate of Success for Untreated Cases</u>		
	0%	20%	40%
<u>AMI</u>			
Unadjusted index	1.7%		
Average Success Rate with Treatment	58.4%		
Treatment Endpoint Index (CAGR)	0.6%	0.0%	-1.7%
<u>Congestive heart failure</u>			
Unadjusted index	2.3%		
Average Success Rate with Treatment	54.1%		
Treatment Endpoint Index (CAGR)	1.2%	0.6%	-1.7%
<u>Pneumonia</u>			
Unadjusted index	2.1%		
Average Success Rate with Treatment	57.8%		
Treatment Endpoint Index (CAGR)	0.7%	-0.1%	-2.6%

- Unadjusted index - Resource Cost (RC) of quality change

$$RC = \left(\frac{\text{Price of Treatment}_1}{\text{Price of Treatment}_0} \right) - \left(\frac{\Delta RC}{\text{Price of Treatment}_0} \right) = \frac{\text{Price of Treatment}_1 - \Delta RC}{\text{Price of Treatment}_0}$$

- How to measure cost of technological change $-\Delta RC$?
- Assumption of constant cost per outcome:

$$\Delta RC = \text{Price of Treatment Per Outcome} \cdot \Delta \text{Successful Outcome}$$

$$\Delta RC = \left(\frac{\text{Price of Treatment}_1}{\sigma_1} \right) * (\sigma_1 - \sigma_0)$$

- Implies:

$$RC = \frac{\text{Price of Treatment}_1 - \left(\frac{\text{Price of Treatment}_1}{\sigma_1} \right) * (\sigma_1 - \sigma_0)}{\text{Price of Treatment}_0} = \frac{\text{Price of Treatment}_1 \left(\frac{\sigma_0}{\sigma_1} \right)}{\text{Price of Treatment}_0}$$

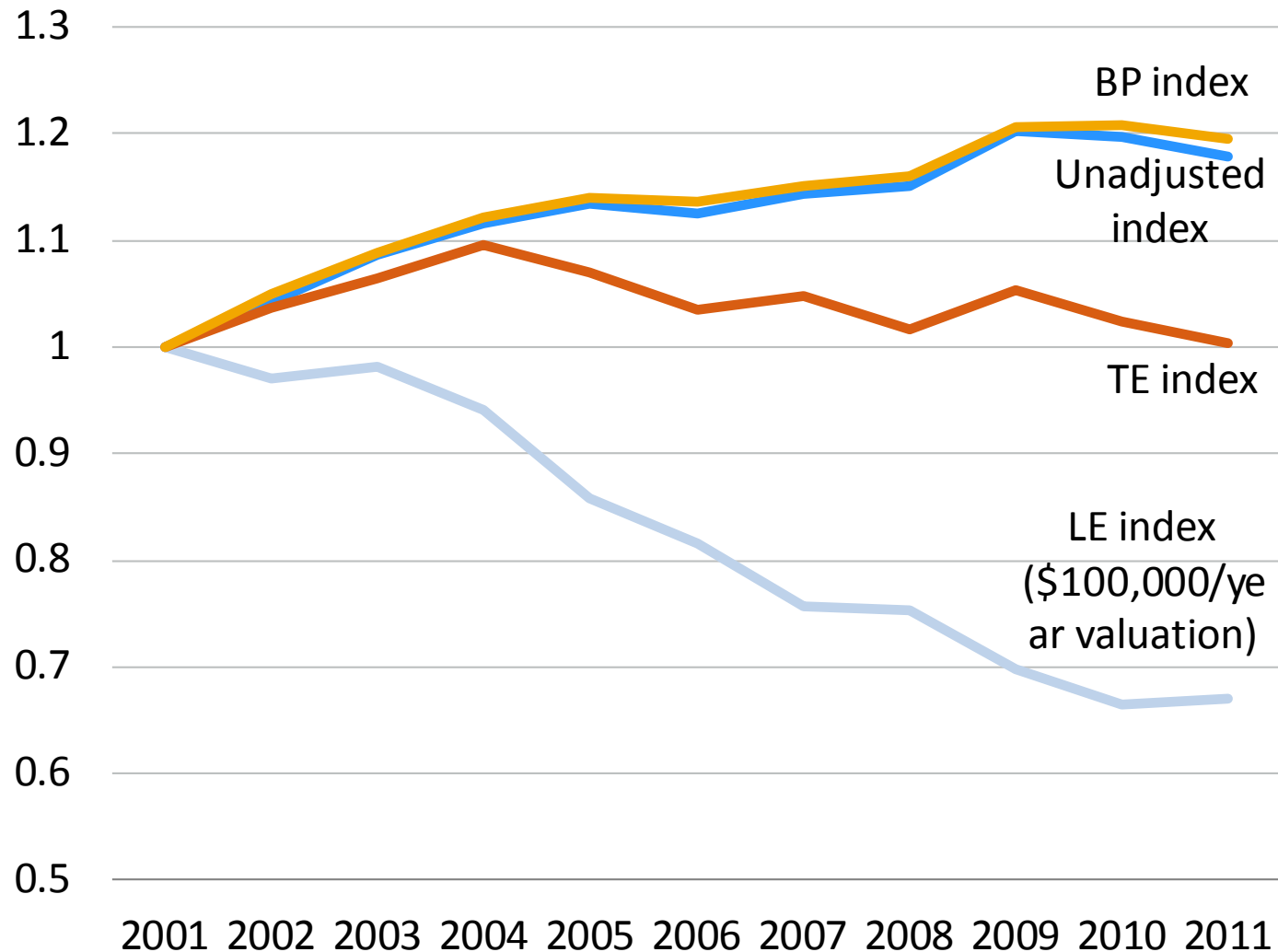
$$RC \approx TE$$

- Run regression for each year:

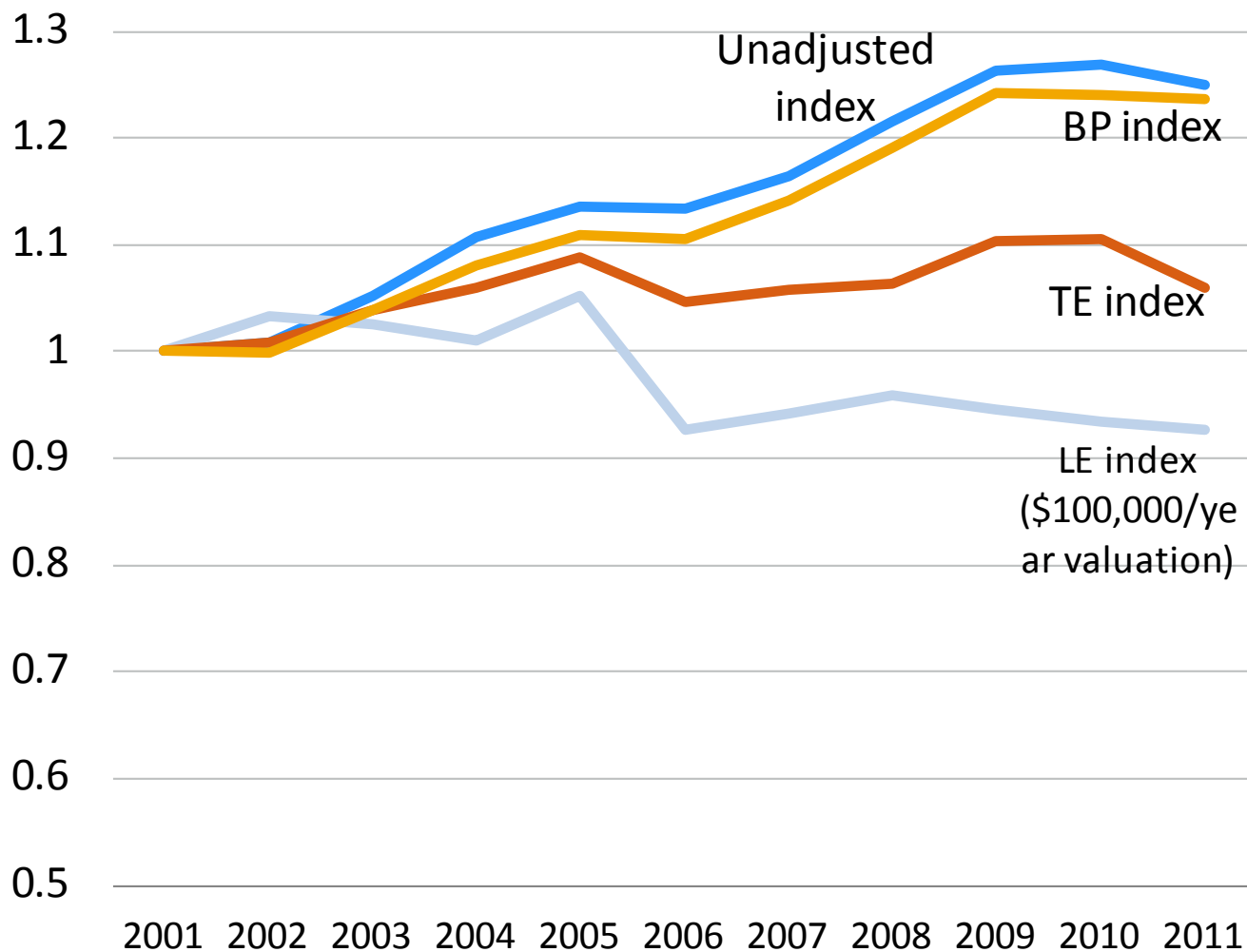
$$Y_i = \alpha + X_i\beta + Z_i\gamma + \varepsilon_i$$

- Y_i – patient spending
 - X_i – patient-level severity controls
 - Z_i – technologies or evidence-based treatment
- Are we able to select the “correct” technologies?
 - Technologies for AMI
 - Catheterization (CATH), Percutaneous Coronary Intervention (PCI), and Coronary Artery Bypass Grafting (CABG)
 - Technologies for Congestive Heart Failure
 - Implantable Cardioverter Defibrillator (ICD), Cardiac Resynchronization Therapy Defibrillators (CRT-D), and Cardiac Resynchronization Therapy Pacemaker (CRT-P)

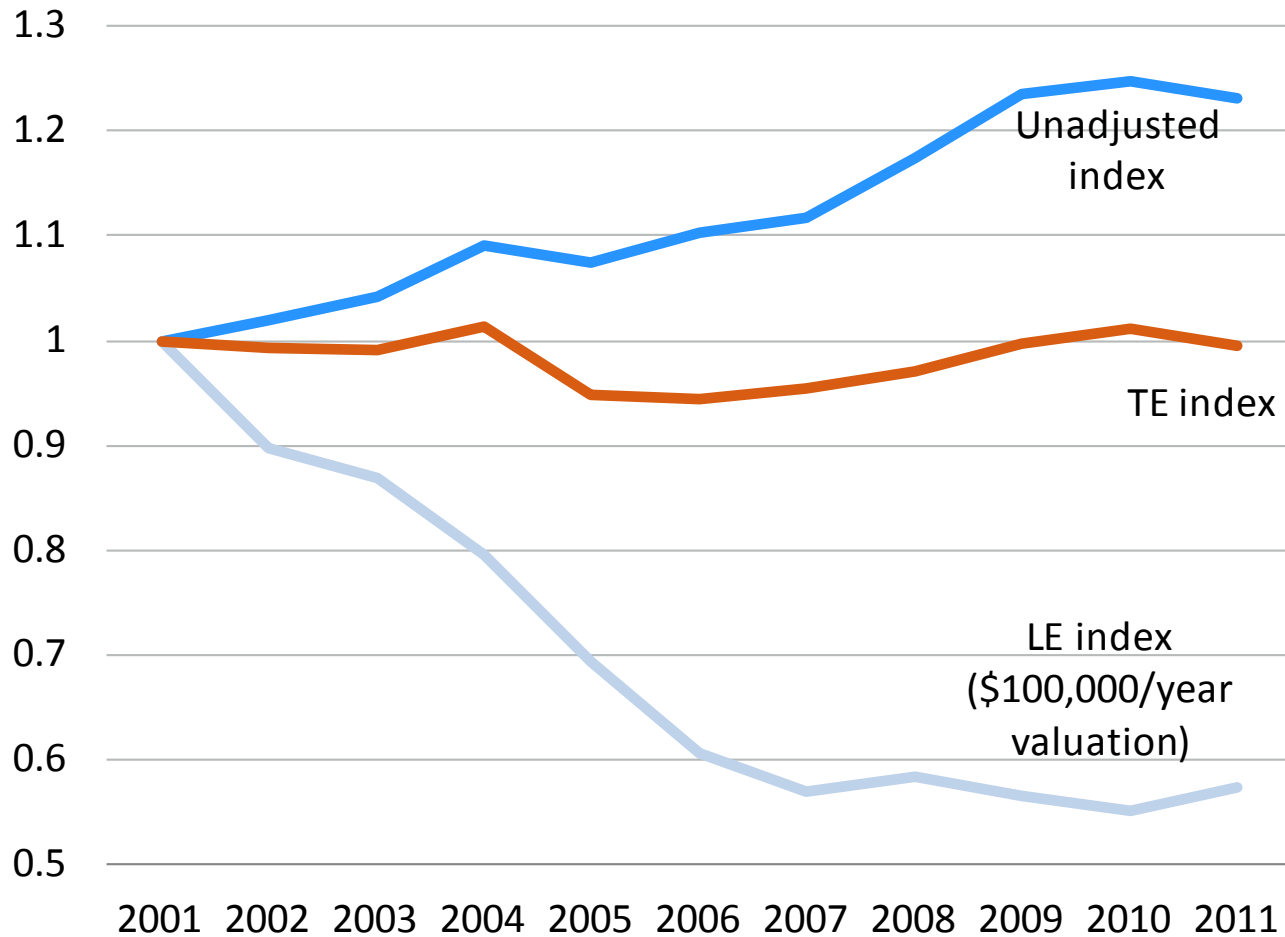
Comparison of Indexes – Heart Attack



Comparison of Indexes – Congestive Heart Failure



Comparison of Indexes – Pneumonia



- Quality adjustment methods indicate an upward bias when not adjusting for quality
- COLI method suggests that average medical care price for the selected conditions are still declining
- Estimates vary across methods and assumptions; hard to choose among them
- Reporting a range of estimates using different methods may be one approach for addressing the wide range of estimates we observe.

Discussion Questions

- Should we develop a range of quality-adjusted estimates for the Health Care Satellite Account? Are there disadvantages for producing a range?
- Is there a public benefit to producing quality-adjusted prices for only a subset of conditions? (e.g., 5-10 conditions out of 200+)
- Is a method that uses the value of a statistical life (e.g., the LE measure) an appropriate methodology to deflate final consumption for the health care sector? Recommended alternatives?
- How to expand beyond acute conditions? Could measures of population health by condition be an intermediate step (e.g., DALYs or QALYs)?