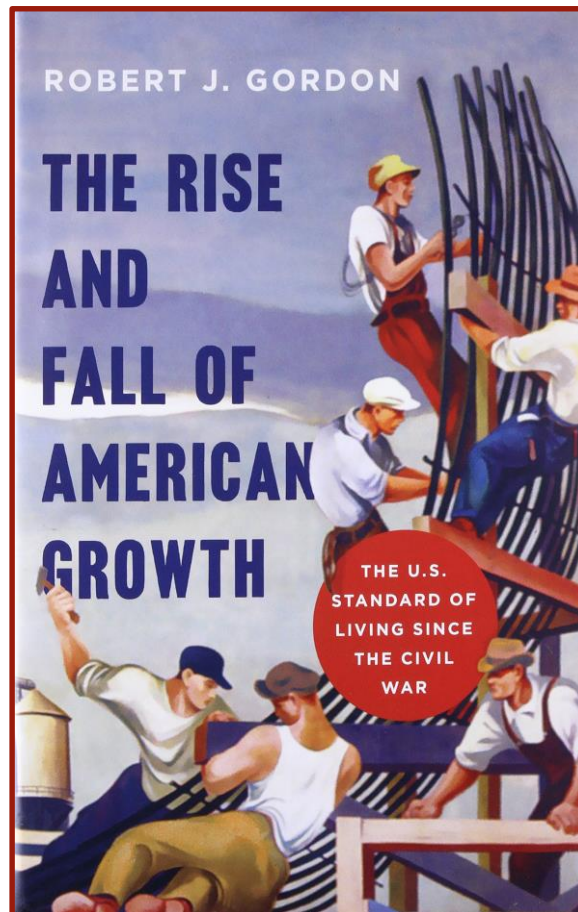# Quantifying Productivity Growth in Health Care Using Insurance Claims and Administrative Data

John A. Romley, Abe Dunn, Dana Goldman and Neeraj Sood

March 15, 2019

There is a big debate about U.S. economic growth

Robert J. Gordon — THE RISE AND FALL OF AMERICAN GROWTH — THE U.S. STANDARD OF LIVING SINCE THE CIVIL WAR

Journal of Economic Perspectives—Volume 31, Number 2—Spring 2017—Pages 145–164

Underestimating the Real Growth of GDP, Personal Income, and Productivity
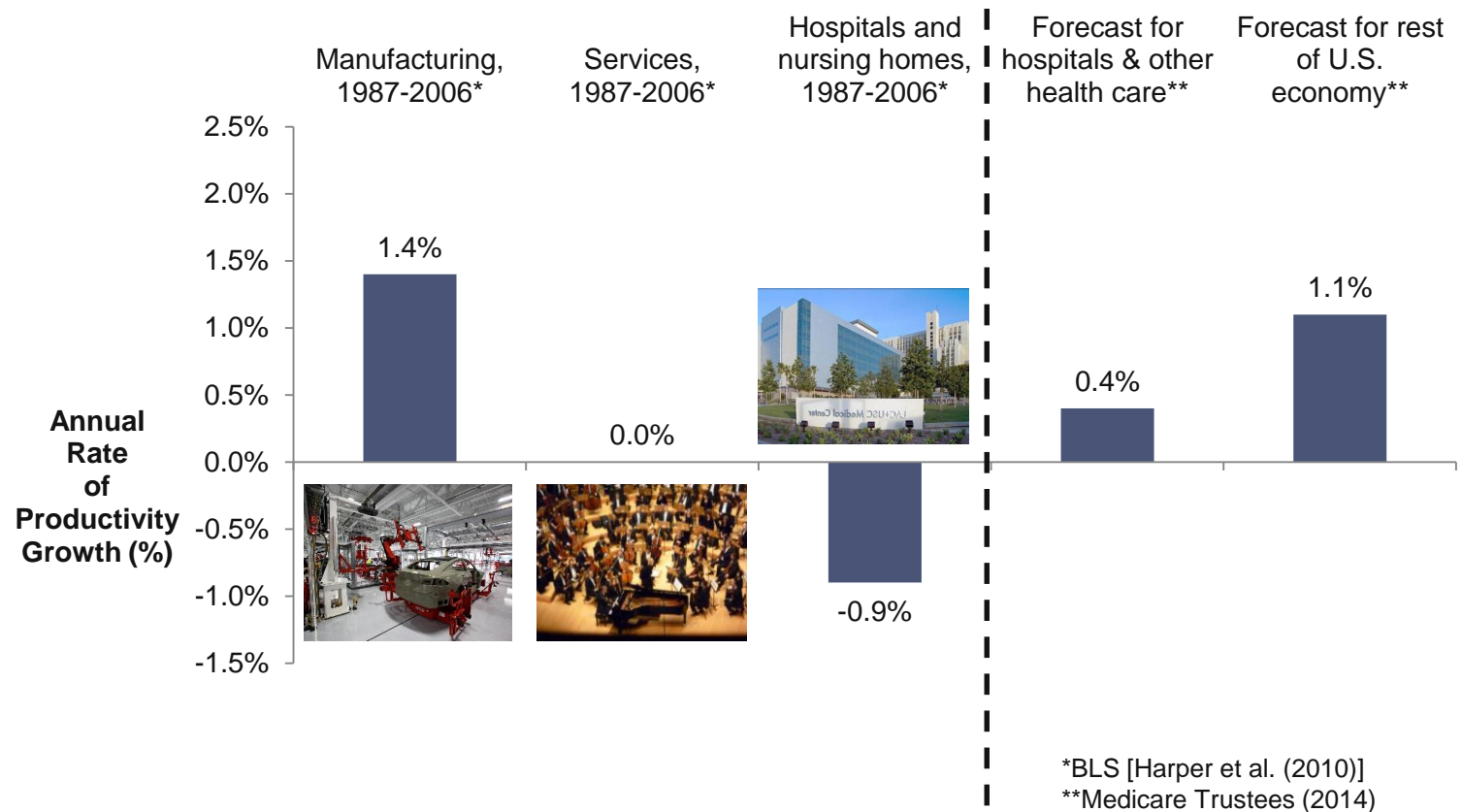
Martin Feldstein

Economists have long recognized that changes in the quality of existing goods and services, along with the introduction of new goods and services, can raise grave difficulties in measuring changes in the real output of the economy. Prominent economists have led and served on government commissions to analyze and report on the subject, including the Stigler Commission in 1961, the Boskin Commission in 1996, discussed in a symposium in the Winter 1998 issue of this journal, and the Schultze Commission in 2002, discussed in a symposium in the Winter 2003 issue of this journal (Stigler 1961; Boskin et al. 1996; National Research Council 2002). But despite the attention to this subject in the professional literature, there remains insufficient understanding of just how imperfect the existing official estimates actually are.

After studying the methods used by the US government statistical agencies as well as the extensive previous academic literature on this subject, I have concluded that, despite the various improvements to statistical methods that have been made through the years, the official data understate the changes of real output and productivity. The measurement problem has become increasingly difficult with the rising share of services that has grown from about 50 percent of private sector GDP in 1950 to about 70 percent of private GDP now. The official measures provide at best a lower bound on the true real growth rate with no indication of the size of the underestimation. Thus, Coyle (2014, p. 125) concludes her useful history of GDP

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† For supplementary materials such as appendices, datasets, and author disclosure statements, see the article page at
https://doi.org/10.1257/jep.31.2.145   doi=10.1257/jep.31.2.145

Productivity growth in health care is a particular concern

Manufacturing, 1987-2006*: 1.4%
Services, 1987-2006*: 0.0%
Hospitals and nursing homes, 1987-2006*: -0.9%
Forecast for hospitals & other health care**: 0.4%
Forecast for rest of U.S. economy**: 1.1%

Annual Rate of Productivity Growth (%)

*BLS [Harper et al. (2010)]
**Medicare Trustees (2014)

Medicare payments to providers are tied to productivity growth

ACA <u>reduces</u> annual "updates" based on productivity growth in <u>broader economy</u>

- In FY 2019, 2.9% increase for inflation reduced by 0.8%

Adjustment has caused concern about viability of health care providers

Yet productivity measurement is particularly challenging in health care

Readily confounded by hard-to-measure aspects of

- Quality of care

- Patient severity

Dealing with the quality of health care is not a new challenge

Boskin Commission addressed CPI

- Found upward bias due to improvements in product quality

Cutler et al. analyzed heart-attack care

- Adjusting for better outcomes, price of treatment *decreased*

THE
QUARTERLY JOURNAL OF ECONOMICS

Vol. CXIII   November 1998   Issue 4

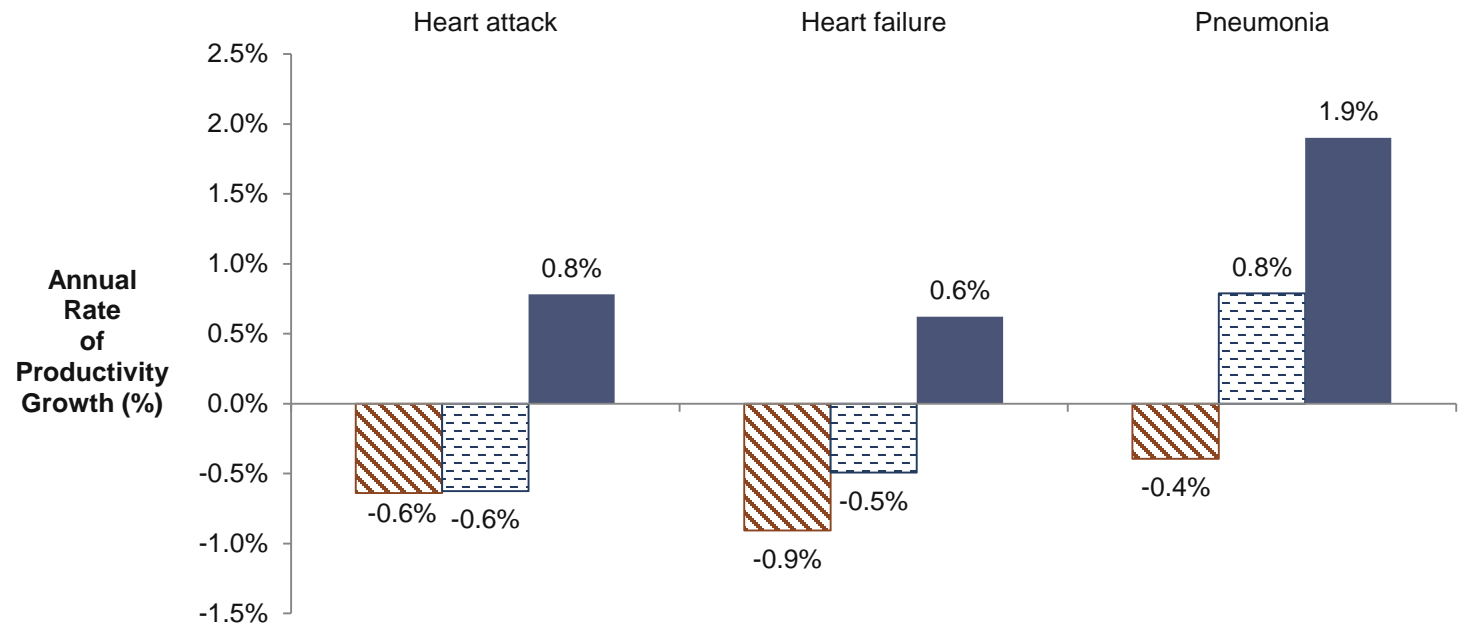### ARE MEDICAL PRICES DECLINING? EVIDENCE FROM HEART ATTACK TREATMENTS*

DAVID M. CUTLER
MARK MCCLELLAN
JOSEPH P. NEWHOUSE
DAHLIA REMLER

We address long-standing problems in measuring medical inflation by estimating two types of price indices. The first, a Service Price Index, prices specific medical services, as does the current CPI. The second, a Cost of Living Index, measures a quality-adjusted cost of treating a health problem. We apply these indices to heart attack treatment between 1983 and 1994. More frequent reweighting and accounting for price discounts lowers the measured price change for heart attacks by three percentage points annually. Accounting for quality change lowers it further; we estimate that the real Cost of Living Index fell about 1 percent annually.

I. INTRODUCTION

The difficulties of deriving accurate price indices for service industries are well-known [Griliches 1992]. In this paper we address the issue of appropriate price indices for medical care. We focus on medical care because it is a large and growing part of the

6

Accounting for quality, U.S. hospitals actually performed well over 2002-2011

Heart attack   Heart failure   Pneumonia

Annual Rate of Productivity Growth (%)

Heart attack: -0.6%, -0.6%, 0.8%
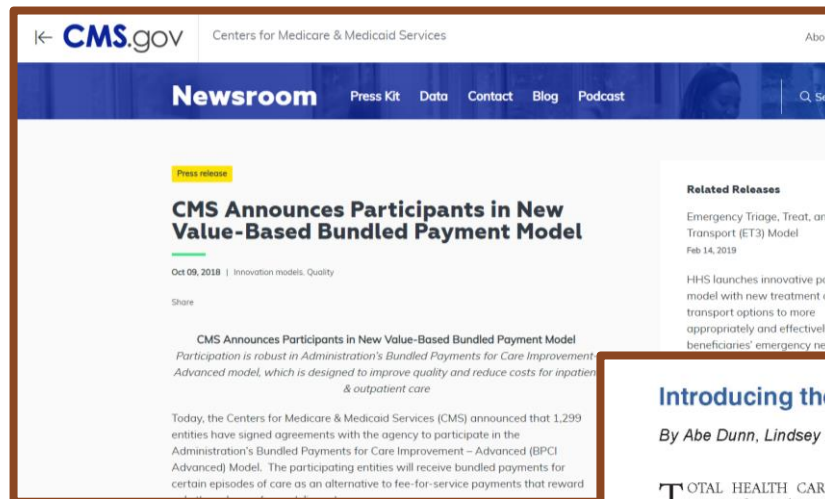Heart failure: -0.9%, -0.5%, 0.6%
Pneumonia: -0.4%, 0.8%, 1.9%

Hospital output is quantity of stays

Adjusting stays for patient severity

Severity-adjusted number of survivors with no unplanned readmissions

7

A comprehensive view ─ not limited to the hospital setting ─ is increasingly relevant

We analyze treatment episodes starting with hospitalization and ending 90 days after discharge

From 2002 through 2014…

- We are awaiting data for 2015 and 2016

Among older Americans in traditional (fee-for-service) Medicare…

- Medicare accounted for 20% of national health spend in 2017 (CMS)
- Traditional Medicare accounted for 66% of program beneficiaries in 2018 (KFF)

Using health insurance claims and administrative records…

- Data provide longitudinal perspective on care and outcomes

For episodes of heart attack, heart failure and pneumonia

- This focus naturally generalizes to other conditions and procedures

Empirical approach

We estimate

$$\ln Y_{ht} = \alpha + \ln \boldsymbol{I_{ht}} \, \boldsymbol{\beta_I} + \boldsymbol{S_{ht}}\boldsymbol{\beta_S} + \boldsymbol{O_{ht}}\boldsymbol{\beta_O} + g(t) + \epsilon_{ht},$$

in which Y_{ht} is the number of "high-quality" episodes that started at "index" hospital *h* in year *t,*

- $\boldsymbol{I_{ht}}$ is the inputs used to deliver these episodes of care,
- $\boldsymbol{S_{ht}}$ is severity measures for patients starting episodes at "index" hospital *h* in year *t,*
- $\boldsymbol{O_{ht}}$ is "other hospital output," and
- $g(t)$ is a function of time

We interpret $g(t)$ as MFP

- Note that Cutler-type measure addresses allocative efficiency and social welfare

Y_{ht}: We use clinically validated and policy-oriented methodologies to identify episodes

CMS Readmission Measures

AHRQ Inpatient Quality Indicators
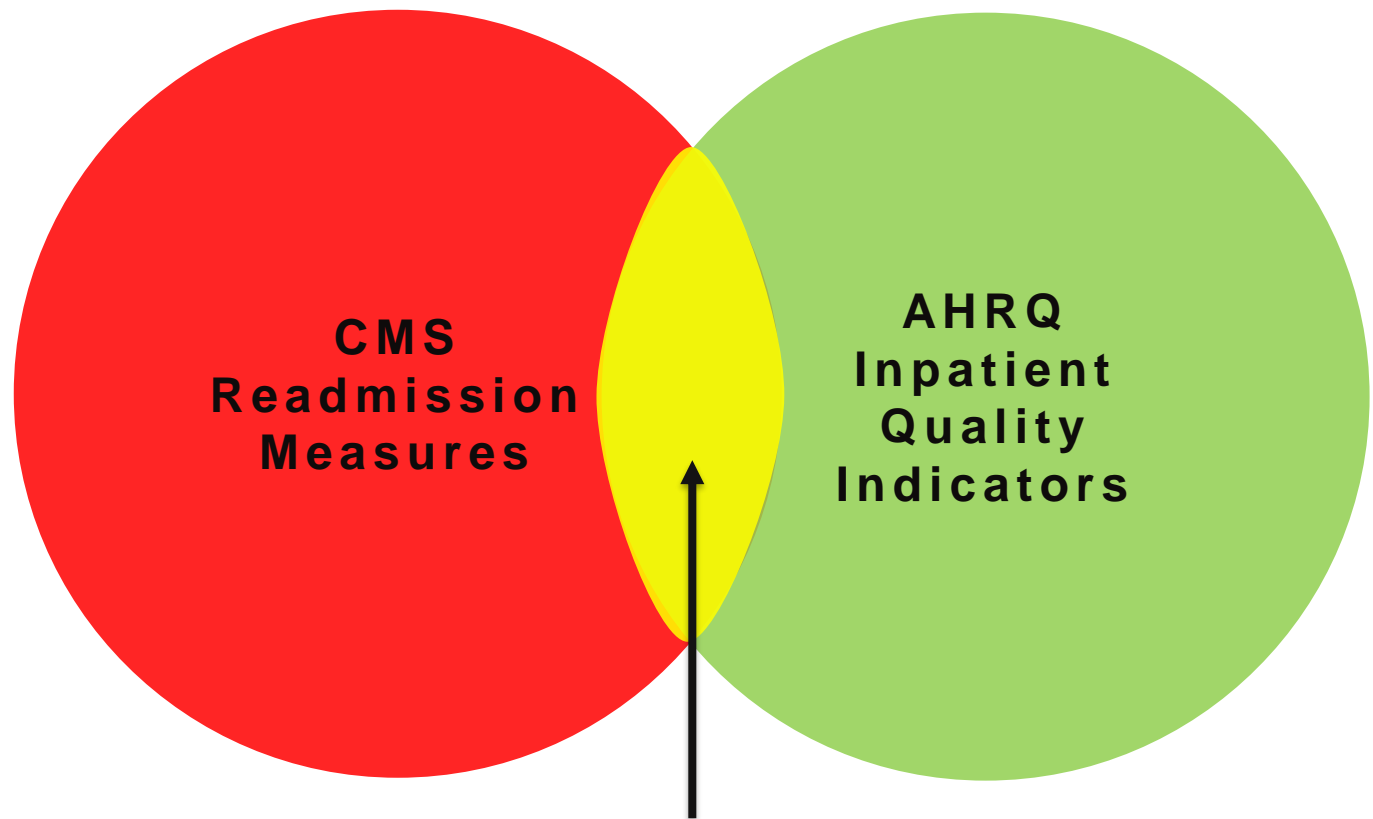
Our patients

Y_{ht}: Episode duration and quality

The vast majority of providers have selected 90-day post-discharge windows for bundled payment, so we use this duration
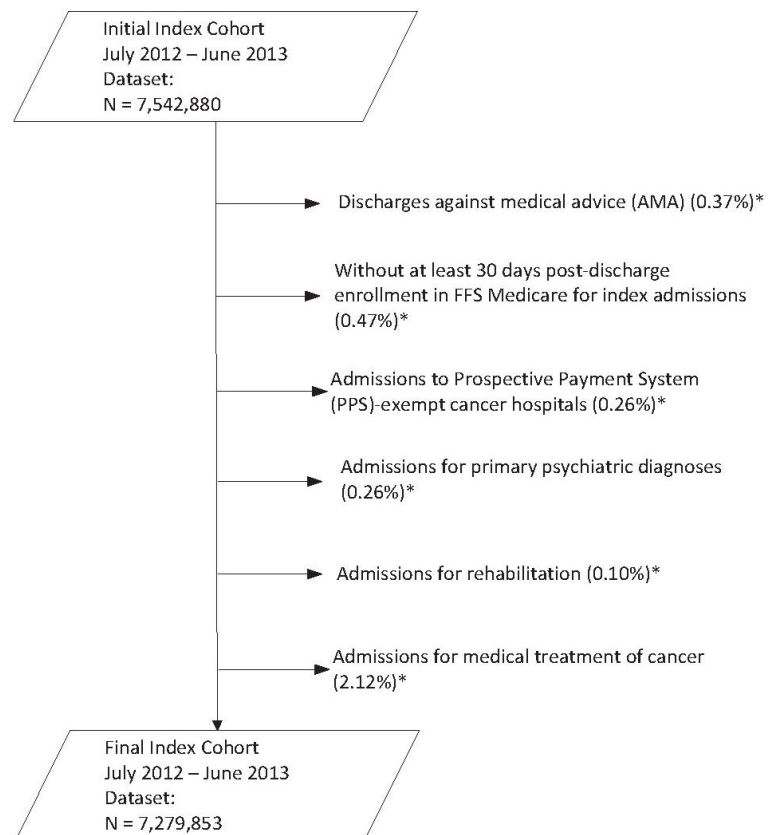
In a high-quality episode, the patient

- is alive at the end of the episode

- avoids an unplanned readmission within 30 days of discharge

- returns to the community (i.e., is not institutionalized)

CMS has developed a complex algorithm for flagging unplanned readmissions

Figure 4.2.1 – Index Cohort Sample in the July 2012-June 2013 Dataset

Initial Index Cohort
July 2012 – June 2013
Dataset:
N = 7,542,880

Discharges against medical advice (AMA) (0.37%)*

Without at least 30 days post-discharge enrollment in FFS Medicare for index admissions (0.47%)*

Admissions to Prospective Payment System (PPS)-exempt cancer hospitals (0.26%)*

Admissions for primary psychiatric diagnoses (0.26%)*

Admissions for rehabilitation (0.10%)*

Admissions for medical treatment of cancer (2.12%)*

Final Index Cohort
July 2012 – June 2013
Dataset:
N = 7,279,853

We use a 20% sample of Medicare Inpatient Files to identify index stays / episodes

Stays / Episodes	Beneficiaries	Hospitals	Description
29,841,183	7,880,612	6,353	All stays at short term acute care hospitals in 20% sample
811,517	635,380	5,510	**Heart attack** (acute myocardial infarction, i.e., AMI) stays
798,414	625,301	5,505	Excluding stays in fourth quarter of 2014 (incomplete follow up)
558,999	501,940	5,290	Stays / episodes meeting **CMS readmission measure** criteria

Y_{ht}: Measuring other aspects of quality

Master Beneficiary Summary Files from CMS report validated dates of death

Institutional claims (Inpatient Files, etc.) report discharge to home
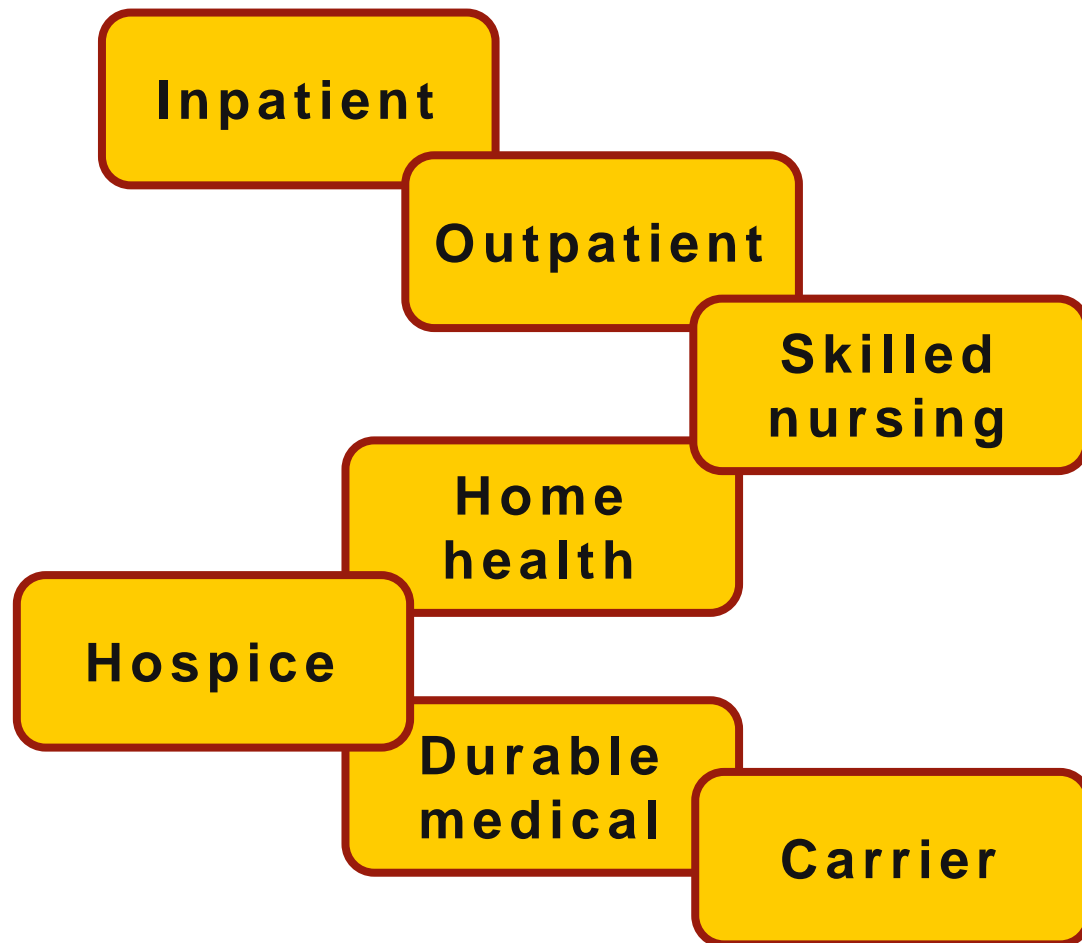
- We use last such claim

I_{ht}: We measure inputs using treatment costs

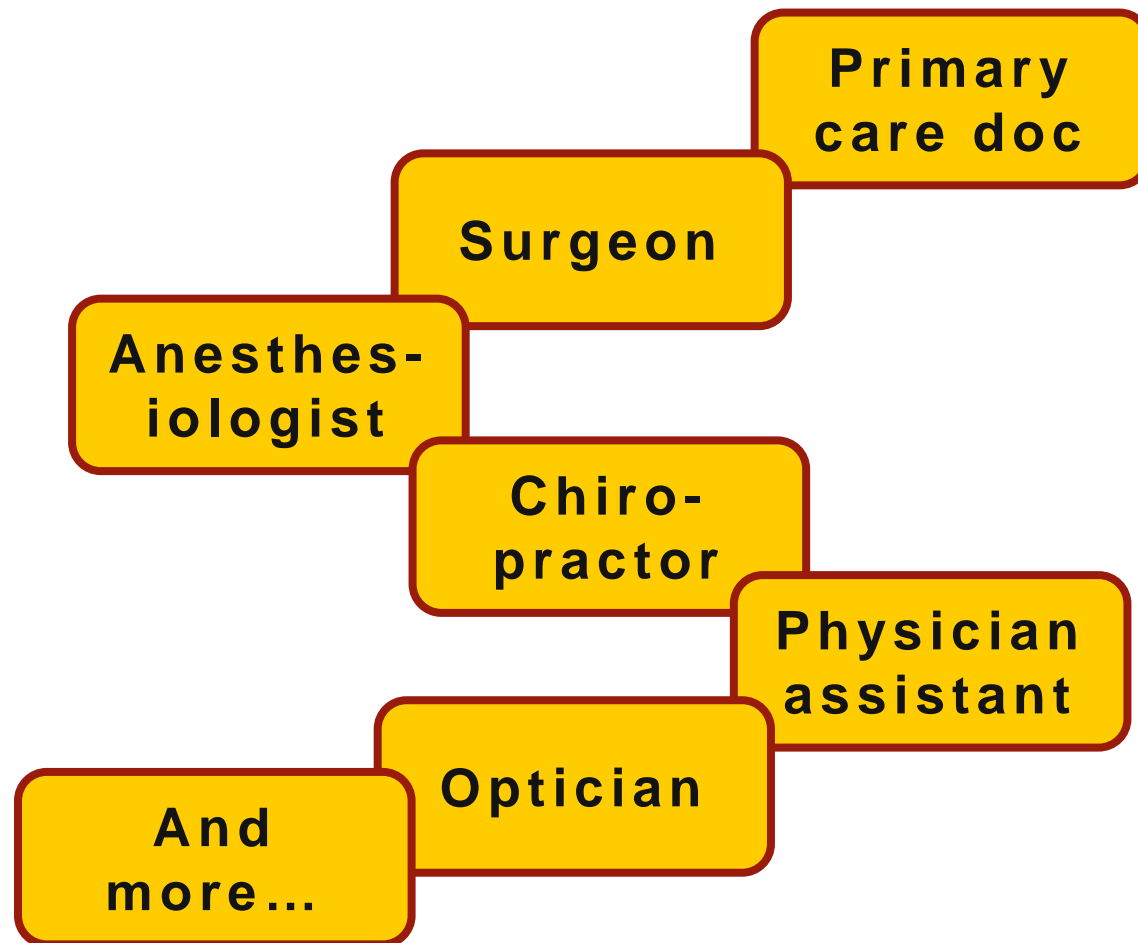**Common in health economics and policy**

We deflate institutional / facility costs using inflation measures from CMS

- Health care professionals do not report costs, so we assume zero price-cost margins in 2002 and apply CMS inflation measure

I_{ht}: We include everything but prescription drugs using various claims files

Inpatient

Outpatient

Skilled nursing

Home health

Hospice

Durable medical

Carrier

I_{ht}: Carrier Files include a wide array of professional services

Primary care doc

Surgeon

Anesthes-iologist

Chiro-practor

Physician assistant

Optician

And more...
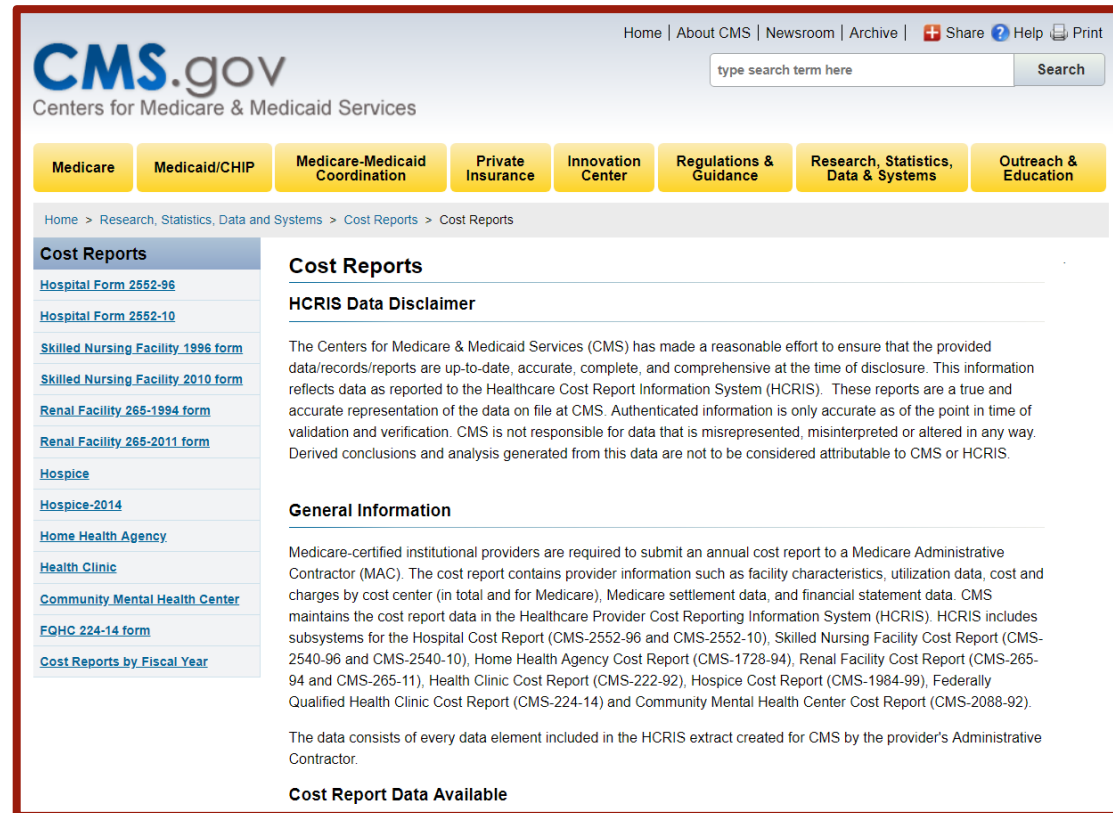
I_{ht}: These claims files are big-ish data

Within 20% sample, 2014 Carrier File includes 178 million claims

24.6 million of these claims matched to our patients

5.3 million fell within episode windows

I_{ht}: For institutions / facilities, we use "Medicare Cost Reports"

I_{ht}: Consider acute-care hospitals

Cost reports have cost-to-charge ratios (CCR)

Claims have charges covered by Medicare

- For covered charges, we have to link line-level records from Inpatient Files to claims

So estimated cost of a hospital stay = Charges * CCR

- Similar for other institutional claims, e.g., home health reports cost per visit and visits are on claim

I_{ht}: Cost data is not infrequently missing

Stays / Episodes	Beneficiaries	Hospitals	Description
29,841,183	7,880,612	6,353	All stays at short term acute care hospitals in 20% sample
811,517	635,380	5,510	Heart attack (acute myocardial infarction, i.e., AMI) stays
798,414	625,301	5,505	Excluding stays in fourth quarter of 2014 (incomplete follow up)
558,999	501,940	5,290	Stays / episodes meeting CMS readmission measure criteria
470,120	426,933	4,837	Excluding episodes with any missing cost-to-charge ratios

S_{ht} and O_{ht} : Patient severity and other hospital output

Patient severity measures include

- AHRQ Inpatient Quality Indicators for risk of inpatient death

- Age, sex and race / ethnicity

- Comorbidities from the index hospital record

- For heart attack, location within heart (e.g., N-STEMI)

- Zip-code sociodemographics from 2000 Census

Other hospital output includes

- Residents per bed from annual CMS IPPS Impact Files

- Tertiary care capabilities

Analytic sample for heart attack episodes

Stays / Episodes	Beneficiaries	Hospitals	Description
29,841,183	7,880,612	6,353	All stays at short term acute care hospitals in 20% sample
811,517	635,380	5,510	Heart attack (acute myocardial infarction, i.e., AMI) stays
798,414	625,301	5,505	Excluding stays in fourth quarter of 2014 (incomplete follow up)
558,999	501,940	5,290	Stays / episodes meeting CMS readmission measure criteria
470,120	426,933	4,837	Excluding episodes with any missing cost-to-charge ratios
457,120	415,562	4,753	Episodes meeting AHRQ IQI risk measure criteria
449,950	409,423	3,859	Excluding index hospital-years with no sociodemographic data

![USCSchaeffer]

Focusing on heart attack, a/k/a AMI, a simple first look

Cost per "High-Quality" Episode (000s of 2014 Dollars)

25
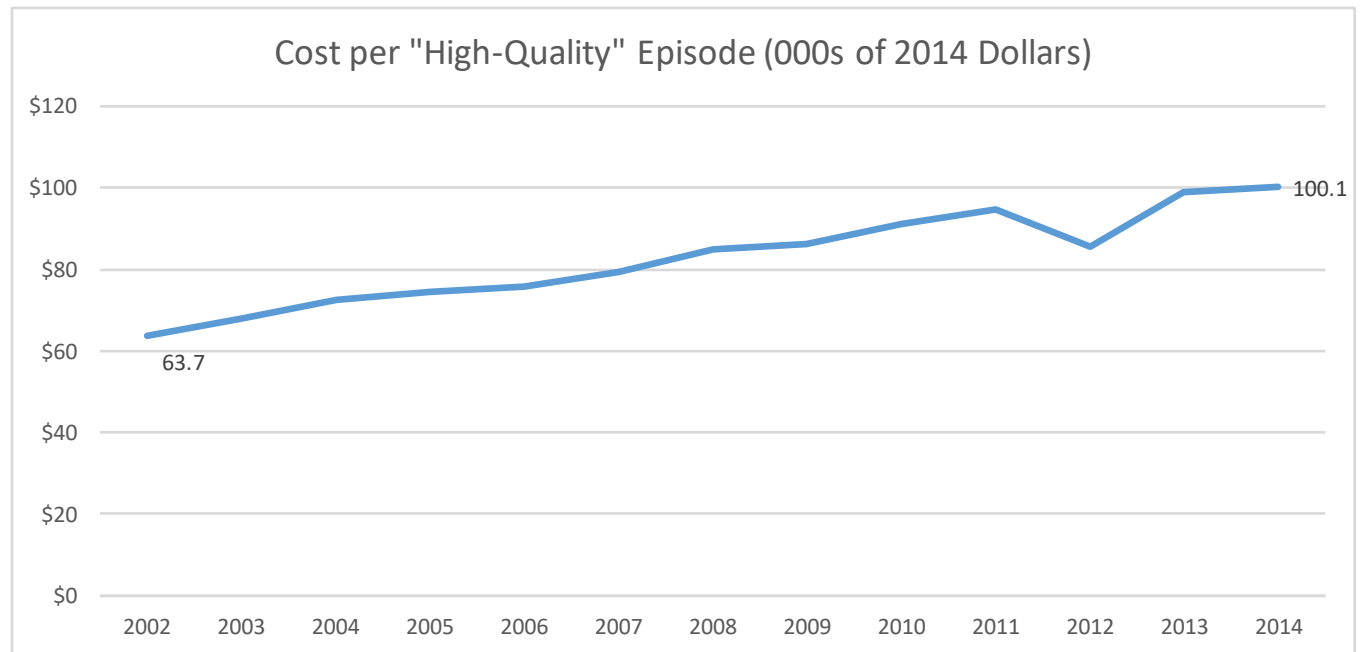
The rate of high-quality episodes has improved

Rate of "High-Quality" Episodes
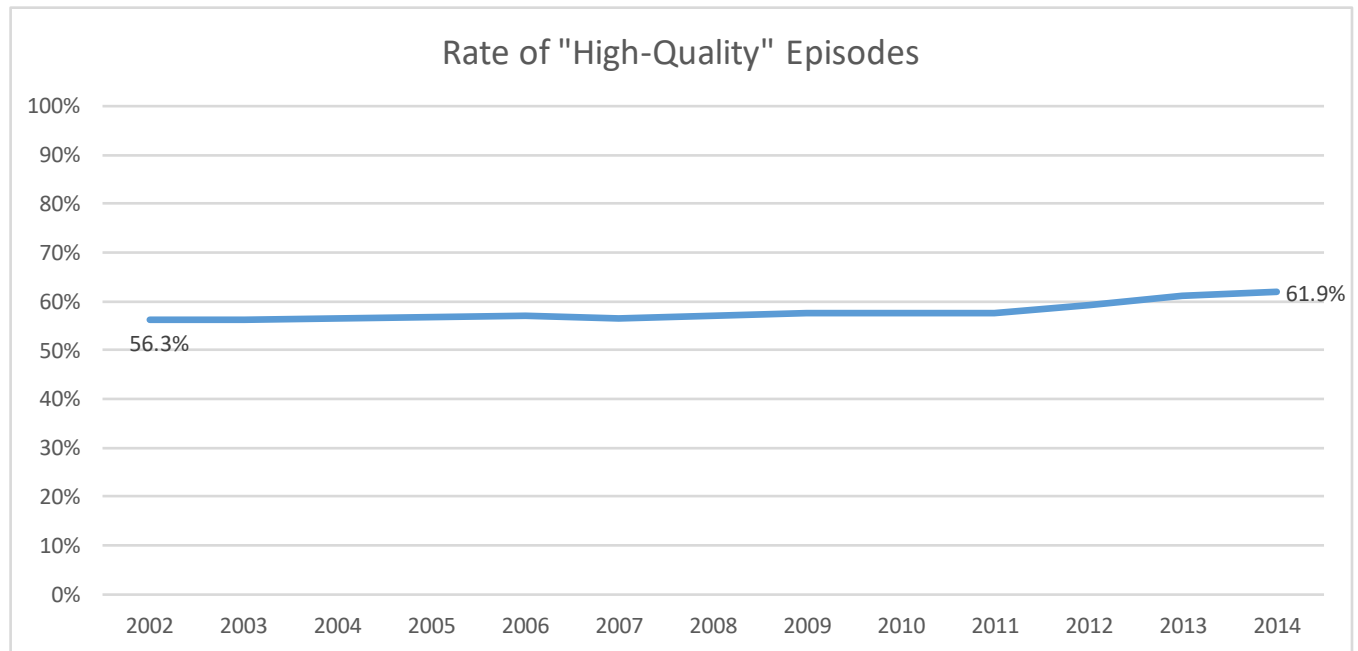
Some of this improvement stems from better survival rates

Rate of Episode Survival

77.4%

82.7%
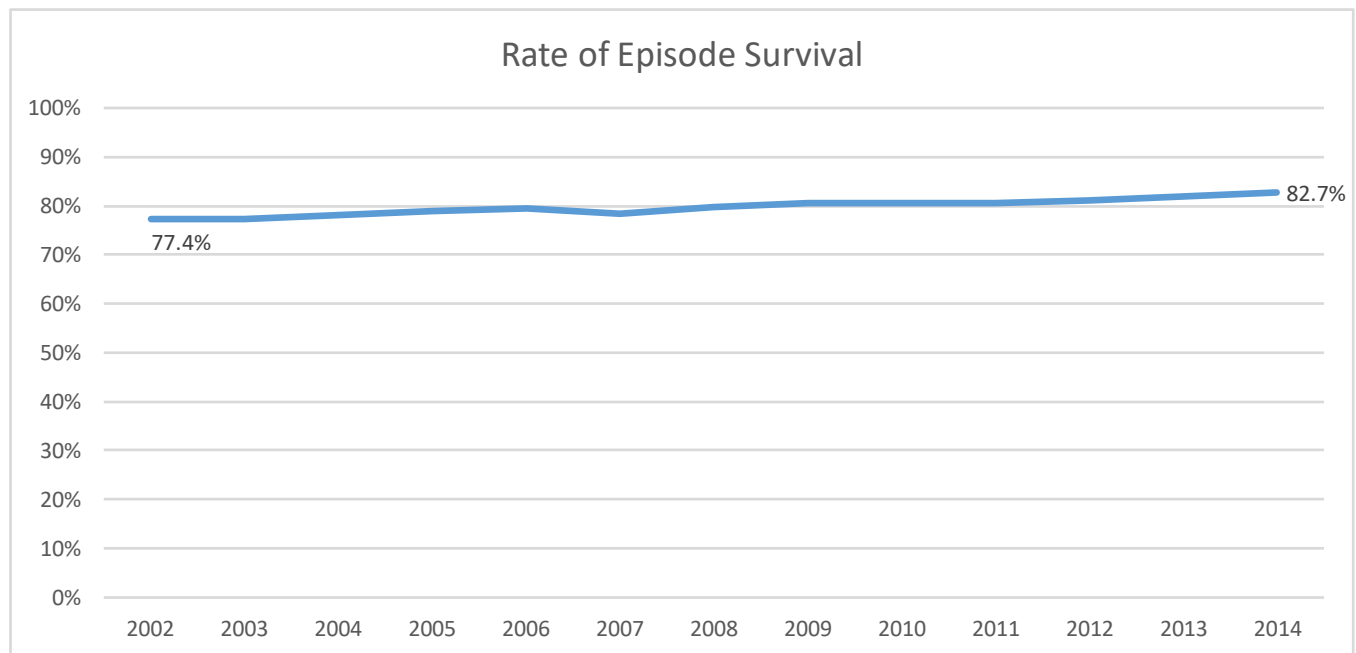
And also greater avoidance of unplanned readmissions

Rate of Unplanned Readmssion Avoidance (30 Day) among Survivors

84.7%

87.8%
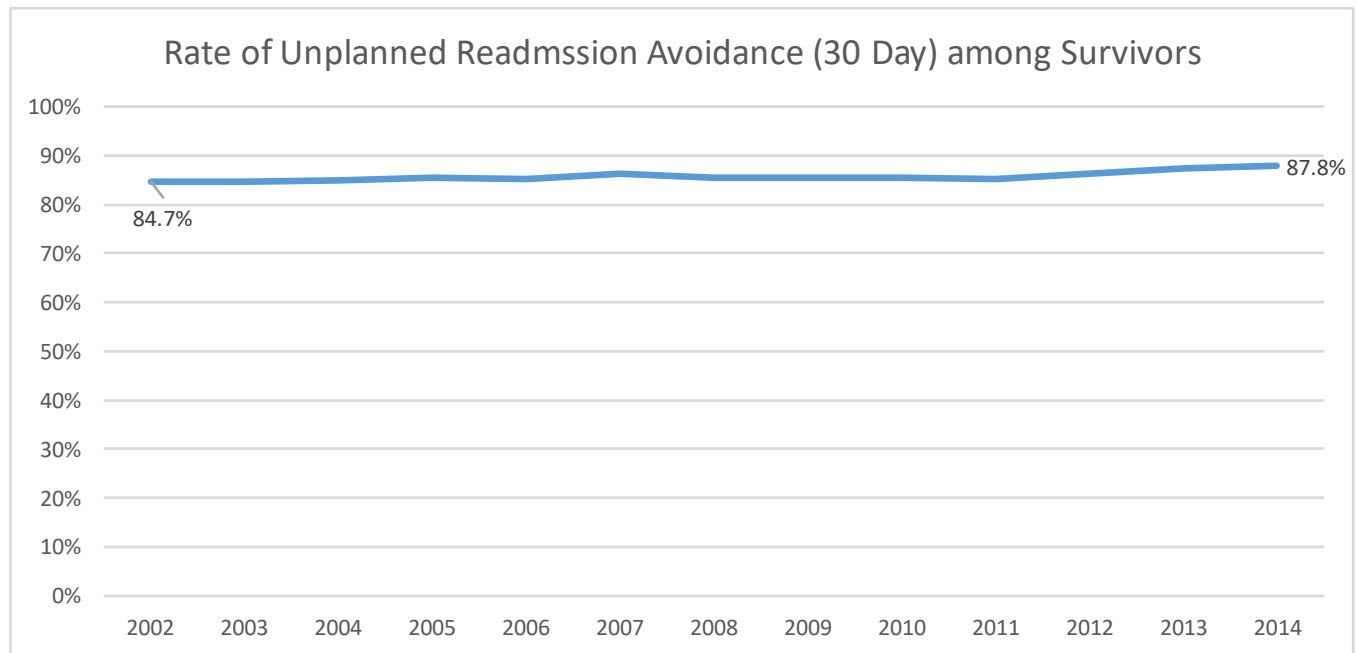
Return to community has not improved

Rate of Home Discharge among Survivors without Readmission

85.9%

85.1%

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
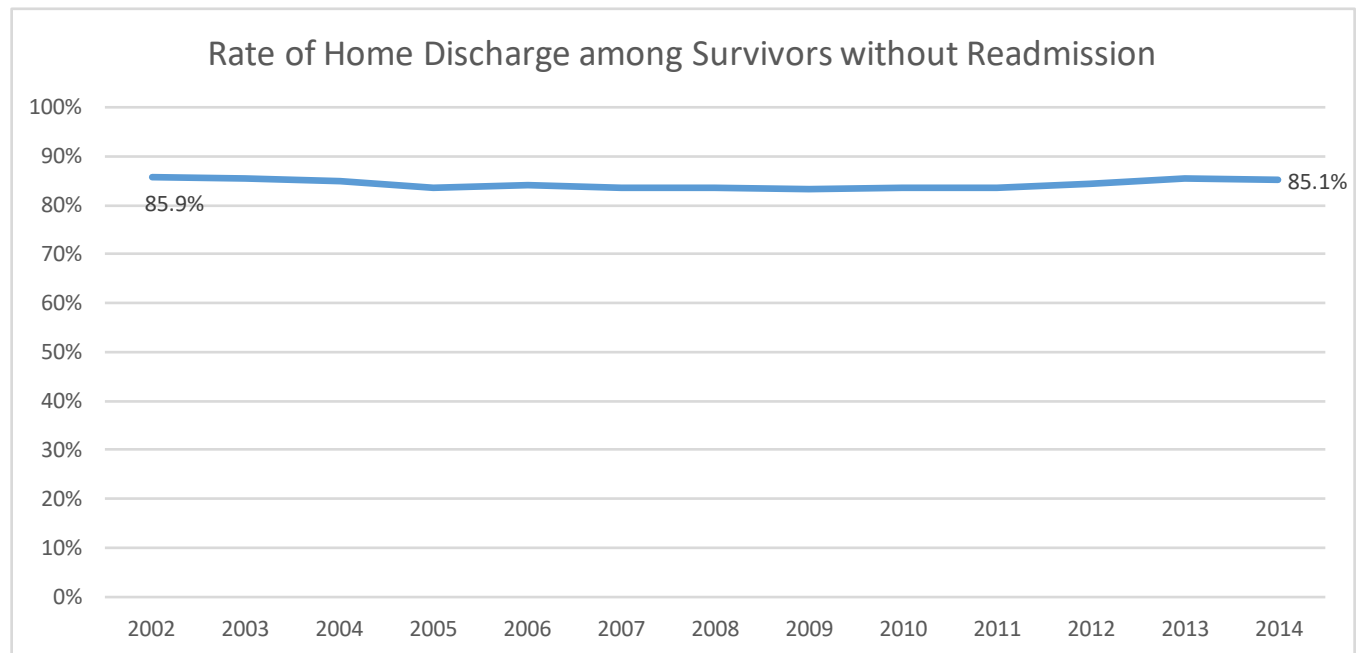
Cost per high-quality episode has grown due to cost growth

Average Cost of Episode (000s of 2014 Dollars)
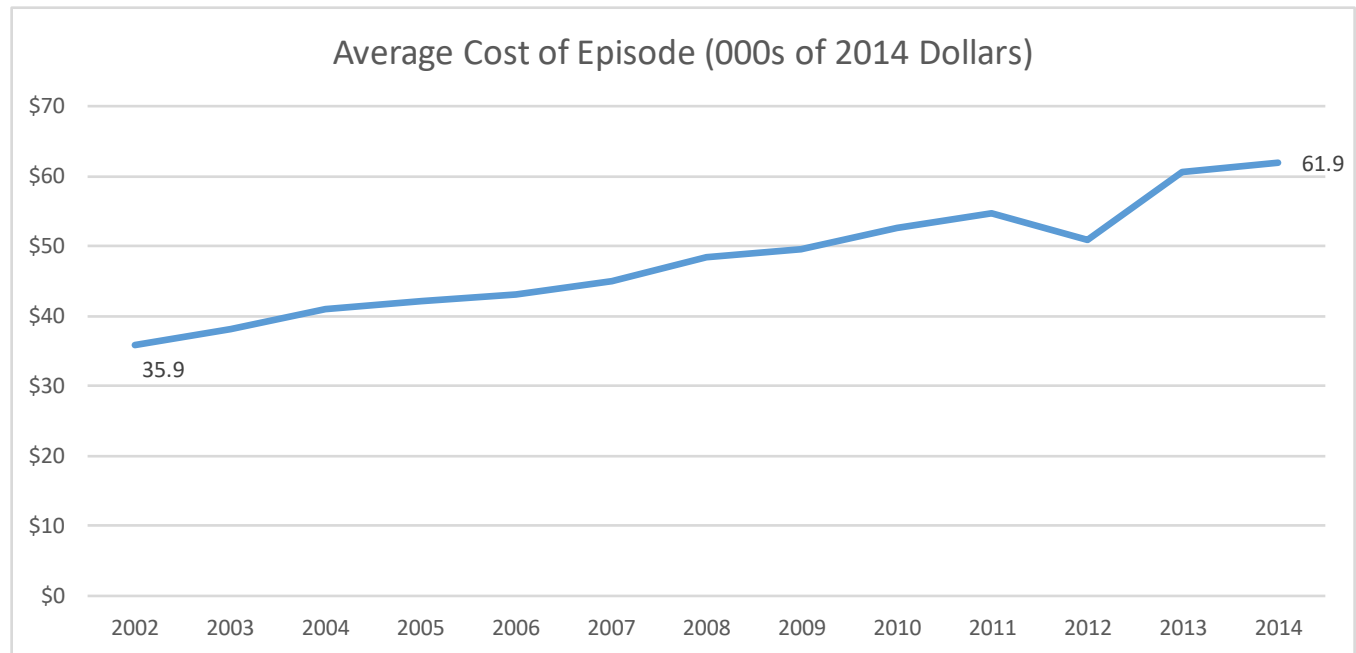
Turning to severity, predicted survival during index stay has declined somewhat

Predicted Inpatient Survival from AHRQ IQI

93.3%

92.7%

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
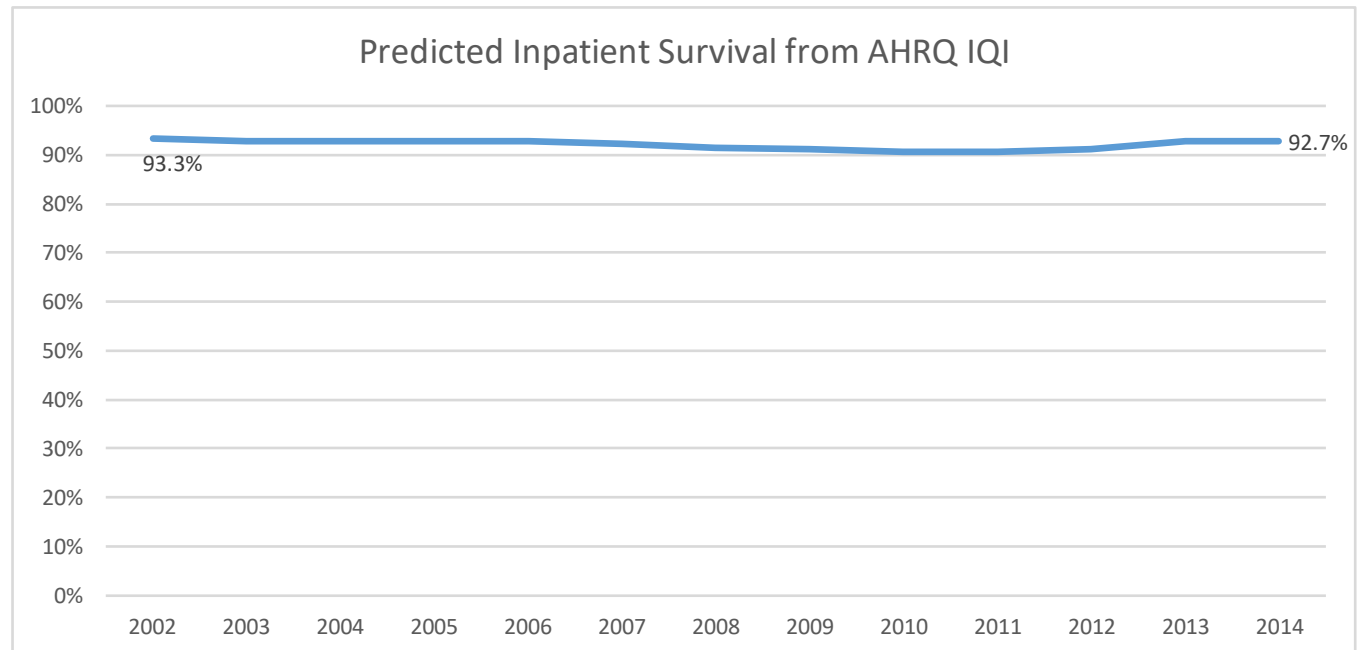
Patient age increased, then returned to level

Average Age at Admission
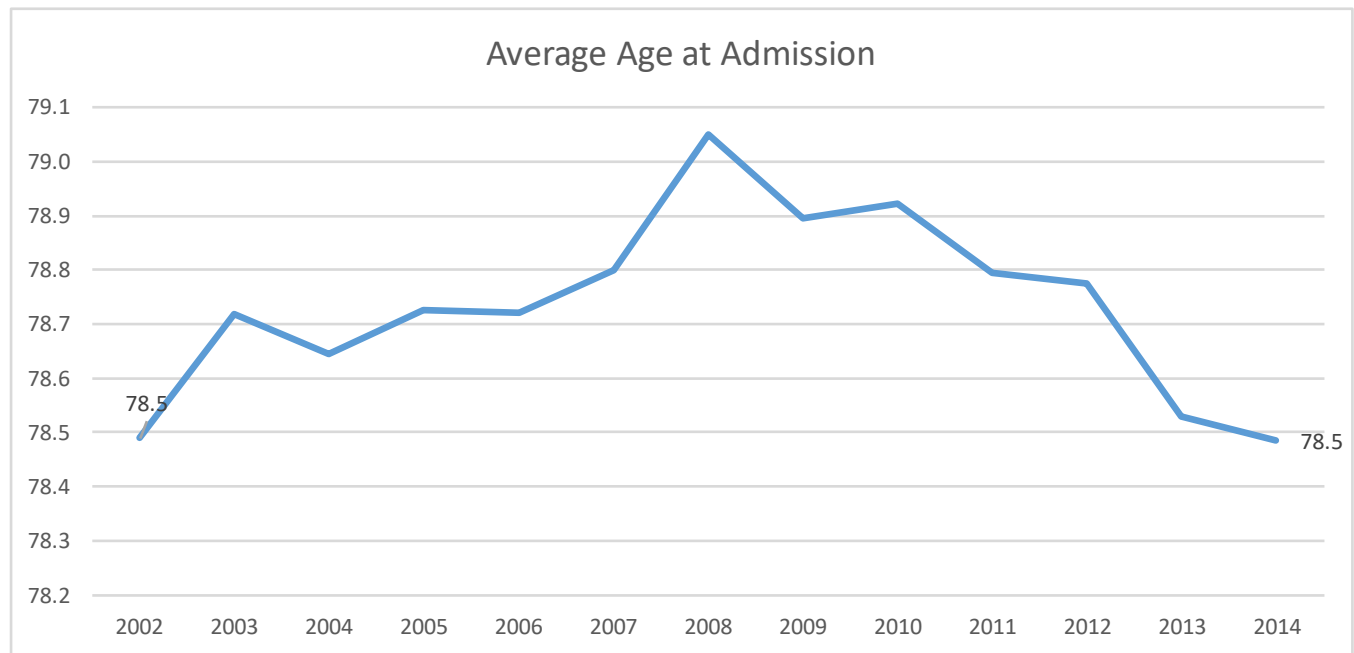
The comorbidity burden grew

Number of Charlson Co-Morbidities on Index Inpatient Record
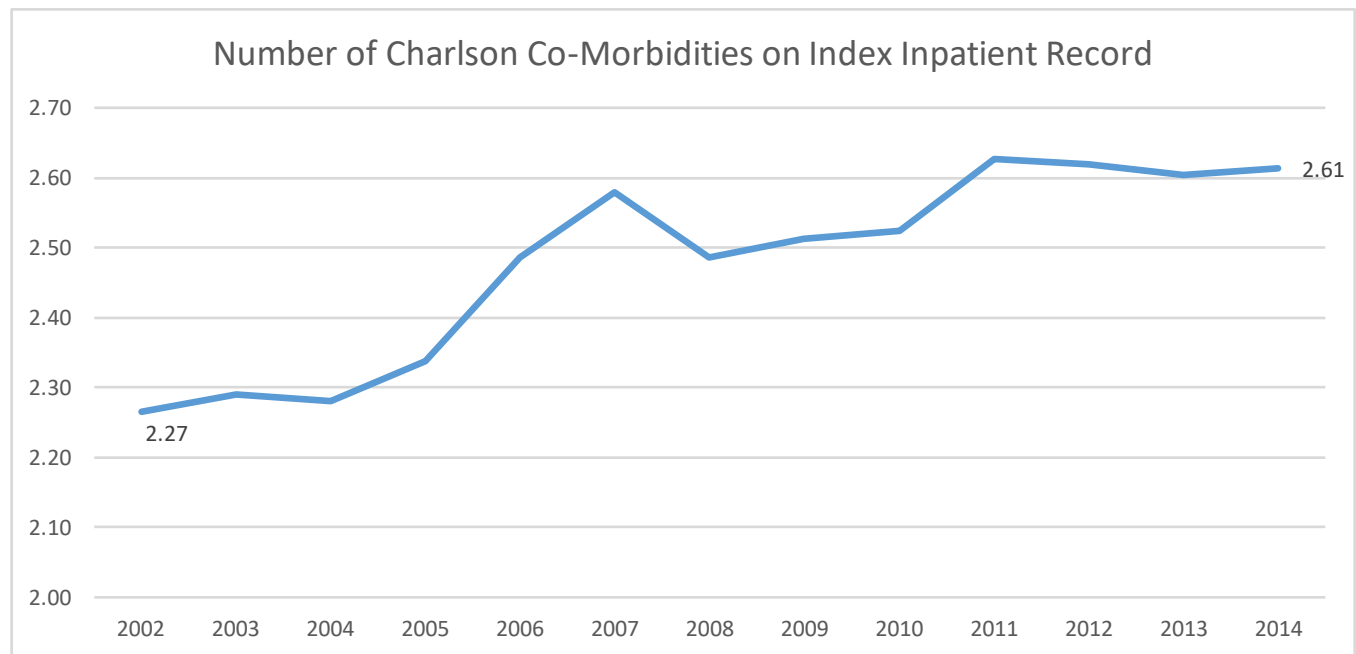
From our regression, we create an aggregate index of patient severity

Patient Severity Index
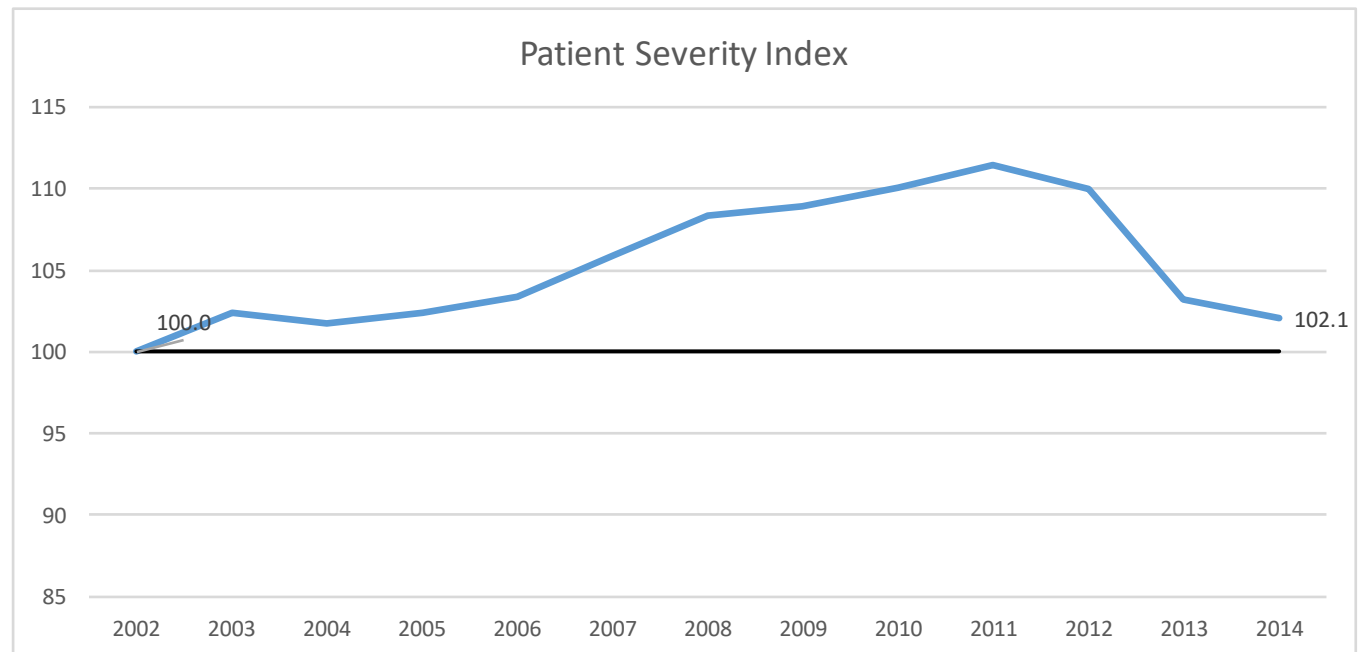
For heart attack episodes, MFP declined, then stagnated

Cumulative Change in Productivity Since 2002

Data points:
- 2002: 0.0%
- 2003: -3.2%
- 2004: -7.6%
- 2005: -9.5%
- 2006: -10.5%
- 2007: -12.4%
- 2008: -11.7%
- 2009: -11.6%
- 2010: -12.8%
- 2011: -13.1%
- 2012: -7.8%
- 2013: -16.9%
- 2014: -15.9%
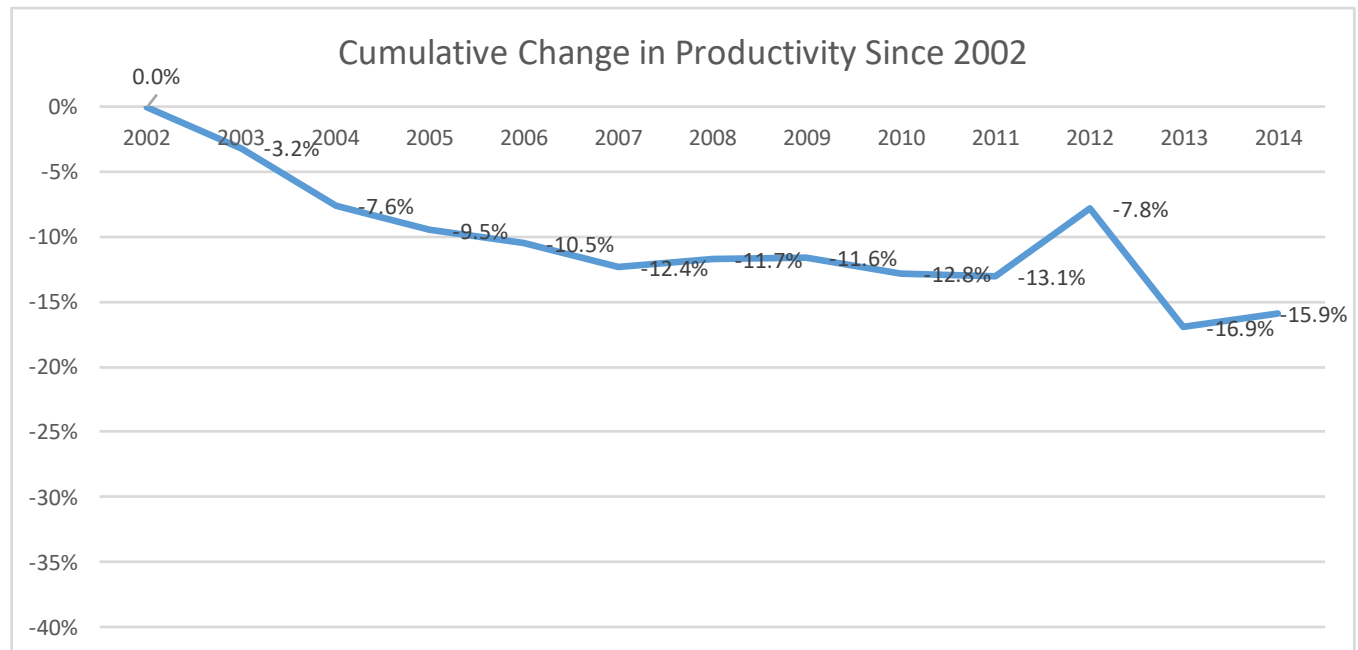
The picture would be more dismal, if quality had not improved

Change in MFP in Delivering AMI Episodes, 2014 Vs. 2002

- Base analysis: -15.9%***
- Ignore quality: -25.6%***
- Ignore severity: -18.3%***
- Ignore other hospital production: -14.5%***
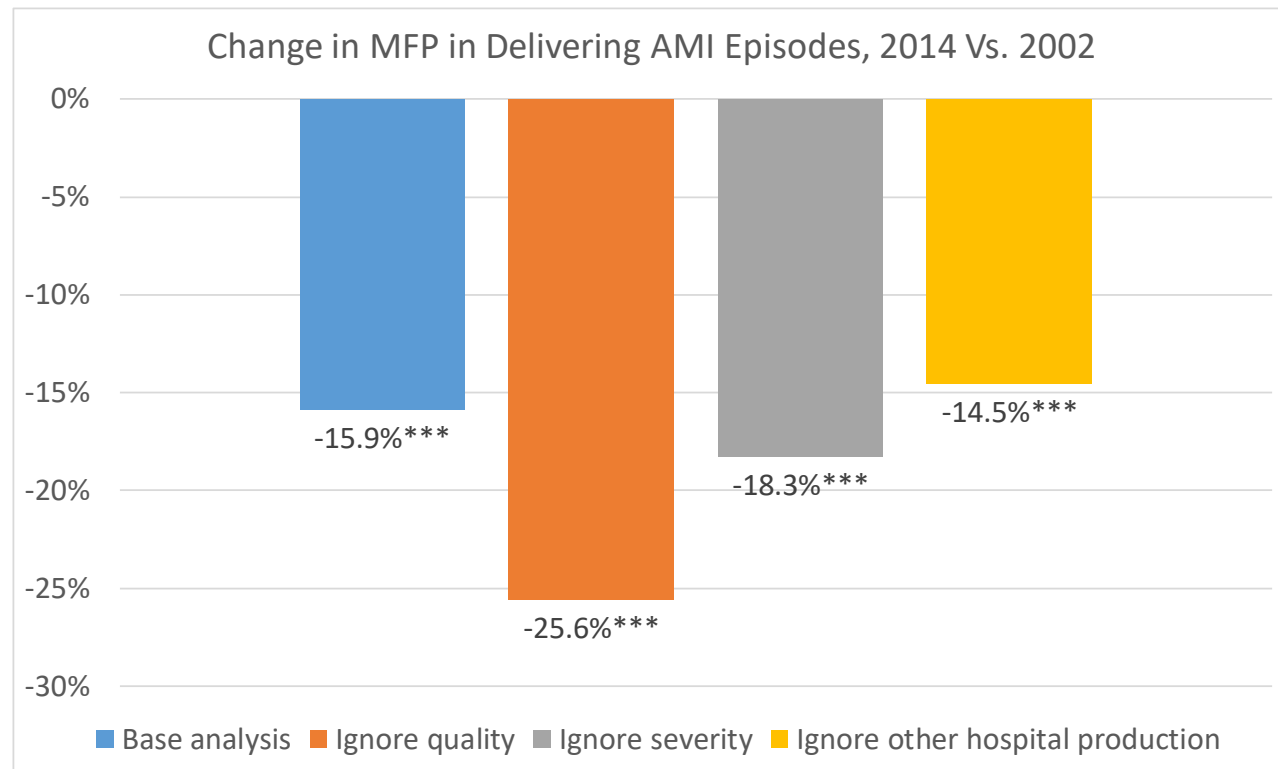
Hospital readmission costs <u>may</u> be a culprit here

Decomposition of Cost per AMI Episode

Legend: Post-index acute inpatient care — All other costs

Data labels: All other costs 28.5 (2002) to 33.6 (2014); Post-index acute inpatient care 7.4 (2002) to 28.3 (2014)
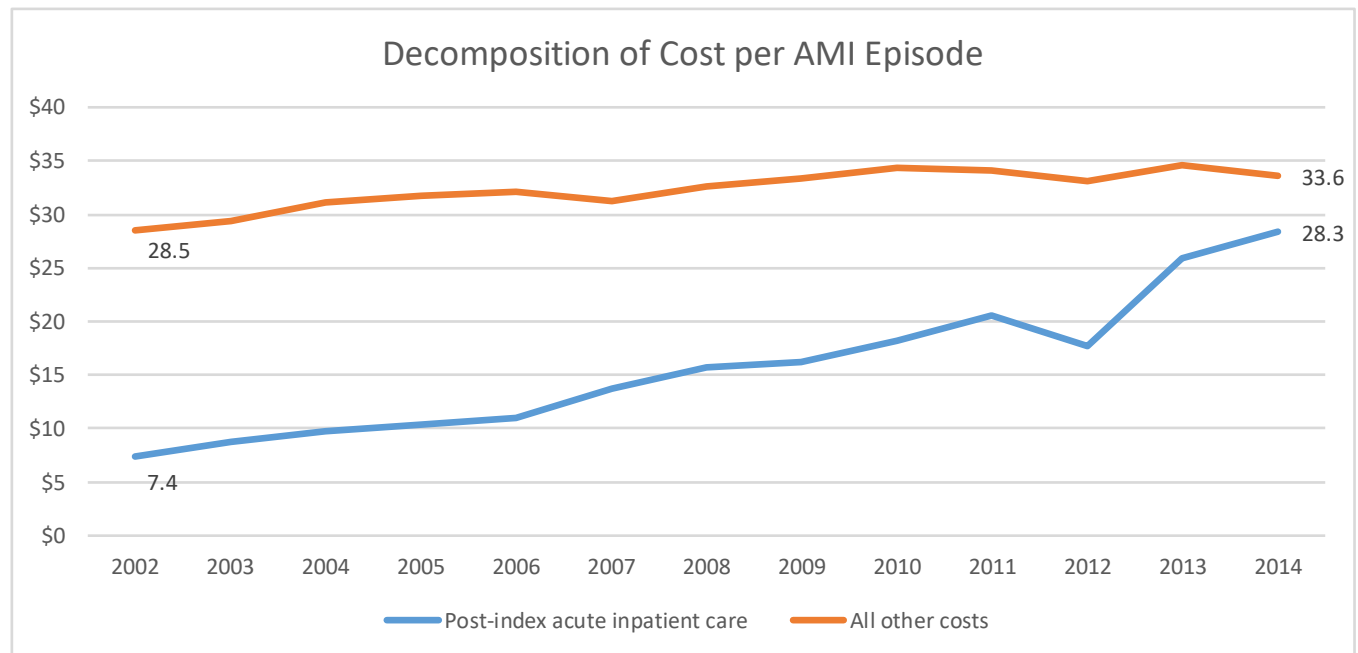
There is a similar pattern for heart failure and pneumonia

Cumulative Change in Productivity Since 2002
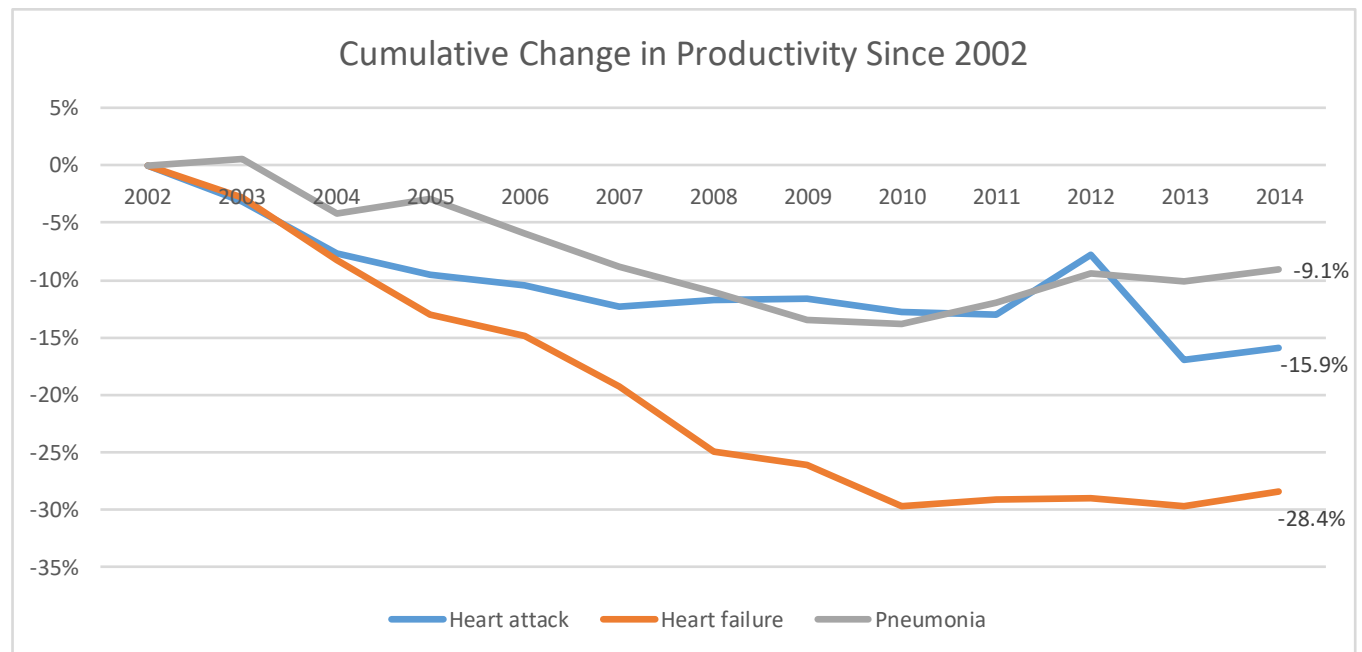
When we focused on hospital <u>stays</u> (Romley et al. 2015), MFP improved
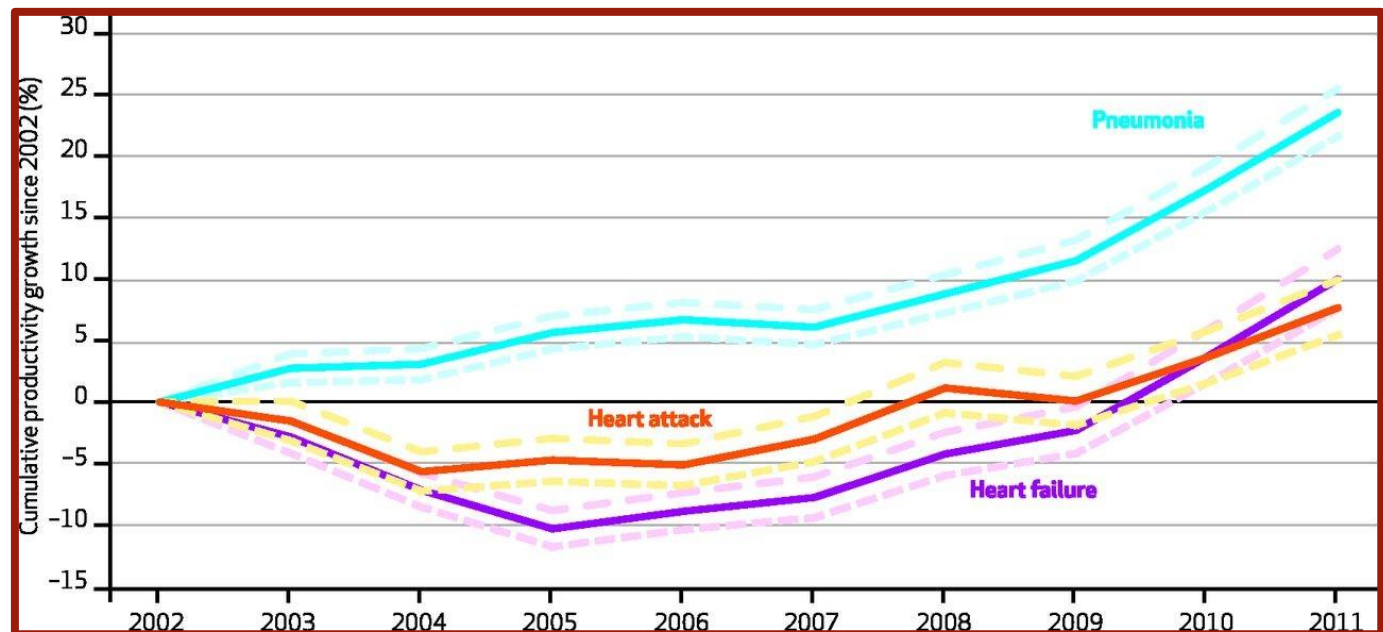
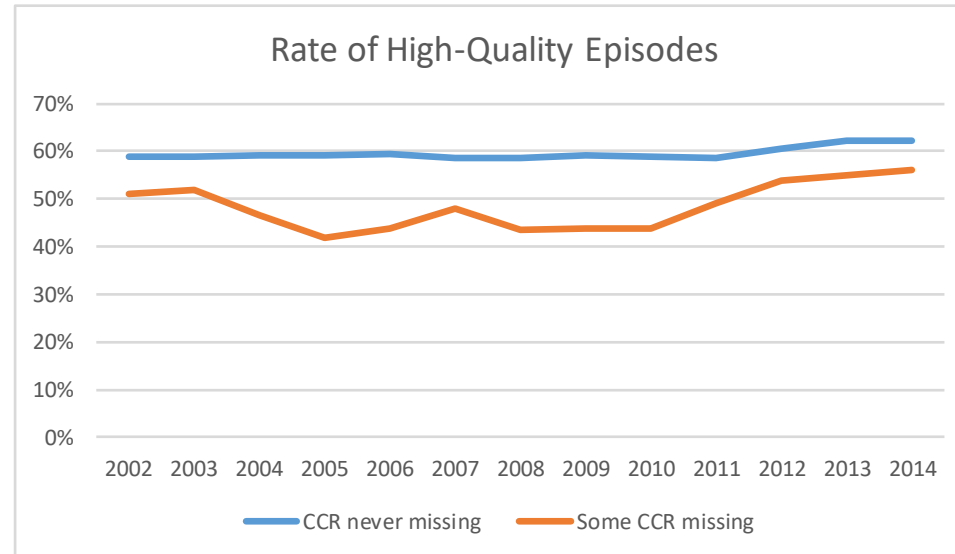# Near- and longer-term refinements

Address missing facility costs

Episodes with complete costs differ from those with missing costs

Rate of High-Quality Episodes

Near- and longer-term refinements

Address missing facility costs

Incorporate prescription drugs?

Incorporate custodial nursing into return to community

Risk adjust using pre-admission claims

Address diagnostic coding behavior

Analyze 2015 and on, including ICD-10 transition

Analyze additional conditions / procedures

Conclusions

If our current findings hold up, MFP in delivering episodes declined substantially in the 2000s, and then stagnated

A different picture of health care MFP may emerge when episodes of care are analyzed

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