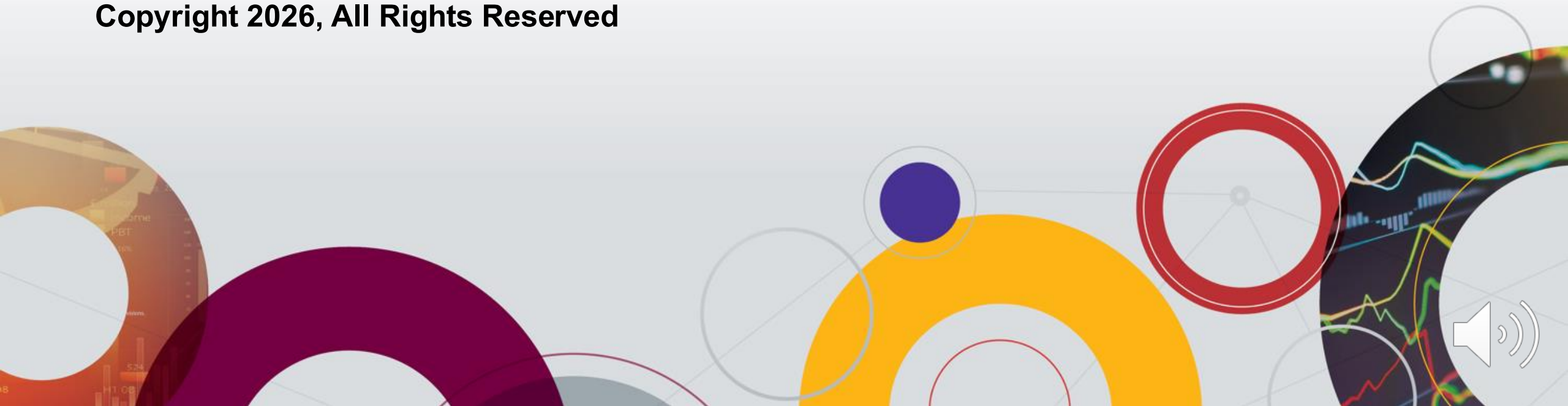


1.3b Problems in Healthcare Motivating Biomedical Informatics and AI

10x10 – Introduction to Biomedical Informatics & Artificial Intelligence
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Problems in healthcare motivating biomedical informatics and AI

Some perspective

Overview of healthcare systems in the US and elsewhere

Notable successes of modern healthcare

Problems of current healthcare

- Cost
- Quality
- Variation
- Access

Healthcare reform in the US and implications for informatics

Problems of US healthcare (that motivate informatics)

Cost

Quality

Variation

Access

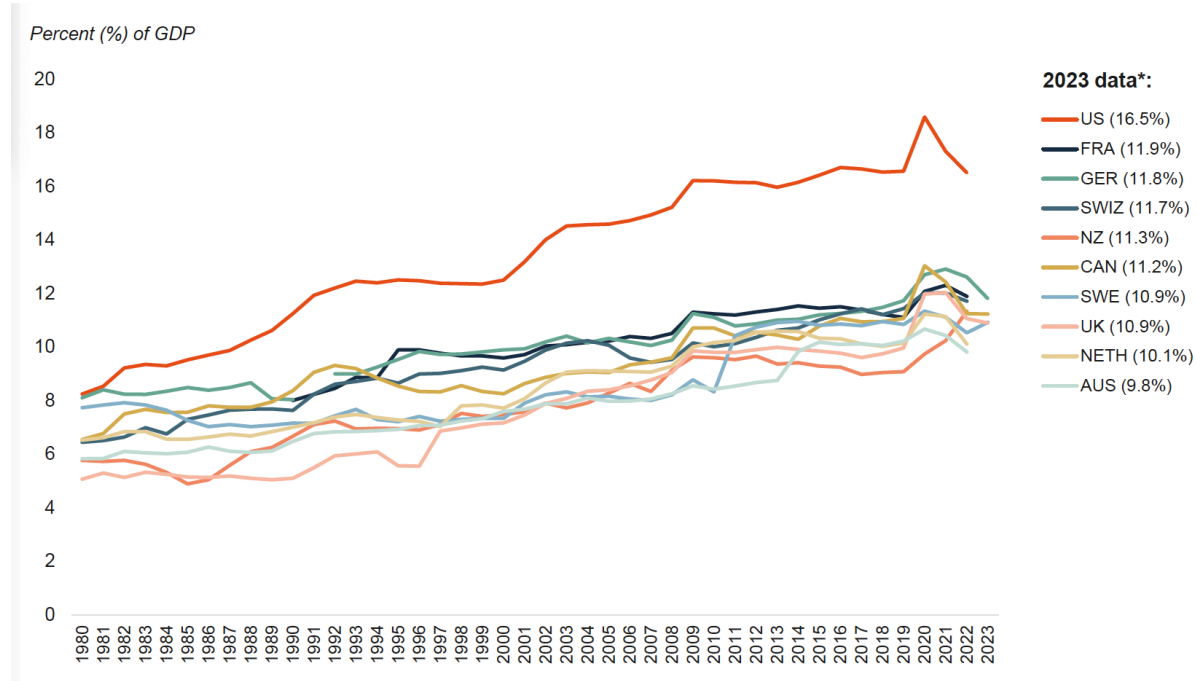
Costs: US pays more

US pays far more per capita and as share of gross domestic product (GDP) for healthcare than any other country (OECD, 2023; Blumenthal, 2024)

Rate of spending growth (Martin, 2025; Keehan, 2025)

- Slowed with passage of Affordable Care Act
- Increased during COVID-19 pandemic
- Projected to exceed general rate of inflation
- Likely to exceed 20% of GDP by 2033

Average annual premium for employer-sponsored family health coverage in 2024 \$25,572 (Claxton, 2024)



But US does not get more

US spends one and a half times as much as other high-income countries but utilization rates largely same (Papanicolas, 2018; OECD, 2023)

- Major drivers are prices of labor and goods, including pharmaceuticals, and administrative costs
- Also spends more on healthcare administration, mostly in private sector, deemed by some to be a crisis (Istvan, 2025)

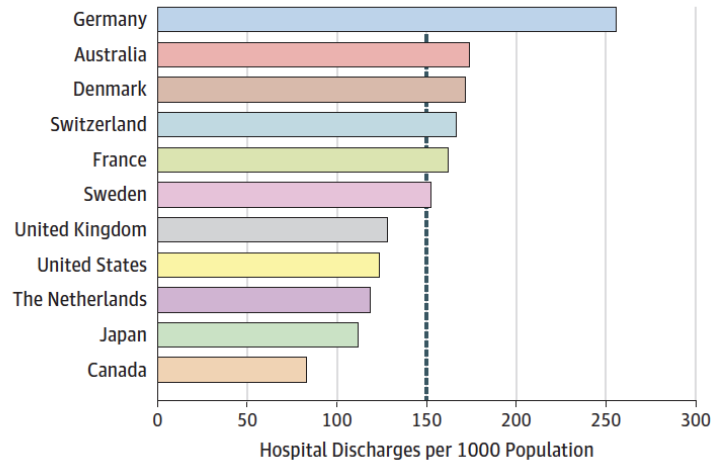
Compared to median OECD, US (Anderson, 2019; OECD, 2023)

- Has fewer physicians and nurses, fewer hospital beds and length of stay
- Has highest rate of maternal and infant mortality and of obesity and chronic illness among OECD

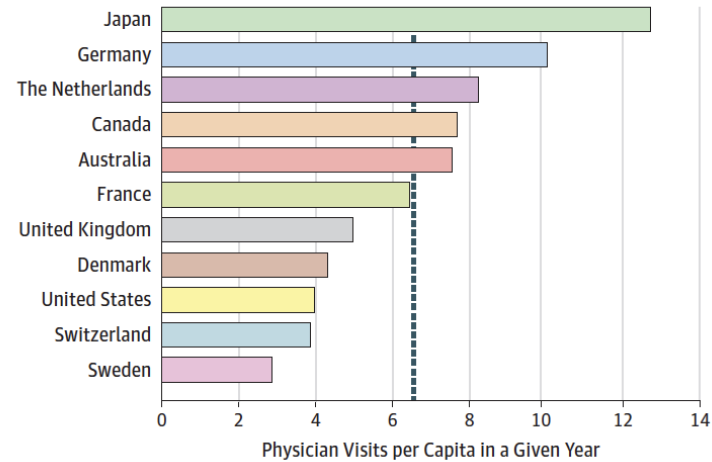
Medical marketing has increased substantially in US since 1997 (Schwartz, 2019)

US physician and hospital use vs. other high-income countries (Papanicolas, 2018; OECD, 2023)

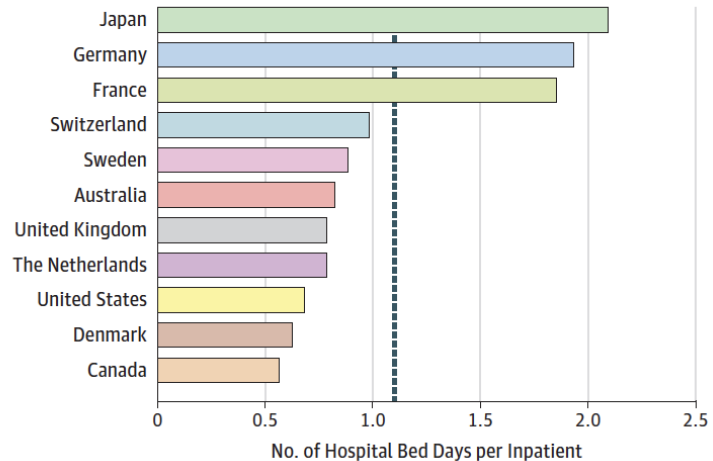
A Hospital discharges



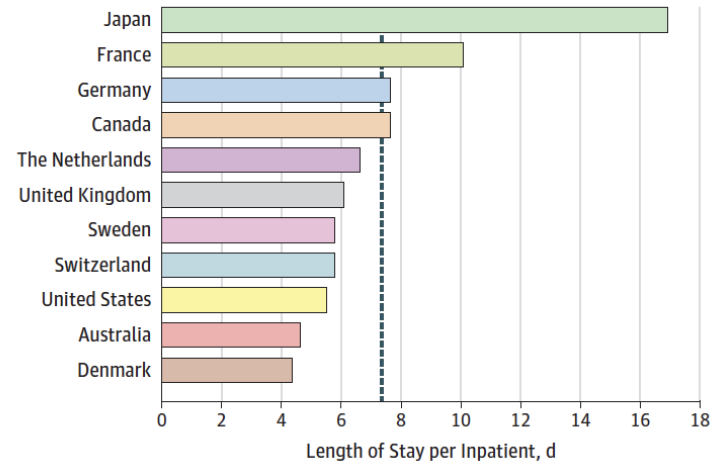
B Consultations^a



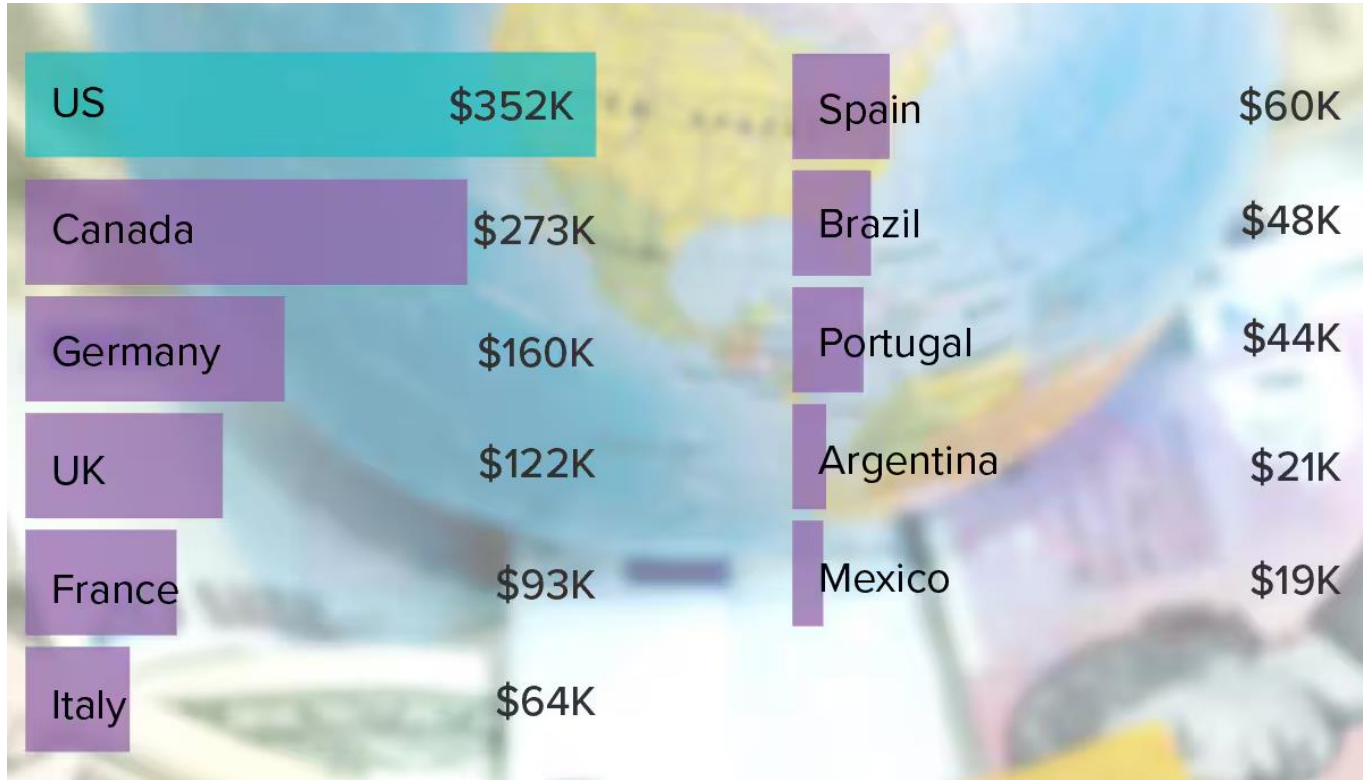
C Hospital bed days



D All-cause length of stay



Also pay disparities for physicians across and within countries



(McKenna, 2023)



(McKenna, 2025)

Aspects of healthcare cause distortions in market economics

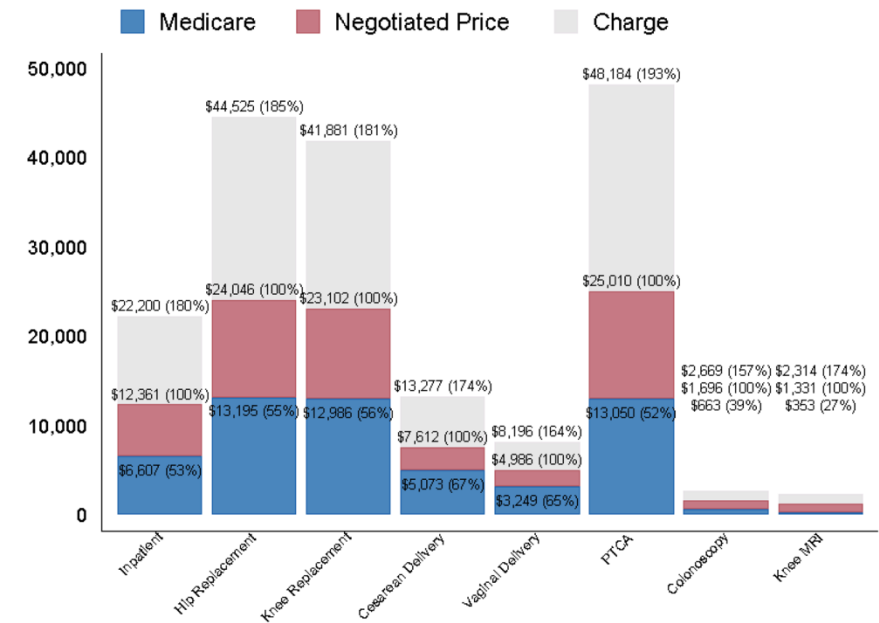
Has been known for years that healthcare does not obey typical “market forces” (Arrow, 1963; Hammer, 2004), e.g.,

- Market is “different” in healthcare and does not respond to normal forces (Wells, 2007; Fuchs, 2010)
- Only 7-33% of healthcare is “shoppable,” i.e., comparable and can be scheduled in advance (White, 2014; Frost, 2016)
- “Sellers” control supply, information, politicians, etc. (Goozner, 2014)
- System gives economic incentives for more use and higher prices for services (Rosenthal, 2017)

System is a “menu without prices” (Garber, 2008)

Only uninsured pay “list price” (Reinhardt, 2006; Cooper, 2019)

- Private insurance reimburses ~250% of Medicare reimbursement (Whaley, 2024)



Market distortions lead to increased costs and excess or harmful care

Market cannot control drug costs

- Daraprim (Lorenzetti, 2015)
- Cancer drugs (Mitchell, 2018)
- Respiratory corticotropins (Hartung, 2017)
- Medicare paid for 134 drugs approved by FDA prior to 2016 but were not endorsed by agencies in Australia, Canada, and the UK that conduct health technology assessments at cost of \$26B (Egilman, 2019)

Physician incentives

- Ownership of ambulatory surgery centers linked to higher volume of surgeries (Hollingsworth, 2010)
- When paid margin for drugs and costs for administration, costs increase by 4-5% (Müller, 2022)

Market distortions (cont.)

When there is uncertainty over evidence, incentives for usage tend to override (Patashnik, 2017)

Growing hospital market consolidation associated with higher hospital prices but only marginally improved quality of care and patient satisfaction (Cooper, 2019; Beaulieu, 2023)

- Higher overuse of care associated with investor ownership of health systems, fewer primary care physicians, and lack of affiliation with a major teaching hospital (Segal, 2022)
- Private equity ownership of hospitals associated with increased hospital-acquired adverse events and surgical site infections (Kannan, 2023)
- Patient care experience worsened after private equity acquisition of hospitals (Bhatta, 2025)

Berwick (2023): self-interest and greed are dangerous to US healthcare system

Another problem in US is opacity in pricing

Only half of top-ranked hospitals and 10% of other hospitals could provide full cost of total hip arthroplasty, with wide variation of those who did provide prices (Rosenthal, 2013)

- Problem persists (Mahomed, 2018)

Only 21% of orthopedic surgeons correctly knew cost of devices they implanted (Okike, 2014)

More hospitals could quote parking rates than cost of electrocardiograms (Bernstein, 2014)

Web sites of hospitals in 8 cities had prices for common elective procedures less than 20% of time (Kratka, 2017)

Health insurers in most other developed countries pay 25-50% of US costs for a variety of procedures (Sanger-Katz, 2020)

New requirements for hospitals to post prices can be difficult for consumers to decipher (Wolfson, 2021)

“Secret shoppers” found poor correlation between hospitals’ self-posted online prices and prices offered by telephone (Thomas, 2023)

There are some ways we know how to control costs

Bundled payments (Joynt Maddox, 2022)

- For lower-extremity joint replacements decreased costs 2.5%, mainly in post-acute care (Haas, 2019)
- For three selected surgical procedures, lowered costs around 10% (Whaley, 2021)
- Systematic review found consistent benefit across studies (Agarawal, 2020)

Primary care (Basu, 2019)

- Adding 10 primary care physicians per 100,000 population associated with 51.5 day increased life expectancy and reduced cardiovascular, cancer, and respiratory mortality by 0.9%-1.4%
- Increase in 10 specialist physicians per 100,000 population corresponded to a 19.2-day increase
- Modern burdens make primary care more difficult
 - Quality measures, electronic health records, consumerism, etc. (McMahon, 2021)
 - Time required for acute, chronic, and preventive desired care would take 26.7 hours per day (Porter, 2022)

Value-based purchasing programs (especially “high-intensity” ones) associated with improved quality and reduced costs (Pandley, 2023)

Healthcare quality – as good as could be?

As system, US ranks last among OECD countries in overall healthcare system performance (Blumenthal, 2024)

- US ranks worst in avoidable mortality

[Annual report of US healthcare quality and disparities](#) from Agency for Healthcare Research and Quality (AHRQ)

Assessing quality

- Correct things not done – errors of omission
- Incorrect things done – errors of commission

	AUS	CAN	FRA	GER	NETH	NZ	SWE	SWIZ	UK	US
OVERALL RANKING	1	7	5	9	2	4	6	8	3	10
Access to Care	9	7	6	3	1	5	4	8	2	10
Care Process	5	4	7	9	3	1	10	6	8	2
Administrative Efficiency	2	5	4	8	6	3	7	10	1	9
Equity	1	7	6	2	3	8	–	4	5	10
Health Outcomes	1	4	5	9	7	3	6	2	8	10

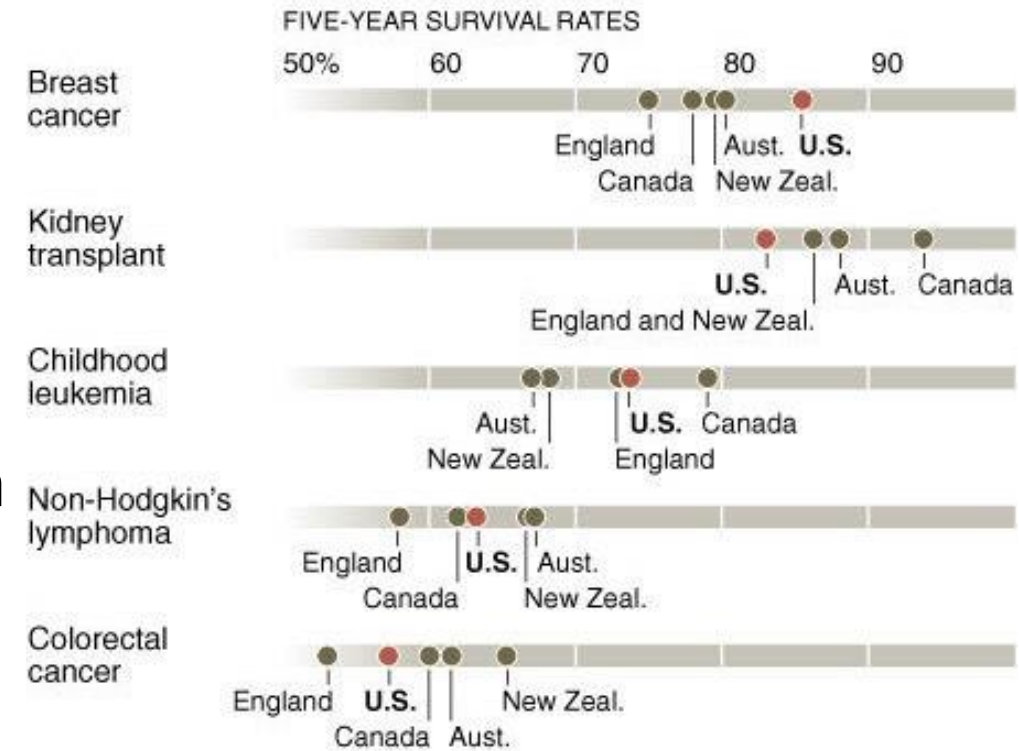
US healthcare quality varies by condition

Summarized by Leonhardt (2009)

According to Commonwealth Fund, US relative to OECD is (Schneider, 2017)

- Middle pack for cancer and heart disease
- Worse for life expectancy and infant mortality

Although US has highest per capita spending on cancer care, after adjustment for smoking, US cancer mortality rate no different than other high-income countries (Chow, 2022)



What we know about quality – errors of omission

Started with McGlynn (2003)

- Sample of nearly 7,000 adults in 12 US metro areas assessed for 30 conditions
- On average, only 54.9% of care was consistent with known quality

Comparable results from similar studies in VA (Asch, 2004) and in Australia (Runciman, 2012)

Extent of underuse of medical services varies widely but effective interventions not broadly known (Glasziou, 2017)

In addition to errors of omission are errors of commission

First brought to light by IOM *To Err is Human* report (Kohn, 2000) that concluded 48,000-96,000 deaths were attributable to preventable errors

- Some argued numbers too high (McDonald, 2000), though researchers rebutted (Leape, 2000)
- Others claimed too difficult to measure with sources of data (Sox, 2000)
- Some noted rate may be significantly higher (Classen, 2011)

Problem persists, and not just related to deaths – analysis of 2800 admissions to Boston teaching hospitals found (Bates, 2023)

- 23.6% of patients had adverse event, 22.7% of which were preventable and 32.3% of which were serious, e.g., adverse drug events, surgical or procedural events, falls, pressure ulcers, or healthcare-associated infections
- 7 deaths, 1 of which was deemed preventable

If errors were considered among the leading causes of death

LEADING CAUSES OF DEATH ¹	
Diseases of the Heart	726,974
Cancer (malignant neoplasms)	539,577
Cerebrovascular Disease	159,791
Chronic Obstructive Pulmonary Disease	109,029
Medical Errors²	44,000–98,000
Accidents and Adverse Effects (motor vehicle accidents = 43,458; all others = 52,186)	95,644
Pneumonia and Influenza	86,449
Diabetes	62,636
Suicide	30,535
Kidney Disease	25,331
Liver Disease	25,175

SOURCES: 1. Centers for Disease Control and Prevention, 1997. 2. IOM, *To Err Is Human: Building a Safer Health System*, 2000.

Courtesy of Dan Masys, MD

Other examples of quality issues

Over-prescription of antibiotics leads to adverse drug events and bacterial resistance

- A problem known for decades (Kunin, 1973)
- Rate of prescription increases during day in physicians' offices (Linder, 2014)
- 25% of prescriptions inappropriate and 18% with no documented indication (Ray, 2019)
- 17% for clinician visits without infection-related diagnosis and 28% not associated with a visit (Fischer, 2020)
- Varies by antibiotic but up to $\frac{3}{4}$ of prescriptions for pneumonia and urinary tract infection not supported (Magill, 2021)
- Problem continues to persist globally and will worsen if not addressed (GBD, 2024)

Low-value (i.e., not indicated) testing by physicians leads to increased visits, diagnostic tests, and procedures (Bauch, 2020)

- Reducing low-value care essential to improved value (Oakes, 2021)

Clinician-owned ambulatory practices more likely to achieve improvements in cardiovascular quality outcomes without increasing staff member burnout than practices owned by hospitals or health systems (Rotenstein, 2023)