

Epi213_Lecture 1

Cost-Effectiveness Analyses in Medicine and Public Health

2017 Jan 12-Mar 23

Dhruv Kazi, MD, MSc, MS

Associate Professor of Medicine

Division of Cardiology, Zuckerberg San Francisco General Hospital

Departments of Medicine and of Epidemiology and Biostatistics

University of California San Francisco

kazi@ucsf.edu

@kardiologykazi

Agenda for the day

1. Introductions
2. Decision Analysis/Cost-Effectiveness Analysis 101
3. Who Should Take the Class (and Who Should Not)
4. Course Logistics/Rules of the Game
5. CEA Project
6. Colloquium on Feb 10, 2017
7. Q&A

Introductions

Dhruv Kazi, MD, MSc, MS

Associate Professor of Medicine

Division of Cardiology, Zuckerberg San Francisco General Hospital

Departments of Medicine and of Epidemiology and Biostatistics

University of California San Francisco

kazi@ucsf.edu

@kardiologykazi

James G. Kahn, MD, MPH

Professor

Philip R Lee Institute for Health Policy Studies

University of California San Francisco

jgkahn@ucsf.edu

Elliot Marseille, PhD

Health Strategies International

emarseille@comcast.net

TAs:

Sili Liu

Sili.Liu@ucsf.edu

Vignesh Arasu

Vignesh.Arasu@ucsf.edu

Course Email:

UCSF.CEA@gmail.com

Class Introductions

Cost-Effectiveness Analysis 101

I assume you have no background in economics

No need to take notes - I'll send along the pdf by the end of the day

No laptop policy

Why perform a cost-effectiveness analysis?

The central idea is that resources are finite, and regardless of the economic status of a nation/region, policy-makers must grapple with the issue of optimal resource allocation. This is the concept of **opportunity costs** - that resources allocated to one program or intervention become unavailable for alternative uses. For instance, investing a chunk of the federal budget on healthcare precludes investments of those dollars in education or defense.

The goal is to facilitate **evidence-based resource allocation**.

Let's consider two examples from opposite ends of the economic spectrum.

US:

GDP: \$17 Trillion

Healthcare = ~18% = \$3 trillion (2015)

per capita = ~\$9500, half of this is public spending

Is this too much?

Two Considerations

How much are we paying?

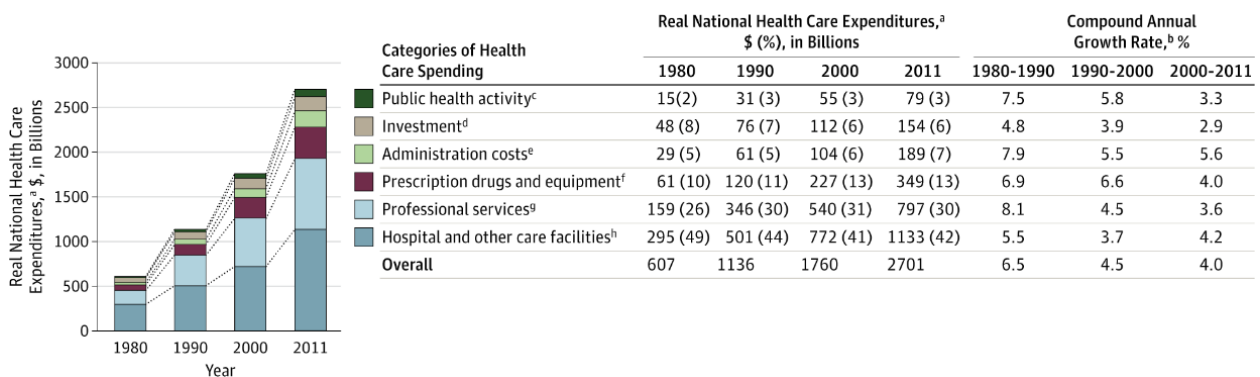
- * Relative to ourselves (Trends over time)
- * Relative to our peers (eg. OECD countries)

What are we getting for that money?

- * Substantial improvements in longevity over the past 3 decades
- * Employs 16% of the workforce
- * BUT, we have worse health outcomes compared with our peers.

Trends over time:

The figure below shows that US health care spending has increased substantially over the past three decades, even after adjusting for inflation.

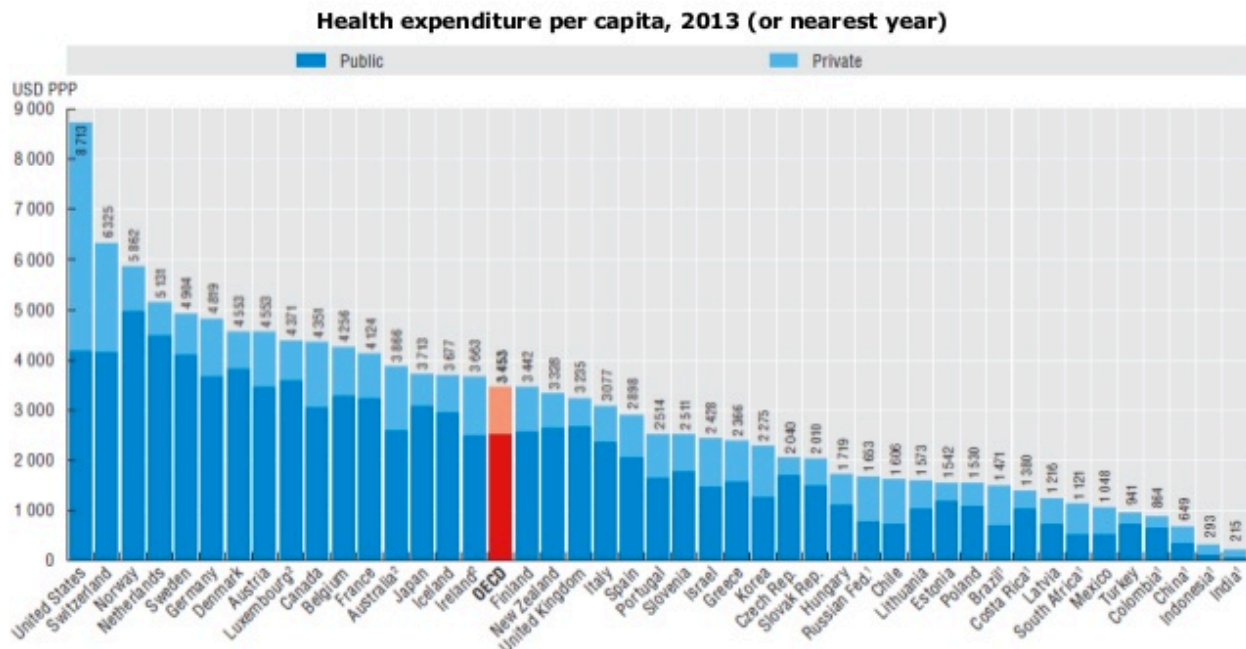


JAMA. 2013;310(18):1947-1964. doi:10.1001/jama.2013.281425

NB. **"Real" costs = after adjusting for inflation.** Compared this with "nominal" costs, which refers to costs before adjusting for inflation. In a country with an inflation rate of 5%, what costs \$100 in one year will cost \$105 in year 2. Thus spending \$105 represents a 5% increase in nominal costs, but no increase in real costs. Online calculators can help you estimate real costs by adjusting for inflation (they are called "GDP deflators").

Comparison with peers:

Health expenditure per capita varies widely across OECD countries. The United States spends two-and-a-half times the OECD average



Note: Expenditure excludes investments, unless otherwise stated.

1. Includes investments.

2. Data refers to 2012.

Source: OECD Health Statistics 2015, OECD; WHO Global Health Expenditure Database.

Question: What is the primary driver for the increase in health care costs for the US?

$$\text{Total Spending} = \text{Number of persons with coverage} \times \text{Intensity of resource use (per capita)} \times \text{Cost per unit resource}$$

Choices:

- Demographic change: Growth in population
- Demographic change: Aging
- Increasing use of resources per capita
- ☒ - Increasing cost of unit resource

#India

GDP: \$1.8 Trillion

Health ~4.7% = \$0.088 Trillion

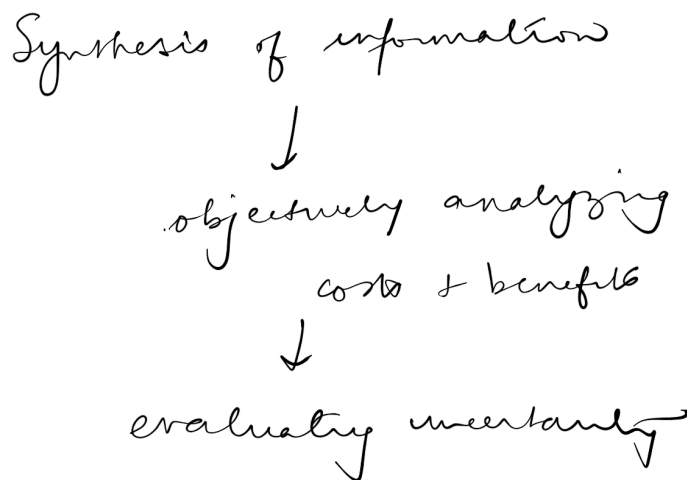
per capita = \$75 per year

But most of this is out-of-pocket spending. The public funds spent on health represent 1% of the GDP. **This high proportion of out-of-pocket spending has substantial implications for equity (wealthier folks have access to better care) and financial protection (a single health event such as a child with a diarrheal illness may impoverish the family).**

Conclusion:

Resource allocation is the ground reality across the economic spectrum

How do CEAs help?



Examples of CEAs:

Clinical

Among patients at high risk of cardiovascular disease, is it cost-effective to use the new cholesterol-lowering therapies known as PCSK9 inhibitors? (One of our case studies for the class)

Among persons living with HIV in Zimbabwe, is it cost-effective to screen for latent tuberculosis?

Among men who have sex with men in the US, is the use of pre-exposure prophylaxis (PrEP) cost-effective?

Public Health

Is it cost-effective to screen high school athletes for cardiovascular disease?

Is it cost-effective to screen all school age children in India for rheumatic valvular disease?

Social Policy

Is it cost-effective to tax sugar-sweetened beverages in San Francisco so as to reduce obesity and related complications?

Among persons experiencing homelessness in the California, is it cost-effective to provide housing with the goal of improving health outcomes?

Types of CEAs:

	Costs	Outcomes	Assumptions
COST ANALYSIS	✓	✗	$O_1 = O_2$ OR $O = ?$
EFFECTIVENESS ANALYSIS	✗	✓	$C_1 = C_2$ OR $C = ?$
	✓	✓	
	\$	\$	COST-BENEFIT ANALYSIS CBA
	\$	CLINICAL METRIC	COST-EFFECTIVENESS ANALYSIS CEA
	\$	"VALUATION" OF OUTCOMES	COST-UTILITY ANALYSIS CUA

Cost-benefit analyses, where both costs and benefits are expressed in monetary terms, are challenging in medicine because it is hard to put a dollar value on clinical outcomes. For instance, what is the dollar value of an averted stroke? They are more popular in other fields like the environmental sciences: what are the costs and consequences of a clean-air policy. Note the implicit monetary value in a carbon cap-and-trade scheme. CBAs are easier for the lay person to comprehend, and make intersectoral comparisons possible.

Cost-effectiveness analyses measure outcomes in terms of a clinical metric such as stroke averted or increase in survival.

Cost-utility analyses overlay clinical outcomes with a valuation of these outcomes. For instance, quality-adjusted life years, which incorporate survival (clinical metric) as well as quality-of-life (valuation).

What is a good research question?

CEAs are a LOT of work, so it's important to start with a good research question, one where there is **meaningful equipoise**. By which I mean that it is not immediately clear which of the strategies under consideration is clinically and economically superior, and there is a real possibility that the findings of this study should could meaningfully alter practice.

For this it's important to remember that the goal of a CEA is to maximize *efficiency* (i.e., the optimal or most efficient use of resources). However resource allocation decisions are about more than efficiency:

$$\text{RESOURCE ALLOCATION} = f(\text{efficiency, equity, political imperatives, other considerations})$$

How critical efficiency is to the overall process of decision-making may vary by circumstance. If your gestalt is that efficiency considerations will drive decision-making in a particular setting (e.g., a sophisticated donor trying to decide between various HIV screening programs), then that's a good question to study.

It follows that violations of efficiency do (and likely should) occur. For instance, it may be less cost-effective to provide services to a severely underserved population (think about nomadic tribes on the Tibetan plateau) than to provide services to an urban population, but equity considerations may drive that resource allocation decision.

TO BE CONTINUED NEXT WEEK:

Example of a Decision Tree:

Analyzing Output (ICERs 101):

Consider a medical condition X for which therapy A is the current standard of care. A new therapy B has been discovered and proven to be more effective than A; it is also more expensive than A.

$$\text{INCREMENTAL COST-EFFECTIVENESS RATIO (ICER)} = \frac{\text{Cost}_B - \text{Cost}_A}{\text{Outcomes}_B - \text{Outcomes}_A}$$

How does one interpret the findings? We'll discuss this in greater detail next time, but briefly, an intervention is considered "cost-effective" if its ICER is less than a certain established threshold.

For the US, used to be \$50,000/QALY, now \$100,000/QALY (arbitrary, consensus-based)
 For most Western European countries, a more explicit threshold of 20-30K euros per QALY
 For the UK, an implicit threshold of 15K-25K pounds per QALY

WHO recommendation (arbitrary):

ICER < 1 GDP per capita per QALY = highly cost-effective

ICER > 3 GDP per capita per QALY = not cost-effective

Sensitivity Analyses:

Alternative ways of dealing with uncertainty:

Example: 58 year old asymptomatic woman who presented with vertigo. Her primary care provider requested an MRI of the brain that showed an incidental cerebral artery aneurysm. The vertigo resolved and was attributed to labyrinthitis. How do we manage the aneurysm?

Alternative ways of dealing with uncertainty:

Dogmatism.	<i>All aneurysms should be surgically clipped.</i>
Policy/Tradition.	<i>At UCSF we clip all aneurysms.</i>
Experience.	<i>I've referred a number of aneurysm patients for surgery. They've done well.</i>
Whim.	<i>Let's clip this one.</i>
Nihilism.	<i>It really doesn't matter.</i>
Defer to experts.	<i>Vascular neurosurgeons say clip.</i>
Defer to patients.	<i>Would you rather have surgery or live with your aneurysm untreated?</i>

Or, DECISION ANALYSIS

Components of a CEA?

Caveats:

How this class is organized

Didactics Thu 1-3, Mission Hall 1407

Fast paced course, didactics + lots of out of class project work

2 units(+1 unit if needed for folks working on individual projects)

Teaching philosophy

Adult learning, self-directed

Minimal onerous assignments, focus on class project

Open to feedback: email TAs or me

Course Goals

Sophisticated consumers of CEAs (don't take them at face value!)

Sophisticated creators of CEAs

Effective (verbal and non-verbal) communicators of your findings and their implications

Preparing for class (~2 hours):

Required viewing, reading (for real)

Suggested reading (may be after class?)

In class (2 hours):

Interactive

No need to take notes

No laptop policy (may to revisit if there is a mutiny)

Class participation is strongly encouraged.

Homework Assignments (1 hour):

Minimal, to test key concepts

Answers provided after submission

Graded, but mostly on completion

No late submissions

May be a mid-term assignment (take home, UCSF honor code applies)
Will be online no later than Friday 5pm PST, due Wednesday evening 5pm PST

CEA Project (4-5 hours):

Groups of 2-3 (after class 2)

Individual projects ok but same requirements (+1 unit)

Tasks: Defining a question --> Evaluation background --> Developing a decision tree --> Defining input parameters --> Running the analysis --> Interpreting the output --> Conducting appropriate sensitivity analyses --> Effectively communicating findings -->

Written report (individual)

Pre-defined individual roles

Assigned project mentors +TAs

Written report: 600 words + 2 tables + 2 figures

Software:

TreeAge Pro

UCSF MyResearch

Other software? If you have a compelling need to use it. I strongly encourage you to try TreeAge for this class. You'll get farther.

Text Books:

- [Methods for the Economic Evaluation of Health Care Programmes](#) by M. F. Drummond et al. Oxford Medical Publications. 4th Edition. 2015.

- [Decision Modeling for Health Economic Evaluation](#) by Andrew Briggs, Mark Sculpher, and Karl Claxton. Oxford University Press. First edition. 2006.

Note: These books are recommend but not required.

Email Policy:

UCSF.CEA@gmail.com

Subject line: "Re: Epi213 Assignment"

TAs (1-2 business day response time) —> Kazi (response on Mondays and Thursdays)

Attendance Strongly Recommended:

Save the Date

Friday, February 10, 2017
8:30 am–5:00 pm
UCSF Mission Bay
Genentech Hall

The Fourth Annual Global Health Economics Colloquium: The Economics of Non-Communicable Diseases



Genentech Hall, UCSF Mission Bay
UCSF-Stanford-UC Berkeley Global Health Economics Colloquium
"The Economics of Non-Communicable Diseases"

- The economics of aging (in Costa Rica)
- What is the association between free trade and obesity?
- How does one think about the cost-effectiveness of fabulously expensive drugs (in the US)?
- What are the recent methodological advances in CEA?
- Review the Recommendations of the "Second Panel for Cost-Effectiveness in Health and Medicine"
- Ethics of CEA
- What are the priorities in health economics under #45

Register here:

\$15 students, \$60 faculty and staff, \$90 private sector
Purchase tickets at ghecon2017.eventbrite.com

For more information, contact Devon McCabe at GHECon@UCSF.edu

Summary:

Fast-paced class: you'll work hard but learn a LOT

Time commitment: 1-2 hours reading, 2 hours in class, 1 hour assignment, 4 hours class project

Assignment available Friday 5pm PST, due Wednesday 5pm PST

Group project: majority of your grade, majority of your learning

Software: TreeAge (1 per group)

Individual written reports: 600 words + 2 figures + 2 tables

Individual projects ok but only if able to commit that kind of time (+1 unit if working on individual projects).

Feedback?

Assignment due next week (check back online in 24 hours).

Thanks!