Cost-Effectiveness Analysis

Sherry Glied, Ph.D.
Mailman School of Public Health
Columbia University

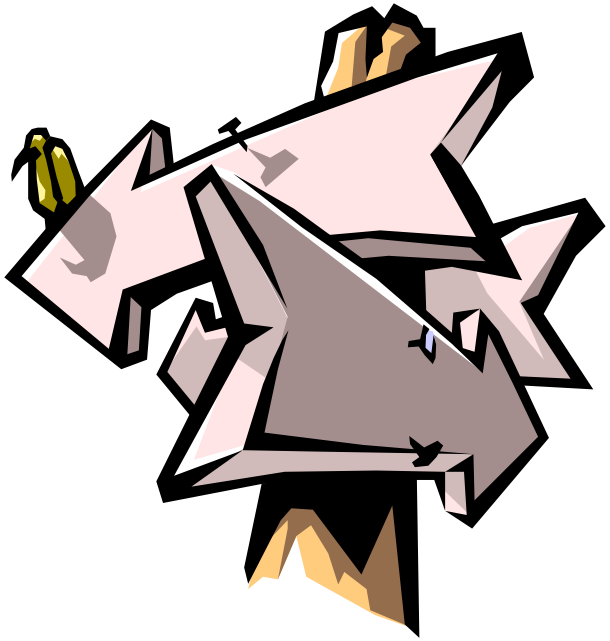
What is CE?

- Traditionally used to evaluate government interventions
  - roads
  - vaccines
- Now -- medical interventions
  - 8000+ Medline cites since 1997
  - clinical trials

Why?

- More health care choices
  - Use new antibiotics? Do additional tests?
- Increasing costs of health care
  - $4 billion cost of treating drug resistant strains in 1995
- Insurance
- Externalities
  - Person making decision may not bear full costs

- Explicit part of health service decision making
  - UK
- Medicare coverage decisions
  - pneumoccocal vaccine
- Private Insurers
  - one element in decisions



What is CE?

- A ratio
  - incremental costs/incremental outcomes
- A tool
  - evaluate tradeoffs
- A summary statistic
  - combine utilization and broad outcome

The Key Economic Question

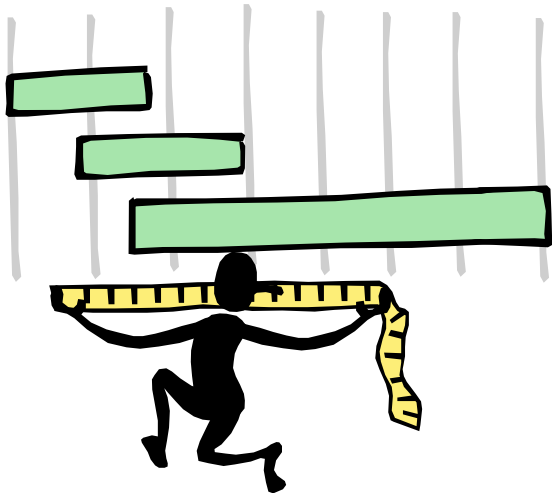
- Relative to what??

tradeoffs

CE Always Compares:

- New treatment to alternative treatment
  - BUT: Could be
    - no treatment
    - could be standard care
    - could be yet another alternative

What It Isn't



- Cost-effective ∴ cheaper
- Cost-effective ∴ cheaper per life saved
- Cost-effective ratio = how much ADDITIONAL cost per ADDITIONAL outcome gained?

Consider new treatment X relative to standard of care Y:

	Less $	More $
Worse Outcome	A?	~~B~~
Better Outcome	C	D?

Focus on More Costs, Better Outcomes

- CE asks first
  - How <u>much</u> more does X cost than Y?

- Suppose, for a population of 2000 patients:

X	Y
$15,000,000	$5,000,000

$10,000,000

- CE asks next
  - How <u>much</u> better outcomes does X achieve than Y?
  - Suppose intervention saves one year of life if it works
- Suppose, for this population:

X	Y
500 deaths	1000 deaths

500 life years saved

CE Ratio

$$\frac{\$15{,}000{,}000 - \$5{,}000{,}000}{1000\text{-}500}$$

$$= \frac{\$10{,}000{,}000}{500}$$

= $20,000 per additional life year saved

Note

- Treatment Y is cheaper ($2500 vs. $7500 per patient treated)

- Treatment Y costs less per life saved

  (15,000,000/1500) for X = $10,0000

  (5,000,000/1000) for Y = $5,000

Is Treatment X Cost-Effective?

- Recall CE ratio:

Relative to treatment Y, treatment X cost
$20,000 per life year saved

Is That Too Much?

- No simple answer
- Well within range of other interventions in wide use

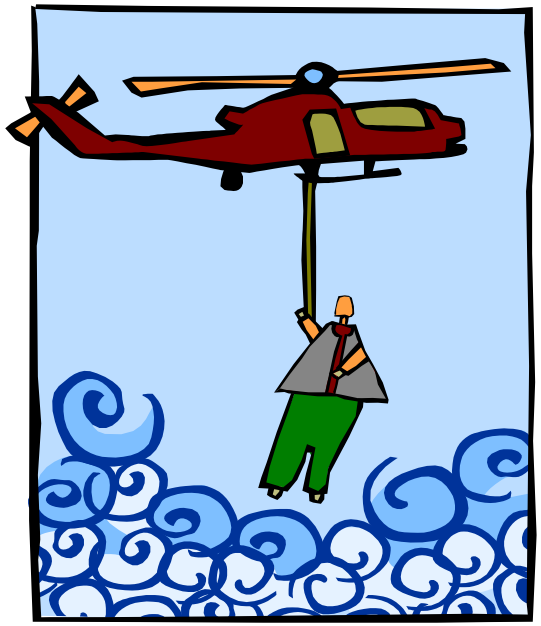
Cost-Effectiveness of Life-Saving Interventions

Intervention	Cost per Life-Year
Polio Vaccination	<$0
Mammography at 50	$ 810
55 MPH Speed limit	$ 6,600
2 vessel CABG	$28,000
Pneumonia vaccine for healthy adults <56	$66,000
Hypertension screening for asymptomatic 20 year old women	$87,000

- Now suppose instead for this population:

X	Y
500 deaths	501 deaths

1 life year saved



CE Ratio

$$\frac{\$15{,}000{,}000 - \$5{,}000{,}000}{501\text{-}500}$$

$$= \frac{\$10{,}000{,}000}{1}$$

= $10,000,000 per additional life year saved

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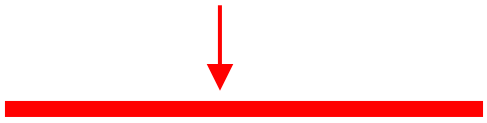
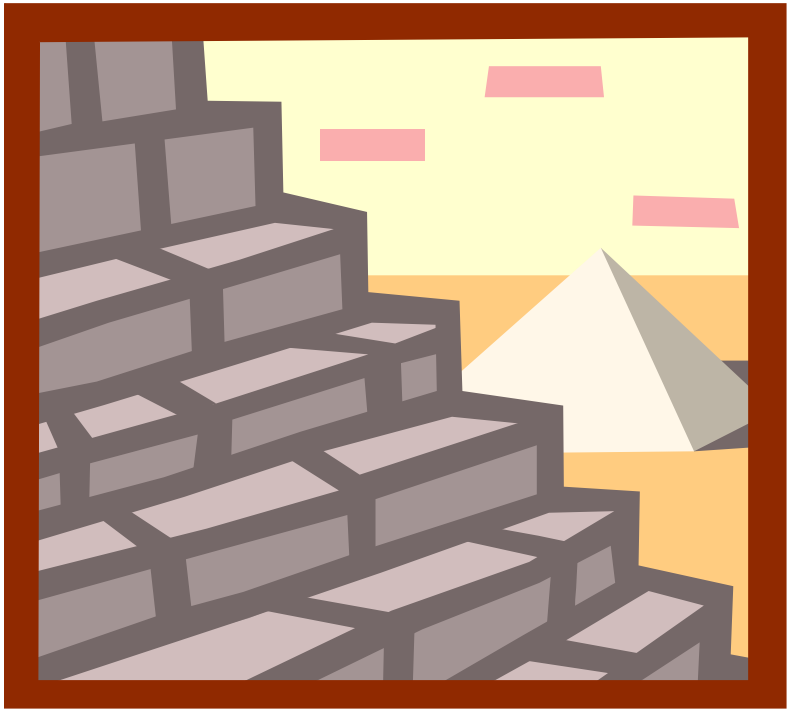


What does this mean?

- CE doesn’t say “DON’T DO IT!!”
- CE says -- “CONSIDER THE TRADEOFFS”

Walk Through Steps

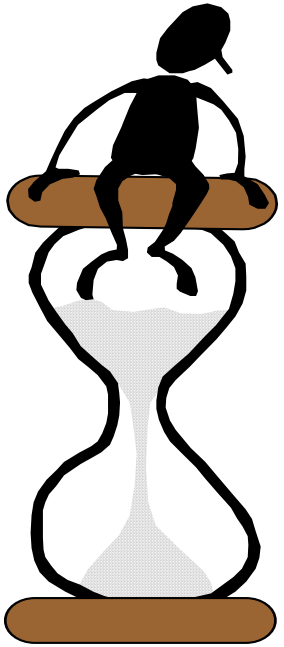
- Identify two alternatives
- Choose perspective
- Define population
- Measure costs
- Measure outcomes
- Compare
- Assess



Alternatives

- Generally, choose options that address:
  - similar outcomes
  - similar population
- Well suited to clinical trial

Perspective



- Patient
  - What will it cost me?
  - What will happen to me?
- Provider
  - How much will providing service cost?
  - What benefit from better outcomes?

Perspective

- Payer
  - Insurer or Medicare
    - What does it cost me to provide this now…
      - rather than treat it later
        - » if the person still belongs to my health plan etc…

Societal Perspective

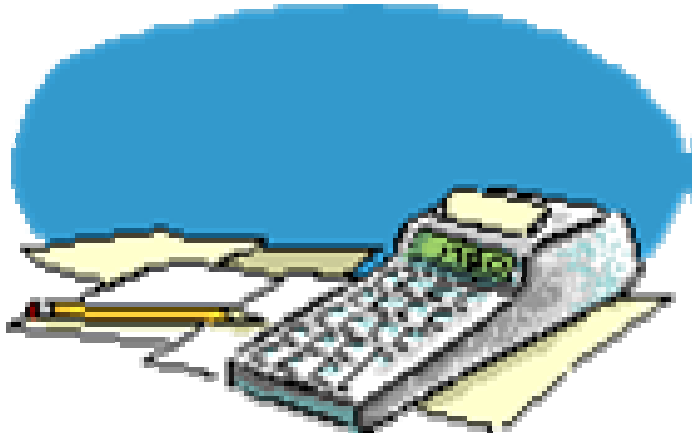
- Preferred choice
- All costs -- no matter where incurred
- All outcomes -- no matter who they happen to (this patient + others)
- All time periods -- now and in the future
- Critical in case of externalities

Population

- Best to compare costs and outcomes in statistically similar populations
  - want the true effect of the interventions
- Can look at incremental analyses within population:
  - cost-effectiveness of X vs. Y for women vs. men

Costs

- Health care utilization
  - drugs, hospital, physician visits, nursing homes
- Other directly incurred costs
  - home aide, transportation costs
- Time costs
  - patient, family members
- Work losses (?)



Outcomes

- Want these to be:
  - broad
  - generalizable

Outcome options

- clinical endpoints
  - Cases of resistant disease
- Lives saved
  - 1 year vs. 10 years
- Life years saved
  - pain vs. no pain
- Quality-adjusted Life-Years saved

QALYs

- Subjective assessment of health state at each point in time

- How long and how well do you live?

Ask directly

- Questions about tradeoffs
  - Live 1 year in good health, then die instantly

  OR

  - Live 10 years in condition A, then die instantly

Infer from Survey

- Construct QALYs based on validated survey instruments

Compare

- Intervention A

Cost = x

QALYs gained = q

- Intervention B

Cost = y

QALYs gained = p

CE: A vs. B =

x-y/(q-p) =

$ per QALY

What is learned?

- Were outcomes confined to clinical endpoints or was quality of life, from subjective perspective, improved?
- Did we achieve outcomes at enormous cost or at moderate cost?
- Did some groups gain more than others?
- What is the best way -- in terms of “bang for the buck”-- to target intervention?