Epi213_Lecture 2_v2018

Cost-Effectiveness Analyses in Medicine and Public Health

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Agenda for the day

1. Logistical issues re homework
2. Quick review: what makes a good question, ICERs, cost-effective v cost-saving
3. Components of a CEA: PICO-HS
4. Key concept: expected value
5. Decision tree
6. Base-case and sensitivity analyses
7. Key steps in formulating a decision tree
8. Reference case
9. If time permits: rates v probabilities, discounting
10. Plan for next week
11. Sign up for the colloquium? Feb 10, 2017

Any logistical issues re homework?

Email jig your completed homework assignments by Tuesday evening 5pm PST at UCSF.CEA@gmail.com
Expect corrected homework + answer key in response.
Homework will constitute 20% of your eventual grade.

What constitutes a good research question?

***meaningful* equipoise**

RESOURCE ALLOCATION = f (efficiency, equity, political imperatives, other considerations)

Incremental Cost-Effectiveness Ratio (ICER):

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.

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

“Thresholds”:

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

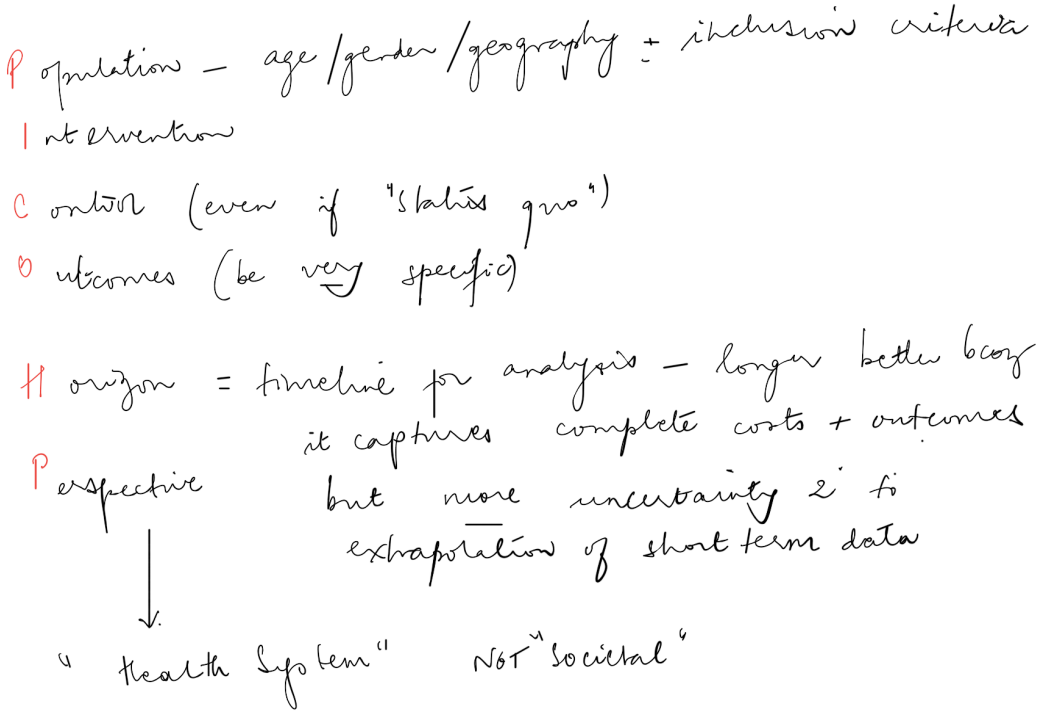
WHO recommendation (arbitrary):
ICER < 1 GDP per capita per QALY = highly cost-effective
ICER > 3 GDP per capita per QALY = not cost-effective

Cost-Saving vs. Cost-Effective

Cost-saving implies implementing the new intervention generates the same or better outcomes but at a lower cost. Thus the new option is called the *dominating* option (aka a "no brainer").

Cost-effective implies that the new intervention/strategy being evaluated costs more but the improved outcomes would make the additional investment seem worthwhile or of reasonable value. In a practical sense, one would calculate the incremental cost-effectiveness ratio and compare it with some *willingness-to-pay* threshold (e.g., 100,000 dollars per quality-adjusted life year), and if ICER <= WTP, we would declare it cost-effective.

Components of a good CEA question



Discuss Examples of good CEA questions

Among gay men age 35-45years in San Francisco, is the provision of an online behavioral intervention cost-effective relative to usual care in reducing tobacco use and improving quality-adjusted survival using a 10-year analytic horizon and a health system perspective?

Among persons age 25-60 years in India who have a previous history of coronary heart disease, is treatment with a fixed dose combination pill of evidence-based medications cost-effective relative to usual care, considering a health system perspective and a lifetime analytic horizon?

Key concept:

Expected value

Estimate the expected values in the following scenarios:

Scenario 1
50% chance of survival for 10 years,
25% chance of survival for 5 years, and
25% chance of immediate death.
Expected survival = _6.25__ years

Scenario 2
1% chance the cost is $1,000,000,
33% chance the cost is $100,000,
33% chance the cost is $10,000, and
33% chance the cost is $0.
Expected cost = $__46,300

Creating a Decision Tree

Background: A woman is incidentally discovered to have a 6mm aneurysm (dilatation) of a blood vessel in the brain. These aneurysms are usually asymptomatic but still at risk of spontaneously bursting and bleeding into the brain, resulting in severe disability or death. The alternative is to surgically clip the aneurysm; this surgery carries a risk of peri-op mortality; but survivors can expect a normal life expectancy. **Should our patient have surgery?**

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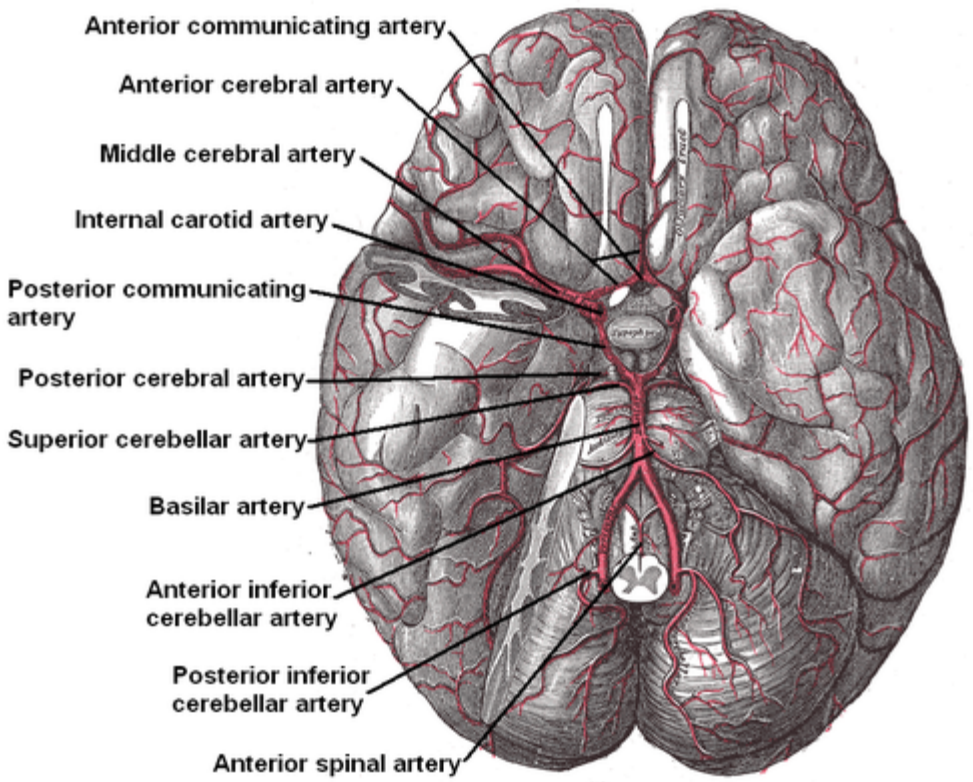
Research Question:


Anterior communicating artery
Anterior cerebral artery
Middle cerebral artery
Internal carotid artery
Posterior communicating artery
Posterior cerebral artery
Superior cerebellar artery
Basilar artery
Anterior inferior cerebellar artery
Posterior inferior cerebellar artery
Anterior spinal artery

Among persons with asymptomatic intracerebral aneurysms (6mm in diameter), is surgical clipping cost-effective relative to watchful waiting from a health system perspective and a lifetime analytic horizon.

Decision Treel (see attached triage file by Aida).

Input parameters:

Transition Probabilities:
Life Expectancy from diagnosis = 35 years
Lifetime risk of rupture with watchful waiting = 5.0%
A ruptured aneurysm would require emergent surgery: 45% will die, 25% will have severe disability, the remaining will survive
Surgical mortality = 2%
If successfully operated, normal life expectancy (35 years)

Costs:
Elective Surgery: $30,000
Emergent Surgery and recovery: $150,000
Disabled care (lifetime): $1,000,000

Quality of Life:
Full Health = 1
Severe disability = 0.3
Death = 0

Base-Case Analysis

Sensitivity Analyses

What if the surgical mortality ranged from 2 to 10%
What if the cost of elective surgical clipping ranged from $15,000-$60,000

Key Steps in a Decision Analysis:

- Meaningful question
- Clearly define PICO-HS, particularly Outcomes
- Search for transition probabilities

- Search for outcomes and costs
- Perform a base-case analysis
- Perform sensitivity analyses
- Communicate your findings

General Approach:

- Ask a meaningful question
- Start simple, then iteratively expand/ealborate
- Allocate approximately equal time to the decision tree, data collection, sensitivity analyses, and communication
- Delve into and enjoy modeling. Have fun with the nuances. Master the challenges.