

Cost-Effectiveness Using Decision-Analytic Models

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Overview

- This presentation will focused on the decision-making process and fundamental models used in cost-effectiveness analysis.
- Examples of Cost-Effectiveness Analysis
- Limitations and strengths will be discussed.
- Resources for further discussion.

Learning Objectives

- At the end of the presentation, you will learn the following for your own study design:
 - the decision-making process.
 - the framework used in decision-analytic model.
 - the application in cost-effectiveness analysis.

Outline of Presentation

1. Concept of “PROACTIVE” in Modeling.
2. Structure of Decision Analysis
3. Components of Cost-Effectiveness Analysis
4. Research Studies
5. Limitation and Strengths
6. Resources

Decision Analysis

“A good decision is a logical decision – one based on *uncertainties, values, and preferences* of a decision-maker.”

Ronald Howard

Professor, Stanford University

PROactive

Step 1: Defining the problem

P: Problem

R: Reframe the perspective

O: Objectives of interest

proACTIVE

Step 2: What are the alternatives, consequences and trade-offs?

A: Consider Alternatives.

C: Model Consequences

T: Identify Trade-offs.

proact**IVE**

Step 3: Integration and exploration

I: Integrate evidence

V: Optimize Expected Value

E: Evaluate Uncertainty.

PROACTIVE

P: Problem

R: Reframe

O: Objectives

A: Alternatives

C: Consequences

T: Trade-offs

I: Integrate

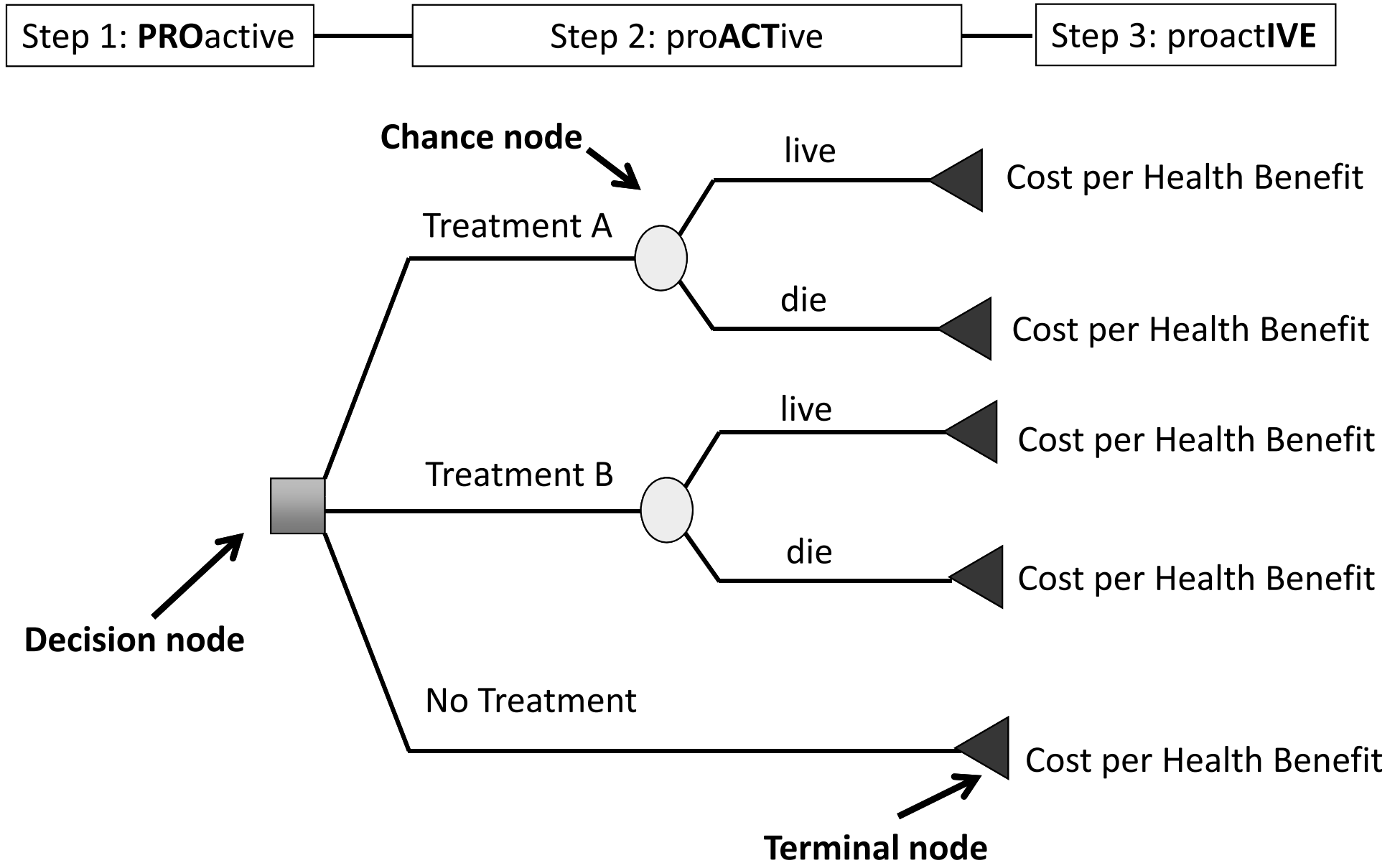
V: Value

E: Evaluate

A Decision Tree

A visual representation of all the possible options and the consequence that may follow each option.

Decision Analysis Tree



Cost-Effectiveness

- Using decision-analytic models to consider the economics costs of health care.
- Health resources are consumed in order to produce health benefits.

Research Questions

- What is the most efficient use of this health resources, given the alternative uses?
 - Time
 - Resources
 - Cost

Time-effectiveness



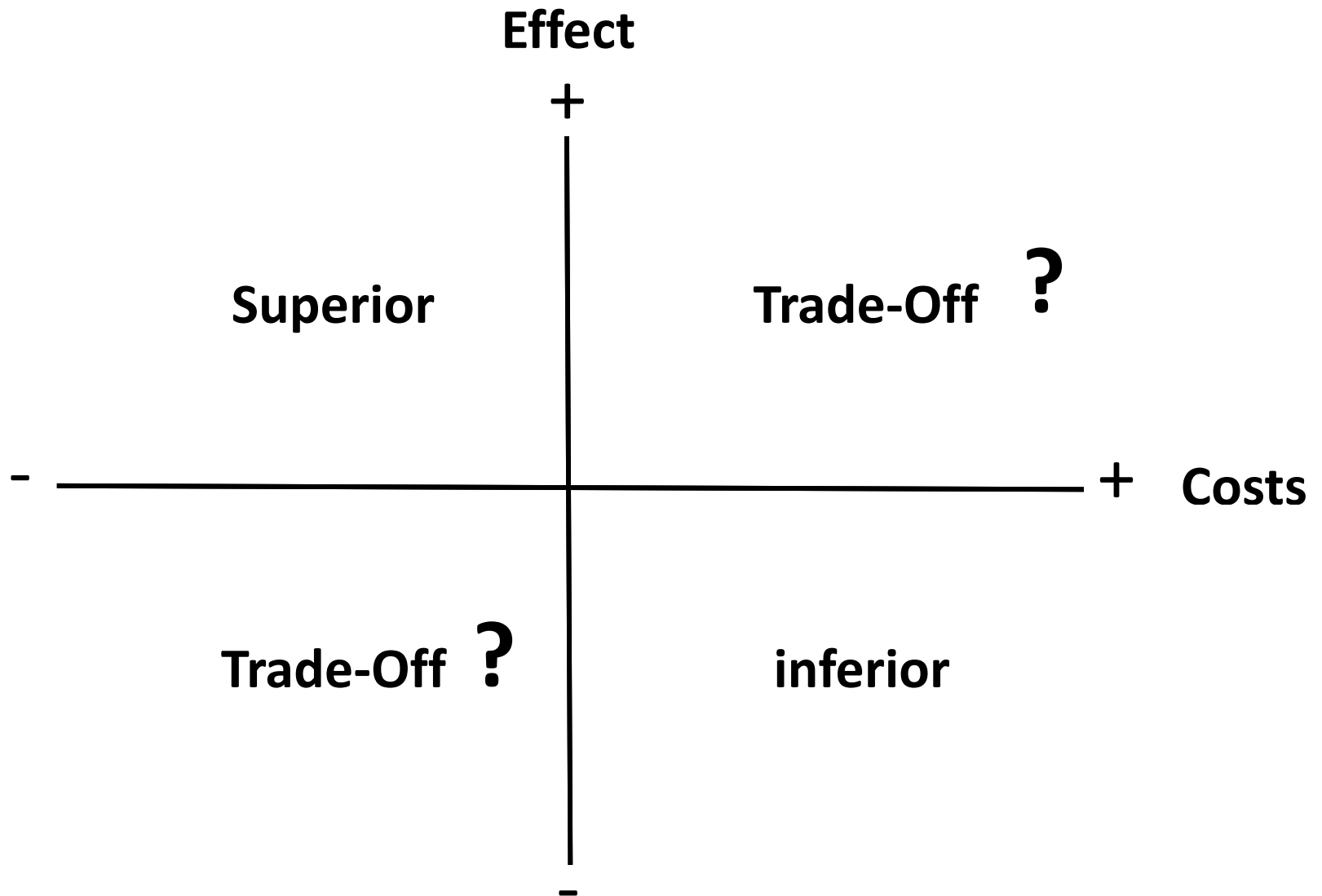
An hour of a physician's time spent with one patient is unavailable for another patient.

Resource-effectiveness

- Health resources are consumed in order to produce health benefits.
- Resources used for one program cannot be spent to increase the program use of another or invest in new program.



Cost-Effectiveness Graph



Cost-effectiveness

- Common measure of costs & health effectiveness.
- Measure can be expressed as
 - Cost
 - Case of disease prevented
 - Lives saved
 - Years of life saved
 - Quality adjusted life year

Perspective

- A range of decision-makers confront these decisions.
 - Societal perspective
 - Patient
 - Provider
 - Organizational

Different Types of Cost

- *Total Resource Use* includes different types of cost
 - Health care resource
 - Nonhealth care resource

Cost Calculation

- Laying out the cost
- Categorize the cost in term health vs. non-health cost
- Organize the sequence of event
 - Initial cost
 - Induced cost
 - Adverted cost
- Consider short or long-run resource cost

Probabilities

- Probability is the chance of the event.
- Range in 0 to 1.0
- 0 = event is impossible
- 1 = event is certain
- 0.5 = the event is equally as likely to occur as not to occur

Preferences

- Preference-based measures reflect the values an individual has for a particular health states or the relative desirability of health outcome.

Effectiveness

- Health benefits in CEA can be expressed as
 - Single measure of health outcome
 - Number of Cases Prevented
 - Number of Cases of Cancer Detected
 - Number of Hospital Days Reduced
 - Combined measures
 - Quality Adjusted Life Years (QALYs)

Using cost-effectiveness analysis

- Cost-effectiveness using decision-analytic modeling
 - summarize large amount of information.
 - clarify the decision-making process.
 - compare the different scenarios in complex system.

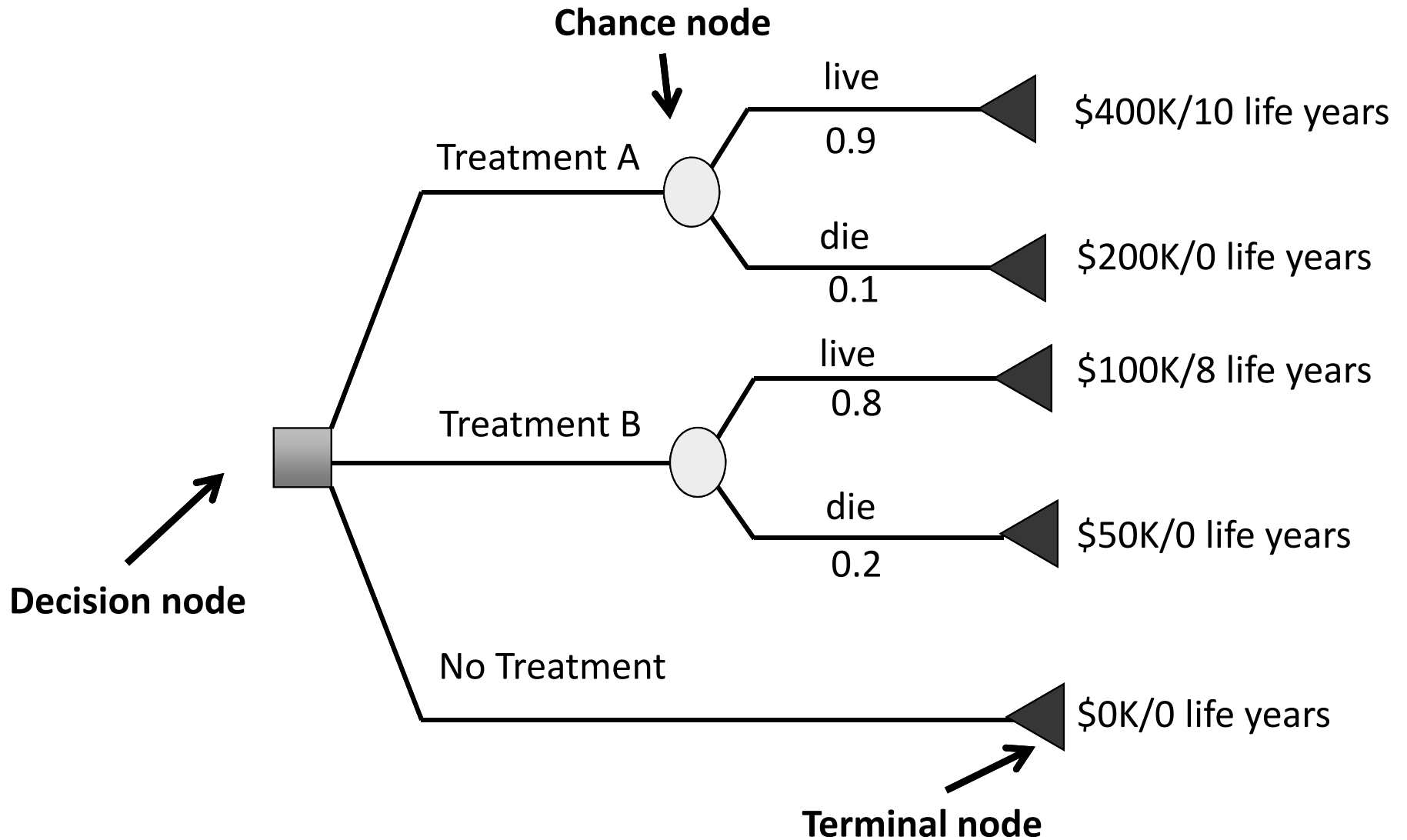
Incremental Cost-effectiveness ratio (ICER)

Incremental cost-effectiveness ratio (ICER)

- costs to benefits and is expressed as \$ per life saved or the cost per QALY saved.

$$\frac{\text{Cost}_{\text{intervention A}} - \text{Cost}_{\text{intervention B}}}{\text{Effectiveness}_{\text{intervention A}} - \text{Effectiveness}_{\text{intervention B}}}$$

Decision Analysis Tree



Incremental Cost-Effectiveness Ratio (ICER)

Question: Is the extra health benefit worth the extra cost?

\$400K intervention A **−** **\$100K** intervention B

10 life years intervention A **−** **8 life years** intervention B

ICER =

\$300 K per 2 life years = \$150K / life year

Answer: If intervention A is chosen, the additional investment of \$150K results in one additional life year, relative to Intervention B.

Handling Uncertainty

Parameter and Model structure uncertainty addressed using sensitivity analyses.

- One-Way
- Two-Way
- Multi-way
- Probabilistic

Examples

Cost-effectiveness Studies Registry

<https://research.tufts-nemc.org/cear4/>

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CEVR Updates and Events

- The CEA Registry is now updated through 2011. Search the Registry. Read our blog post.

NEWS

- Health Affairs article asserts that "Medical groups can reduce costs by investing in improved quality of care for patients with diabetes."

BLOG

CEA Registry Data Update for 2011 Studies

Dear Friends: The Tufts Cost-Effectiveness Registry (www.cearegistry.org) is now updated with cost-utility studies published through 2011.

Limitations

- Availability of Data
- Modeling vs. Real-time Experiment
- Assumption
- Uncertainty

Strengths

- Illustrate a Visual Aid.
- Formulate Objective.
- Evaluate Complex System.
- Inform Policy and Guidelines.
- Guide Research.

References and Resources

- *Cost-effectiveness in Health and Medicine*, Gold, Siegel, Russell, and Weinstein, eds. (1996), New York: Oxford Univ. Press.
- *Decision Making in Health and Medicine*, Hunink, and Glasziou (2001), Cambridge University.
- *Decision Modelling for Health Economic Evaluation*, Briggs, Claxton, and Sculpher (2007), Oxford Univ. Press.
- *Designing and Conducting Cost-Effectiveness Analyses in Medicine and Health Care, 2nd Ed.*, Muennig. (2007), New York: Oxford Univ. Press.
- Software: TreeAge

HERC resources

<http://www.herc.research.va.gov/home/default.asp>

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Summary

- Use “PROACTIVE” modeling in your design.
- Construct a decision analysis tree.
- Use cost-effectiveness analysis.
- Compare research studies.
- Understand the limitations and strengths.
- Find resources and references.

Contact Information

*If you have any questions or would like to collaborate,
please contact me:*

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