Health Economics - Exercise
Cost Effectiveness Analysis in Health Care

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Objectives

The objective of the seminar is to develop and analyse a decision tree and in particular to do so to conduct a cost-effectiveness analysis.

Basic tree

The basic tree being built based on the example reported in Georgeson, S., Meyer, K.B. and Pauker, S.G. (1990) "Decision analysis in clinical cardiology: when is coronary angiography required in aortic stenosis?" Journal of the American College of Cardiology 15: 751-762.

The decision problem

The question in the Georgeson example: "Is Coronary Angiography Necessary before Aortic Valve Replacement?"

Scenario and question: A 63 year old woman presents with severe aortic stenosis. She has no angina and no special risk factors for Coronary Artery Disease (CAD). Aortic valve replacement (AVR) is recommended. Should she undergo preoperative coronary angiography?

Basic data from literature review:

- coexisting CAD increases operative mortality of AVR for aortic stenosis
- prevalence of CAD in patients with aortic stenosis: 40-80%; prevalence in general population of 60 to 70 year olds: 10-15% in men and 5-10% in women
- patient medical history, physical examination and Electrocardiogram (ECG) do not differentiate reliably patients with aortic stenosis and CAD from patients with stenosis alone.

Basic tree: Short term model – utility assessment

- Decision: angiography (catheterization)/ no angiography (no catheterization)
- With no angiography the patient undergoes the aortic valve replacement but the probability of survival depends on whether the patient has coronary artery disease

- The utility of survival is assigned a value of 1, while the value of death is assigned a value of 0.
- If angiography then there is a chance of death from angiography or alternatively if survive angiography and will go on to have surgery
- The angiography will show whether the patient has coronary artery disease
- If the patient has coronary artery disease then patients undergo aortic valve replacement and a coronary artery bypass graft (CABG).
- If the patient does not have coronary artery disease then the patient undergoes aortic valve replacement only
- With either alternative there is a probability of surviving or dying

Probability of short term events

Variables	Baseline value
Probability of dying at angiography	0.002
Probability of CAD	0.067
Probability of dying at AVR alone, non CAD	0.028
Probability of dying at AVR with CAD, but without CABG	0.122
Probability of dying at AVR with CAD and CABG	0.061

- the **utility** of survival is assigned a value of **1**, while the value of death is assigned a value of **0**

Additional information:

Cost data
Angiography = $1,000
Aortic valve replacement $10,000
AVR and CABG = $11,000

Life expectancy:
AS without CAD = 13.3 years
AS with CAD, no CABG = 6.2 years
AS with CAD, CABG = 8.8 years

Exercise

1) **Perform a cost-effectiveness analysis producing:**
    a. **a decision tree**
    b. **Calculate expected costs and benefits**
    c. **Calculate ICER**

Medical definitions:

Aortic valve stenosis: disease of the heart valves in which the opening of the aortic valve is narrowed. Decreases blood flow from the heart. Main symptom is shortness of breath on exertion. Most commonly caused by age-related progressive calcification of the aortic valve

Coronary Artery Disease: The disease is caused by plaque building up along the inner walls of the arteries of the heart, which narrows the arteries and restricts blood flow to the heart. It limits blood flow to the heart muscle, and is most common cause of heart attack.

Aortic valve replacement: The aortic valve is removed and replaced with an artificial valve.

Coronary angiography: Diagnostic test that uses dye and special x rays to show the insides of coronary arteries.

Coronary artery bypass graft (CABG): Operation that diverts blood around narrowed or clogged parts of the major arteries (blood vessels), to improve blood flow and oxygen supply to the heart. It involves taking a blood vessel from another part of the body, usually the chest or leg, and attaching it to the coronary artery above and below the narrowed area or blockage. The graft diverts the flow of blood around the part of the coronary artery that is narrowed or blocked.

Health Economic Definitions:

Decision tree: a visual representation of a decision problem intended to help people make better decisions. Each node represents either a choice by the decision-maker, a probabilistic outcome, or a terminal node. A decision tree can be used to determine the probability and net value of benefits and costs depending on which treatment alternatives are chosen.

Expected value: the expected value is calculated as the sum over all possible outcomes of the probability of the outcome multiplied by the value of the outcome. Can be calculated for both the costs and the benefits of a treatment.

Sensitivity Analysis: sensitivity analysis allows for uncertainty within an economic evaluation. It shows how responsive the result is to changes in key economic parameters. Values are varied around key parameters to see if the results are sensitive to such variations.