IE 485

Decision Making in Health Care

Course Objectives

The purpose of this course is to provide an introduction to the use of **decision sciences in health-care industry**.

As the pressures of managed care and increasing health care costs push providers, payers and purchasers of health care to become more efficient, methods for understanding the appropriate basis for how to allocate shrinking health care resources must be understood.

Course Objectives

In addition to developing a conceptual understanding of medical decision making, you will develop technical skills in decision analysis including:

- The creation and evaluation of decision trees
- The use of sensitivity analysis,
- Using Markov processes
- Incorporation of specific patient preferences through the use of utility analysis
- The use of multi-criteria decision making tools in health care resource allocation.

Examples from the current medical literature will be discussed.

Decision Making Process

Decision Making:

The study of **identifying** and **choosing** alternatives based on the **values** and **preferences** of the decision maker.

Harris, R. (1998) Introduction to Decision Making, VirtualSalt. http://www.virtualsalt.com/crebook5.htm

Decision Making in Health Care

The decision makers in health care services: those who plan, provide, receive, or pay for it

Health care policy making: MoH, SSI

Medical decision making:

Physicians must frequently choose treatment long before they know which disease is present

Even when the illness is known one must usually select from **among several treatment options** the consequences of each cannot be foretold with certainty.

Decision Making in Health Care

Some example decision settings:

- Should clinicians check the blood pressure of each adult who walks into their offices?

- Should health care planners start a breast cancer screening programme?

- Should local health departments free scarce resources used for cancer treatments to increase the care for new-borns?

The Creation and Evaluation of Decision Trees

- This lecture focuses on determining the appropriate clinical strategy for patients

- The analysis method involves building a decision tree, evaluating the tree and performing sensitivity analysis

Medical Decision Analysis

Decision Analysts

- Deliberatively seek out new creative alternatives
- Identify possible outcomes
- Identify relevant uncertain factors
- Encode probabilities for the uncertain factors
- Specify the value placed on each outcome (cost, QALYs, LE)
- Formally analyze the decision

Decision Analysis Using a Decision Tree

A construction worker with a badly infected compound fracture of the left ankle presents to your consulting room.

The infection is not only threatening to destroy the ankle itself, but is spreading proximally and the septic complications are potentially life threatening.

You are now faced with the difficult decision:

(1) Should you perform a below knee amputation immediately?

(2) Should you perform a surgical debridement followed by antibiotic treatment to save the ankle?

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Although the second option offers a chance of complete recovery , it is associated with a substantial risk of infection that spreads, possibly leading to an above or below the knee amputation, or even death. Even this second option is successful, there is still a chance of minor long term disability of the limb.

Question:

What is the main clinical problem here?

a) Headache

b) Fractured ankle

c) Broken arm

What is the choice that has to be made?

You are now faced with the difficult decision:

(1) Should you perform a below knee amputation immediately?

(2) Should you perform a surgical debridement followed by antibiotic treatment to save the ankle?

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- What is the choice that has to be made?
- Below knee amputation
- Debridement and antibiotics

- What are the possible outcomes?

You are now faced with the difficult decision:

(1) Should you perform a below knee amputation immediately?

(2) Should you perform a surgical debridement followed by antibiotic treatment to save the ankle?

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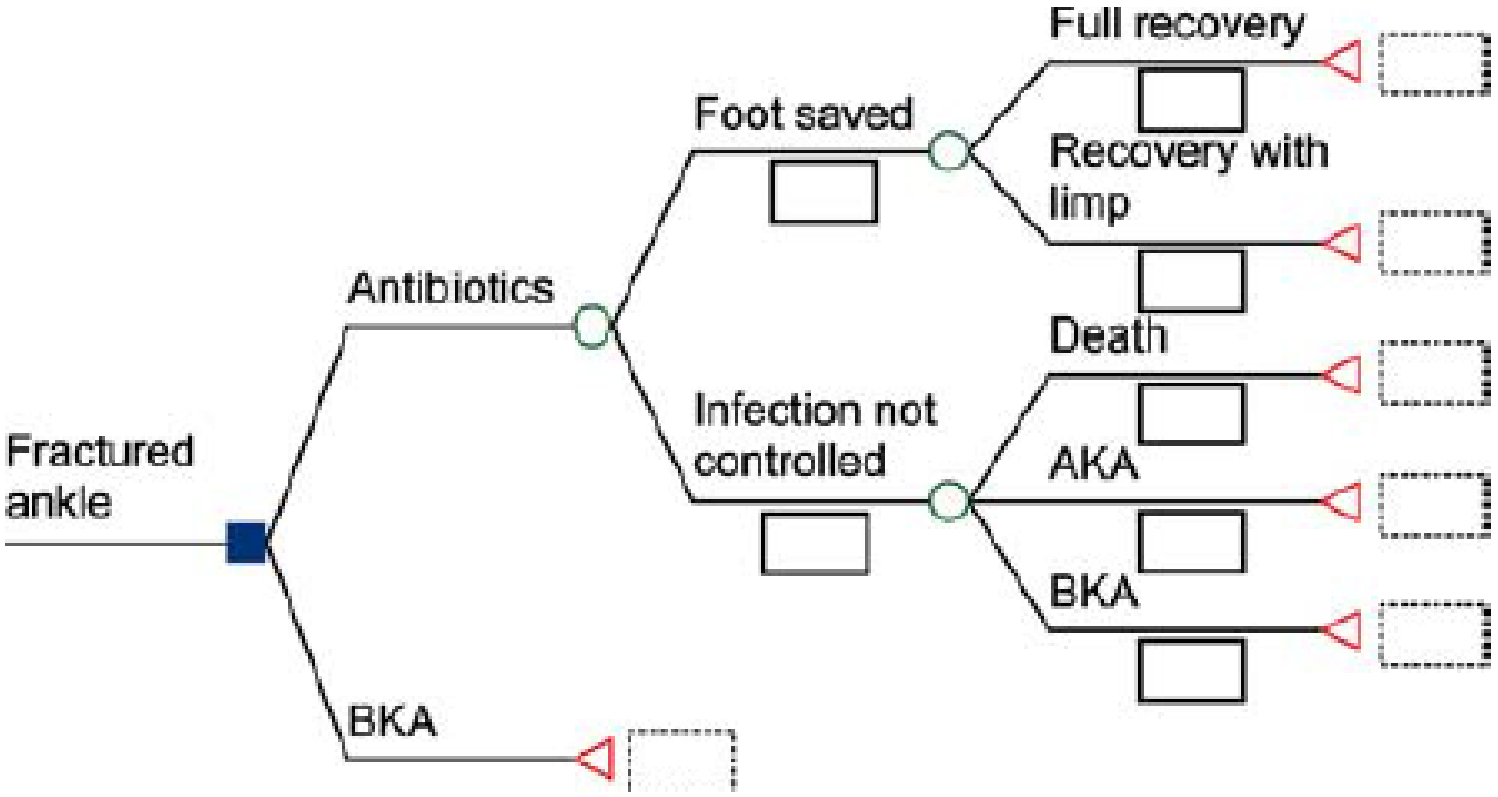
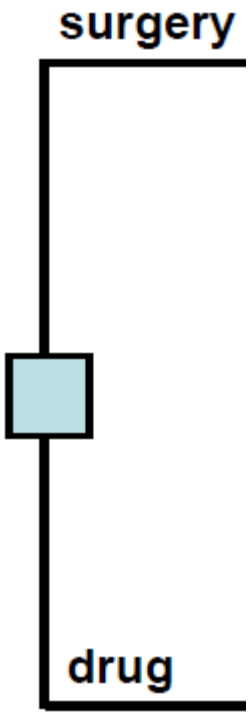
- What are the possible outcomes?
  - If the first option is chosen: BKA
  - If the second option is chosen: (We do not know whether infection will be controlled)
    - If not controlled: BKA, AKA or death
    - If controlled: Full recovery or recovery with limp


Fractured ankle
Antibiotics
BKA
Foot saved
Infection not controlled
Full recovery
Recovery with limp
Death
AKA
BKA

Elements of a Decision Tree

Decision Node: A point in a decision tree at which several choices are possible. The DM controls what is chosen

The choices should be mutually exclusive



Mutually exclusive:

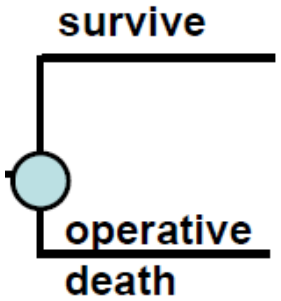
The intersection of the events is empty

One and (only one) of the events must occur

Elements of a Decision Tree

Chance Node: A point in decision tree at which chance determines which outcome will occur

The outcomes should be mutually exclusive and collectively exhaustive



Collectively exhaustive

The set of events take up the entire outcome space

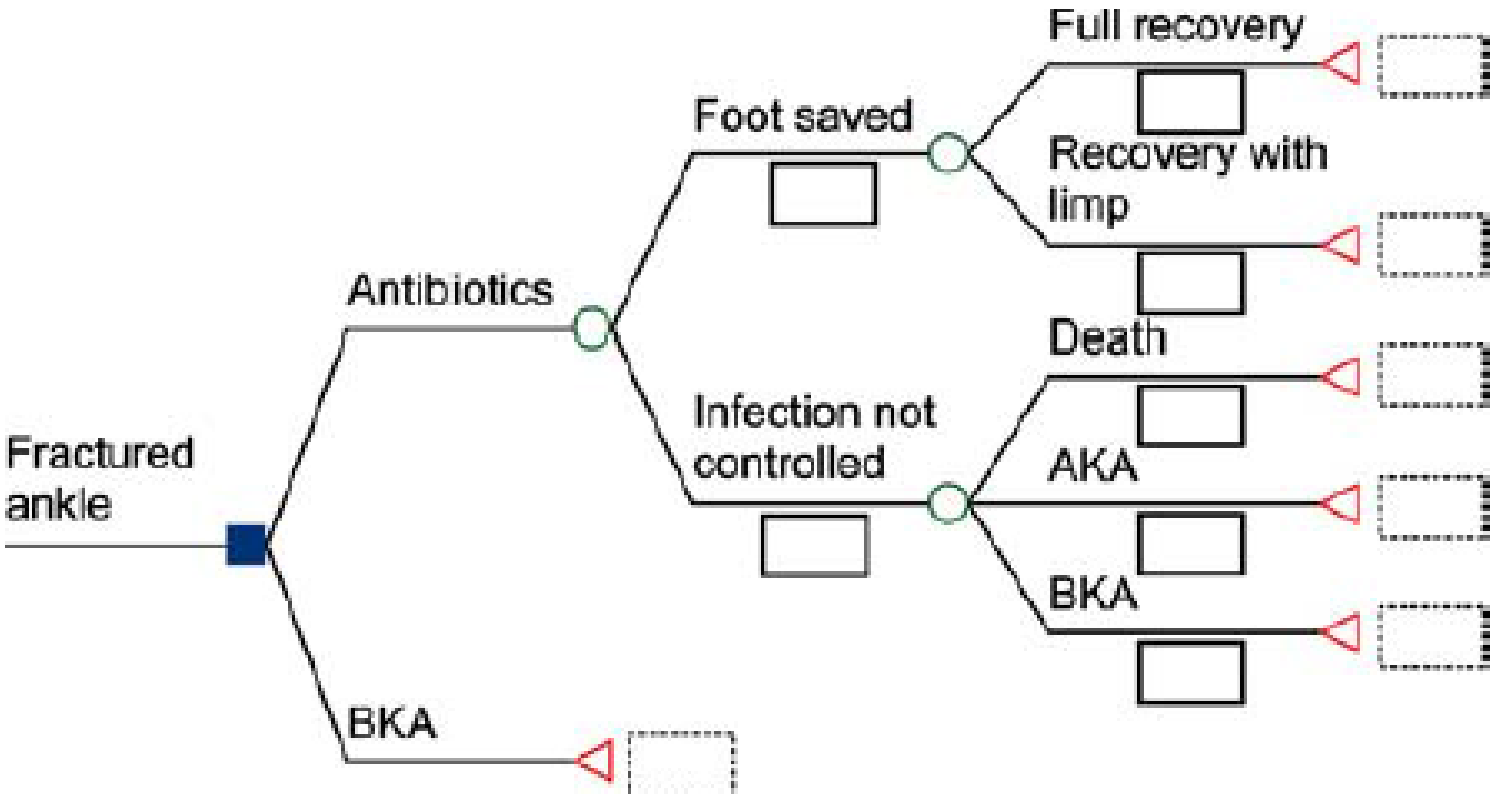
At least one of the events must occur

- Terminal Node: Final outcome state associated with each possible path way

Elements of Decision Analysis

- Structure the Problem
  - Identify decision alternatives
  - List possible clinical outcomes
  - Represent sequence of events
- Assign probabilities to all chance events
- Assign utility or value, to all outcomes
- Evaluate the expected utility of each strategy
- Perform sensitivity analysis

Structure the problem:



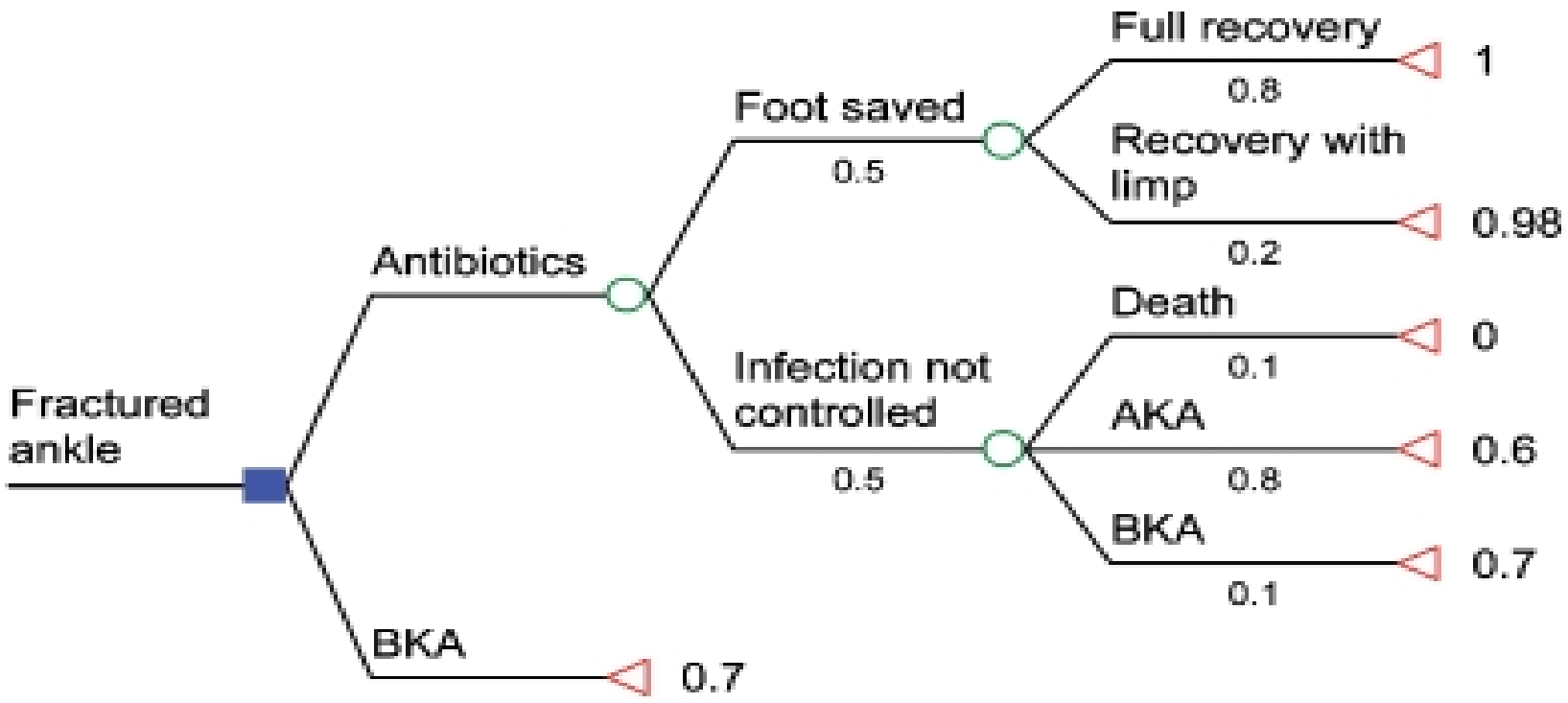
Elements of Decision Analysis

- Structure the Problem
  - Identify decision alternatives
  - List possible clinical outcomes
  - Represent sequence of events
- **Assign probabilities to all chance events**

Table 1. Representative Probabilities to be Assigned to All Outcomes Represented in the Decision Tree in Tip 1

Outcomes	Probability
Probability of foot saved using antibiotics	0.50
Probability of full recovery after foot saved	0.80
Probability of recovery with limp after foot saved using antibiotics	0.20
Probability of death after infection is not controlled by antibiotics	0.10
Probability of above the knee amputation if infection not controlled by antibiotics	0.80
Probability of below the knee amputation if infection not controlled by antibiotics	0.10
Probability of survival after immediate below knee amputation	1.00

A

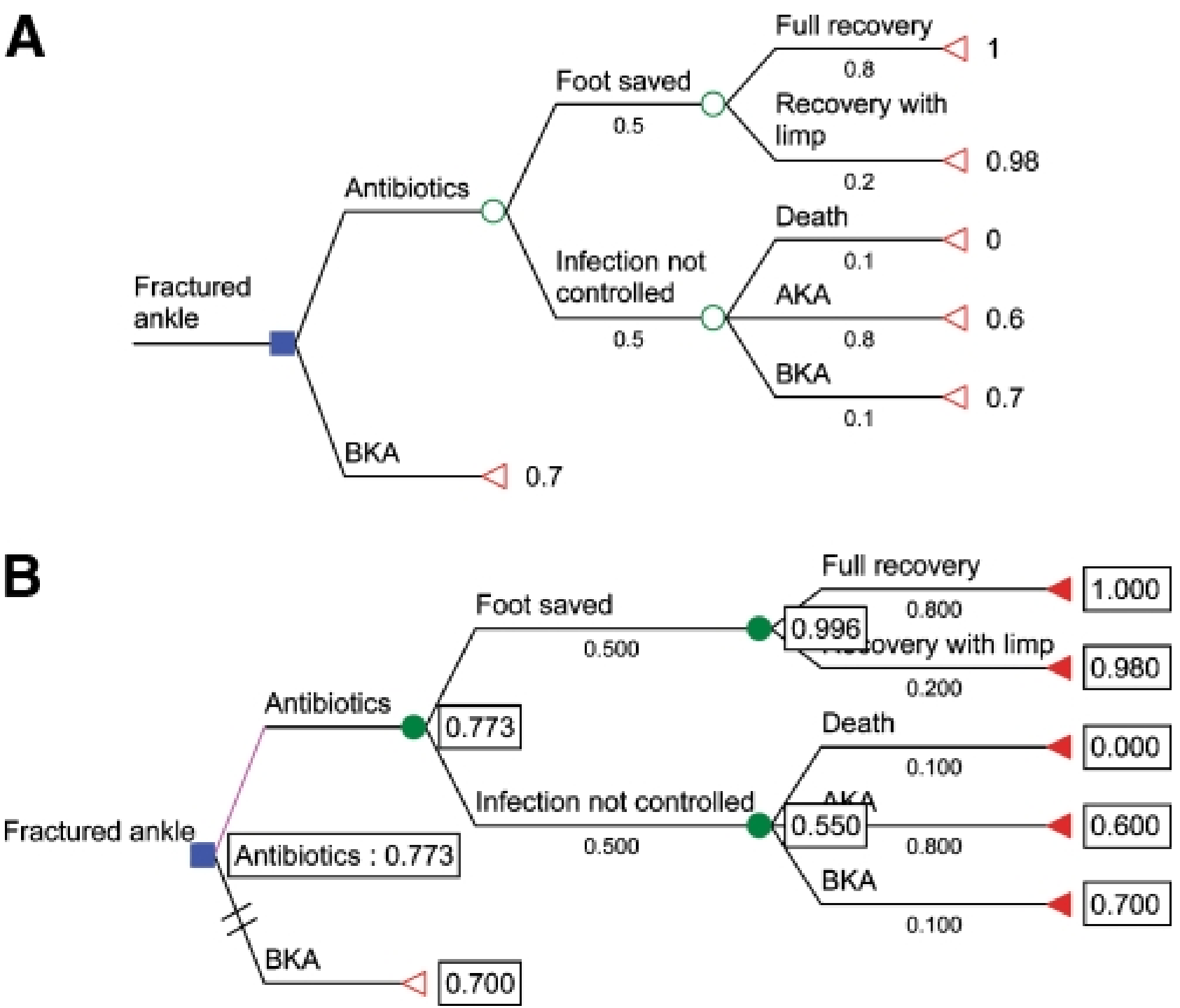

Fractured ankle
Antibiotics
Foot saved
0.5
Full recovery
0.8
1
Recovery with limp
0.2
0.98
Infection not controlled
0.5
Death
0.1
0
AKA
0.8
0.6
BKA
0.1
0.7
BKA
0.7

Elements of Decision Analysis

- Structure the Problem
  - Identify decision alternatives
  - List possible clinical outcomes
  - Represent sequence of events
- Assign probabilities to all chance events
- **Assign utility or value, to all outcomes**

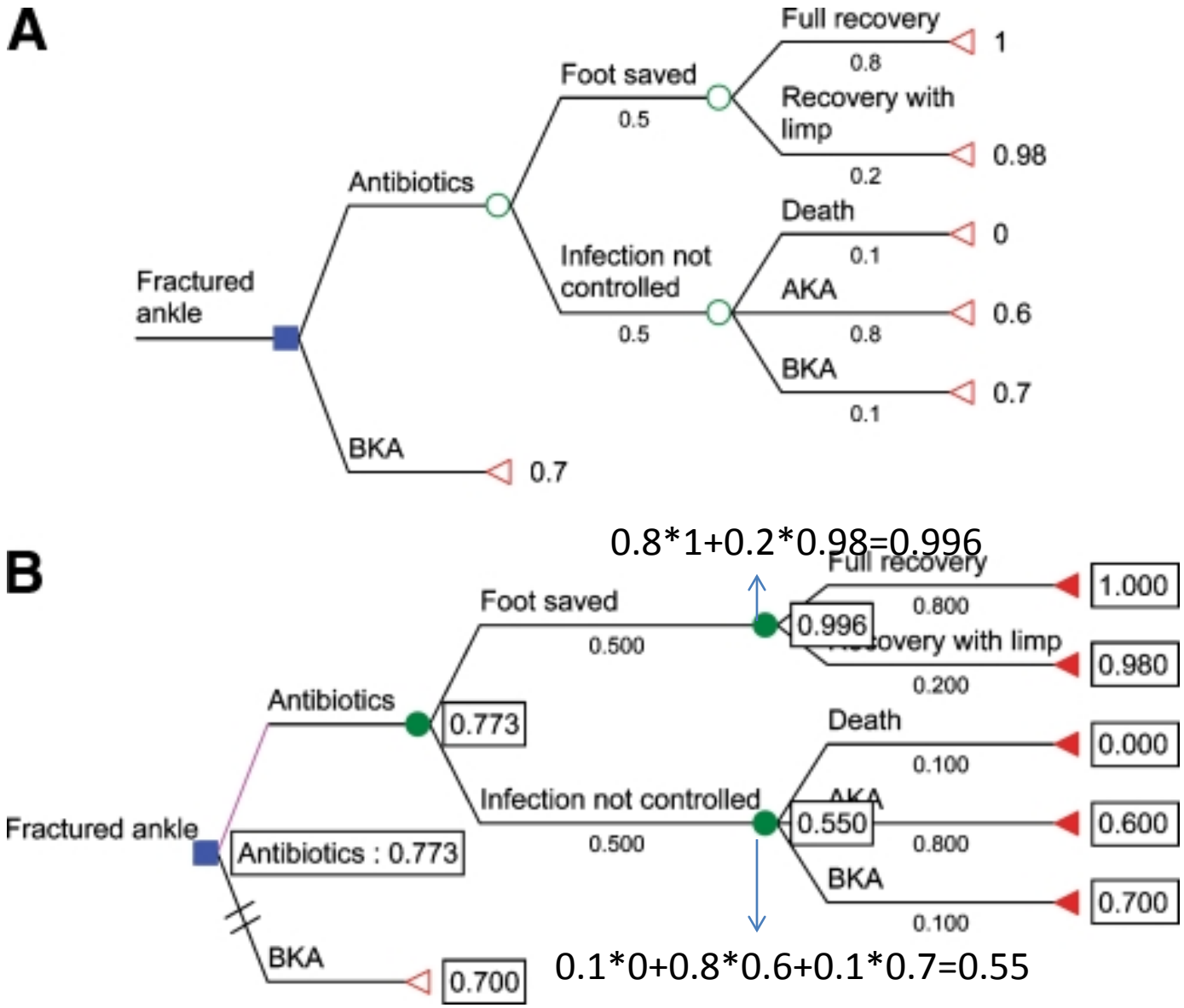
Table 2. Patient Valuation of Different Possible Outcomes are Proportionately Represented as "Utilities" on a Scale Ranging from 0 (Death) to 1 (Full Recovery with No Amputation or Limp)

Possible outcome	Utility*
Recovery with a limp	0.98†
Recovery with foot amputation	0.70
Recovery with leg amputation	0.60†
Entire limb saved and no limp	1.00 (assumed)
Death	0.00 (assumed)


A
Fractured ankle
Antibiotics
BKA
0.7
Foot saved
0.5
Infection not controlled
0.5
Full recovery
0.8
1
Recovery with limp
0.2
0.98
Death
0.1
0
AKA
0.8
0.6
BKA
0.1
0.7
B
Fractured ankle
Antibiotics : 0.773
BKA
0.700
Antibiotics
0.773
Foot saved
0.500
Infection not controlled
0.500
0.996
Full recovery
0.800
1.000
Recovery with limp
0.200
0.980
0.550
Death
0.100
0.000
AKA
0.800
0.600
BKA
0.100
0.700

Elements of Decision Analysis

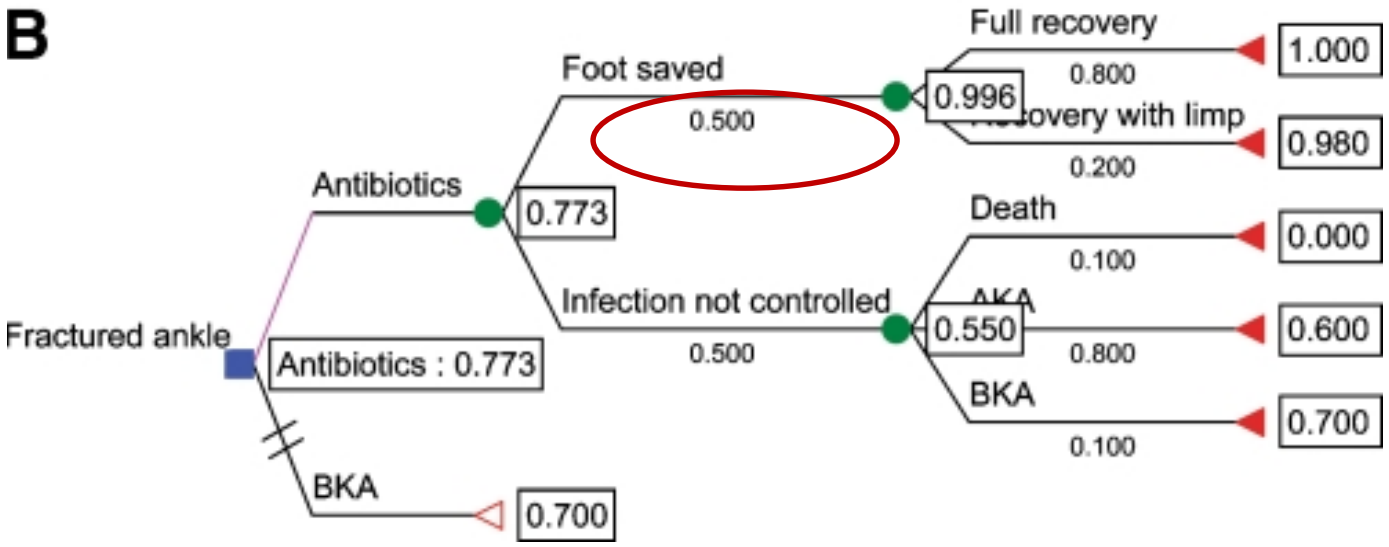
- Structure the Problem
  - Identify decision alternatives
  - List possible clinical outcomes
  - Represent sequence of events
- Assign probabilities to all chance events
- Assign utility or value, to all outcomes
- **Evaluate the <u>expected</u> utility of each strategy**

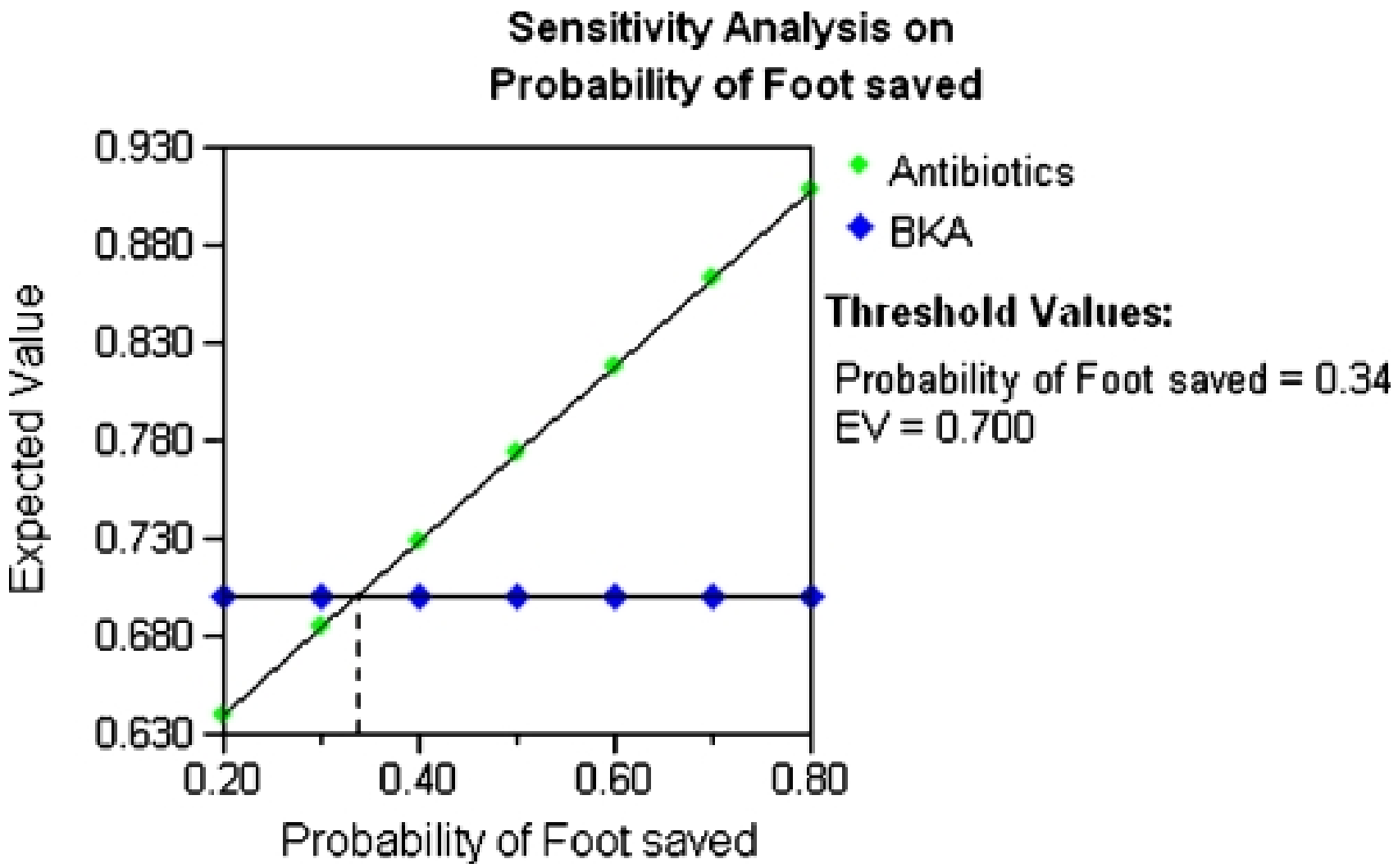

A
Fractured ankle
Antibiotics
Foot saved
0.5
Full recovery
0.8
1
Recovery with limp
0.2
0.98
Infection not controlled
0.5
Death
0.1
0
AKA
0.8
0.6
BKA
0.1
0.7
BKA
0.7
0.8*1+0.2*0.98=0.996
B
Fractured ankle
Antibiotics : 0.773
Antibiotics
0.773
Foot saved
0.500
0.996
Full recovery
0.800
1.000
Recovery with limp
0.200
0.980
Infection not controlled
0.500
0.550
Death
0.100
0.000
AKA
0.800
0.600
BKA
0.100
0.700
BKA
0.700
0.1*0+0.8*0.6+0.1*0.7=0.55

Elements of Decision Analysis

- Structure the Problem
  - Identify decision alternatives
  - List possible clinical outcomes
  - Represent sequence of events
- Assign probabilities to all chance events
- Assign utility or value, to all outcomes
- Evaluate the expected utility of each strategy
- **Perform sensitivity analysis**

What happens if this probability changes?




Sensitivity Analysis on
Probability of Foot saved
0.930
0.880
0.830
0.780
0.730
0.680
0.630
Expected Value
0.20
0.40
0.60
0.80
Probability of Foot saved
Antibiotics
BKA
Threshold Values:
Probability of Foot saved = 0.34
EV = 0.700

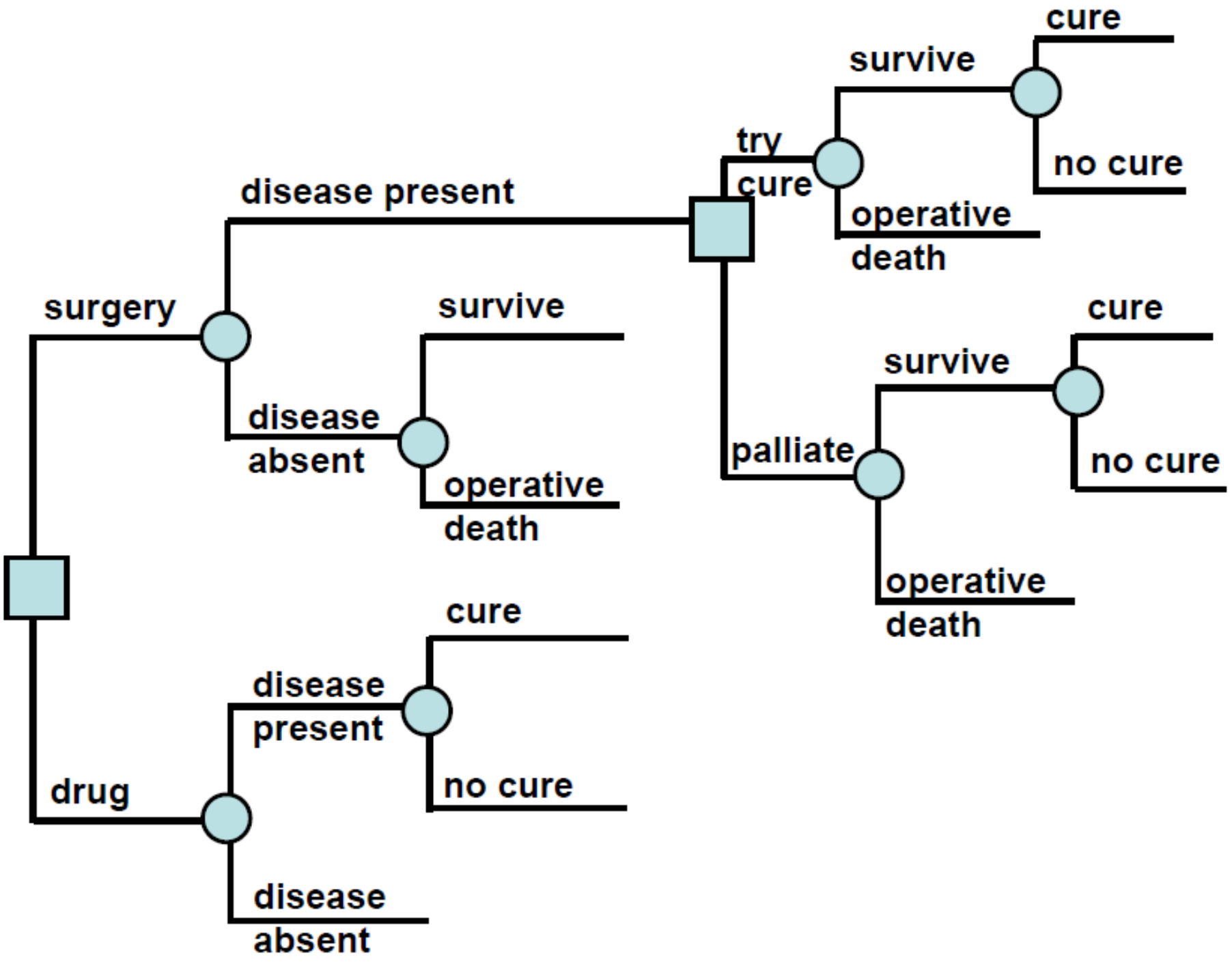
Another Example

A symptomatic patient

- Operate (risky)
- Medical management (drug therapy)

If disease present at surgery, must decide whether try for cure or palliate (to ease symptoms without curing the underlying disease)

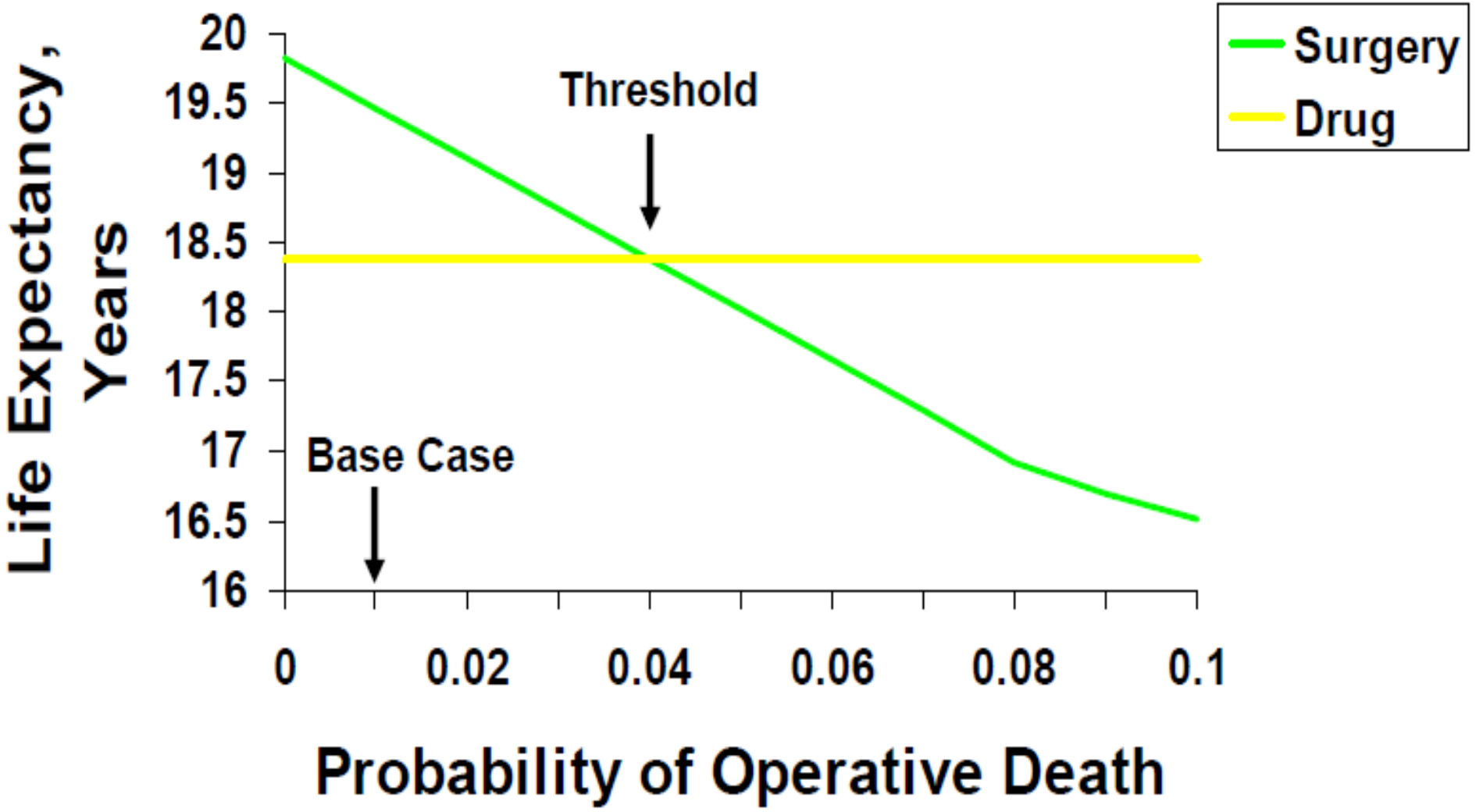
We want to evaluate surgery versus medical management


cure
survive
no cure
try
cure
operative
death
disease present
surgery
survive
disease
absent
operative
death
cure
survive
palliate
no cure
operative
death
cure
disease
present
no cure
drug
disease
absent

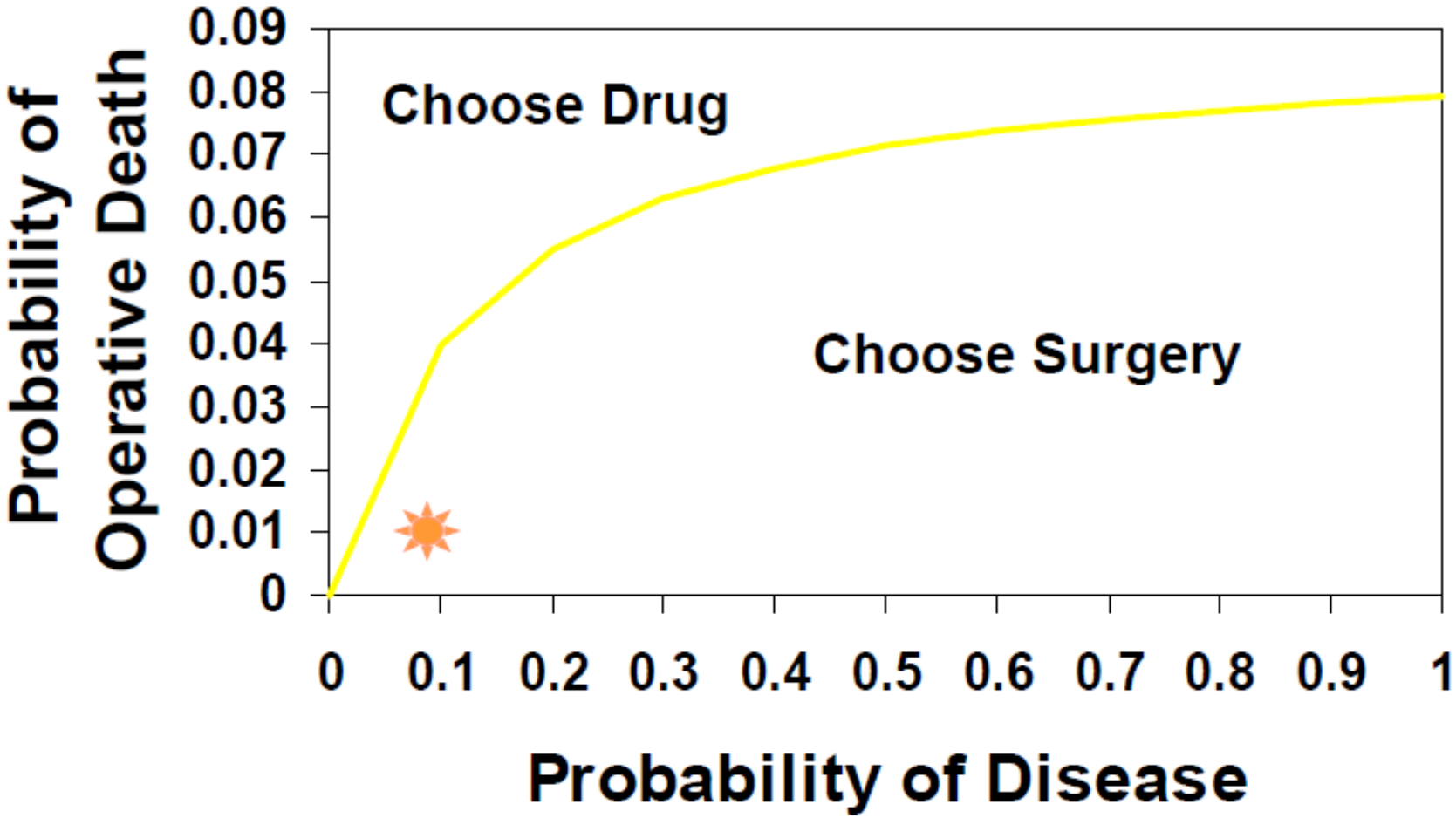
Sensitivity Analysis

- Systematically asking what of question to see how the decision result changes
- Determines how robust the decision is
  - One parameter varied (Threshold analysis)
  - Multiple parameters systematically varied (Multi-way analysis)

One-way Sensitivity Analysis



Two-way Sensitivity Analysis



IE 485 - Intro

QUIZ!

www.getkahoot.com

Don’t forget to enter nicknames as your ID’s.