Decision Tree

Introduction:

• Decision analysis can be broadly defined as a probabilistic (احتمالی) method for modelling problems under uncertainty (تردید یا شک). Cost effectiveness evaluations represent a typical example of such a problem, as they are performed for decision making regarding reimbursement of drugs or health care budget allocation, in presence and under the influence of random variables.

Standard tools for pharmacoeconomic evaluations include regression techniques and decision-analytic models, e.g decision trees (DTs), Markov State-transition models, and discrete event simulations.

A decision tree is a decision support tool that uses a tree like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs and utility.

DTs are so far the most used tool to support decision making under uncertainty. The decision problem is represented by means of a tree-like structure.

Decision Tree

A decision tree is a graph that uses a branching method to illustrate every possible outcome of a decision.

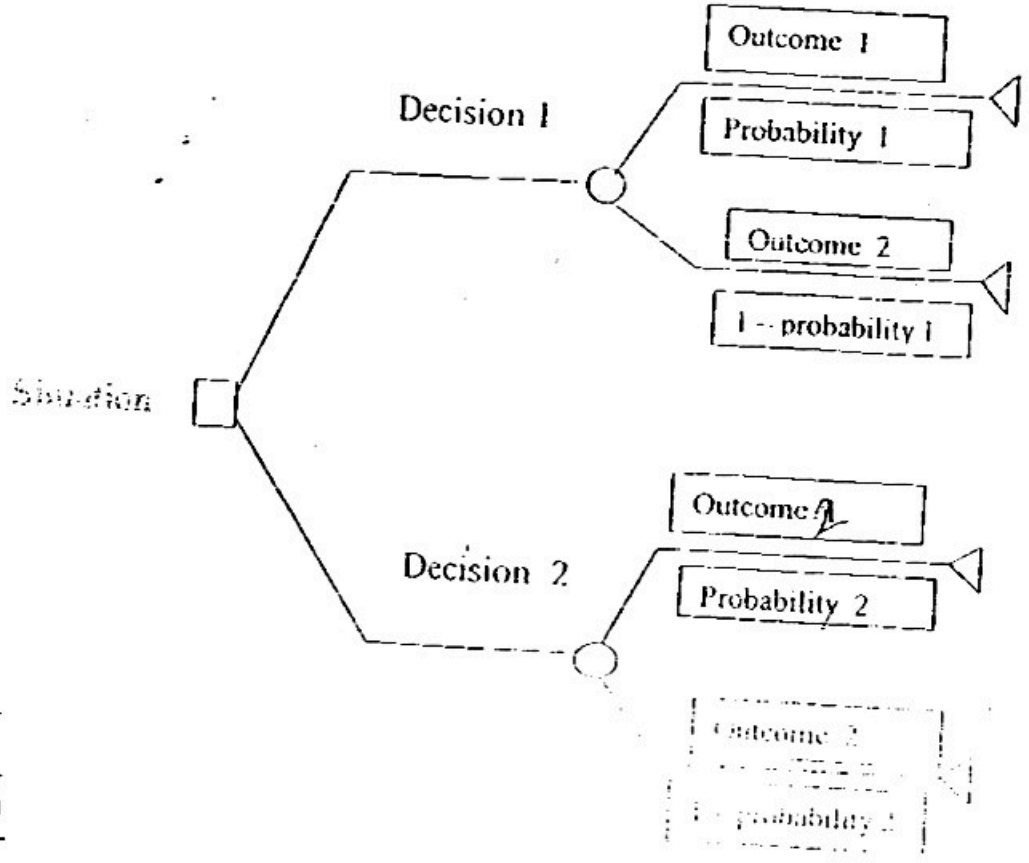
Combined with conditional probabilities and utilities (e.g. costs, quality of life multipliers) associated with the different decisions).

- However, drawbacks of DTs include the fact that in case of very complex problems they may become intractable, as they usually do not allow for a compact representation; and the algorithms used to perform the computations are not the most efficient.

A decision tree consists of 3 types of nodes:

1. Decision nodes - commonly represented by squares
2. Chance nodes - represented by circles
3. End nodes - represented by triangles

- Decision trees are always read from left to right.



The decision tree has several components that are always present and need to be carefully developed.

→A decision model comprises the modelling structure itself (the decision tree) which represents the decision that is being made and the outcomes that can occur as the results of each decision.

→The decision tree should start with a specific problem formulation (situation). In pharmacoeconomic models, these should represent the actual choice being made and should include the necessary descriptors of the population in which the decisions and being made to allow the reader to understand the context of the choice. The context is followed by a decision node (square) and should include as comparators the relevant, real choices the decision maker has at his or her proposal.

→The decision node is followed by a chance node (circle) with branches leading to the possible outcomes from each event. The chance node represents the probabilities beyond the control

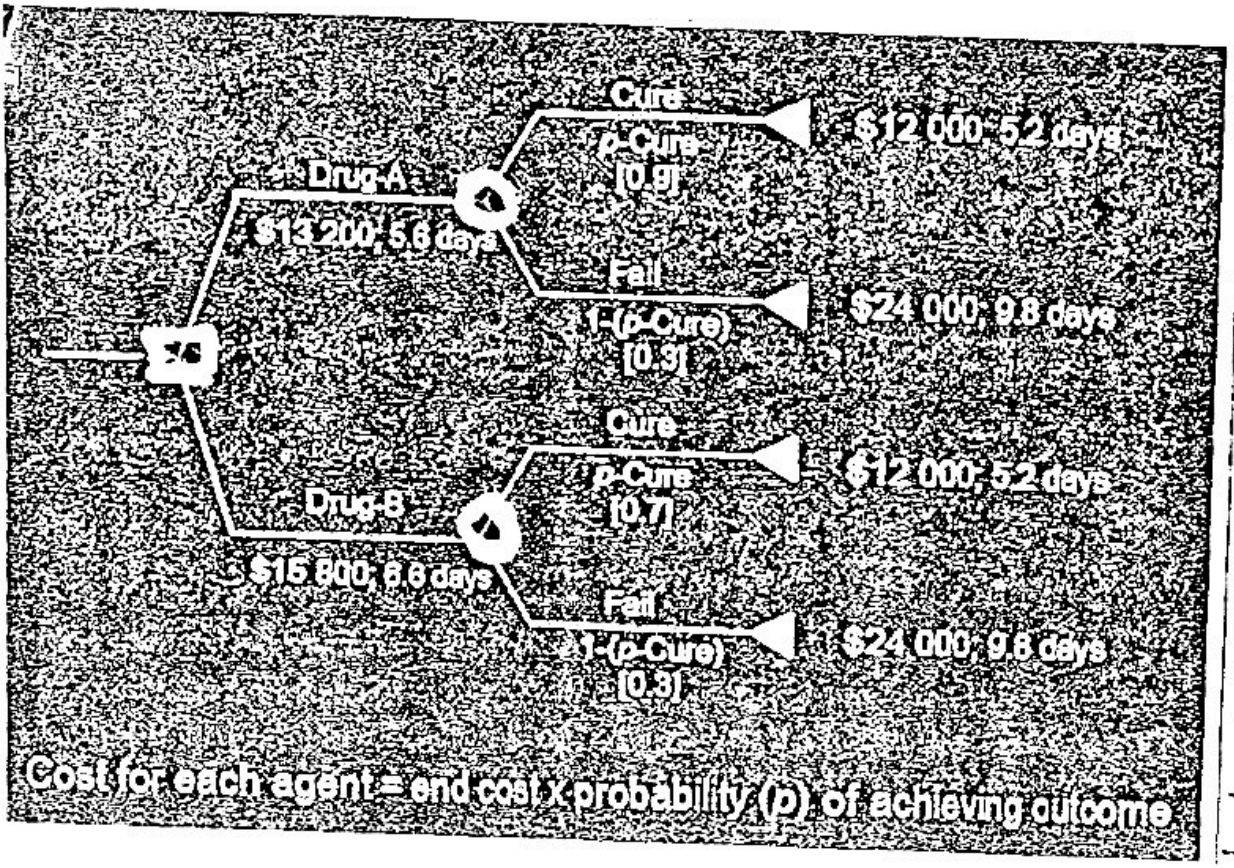
of the decision maker either a desired outcome or undesired outcome. The probabilities were obtained from the literature. Note that the probabilities at each node add to one and are mutually exclusive and exhaustive.

→ The tree branch is followed by a terminal node. This is the end of outcome measurement of interest and an output value must be assigned in terms of effectiveness, utility or more usually costs (direct plus indirect expenses).

→ Just as in basic economic models in which consumers are assumed to purchase the best value - the assumption in clinical decision analysis is that the decision makers and patients will choose the option that produces the outcome with the best value.

- In the example shown in Figure, Drug A may be more expensive (drug cost), however it is more effective, with lower overall costs and a shorter length of stay (LOS) resulting from

its use. Drug B has a higher rate of treatment failures, with the associated costs of managing these failures and prolonged LOS contributing to its higher overall cost. The resulting cost for each agent is obtained by multiplying the end cost by the probability of achieving that outcome. Depending on the relative costs associated with treatment failures when compared with the costs of cures, the decision to choice one agent over the other may change.



- The goal of a pharmacoeconomic assessment is is to enhance overall patient care for a given set of resources. It is important to realise that an evaluation needs to look at the decision that will maximise the value of healthcare services, not simply reduce the costs of drug therapy.

Advantages:

- Decision trees are simple to understand and interpret.
- They have value even with little hard data. Important insights can be generated based on experts describing a situation (its alternatives, probabilities and costs) and their preferences for outcomes.
- Allow the addition of new possible scenarios.
- Can be combined with other decision techniques.

Uses:

- A decision tree may be used to compare the choice, costs and outcomes for different agents.
- In any pharmacoeconomic evaluation, it is

essential to identify, measure and compare all costs and outcomes of drug therapies.
-Decision trees, influence diagram, utility functions, and other decision analysis tools and methods are taught to students in schools of business, health economics, and public health, and are examples of operations research or management science methods.

□ Disadvantages:

Calculations can get very complex particularly if many values are uncertain and/or if many outcomes are linked.