AbstractID: 14506 Title: How to Make Clinical Decisions in the Multicriteria Framework

Multiattribute decision making begins with the premise that the solution to the problem at hand involves multiple goals, some of which are mutually antagonistic, and not all of which can be achieved in a single solution. Choosing a multiobjective optimization algorithm should be done in conjunction with the selection of a decision making approach. A vital component of the decision making method is to be explicit about the criteria, how they are to be evaluated and how they relate to the value structure of the decision maker.

Much of the theory of multiattribute decision theory stems from economic theory. In particular, Pareto optimality was first formulated as the condition in which it is impossible to make one person better off without making someone else worse off. Another economic concept, utility, is used to quantify values on a relative scale. In problems not related to economics, it is usually the case that the criteria used to make a decision are difficult to formulate in terms than can be mathematically optimized. For example, in radiation therapy, surrogates for patient outcomes must be formulated in terms of physical dose deposition.

Mathematical optimization algorithms can take several forms. Prior methods require the user to input some preferences before the optimization can proceed. Such methods can produce a single “optimal” solution. Interactive methods rely on feedback between the decision maker and the optimization algorithm. These methods can be the most efficient at searching but require considerable commitment from the decision maker. Posterior optimization methods produce a set of solutions that hopefully spans the trade-offs of interest. The mathematical optimization is followed by a decision making process that selects one of them.

Learning objectives:

1. To appreciate the relationship between Pareto optimality and decision making.
2. To understand the current state of decision making and how it relates to other approaches.
3. To understand how multiattribute decision making approaches in radiation therapy relate to methods used in other fields such as operations research.
4. To become acquainted with the basics of decision theory such as utility theory.