

PUB HLTH 431
Decision Analysis and Models of Decision Making
1.0 Credit
Fall 2006 (September 20 – December 6, 2006)

Time: Wednesdays, 6:00 – 9:00 PM

Location: McGaw Room 2-403, 710 N. Fairbanks

Course Instructor (office hours by appointment):

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I. Course Description

This course will focus on the core areas underlying decision analysis and medical decision making: the use of probabilities in medicine, choice and interpretation of diagnostic tests, decision tree construction and analysis, quantifying patient preferences, and cost-effectiveness analysis. Students will learn methodologies for dealing with complex decisions both on an individual patient level and at a policy level, and will have hands-on experience in applying these to a problem of their choice.

II. Prerequisites

None.

III. Course Objectives

After completion of the course, students should be able to do the following:

Probabilities in medicine:

- explain how the concept of probability is used to make medical decisions
- demonstrate the use of personal experience to make a subjective probability estimate
- describe the concepts and potential biases of three types of heuristics: representativeness, availability, and anchoring and adjustment
- differentiate the 2 methods of objective probability assessment: population prevalence and clinical prediction rules

Diagnostic tests:

- explain how the performance of diagnostic tests is studied
- construct and explain the meaning of the 2 x 2 table
- define and differentiate the meaning of sensitivity, specificity, and likelihood ratios
- calculate these measures from raw data
- calculate post-test probability (predictive value)

- demonstrate how pretest probability, sensitivity, and specificity affect posttest probability
- define and explain the ramifications of the differences between a study population and the clinically relevant population
- list the biases that can enter into studies of test characteristics, and explain the expected impact that each would have
- create and interpret receiver operating characteristics curves

Basic decision analysis:

- define and explain the use of expected value decision making
- define and demonstrate the use of the terminology and notation of decision tree analysis
- construct decision trees for a complex clinical problem
- calculate the expected value of alternative management strategies
- demonstrate the use of the basic approach to handling uncertainty in decision analyses: 1-way sensitivity analysis

Advanced decision analysis:

- list and differentiate the different ways of handling uncertainty in decision analyses, including 2-way and 3-way sensitivity analyses, and Monte Carlo analysis
- demonstrate the use of Markov modeling

Decision analysis software:

- use a decision analysis program (DATA) to perform basic and advanced decision analysis

Assessing patient preference:

- explain the meaning of a utility
- perform a standard reference gamble to measure utility
- define the meaning of quality-adjusted life expectancy
- perform a time trade-off to measure quality-adjusted life expectancy
- identify sources of potential error in utility assessment

Cost-effectiveness analysis:

- define cost-effectiveness analysis, marginal cost-effectiveness, direct and indirect costs, discount rate, and cost-benefit analysis
- explain how cost-effectiveness analyses can be used to decide among treatment alternatives or to decide where to spend limited resources
- structure a cost-effectiveness analysis as a decision tree

Threshold model of decision making:

- define the concepts of treatment thresholds
- identify factors which determine the treatment threshold
- explain the threshold model for test selection

IV. Teaching Format

Teaching sessions are highly interactive seminars with printed materials for the students, which make each session function as a workshop.

Software instruction occurs with students actively using the software on their own computers in real time, while the instructor demonstrates use of the program using a computer projector. These occur over 2 sessions, with homework projects assigned in between to consolidate facility with the program.

NOTE: Students must bring a Windows-based laptop computer to the 2 software instruction sessions.

V. Student Evaluation

Students are evaluated based on:

1. Class attendance and participation (33%)
2. Satisfactory completion of a final decision analysis project (67%). The problem is generated by the student, and may be either a decision analysis or cost-effectiveness analysis. It may be focused on an individual patient decision or a policy decision. Each student works closely with the course director and faculty mentors in developing the problem and the tree, and prepares both an oral presentation for the rest of the class and a written summary of the problem, tree, results, and conclusions.

VI. Readings

There is no required textbook. Readings for some of the sessions will be provided by the instructor. Optional readings will be given from “Decision Making in Health and Medicine: Integrating Evidence and Values” by Myriam Hunink et al. (Cambridge University Press).

VII. Course Evaluation

The Programs in Public Health administer web-based course evaluations to students for each course near the end of the quarter. Your completion of both the Unit (course) and Faculty evaluations is required; failure to complete the evaluations will result in an incomplete grade until the evaluations are submitted. You will be sent the web link and instructions via e-mail later in the quarter. You will have about 2 weeks time to complete the evaluations before grades are submitted.

Decision Analysis and Models of Decision Making
 Public Health 431
 Fall, 2006
 Preliminary Course Schedule
 Wednesdays (except as highlighted **in bold**), 6:00 – 9:00 PM

Date	Topic(s)	Preparation
Sep. 20	Orientation Probabilities in medicine	
Oct. 4	Decision trees Basic decision analysis	
Oct. 9 MONDAY	Measuring patient preferences and outcomes	Problem in Module 4 Problem set
Oct. 11	Cost-effectiveness analysis	Problem set Read article <ul style="list-style-type: none"> • Mammography CEA
Oct 18	Basic DATA (decision analysis software) Discuss project question	Preliminary choice of project question Reread article <ul style="list-style-type: none"> • Mammography CEA
Oct. 25	Advanced concepts in decision analysis 1 – Markov models	Final choice of project question Problem set Create Module 7 tree structure in DATA Read article: <ul style="list-style-type: none"> • Sonnenberg (background on Markov models)
Nov. 1	Advanced DATA 1 – Markov models	Read articles: <ul style="list-style-type: none"> • Tsevat (example of article using Markov model) • Mammography CEA Construct the Markov tree behind the mammography CEA. Work on project
Nov. 6 MONDAY	Diagnostic test use: calculating post-test probabilities, ROC curves	Problem set Recreate mammography Markov model in DATA. Work on project
Nov. 8	Advanced concepts in decision analysis 2 – Monte Carlo, incorporating imperfect information Diagnostic test use: threshold model	Read articles: <ul style="list-style-type: none"> • UFCT (calculate test characteristics from raw data) • Ferritin (example of use of ROC's) Work on project
Nov. 15	Advanced DATA 2 – Monte Carlo, cost-effectiveness analysis	Problem set Work on project
Nov. 22	Holiday	Relaxation techniques
Nov. 29	Project presentations - 1	
Dec. 6	Project presentations - 2	

Project Instructions

Purpose of the project

The project is intended to (1) allow the course director to evaluate your understanding of the concepts and techniques of the course, and (2) give you an opportunity to gain experience with them. While there is the potential for the projects to develop into a publishable paper, that is not the goal within the course. At most, they should be considered as pilots, although in some cases they might come close to a “finished product”.

Requirements

1. Construct a decision analysis or cost-effectiveness on any question (medical or other) that is of interest.
2. This will entail:
 - a. Framing the problem
 - b. Creating a decision tree
 - c. Finding relevant data, or making up reasonable approximations
 - d. Analyzing the tree for its results (expected value, or cost-effectiveness ratios)
 - e. Performing at least one sensitivity analysis on a variable
 - f. Writing a short report, to include:
 1. Background
 2. Methods (especially assumptions)
 3. Printout of the decision tree
 4. Results
 5. Printout of sensitivity analysis/analyses
 6. Conclusions, including potential next steps
 7. References, if any

Presentation

Presentation and discussion should be around 20 minutes. You can use PowerPoint, overhead projector, or other format that you find most effective. It should include:

1. Oral presentation, including background, assumptions, decision tree, results, and sensitivity analysis/analysis, and conclusions
2. Handouts of trees and sensitivity analyses for each of the students

Timeframe

You should pick at least a tentative project by October 18. You should plan on meeting with the course director or faculty mentor at least 3 times in the course of working on the project. This will be to discuss framing the analysis, the decision tree structure, and the analysis itself. You may want to schedule more meetings.