Course Objectives:

This course provides hands-on training in decision and cost-effectiveness analysis using TreeAge software. It is intended for those students who are interested in doing their own modeling, as it is a time-intensive lab and project course. Topics to be covered include:

- How to use TreeAge.
- How to program Markov Models in TreeAge.
- How to do one-way sensitivity analyses and create tornado diagrams.
- How to do Monte Carlo probabilistic sensitivity analyses.
- Pitfalls and controversies in cost-effectiveness modeling.

Course Requirements:

Each student will complete a three-part tutorial using TreeAge. Thereafter, students will complete an pre-specified cost-effectiveness project using the same model inputs and suggestions. Hence, there will be a correct answer. Most of your work on the decision model will be completed outside of class, and homework assignments will lead to progressive completion of the model. However, in-class time will be available after lectures, where students may work on their models with faculty available.

Homework = 30%
Class Project = 70%
  - Tree files
  - 300-350 word abstract and PowerPoint presentation (10 minutes maximum)

Course Mechanics:

1.0 credit, 2 hours/session, 8 sessions.

The computer classroom has full copies of TreeAge. You may choose to do most of your work in the computer lab. However, it is strongly recommended that you download a student version of TreeAge for home use during the course, which is limited to 125 nodes (sufficient for the project), expires in 6 month, and is available for download from TreeAge at a cost of $45. Go to https://www.treeage.com/shop/ to purchase the Student Course License for TreeAge Pro Suite. This version is for educational purposes only. We will supply additional handouts as needed.

Recordings Policy:

This course may be video and audio recorded (hereby referred to as “Recordings). By enrolling this course, you hereby give the University of Pittsburgh and the Institute for Clinical Research Education, through its faculty, employees, agents, licenses or assigns, the irrevocable and worldwide right to use your name, voice, likeness and/or image in all forms and media (to include internet websites and online course websites). You waive your right to inspect or approve the finished version(s) of the Recordings, including any copy that may be created in connection therewith. You understand that you will not be paid for your participation in the Recording and that you are not entitled to your own copy of the Recording. You understand that the University of Pittsburgh is not responsible for any unauthorized use of the Recording. You have read this syllabus and have no ques-
tions about the contents and are an adult over the age of 18.

Session 1  
Course overview and TreeAge tutorial

Concepts and Topics:
In this session we will introduce the mechanics of the course and discuss the project assignment, then provide an introduction to the computational aspects of decision modeling and take you through the tutorial using TreeAge Pro Suite. This will include tree construction (branches, nodes, probabilities, values) and tree evaluation (average out/fold back).

At the end of this session, students will be able to:
1. Construct a tree in TreeAge Pro
2. Explain the benefits and uses of decision modeling

Competencies

Methodology: Compare strengths and weaknesses (feasibility, efficiency, generalizability, validity, and ability to derive unbiased inferences) of different research paradigms and methodologies.

Data Management and Biomedical Informatics: Organize datasets (variable display and structure) appropriately for given statistical techniques.

Applied Analytic Techniques: Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

Required Reading (during the session)

Session 2  
Tree Building and Assigning Health States

Concepts and Topics:
In this session we will discuss basic tree building concepts, assigning health states in a Markov model, and the simplifying assumptions they entail.

At the end of this session, students will be able to:
1. Explain considerations in building a tree in TreeAge Pro
2. Describe how and when to use a Markov model

Competencies

Data Management and Biomedical Informatics: Organize datasets (variable display and structure) appropriately for given statistical techniques.

Applied Analytic Techniques: Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

Required Reading (prior to session):

Homework: Assign Markov health states for the project – bubble diagram and tree format
### Session 3  
**Mathematical concepts in modeling**

**Concepts and Topics:**
In this session we will discuss mathematical concepts you will have been exposed to in the tutorial: the half-cycle correction, accounting for competing causes of mortality, and rates and probabilities.

At the end of this session, students will be able to:
1. Explain various mathematical concepts pertinent to decision modeling
2. Perform calculations using decision analysis software programming

**Competencies**

*Applied Analytic Techniques:* Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

**Required Reading (prior to session):**

**Homework:** Apply half cycle correction and life table mortality into tree

### Session 4  
**Sensitivity Analysis**

**Concepts and Topics:**
This session will cover one-way sensitivity analyses and their use in “de-bugging” trees. Additionally, students will be walked through a method for graphically representing the results of one-way sensitivity analyses in a tornado diagram. Finally, we will review the concept, already introduced in the tutorial, of probabilistic (or 2nd order Monte Carlo) sensitivity analyses.

At the end of this session, students will be able to:
1. Explain how and when to employ one-way sensitivity analyses
2. Create a tornado diagram
3. Describe the uses of probabilistic sensitivity analyses

**Competencies**

*Applied Analytic Techniques:* Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

**Required Reading (prior to session):**

**Homework:** Semi-working model

### Session 5  
**Representing uncertainty in CEA results**

**Concepts and Topics:**
Newer techniques, such as acceptability curves, will be discussed as well as challenges for future cost-effectiveness research.

At the end of this session, students will be able to:
1. Provide methods for representing CEA uncertainty
2. Explain which methods for representing uncertainty are most appropriate for a given situation

Competencies

Applied Analytic Techniques: Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

Required Reading (prior to session):

Session 6 Value of information analysis

Concepts and Topics:
Value of information analysis and its major product, the expected value of perfect information, will be discussed. This technique shows great promise as an aid for decision making and for future research resource allocation.

At the end of this session, students will be able to:
1. Describe value of information analysis
2. Discuss the ramifications of perfect information
3. Provide examples of beneficial future studies using value of information analysis

Competencies

Applied Analytic Techniques: Determine and apply a range of appropriate statistical techniques to answer research questions and explain the implications of missing data on conclusions drawn from statistical results.

Required Reading (prior to session):

Homework 3 (semi-working model) due.

Session 7 Accounting for future costs

Concepts and Topics:
Handling of “unrelated” future costs of health care, an area of unresolved controversy, will be considered.

At the end of this session, students will be able to:
1. Discuss the rationale for including future costs in CEA
2. Describe the mechanics of including future costs into a model

Competencies

Methodology: Compare strengths and weaknesses (feasibility, efficiency, generalizability, validity, and ability to derive unbiased inferences) of different research paradigms and methodologies.

Required Reading (prior to session):
1. Meltzer D. Accounting for future costs in medical cost-effectiveness analysis. Journal of Health Economics 1997;16(1):33-64. (okay to skip Section 2 if you are not mathematically oriented)
Session 8  Student Presentations

Concepts and Topics:
In this session, students will present their findings in a formal PowerPoint presentation (10 minutes maximum) and be critiqued by Dr. Smith.

At the end of this session, students will be able to:
1. Articulate clearly the results of research relating to decision analysis

Competencies

Oral Communication: Prepare and deliver oral presentations of research at a variety of stages to a range of audiences, and respond to constructive criticism and questions.

Oral Communication: Prepare critiques of oral presentations.

Written Communication: Prepare written presentations of research at a variety of stages to a range of audiences, technical and non-technical, and respond to constructive criticism and questions.