Medical Decision Making

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Decision Analysis

- Quantitative, systematic
- Identifies alternatives, outcomes, utility of outcomes
- Uses models
 - Represent structural relationships
 - Deterministic
 - Probabilistic
 - Compute expected outcomes of each alternative
 - Balance feasibility v. reality / simplicity v. complexity
 - Examine robustness

Identify Alternatives

- Mutually exclusive
 - A, B mutually exclusive $\Rightarrow P(A \cap B) = 0$
 - One and only one of the events must occur
- Collectively exhaustive
 - A, B collectively exhaustive \Rightarrow P(A) + P(B) = 1
 - Events represent entire outcome space
 - At least one event must occur

Identifying Outcomes

- Multi-dimensional
- Examples:
 - Costs
 - Infections averted
 - Life years (LY) saved
 - Quality adjusted life years (QALY) saved
 - "Effectiveness"
- Ultimately utils Howard school
- Cost-effectiveness
 - Incremental cost to effectiveness ratio (ICER)

Cost-Effectiveness Plane

	Increased Costs Decreased Effectiveness Use status quo	ΔC I I I	Increased Costs Increased Effectiveness Is ICER < WTP?
ΔE	Decreased Costs Decreased Effectiveness Probably use status quo	I I T	Decreased Costs Increased Effectiveness Use new strategy

Steps

- Determine problem
- Determine status quo intervention
- Determine alternative interventions
- Analysis
- Sensitivity Analysis

Example

- Hypothetical cohort with prevalent disorder
- Treatment
 - Reduces probability of serious complications
 - Long term side effects
- There is an imperfect test for disorder
- Alternatives:
 - Treat no one
 - Test all and treat positives
 - Treat all

Decision Diagram



Example cont.

- Outcomes
 - No disorder, no treatment
 - No disorder, treatment
 - Disorder, treatment, complications
 - Disorder, treatment, no complications
 - Disorder, no treatment, complications
 - Disorder, no treatment, no complications
- For each outcome assume known costs and LE (clinical trial)
- Intermediate events
 - Tests
 - Side effects

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Now What?

- Now we have our tree structure
- Lets start filling in probabilities

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<	2 branches	nodes in subtree



Recap

- Thus far...
 - Created decision tree
 - Used descriptive variable names
 - Used clones to take advantage of parallel structure
 - Tracking variables
- Now What?
 - Outcomes
 - Assume we know from clinical trial
 - Costs
 - Life years



Effectiveness Outcomes

- Normal 15 life expectancy
- Disorder 3 year detriment
- Complications 10 year detriment
- Treatment 0.05 year detriment

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Add Complications Tracker



Add Complications Tracker

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Add Disorder Tracker

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Caveats

- Assumed full knowledge of
 - Future life expectancy
 - Future lifetime costs
- Inappropriate if payoffs without full lifetime info
 - Markov model

Thank you!