Teaching health economics to students without strong backgrounds in quantitative methods

In-class activities improve comprehension and retention of abstract concepts

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Boston University School of Public Health
Teachers understand concepts

Students don’t
Probabilistic sensitivity analysis

“A simulation procedure in which all input parameters are considered as random quantities and therefore are associated with probability distributions that describe the background knowledge of the decision-maker”
Concepts that are memorized rather than comprehended are often not retained over time.
In-class activity: Requirements
No vaccination → Flu (25%)

No flu → No hospitalization (80%)

Hospitalization → Cost = $3,000, Utility = 0.80 QALY

Flu (20%)

No hospitalization (75%)

Cost = $0, Utility = 0.95 QALY
Vaccination

Flu

No flu

Hospitalization

Cost = $3,100
Utility = 0.80 QALY

20%

10%

80%

Cost = $600
Utility = 0.90 QALY

Cost = $100
Utility = 0.95 QALY

90%
Deterministic modeling
No vaccination

<table>
<thead>
<tr>
<th>Flu</th>
<th>No flu</th>
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<tbody>
<tr>
<td>25%</td>
<td>75%</td>
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Hospitalization

<table>
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<tr>
<th>No hospitalization</th>
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<tr>
<td>20%</td>
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<td>80%</td>
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</table>
No vaccination

Flu: 25%
No flu: 75%

Hospitalization: 20%
No hospitalization: 80%
No vaccination

Flu
- 25%
- 75%

No flu
- 25%
- 80%

Hospitalization
- 20%

25% * 20% = 5%
25% * 80% = 20%
75%

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No vaccination

Flu
- 25%

No flu
- 75%

Hospitalization
- 20%
  - Cost = $3,000
  - Utility = 0.80 QALY

No hospitalization
- 80%
  - 25% * 80% = 20%
    - Cost = $500
    - Utility = 0.90 QALY

75%

Cost = $0
Utility = 0.95 QALY
Stochastic modeling: Microsimulation
No vaccination

Flu

- No flu: 75%
- Flu: 25%

Hospitalization

- No hospitalization: 80%
- Hospitalization: 20%
No vaccination

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<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Flu</td>
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25% Flu
75% No flu

No hospitalization

20%
No vaccination

Flu

No flu

Hospitalization

20%

No flu

25%

75%

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No vaccination

Flu

Hospitalization

No flu

75%

7%

5%

20%

80%

1 - 2

3 - 4

5 - 6

7 - 8

9 - 10

H

NH

NH

NH

NH

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No vaccination

Flu

No flu

Hospitalization

No hospitalization

75%

20%

80%

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**Boston University** School of Public Health
No vaccination

Flu

- 25%

No flu

- 75%

No hospitalization

- 80%

Hospitalization

- 20%
No vaccination

- Flu: 25%
- No flu: 75%

Hospitalization: 20%

No hospitalization: 80%

Cost = $500
Utility = 0.90 QALY
A diagram illustrating the outcomes of flu vaccination:

- **No vaccination**
  - Flu: 25%
  - No flu: 75%

- **Hospitalization**
  - 5%
    - Cost = $3,000
    - Utility = 0.80 QALY

- **No hospitalization**
  - 20%
    - Cost = $500
    - Utility = 0.90 QALY

- **No flu**
  - 80%
    - Cost = $0
    - Utility = 0.95 QALY

**Total Utility Calculation**

- **No flu** with vaccination: 0.95 QALY
- **Hospitalization** with vaccination: (1 - 0.05) * 0.80 = 0.76 QALY

**Total Utility** = 0.76 + 0.95 = 1.71 QALY

**Cost** with vaccination = $500

**Utility** = 0.90 QALY

**Total Cost** = $500

**Total Utility** = 0.90 QALY

**Total Cost + Total Utility** = $500 + 0.90 = $500.90
Repeat the drill multiple times

Like 5x
<table>
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<tr>
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Activity variations

- Deterministic modeling

- Stochastic modeling
  - First order simulation
  - Second order simulation

- Markov model/process
  - Make sure to distinguish the difference between a simulation using a simple decision tree, a deterministic Markov model/process, and a simulation using a Markov model/process
Feedback

“I really liked the way you explained probabilistic sensitivity analysis it really helped me encode the concept, and I probably will never forget this even though it’s very complex”.

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Thank you!

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