Preference Assessment 1
Measuring Utilities Directly

April 8, 2016

Cancer of the Larynx, Stage T3

Survival with tracheostomy and artificial speech

Surgery

Death

Survival with normal anatomy and normal speech

Radiation Therapy

Death
Health Utilities

- Fundamental values that describe an individual’s preferences for health outcomes
- Direct measurements (this presentation)
- Indirect measurements (next presentation)

### RANKING AND SCALING OUTCOMES

<table>
<thead>
<tr>
<th>Rank</th>
<th>Value</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
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<td>65</td>
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</tr>
<tr>
<td>3</td>
<td>58</td>
<td>10-year survival with normal anatomy and normal speech</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>10-year survival with tracheostomy and artificial speech</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
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SUMMARY OF RANK-AND-SCALE METHOD

1. The analyst identifies the outcomes
2. The subject ranks the outcomes
3. The analyst defines the scale range and units
4. The rank anchors each end of the scale with an outcome
5. The subject assigns scale values to the intermediate outcomes
6. The analyst checks to make sure the ranks and values are compatible
Note how anxious (on average) you felt over the past 24 hours with a mark (1) on the line below.

Not at all

Anxious

Extremely

Anxious
SUMMARY OF VISUAL ANALOGUE METHOD

1. The analyst specifies the outcome being measured
2. The analysts explains the visual scale
3. The analyst illustrates each end of the scale with an outcome
5. The subject identifies a point on the scale that corresponds to the outcome level of interest
6. The analyst converts the point into a numerical value

Rank-and-Scale Method and Visual Analogue Scale Method

- Easy to use
  - Face-to-face
  - Telephone
  - Mail
  - Computer/Internet
- Do not satisfy the assumptions of the underlying theory

Basic Reference Gamble or Standard Gamble

- Principal advantage is that it does satisfy the assumptions of underlying theory
  - Incorporates the value of choosing
  - Incorporates the value of risk
- Principal disadvantage is that it is difficult for people to understand and use, especially people who are sick or are answering for loved ones who are sick
SUMMARY OF THE STANDARD GAMBLE METHOD

1. The analyst explains that the choice is between a certain outcome and a gamble
2. The analyst defines the best outcome, and makes it part of the gamble
3. The analyst defines the worst outcome, and makes it part of the gamble
4. The analyst specifies the probabilities of the gamble
5. The subject identifies a certain outcome that is equivalent to the gamble

SUMMARY OF A COMMON VARIANT OF THE STANDARD GAMBLE METHOD

1. The analyst explains that the choice is between a certain outcome and a gamble
2. The analyst defines the best outcome, and makes it part of the gamble
3. The analyst defines the worst outcome, and makes it part of the gamble
4. The analyst specifies a certain outcome
5. The subject identifies the probabilities that make the gamble equivalent to the certain outcome

![Graph showing the relationship between Utility and Certainty Equivalent in Years of Life]
Time-Tradeoff Method

• Satisfies the theoretical assumption for choice
• Does not satisfy the theoretical assumption for risk
• Easier for people to do than the standard gamble method and harder for them to do than the rank-and-scale or visual analogue methods

THE TIME-TRADEOFF METHOD

Assume your life expectancy is 25 years. If you had a tracheostomy with artificial speech, would you be willing to accept a somewhat shorter survival in exchange for normal anatomy with normal speech? If so, how many years out of 25 years would you give up for normal anatomy with normal speech? For example, would you give up 5 years and choose 20 years with normal speech rather than 25 years with artificial speech? If not, what number of years with normal speech would be equal to 25 years with artificial speech?

Assume your life expectancy is 10 years. If you had a tracheostomy with artificial speech, would you be willing to accept a somewhat shorter survival in exchange for normal anatomy with normal speech? If so, what number of years with normal speech would equal 10 years with artificial speech?

EQUIVALENT YEARS OF LIFE

<table>
<thead>
<tr>
<th>Tracheostomy with Artificial Speech</th>
<th>Normal Anatomy with Normal Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>12.5</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
</tr>
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</table>
Curve for Normal Anatomy and Normal Speech from Standard Gamble Method

Using the Normal Speech Curve and the TTO Responses to Generate the Tracheostomy Curve

Add Information from Time-Tradeoff Method to this Curve
Add More Information from Time-Tradeoff Method to this Curve

Construct Tracheostomy Curve

Population Lossing

Radiation  Surgery
SUMMARY OF THE TIME-TRADEOFF METHOD

1. The analyst defines the outcomes

2. The analyst specifies the number of years in the worse health state

3. For the specified number of years in the worse health state, the subject identifies the equivalent number of years in the better health state

Asian Viral Disease

Imagine that the U.S. is preparing for an epidemic of an unusual viral disease from Asia, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the consequences of the programs are as follows.
Asian Viral Disease

If Program A is adopted, 200 people will be saved.

If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and a 2/3 probability that no people will be saved.

---

Asian Viral Disease

If Program A is adopted, 400 people will die.

If Program B is adopted, there is a 1/3 probability that no people will die, and a 2/3 probability that everyone will die.

---

Which of the two programs do you favor?

<table>
<thead>
<tr>
<th>Description</th>
<th>Program A</th>
<th>Program B</th>
</tr>
</thead>
<tbody>
<tr>
<td>X “saved”</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Y “die”</td>
<td>↓</td>
<td>↑</td>
</tr>
</tbody>
</table>
OPTIONS FOR SOLVING THE UTILITY-MEASUREMENT PROBLEM

1. Do not perform a decision analysis
2. Create a model whose outcomes can be compared on a natural scale
3. Identify and resolve inconsistencies while utilities are being measured
4. Use more than one method to measure utilities
5. Perform sensitivity analyses

Summary Issues: Scale

- Any scale will work
- 0 to 100 most common
- 0 to 1 second most common
- Scales with minus numbers (because all the outcomes are “bad”) are prone to human error

Summary Issues: Whose Preferences to Measure?

- Patients understand the outcomes better
- Members of the general public pay for the decisions
Other Summary Issues

• 4 direct measures for measuring utilities
• Any of these 4 methods can be used alone to measure utilities for the outcomes of a decision problem
• Any of these 4 methods can be used alone to calculate QALYs
• Few published studies use any of these 4 methods; most use indirect methods

Answers for EP550 Homework 6

Summary of Individual Responses

Manuscript

Summary of Individual Responses

Table 1. Number of responses by item and grade.

<table>
<thead>
<tr>
<th>Item</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
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<tbody>
<tr>
<td>Relevance</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
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<td>1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completeness</td>
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<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Appeal</td>
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<td>1</td>
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<tr>
<td>Educational Value</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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Table 2. Number of responses by recommendation about publication.

<table>
<thead>
<tr>
<th>Publication Recommendation</th>
<th>Number of Responses</th>
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<tbody>
<tr>
<td>Reject</td>
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<tr>
<td>Reconsider after major revision</td>
<td>3</td>
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<tr>
<td>Accept after satisfactory revision</td>
<td>1</td>
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<tr>
<td>Accept</td>
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<tr>
<td>Total</td>
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Table 3. Number of responses by recommendation for an editorial.

<table>
<thead>
<tr>
<th>Editorial Recommendation</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>No response or not applicable</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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</table>
Amniocentesis and sampling of chorionic villi can diagnose trisomy 21 accurately, but they can lead to miscarriages (1-2 per 100 tests). Screening tests such as ultrasound (to estimate translucency under the skin behind the baby’s neck) and markers in maternal serum (hCG, free beta hCG, AFP, and estriol) can estimate the risk of trisomy 21 but not confirm it or rule it out with confidence. When these screening tests first became available, if the mother was ≥ 35 years of age, amniocentesis and chorionic villus sampling were offered without prior screening using ultrasound or serum markers. If she were < 35 years of age, screening was done first to estimate the level of risk, and amniocentesis and chorionic villus sampling were offered only to high-risk women. Today, most women are screened regardless of age, and amniocentesis and chorionic villus sampling are offered only to high-risk women.

Cell-free fetal DNA (cffDNA) originates from trophoblasts in the placenta, circulates in maternal blood, and constitutes 2-6% of the DNA in maternal blood. cffDNA can be detected as early as 7 weeks after gestation starts. The amount increases as pregnancy progresses, and it is no longer detectable 2 hours after birth. cffDNA testing has no risk of miscarriage because it requires only a blood sample from the mother.
Recent advances in cell-free fetal DNA (cffDNA) technology have resulted in very high detection rates for trisomy 21 (c. 99%) with false-positive rates below 1%\textsuperscript{7–10}. . . the American College of Obstetricians and Gynecologists (ACOG) has recommended a hybrid approach to cffDNA screening whereby patients ≥35 years of age are considered at sufficiently high risk to be eligible for . . . cffDNA screening while patients <35 years of age are to be screened first with one of the traditional screening protocols\textsuperscript{11}.

“. . . [Also,] primary screening [of all pregnant women] with cffDNA has been suggested\textsuperscript{12} . . . [In addition,] recent studies indicate that a contingent approach to cffDNA screening, in which a high-risk group is identified initially through traditional and less expensive screening methods and only patients in this group are offered cffDNA screening, may be more cost-effective\textsuperscript{13–15}.”

\textbf{Problem}

Create a decision model for examining the consequences of different programs that are recommended for using the cell-free fetal DNA test to screen pregnant women for fetuses that have trisomy 21.
"Also, primary screening [of all pregnant women] with cffDNA has been suggested. In addition, recent studies indicate that a contingent approach to cffDNA screening, in which a high-risk group is identified initially through traditional and less expensive screening methods and only patients in this group are offered cffDNA screening, may be more cost-effective."

"Recent advances in cell-free fetal DNA (cffDNA) technology have resulted in very high detection rates for trisomy 21 (c. 99%) with false-positive rates below 1%. The American College of Obstetricians and Gynecologists (ACOG) has recommended a hybrid approach to cffDNA screening whereby patients ≥35 years of age are considered at sufficiently high risk to be eligible for cffDNA screening while patients <35 years of age are to be screened first with one of the traditional screening protocols."
Screen everyone with cfDNA.

Choose

Start with traditional screening, then add cfDNA when pregnancy is hi risk.

If > or = age 35, use cfDNA; if < 35, start with traditional screening, then add cfDNA when pregnancy is hi risk.
Background
Fever is a common symptom in the emergency department (ED). Fever can be caused by bacterial infections, which are treated with antibiotics. Often, bacterial infections cannot be ruled out in the ED using standard diagnostics, and empiric antibiotic treatment is started. Procalcitonin (PCT) is a biomarker for bacterial infections, but its role in an undifferentiated ED population remains unclear. We hypothesize that PCT-guided therapy may reduce antibiotic prescriptions in undifferentiated febrile ED patients. The primary objectives of this study are to determine a) the efficacy, b) the safety of PCT-guided therapy, and c) the accuracy of the biomarker PCT for bacterial infections. The secondary objective is to study the cost-effectiveness of PCT-guided therapy.
Methods/design: This is a multicenter noninferiority randomized controlled trial that compares procalcitonin-guided therapy with usual care. All adult ED patients with fever (≥38.2 °C) are randomized between standard care with and without the addition of a procalcitonin level, after written informed consent.

PCT-guided therapy
PCT-guided therapy is defined as the initiation of antibiotics, based on all available diagnostics with the addition of PCT-levels. The PCT results are appraised using a two-point scale, in which bacterial infections are respectively deemed unlikely (PCT < 0.5 μg/L) and likely (PCT ≥ 0.5 μg/L). These cut-off values are used in other trials [26–28].

Follow-up
One month after inclusion, patients will be contacted by telephone by one of the investigators. Course of the disease, including medicine use, related GP hospital visits (and diagnostics/prescriptions), and labor productivity losses, will be evaluated. Three months after inclusion, one of the investigators will contact patient’s GP in order to evaluate the final outcome of the febrile episode. Patients are allowed to participate only once.
Statistical analyses for the secondary study parameters

The study will involve an economic evaluation from the societal perspective comparing procalcitonin-guided therapy with usual care. The economic evaluation will use the technique of cost-minimization analysis, which compares two interventions of identical effectiveness to find out which is less costly. Total treatment costs will be compared between the procalcitonin-guided therapy arm and the control arm, including costs for procalcitonin testing (intervention group only), other diagnostic tests, ED visits, antibiotics and other medications, adverse effects of antibiotics, hospital admissions, return visits to the general practitioner and other related medical consumption. These costs will be taken into account during the one-month follow-up period. Unit prices will be calculated using real economic cost prices or using standard cost-prices for health economic evaluations [24].

Unit prices will be multiplied by the quantities for each resource used, and then summed over the separate types of resource to give a total cost per patient. In addition, differences in labor productivity losses will be evaluated by comparing costs of absence from work (absenteeism) and reduced productivity while at work. Moreover, productivity losses related to unpaid work (e.g., household work, shopping, odd jobs, and voluntary work) will be included. Productivity losses will be evaluated using the Productivity Costs Questionnaire [25]. Mean total costs will be calculated for patients in each treatment group.