Measurement of Health-related Quality of Life and Utilities

Kit N. Simpson, Dr.P.H.

Slides courtesy of Elinor C.G. Chumney

Measuring Effects or Outcomes

- Effects can be measured in a number of ways, depending on the treatment under analysis.

Measuring Effects

<table>
<thead>
<tr>
<th>Hierarchy of Health Outcome Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome includes clinical and contemporary measures that people experience (feel and act) and care about</td>
</tr>
</tbody>
</table>

- Clinical outcome
- Symptom
- Health perceptions
- Function
- Resource use
- Cost
Measuring Effects or Outcomes

- However, effects are standardized in CBA (which measures effects in $) and CUA (which measures effects in QALYs), facilitating comparison across studies

How is Quality of Life Measured?

- By objective instruments: How do you function and feel?
  - SF36: 36 generic health questions that probe physical and mental health and energy
  - Mos-HIV40: 40 questions that probe physical and mental health, energy and symptoms related to AIDS

How is Quality of Life Measured?

- By subjective instruments: How important is it to you to function and feel well?
  - Standard Gamble Utilities (gold standard)
  - Time Trade-off Utilities (nearly gold standard)
  - Visual Analog Scale: health thermometer rating (quick and cheap but varies widely)
How is Quality of Life Measured?

- By a mixed “translation” using a generic quality of life instrument, like the EQ5D (EuroQol), a rating scale and data from a population that received both the instrument and a Standard Gamble assessment.

Cost-benefit analysis (CBA)

- Effects are also measured in currency units
- Willingness-to-pay (WTP) or contingent valuation used to measure the dollar value of an intervention’s outcome
  - Subjects are first given description of health state (i.e. diabetes or MS) and then asked how much they would be willing to pay for a particular treatment or intervention with some benefit
  - The intervention is then valued by the maximum amount the subject would be willing to pay for it
- Measurement problems: Amount a subject willing to pay may be dependent upon his/her
  - Net worth ($100 may be a lot to some and a little to others)
  - Gaming of a hypothetical situation (tendency to overstate)
  - Experience with the illness described

Cost-utility analysis (CUA)

- Effects measured in quality-adjusted life years (QALYs)
  - Recognizes that the output of health care cannot be considered merely in terms of extra years of life; there are two important aspects of any intervention:
    - Quantity of life (life expectancy or mortality)
    - Quality of life (more difficult to measure morbidity)
- CER ($/QALY) indicates the costs required to generate the equivalent of one additional year of perfect health (1 QALY)
  - Decision rule: Generally, interventions with a CER less than $50,000/QALY are considered to be cost-effective
When is CUA appropriate?

- When quality of life is the or an important outcome
- When morbidity as well as mortality is affected
- When a wide range of different outcomes are relevant
- When it is important to compare results with other CUA studies

CUA: Utilities

- Utility or health-related quality of life (HRQOL)
  - Ranges from 0 to 1
    - 0 = death or a fate worse than death
    - 1 = perfect health
  - Allows patient to define their subjective perceptions and expectations of “health”
- Measured using:
  - TTO
  - Standard gamble
  - VAS
  - Generic or disease-specific instruments

CUA: Examples of utilities or health state valuations

<table>
<thead>
<tr>
<th>Health State (HS)</th>
<th>Description</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No problems</td>
<td>1.00</td>
</tr>
<tr>
<td>B</td>
<td>No problems walking about; no problems with self care; some problems with performing usual activities; moderate pain or discomfort; not anxious or depressed</td>
<td>0.79</td>
</tr>
<tr>
<td>C</td>
<td>Some problems walking about; unable to wash or dress self; unable to perform usual activities; moderate pain or discomfort; moderately anxious or depressed</td>
<td>0.17</td>
</tr>
<tr>
<td>D</td>
<td>Death</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>Confined to bed; unable to dress or wash self; unable to perform usual activities; extreme pain or discomfort; extremely anxious or depressed</td>
<td>-0.21</td>
</tr>
</tbody>
</table>
CUA: QALYs

- QALY = Utility of a HS X Time spent in that HS
  - Valuable measure of patient outcomes
  - Incorporates morbidity and mortality into a single measure
  - A year of life spent in perfect health is more valuable than a year of life spent in less-than-perfect health

<table>
<thead>
<tr>
<th>Utility</th>
<th>Length of time (years)</th>
<th>QALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>.75</td>
<td>3</td>
<td>2.25</td>
</tr>
<tr>
<td>.75</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>.5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

CUA: Calculating QALYs

- Scenario I: Superhuman person X spends 5 years in HS A (perfect health) and then dies

- Scenario II: Patient Y spends 5 years in HS C (less than perfect health with utility of 0.17) and then dies

- Scenario III: Patient Z spends 1 year in HS C, is treated for his condition and spends 3 years in HS B (still less than perfect health but with higher utility of 0.79), and then dies

CUA: Calculating QALYs

- Scenario I: Superhuman person X spends 5 years in HS A (perfect health) and then dies
  \[ \text{QALYs} = \text{Utility} \times \text{Time} = 1.0 \times 5 = 5 \text{ QALYs} \]

- Scenario II: Patient Y spends 5 years in HS C (less than perfect health with utility of 0.17) and then dies

- Scenario III: Patient Z spends 1 year in HS C, is treated for his condition and spends 3 years in HS B (still less than perfect health but with higher utility of 0.79), and then dies

CUA: Calculating QALYs

- Scenario I: Superhuman person X spends 5 years in HS A (perfect health) and then dies
  \[ X \text{ QALYs} = \text{Utility} \times \text{Time} = 1.0 \times 5 = 5 \text{ QALYs} \]
- Scenario II: Patient Y spends 5 years in HS C (less than perfect health with utility of 0.17) and then dies
  \[ Y \text{ QALYs} = \text{Utility} \times \text{Time} = 0.17 \times 5 = 0.85 \text{ QALYs} \]
- Scenario III: Patient Z spends 1 year in HS C, is treated for his condition and spends 3 years in HS B (still less than perfect health but with higher utility of 0.79), and then dies
  \[ Z \text{ QALYs} = \text{Utility} \times \text{Time} = (0.17 \times 1) + (0.79 \times 3) = 2.54 \text{ QALYs} \]
Expected increase in both quality and quantity of life for patients with severe angina

\[ \square = \text{Gain in QALYs from operation} \]

Quality of life

Option A: Medical Management

Option B: Operation (CABG)

Quantity of life (Years)

CUA: Measuring utilities

- Present subject with health state descriptions
- Elicit subject’s preference for the various health states using one of the following:
  - Ratings Scales - Visual Analogue Scale (VAS)
  - Standard Gamble
  - Time Trade-Off (TTO)
- Gauge subjects current quality of life using a questionnaire (generic or disease-specific)

CUA: Generic Instruments

- Designed to be comprehensive and used with a variety of different populations
- Used to compare treatments for different diseases
  - Produces a summary score as well as multi-attribute scores based on each of the following eight health concepts:
    - PF: physical functioning
    - BP: bodily pain
    - RP: role limitations due to physical health problems
    - RE: role limitations due to personal or emotional problems
    - MH: general mental health
    - SF: social functioning
    - VT: energy/fatigue
    - GH: general health perceptions
CUA: Disease-specific instruments

- Questions restricted to health attributes likely to be related to a specific illness of interest
  - ex. Asthma and CHF questionnaires (such as the Minnesota Living with Heart Failure Questionnaire)
- Used to compare treatments for single disease
- More likely to be sensitive to drug-induced changes and side-effects

CUA: Generic vs Disease-specific

- Comparison for the same condition
  ⇒ Can use disease-specific scale
- Comparison across conditions
  ⇒ Must use a general scale
- Ideal to use both instruments within a study

Important considerations when evaluating an instrument

- Validity
  - Ability to measure the truth
- Reliability
  - Consistency of measuring a given trait or behavior
  - Determined by repeat administration
- Sensitivity
  - Ability of instrument to reflect true changes or differences (ability to detect changes in the condition of a patient over time)
- Responsiveness
  - Ability to detect clinically important changes in outcomes over time
## SF-36 Norms in the U.S.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>PF</th>
<th>RP</th>
<th>BP</th>
<th>GH</th>
<th>VT</th>
<th>SF</th>
<th>RE</th>
<th>MH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males 18-24</td>
<td>54.3</td>
<td>54.5</td>
<td>51.7</td>
<td>52</td>
<td>49.9</td>
<td>50.8</td>
<td>52.7</td>
<td>49.8</td>
</tr>
<tr>
<td>Males 25-34</td>
<td>54.6</td>
<td>53.6</td>
<td>53.2</td>
<td>52.5</td>
<td>51.6</td>
<td>52.5</td>
<td>52.8</td>
<td>51.3</td>
</tr>
<tr>
<td>Males 75+</td>
<td>39.6</td>
<td>39.7</td>
<td>46.3</td>
<td>44.3</td>
<td>47.9</td>
<td>45.6</td>
<td>43.6</td>
<td>50.8</td>
</tr>
<tr>
<td>Females 18-24</td>
<td>53</td>
<td>51.7</td>
<td>51.9</td>
<td>48.1</td>
<td>45.7</td>
<td>48.3</td>
<td>48.3</td>
<td>45.3</td>
</tr>
<tr>
<td>Females 25-34</td>
<td>53</td>
<td>51.7</td>
<td>51.4</td>
<td>50.9</td>
<td>48.1</td>
<td>49.4</td>
<td>49.7</td>
<td>47.8</td>
</tr>
<tr>
<td>Females 75+</td>
<td>37.2</td>
<td>40.4</td>
<td>44.9</td>
<td>46.4</td>
<td>47.9</td>
<td>46.2</td>
<td>43.6</td>
<td>50.4</td>
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