Problem

• Return to instructor’s radial head crack
• How can we get the instructor to express a preference for that health state in comparison with others?
  – What is typically asked of ER patients who are there for an injury? Is this a tradeoff?
  – What matches with theory?
Introduction

• Trying to obtain a preference weighted measure with *interval* properties to use in a QALY calculation
  – Interval properties implies that a difference of 0.1 anywhere means the same thing
    • The meaning of a change from 0-0.1 should be the same as the meaning of a change from 0.9-1.0
      – 0 implies death
      – 1 implies perfect health

• Some issues we’ll discuss at the end rely on “ratio” rather than interval properties
Outline

- Discuss methods
  - Standard gamble
  - Time Tradeoff
  - Visual Analog Scale
  - Person Tradeoff
  - Risk Tradeoff
- Compare QALYs with Healthy Year Equivalents
- Discuss other issues of health utility measurement
Objectives

• Calculate health utility value for…
  – Chronic disease
  – Temporary disease
  – States better and worse than death
• Understand the pros and cons of various measures
  – Including the burden of various measures
    • The need for an interviewer
Describing Health States

- Choice of how to describe health states
- No one method is universally agreed upon as best
Scenarios

• Abstraction of reality
• Reading a scenario is not equivalent to seeing and/or interviewing a patient
• Only certain elements are emphasized
• Not everyone describes state the same way
  – Comorbidities may be included or excluded
Taxonomic Description

• List domains
  – Health perceptions, social function, psychological function, physical function, impairment
    • Each of these can get more specific

• Describe status of each domain
  – Various indicators can be used for each domain
    • Social relations
      – Interaction with others or participation in the community

• Domains may interact with one another
Preference and Non-preference Systems

• Preference based
  – Ask subjects to make judgements regarding the value of particular health states in comparison with one another

• Non-preference based
  – Use methods that assign scores to individual components and simply sum component scores
Standard Gamble

- Notation
  - Perfect health denoted as PH
  - Health state to be valued denoted as HS

- Expected utility
  - weighted average of state-specific utilities

- Assume
  - utility of death = 0
  - utility of perfect health = 1
Chronic & Preferred to Death Calculation

- \( EU(HS) = (1-p_{PH})U(\text{Death}) + p_{PH}U(\text{PH}) \)
  - In question posed to respondent:
    - Specify that experience both HS and PH for the same number of years, which is the rest of the person’s life
  - Conventions are arbitrary
    - Contribute to tractability
Chronic & Preferred to Death Result

• From…
  – EU(HS) = (1 - p_{PH})U(Death) + p_{PH}U(PH)

• To…
  – EU(HS) = p_{PH}

• Consider varying responses…
  – A higher probability of perfect health
    • Implies lower probability of death
    • Implies higher valuation of health state
Standard Gamble – Temporary Health State

• What has a value of 0?
• Alternative #1: Assign worst temporary health state a value of zero
  – Arbitrary
    • While individuals may have different feelings about death it is easily identified and recognizable
  – Score similarly to chronic conditions
Standard Gamble – Temporary Health State

• Alternative #2: Suppose want to put on the 0-1 death-perfect health scale
  – Get a value for the worst temporary health state (still arbitrary) as a short chronic disease
    • Not same as basic standard gamble since don’t have usual life expectancy
  – Then value others of increasing value

• \( EU(HS) = (1 - p_{PH})U(Worst) + p_{PH} \)
  – Knowing \( U(Worst) \) allows calculation
Standard Gamble – State Worse than Death

• Change what is “certain” as the certain outcome needs to have a value between the other two
  – Death is certain
  – 0 = (1 - p_{PH})U(HS) + p_{PH}U(PH) \Rightarrow U(HS) = -p_{PH}/(1-p_{PH})

• Consider varying responses
  – As the probability of perfect health increases
    • Utility of the health state decreases
    • As the respondent indicates that a lower probability of the health state in question makes her indifferent to death the utility associated with that health state must be lower
Problems with Expected Utility Theory

• Does it hold?
• Some findings suggest that respondents will value a gain less than a loss of similar magnitude
  – Prospect theory
  – People really like to avoid losses
End Result of Expected Utility Theory Problems

• Desire to avoid death
  – Place very low probability on death & very high probability on perfect health

• Results in very high values for what seem to be “bad” health states
  – Result 1: Overestimate utility of conditions
  – Result 2: Underestimate utility gain from cure/avoidance
  – Result 3: Potential lack of sensitivity to changes in health
Are People Accustomed to Tradeoffs Implied?

• Clinical choices are more complex than accepting disease or having a treatment that leads to only cure or death

• To facilitate consideration of tradeoffs
  – Use props or visual aids
    • Probability wheel
Time Tradeoff

• Two certain outcomes rather than one certain outcome and one “lottery”

• Assume
  – $U(X \text{ Years in HS}) = X \cdot U(1 \text{ Year in HS})$
  – Oversimplification
  – No discounting
TTO – Chronic Condition Preferred to Death

- $X \cdot U(HS) = Y \cdot U(PH) = Y$
- $U(HS) = Y/X$
  - For a fixed length of time in a health state, the longer the time in perfect health the higher the utility of the health state
Graphical interpretation

• Total value of being in perfect health for 1.5 years is the same as being at 0.25 quality level for 6 years
TTO – Temporary Health State

- Have temporary state for time T
- What is time \( (X<T) \) that would have worst (or any worse) temporary state followed by perfect health for remainder of T?
- \( T \ U(HS) = X \ U(WORSE) + (T-X) \ U(PH) \)
- \( U(HS) = 1 - (1- U(WORSE)) \frac{X}{T} \)
- Consider varying responses
  - Longer in worse state yields lower HS
- Can convert to a death to perfect health scale by scoring the worst health state as a short chronic condition just as in standard gamble
TTO – States Worse than Death

• Setup with 2 choices
  – Immediate death or healthy for Y years and ill for T-Y years
    • Does it matter whether you begin healthy or unhealthy?

• Set utilities equal
  – 0 = Y + U(HS) (T-Y)
  – U(HS) = Y / (Y-T)
    • The longer the time that the person would need to spend in perfect health the lower the value of the health state
TTO – Issues

• Time tradeoff focuses on years at end of life
  – Years at end of life are valued less with discounting
    • May lead to bias without discounting correction
Visual Analog Scale

- Not preferred by some health economists
- Use a scale with anchor points
  - 100 is perfect health
  - 0 could be death or worse imaginable state
    - Issue will arise if zero is worst imaginable state
      - Need to obtain valuation of death in order to make the analysis similar to standard gamble and time tradeoff
VAS Empirical & Theoretical Issues

- Are we making tradeoffs?
- This method leads to lower scores than other two measures
  - Perhaps because not making explicit tradeoffs
  - Perhaps because in making tradeoffs not forced to consider death
Healthy Year Equivalents

- Procedure
  - Start with a health state and ask a standard gamble question
  - Then tell how many years in full health would provide equal value
- With no discounting seems identical to time tradeoff
  - However, what is being measured?
    - # of years in PH with same utility as X years in HS
    - Not impute Y/X ratio to the other length of time
      - May be important with discounting
- Other considerations
  - Can describe health trajectories
  - Burden of asking for each length of time
Person Tradeoff (PTO)

• References
  – Richardson SSM 39:7-21
  – Prades HE, 6: 71-81

• Why consider this?
  – Does it yield a better social value of HS?
  – Does consistency of value obtained in original DALY exercise depend on PTO method or on multiple step validation
PTO Methods

• One formulation of the question
  – “With W people in adverse state A, and Z people in adverse state B, you can only cure one group. Whom would you choose to cure?”
  – Vary W and Z until the respondent is indifferent
  – Assume both will live same length of time after cure
PTO Calculation

- Setting utility gains or disutilities equal rather than setting utility levels equal
  - \( W(1-U(A)) = Z(1-U(B)) \)
  - \( (1-U(B)) = \left[\frac{W}{Z}\right](1-U(A)) \)
Alternative PTO Question

• Helps to make tradeoffs among population explicit
• “How many chronically ill people would need to be cured to be indifferent to saving 10 healthy people with similar life expectancy who are about to die?”
  – $Z \times (1-U(B)) = 10(1-0)$, where $0 = U(\text{Death})$
  – $U(B) = \frac{(Z-10)}{Z}$
  – Deals directly with states worse than death
    • Any $Z<10$ implies a health state worse than death
  – Consider varying responses
    • As $Z$ increases, $U(Z)$ also increases
PTO Advantages

- No special methods for:
  - Temporary health states
  - States worse than death
- Since assume same life expectancy have no discounting issues
- Compare any two health states
- Can ask series of questions to work from worse states to better states
PTO Issues

• Not valuing one’s own health so it violates the principle of one person’s valuation of their own health
  – How important is this principle
  – We typically use the population average value

• Alternative frames of reference
  – Is number chronically ill or about to die fixed?
  – Are we talking about 10 people, 1,000 people or 100,000 people
  – Is there a decreasing marginal utility per person saved?

• No uncertainty
PTO & Prospect Theory

• Prospect theory
  – Similar magnitude loss is valued much more than a gain
  – Value of achieving an outcome depends on where one starts
    • Importance of relative rather than absolute
Risk-Risk Tradeoff

• Reference
  – Clarke et al., Quality of Life Research, 6: 169

• Questions still compare three states
  – PH, HS, Death

• Have risks with all three states on both sides of equation

• Deal with risks for two states worse than perfect health
RRTO - Empirical Example Scenario Setup

- Multimedia presentation has appearance of a population measure
- Two cities
- Natural disaster may strike tomorrow that is not under individual’s control
- City A has a higher risk of painless death from disaster
- City B has a higher risk of HS
- No discounting issues
RRTO - Empirical Example Mathematical Setup

- Vary probabilities until expected utilities are equal
- Maintain $p_{DA} > p_{DB}$ and $p_{HSA} < p_{HSB}$
- If had higher probabilities of both less than perfect health states in one city, the expected utility of living there would necessarily be lower

$$p_{HSA} U(HS) + p_{DA} U(D) + [1 - p_{HSA} - p_{DA}] U(PH) =$$
$$p_{HSB} U(HS) + p_{DB} U(D) + [1 - p_{HSB} - p_{DB}] U(PH)$$
RRTO- Empirical Example Calculation

- Use fact that $U(D) = 0$ & $U(PH) = 1$
- $p_{HSA} U(HS) + [1 - p_{HSA} - p_{DA}] = p_{HSB} U(HS) + [1 - p_{HSB} - p_{DB}]$
- $U(HS) = [(p_{DA} - p_{DB}) - (p_{HSB} - p_{HSA})]/[p_{HSA} - p_{HSB}]$
- $U(HS) = 1 + [(p_{DA} - p_{DB})/(p_{HSA} - p_{HSB})]$
RRTO – Empirical Interpretation

- Either the numerator or denominator of the fraction is negative
  - Important because this yields health state utilities that are less than one
- If smaller differences in the probability of a health state than in the probability of death, the state is worse than death
- If hold all fixed other than $p_{HSB}$, increasing $p_{HSB}$ increases the utility of HS
RRTO Empirical Results

• Empirically this measure did not do so well
  – Frame of reference issues
  – Lack of difference between death and health state as adverse events
  – With four variables it may be difficult to conceptualize so the actual implementation varied only two
Measurement when Death $\neq 0$

- Death $\neq 0$
  - Not everyone has the same preferences
  - Expand the scale linearly
  - Assume that $U(PH)=1$ in all cases
  - Have to adjust value of death so that it is at the intended anchor point
  - Reset scale
    - Scale is too short
    - Smaller than actual marginal impacts
Comorbidities and Perfect Health

• Utility without the disease in question is actually something less than one among the general population
  – Misperceived question
    • Maybe respondent problem
    • Maybe survey problem

• Where does life without disease belong
  – Less tractable problem
Implications of Comorbidity Issue

- Moving to life without disease from life with disease has excess marginal impact relative to what it would have if the general population value were used
  - Suppose person considers a value of 1 to be life without a particular disease or in light of other comorbidities rather than PH
    - Patient considers health without the disease in question to be of higher quality than individual in general population
    - Overestimate the effects of getting rid of the disease
Adaptation and Coping

- Difference in perceptions
- Rank health with disease closer to one and decrease marginal impact
- Need general perception of disease
- Individual with disease ranks state with disease higher than general public but other conditions are ranked similarly
- Not as much room for improvement among people with adapted preferences as among the general population