Recommendations for Conducting Cost Effectiveness: Elements of the Reference Case

Ciaran S. Phibbs, Ph.D.

January 13, 2016
What will you learn?

- Why do we need to standardize cost-effectiveness analyses
- What needs to be standardized
- Build on details from previous lecture
PHS Recommendations

PHS Recommendations, JAMA Summary


Poll

- Have you ever conducted a cost-effectiveness analysis?
- Answers
  - No
  - One study
  - More than one study
Why Do We Need Cost-Effectiveness Analysis?

- Health care interventions affect many different outcomes, in different ways.
- Need a common metric to allow comparisons across diverse diseases, conditions, and patient populations (e.g., compare the value of interventions for PTSD and coronary artery disease).
What is Cost-Effectiveness Analysis?

- Tool for making decisions, a common metric to compare diverse interventions
- An intervention or treatment is compared to an alternative; “usual care” is the standard comparator.
- Essentially asking, is the treatment being evaluated “better” than the current standard of care?
What is Cost-Effectiveness Analysis?

- Need to find both the costs of the intervention (and the comparator) and assign values to outcomes

- Outcomes must be measured on a single scale; the standard is Quality Adjusted Life Years (QALYs)
Cost-Effectiveness Analysis vs. Cost-Utility Analysis

- CUA is a specific form of CEA, where the outcome is measured in utilities (usually QALYs)

- More generalizable

- I will use terms interchangeably, but focus of this talk is only CUA
Dominance Principles

- Only available tool if outcomes are not measured in QALYs
- An intervention is favored if it is more effective and costs less
- Extended dominance can be used when 3 or more treatments are being compared
# Application of Dominance

<table>
<thead>
<tr>
<th>Change in Cost</th>
<th>Change in Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Standard care preferred (dominated)</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td>Intervention Preferred (cost saving)</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Examples of Strong Dominance or Cost Saving (better outcomes and lower costs)

- These are RARE!!!
- Many infant/childhood vaccinations/immunizations (Polio, MMR, etc.)
- Age appropriate cervical cancer screening
- Mandatory motorcycle helmet laws
Example of Strong Dominance (better outcomes and lower costs)

- Neonatal surfactant replacement therapy, 50% reduction on RDS mortality
- Reduced mortality increases costs
- But, surfactant reduced treatment intensity and LOS of those who would have survived anyway
- Net result, lower mortality and lower costs
- May see more of these as we develop treatments that address the underlying biologic problem
Incremental Cost-Effectiveness Ratio

- Calculated when one intervention is more effective and more costly

\[
\frac{\text{Cost}_{\text{EXP}} - \text{Cost}_{\text{CONTROL}}}{\text{QALY}_{\text{EXP}} - \text{QALY}_{\text{CONTROL}}}
\]
Application of Critical Cost-Effectiveness Ratio

Change in Cost

Standard care preferred

CE Ratio =$50,000/QALY

Change in Effectiveness

Intervention preferred
Where does the $50,000 per QALY Threshold Come From?

- This is both old and arbitrary.
- When Medicare extended to cover ESRD, estimated gain was $50,000 per QALY
- Revealed public preference
- Never updated for inflation
What is the “Reference Case”

- A standard set of methods and assumptions to serve as a point of comparison across studies
Why Do We Need a Reference Case?

- There are many different assumptions, methods, and perspectives that can affect the outcomes of a cost-effectiveness analysis.
- Without standardization, it would not always be possible to compare the results across studies.
- Standardization greatly increases the policy value of C-E analysis.
PHS Recommendations: Summary

- Adopt perspective of society
- Measure all costs
  - direct cost of intervention
  - all health care expenditures
  - patient incurred cost
- Express outcomes as Quality-Adjusted Life Years (QALY)
PHS Recommendations: Summary (continued)

- All health effects in the denominator of the C/E ratio
- The numerator of the C/E ratio captures all changes in resource consumption associated with the intervention
- Discount costs and outcomes at 3% annual rate
PHS Recommendations: Summary (continued)

- Model when effects of intervention not fully realized during the study period
- Conduct sensitivity analysis
- Test statistical significance of cost-effectiveness findings
- Standards for reporting of C/E analyses.
Societal Perspective

- Adopt perspective of society
- Payer perspective may yield very different results; benefits or costs may occur to others, including:
  - Patient
  - Other payers
  - Other individuals (e.g., family members)
  - Employers
Budget Impact Analysis

- For VA studies, may also consider doing a Budget Impact Analysis, in addition to a CEA
- Provides VA managers with information about the cost of implementation, time line of the costs and benefits; important for budget planning.
- May help speed adoption/implementation
- Will be covered in a later lecture
Denominator vs. Numerator

- All health effects in the denominator, expressed in QALYs
- The numerator of the C/E ratio captures all changes in resource consumption associated with the intervention
- There are gray areas, that could be placed in either
- Avoid double counting.
Poll: Do these belong in the numerator of the ICER? Yes/no answers

- Health care costs associated with the intervention
- Length of stay
- Costs of patient time
- The value of lost productivity
Components Belonging in the Numerator of the C/E Ratio

- Costs of health care services
- Costs of patient time ***
- Costs of care-giving (paid and unpaid)
- Other costs (e.g. travel time)
- Costs measured in constant dollars
- Use wage rates to value time costs
Components Belonging in the Numerator of the C/E Ratio (cont)

- Non-health care costs
  - E.g., education, criminal justice, environment
- Costs imposed on others
  - E.g., employers, rest of society
- Do NOT include lost productivity; would result in double counting
Components Belonging in the Numerator of the C/E Ratio (cont)

- Health care costs that result from living longer
  - Include costs for intervention-related diseases within original expected life span, and for added years of life
  - Include costs of treating adverse events
  - Exclude unrelated health care costs and non-health care costs within original expect life span
  - Exclude non-health care costs for added years of life
  - No recommendation for unrelated health care costs for added years of life
Components Belonging in the Denominator of the C/E Ratio

- Measure health effectiveness in QALYs
- QALYS should be preference based
- Weights based on community preferences
- Use a generic health-state classification, as opposed to disease-specific
- Use age- and sex-specific HRQL to value gains and loses
Modeling May Be Necessary

- Most clinical trials don’t cover full time horizon of the potential effects, both costs & QALYs
- It is allowable to use modeling and/or data from other sources to complete the analysis
- Use of expert judgment should be avoided, if possible
Discounting

- Real discount rate of 3%
- All costs should be adjusted for inflation
- Both costs and health outcomes should be discounted
- Conduct sensitivity analysis of the discount rate.
Sensitivity Analysis

- Conduct sensitivity analysis
- 1-way sensitivity analysis for key assumptions
- 1-way sensitivity analysis under-state overall uncertainty; should also conduct multivariate sensitivity analysis
Bootstrap Determination of Cost-Effectiveness Confidence Region

- Sample n observations with replacement
- Find incremental cost-effectiveness ratio
- Repeat 1,000 times
- Find percentage of replicates that are not “cost-effective”
  - this is the p-value
  - p-value may vary by threshold
Distribution of Bootstrapped Cost-Effectiveness Ratios
Sensitivity Analysis: How Does Significance Vary by CE Threshold?

![Graph showing the relationship between P Value and CE Threshold]

- P Value vs. CE Threshold
- CE Threshold values range from 1,000 to 100,000
Standards for Reporting Results


- List of information that needs to be included to allow comparison across studies

- This is very important from a policy perspective
Alternative Method

- Just to mention, alternative to reporting ICER, net benefit regression.


- HERC Cyber-Seminar, Hoch 8/23/2006
Other References

- **Methods for the Economic Evaluation of Health Care Programmes (Paperback)**


Other References

- ISPOR Task Force for CEA in clinical trials, see:
Next HERC Cyber Course

January 27, 2016

Estimating the Cost of an Intervention
Todd Wagner, Ph.D.