"Great news! The shareholders have approved your heart bypass!"
Health Economics

- The allocation of scarce resources.

  - How do people and firms respond to economic incentives?
  - How do economic factors combine with regulations/institutions to influence the cost and quality of care?
  - Is it economically "favorable" to adopt a new technology over an older one?
What is Economic Evaluation?

Definition: Economic Evaluation is ...

the identification, measure, and comparison of the costs (i.e. resources consumed) and outcomes (clinical, economic, and humanistic) of interventions (pharmaceuticals, non-drug therapies, public health programs).
Why Economic Evaluation?

- The pressure of cost containment
- The need for methods to evaluate medical interventions, especially emerging technologies
- Purpose of economic evaluation
  → efficient resource allocation

NOTE: equity is often not addressed
Who uses Economic Evaluation? (cont.)

- Hospital and health plan managers
  - What drugs should be included on the hospital formulary or PBM services?
  - Which drug delivery system is the best for the hospital?

- Pharmaceutical companies
  - What is the best drug for a pharmaceutical company to develop or disease area to target?
  - Should the company discontinue a clinical trial?
  - What is the economic benefit of a new product?
Who uses Economic Evaluation? (cont.)

- **Government**
  - Which drugs should be included in a Medicaid formulary?
  - Is it cost effective for Medicare to cover annual mammography?
  - Is patient navigation program cost effective for Medicare?

- **Researchers**
  - All of the above!!
  - How to improve the analytical credibility of economic evaluation?
Published Guidelines of Economic Evaluation

- Australia
- Canada – Ontario
- US – BC/BS HTA, AMCP guideline
- UK – National Institute of Clinical Excellence (updated guideline published in 2008)
  - Guide to the Methods of Technology Appraisal
  - Guide to the Technology Appraisal Process
Different forms of economic evaluation.

**INPUTS**
- RESOURCES CONSUMED

**HEALTH CARE PROGRAM**

**OUTPUTS**
- HEALTH IMPROVEMENTS

---

**POSSIBLE MEASUREMENTS**

- **E**
  - In Natural Units
  - (Health Effects)

- **U**
  - In Utility Units
  - (Quality Adjusted Life-years)

- **B**
  - Associated Economic Benefits ($)
  - $B_1$ = Direct Benefits
  - $B_2$ = Indirect Benefits
    - (Production Gains)
  - $B_3$ = Intangible Benefits

- **C**
  - $C_1$ = Direct Costs
  - $C_2$ = Indirect Costs
    - (Production Losses)
  - $C_3$ = Intangible Costs
More Costly

Intervention is less effective and costs more.

Decrease in Health/Quality of Life

Intervention is more effective and costs more.

Increase in Health/Quality of Life

Intervention is less effective and costs less.

Less Costly
Another CE example

A Decision-Analytic Evaluation of the CE of Family History-Based Colorectal Cancer Screening Programs
(S.D. Ramsey et al, American Journal of Gastroenterology 2010)

What is the marginal CE of conducting family history screening (FHS) during annual checkup to identify persons with a first-degree relative (FDR) with colorectal cancer (CRC)?

- Persons w/ an FDR w/ CRC will receive colonoscopy and follow-up, and those with a polyp will be screened and treated for CRC if necessary.
- What are the lifetime costs and years of life saved for each alternative screening strategy?
Usual care: colonoscopy screening for entire population at ages 50, 60, 70, and 80.

With screening, look at marginal CE of each of the following possible strategies:

- Colonoscopy at age 40, then every 10 years to age 80 (40/10).
- Colonoscopy at age 50, then every 5 years to age 80 (50/5).
- Colonoscopy at age 40, then every 5 years to age 80 (40/5).
Figure 1. Adenoma and cancer stages in the MISCAN-COLON microsimulation model. The size-specific prevalence of adenomas, as well as the proportion of adenomas that develop into cancer, is dependent on age and family history for colorectal cancer (1).
• Costs of FHS and CRC screening based on Medicare fee schedules; other costs from the literature.

• Assume 1/3 of a level III (history/exam) office visit used to take family history.

• 2 hour time cost for patient and driver for travel and time for colonoscopy.  
  (time costs based on US median hourly wage).

• Treatment costs of adenomas found and pathology.

• Costs of colonoscopy-related complications.
• Costs of care for persons with CRC by stage.

• Costs are expressed in 2005 US dollars.

• Future costs and YOLS discounted at 3%.
### Table 3: Lifetime costs and effects from the societal perspective, per thousand 40-80 year-old in 2000

<table>
<thead>
<tr>
<th></th>
<th>No screen</th>
<th>50/10</th>
<th>40/10</th>
<th>50/5</th>
<th>40/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening tests</td>
<td>0</td>
<td>983</td>
<td>997</td>
<td>1001</td>
<td>1,027</td>
</tr>
<tr>
<td>Colorectal cancer deaths</td>
<td>23</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Life years</td>
<td>48,285</td>
<td>48,350</td>
<td>48,351</td>
<td>48,351</td>
<td>48,352</td>
</tr>
<tr>
<td>Total lifetime cost</td>
<td>4,269</td>
<td>5,458</td>
<td>5,495</td>
<td>5,496</td>
<td>5,521</td>
</tr>
</tbody>
</table>
Table 4. Incremental cost-effectiveness ratios for colorectal cancer screening considering Usual Care (no family history screening) and alternative schedules following family history screening, all using colonoscopy; comparison groups appear within table, all amounts are in 2005 US dollars.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Usual Care 50/10</th>
<th>FHS 40/10</th>
<th>FHS 50/5</th>
<th>FHS 40/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No screening</td>
<td>18,069</td>
<td>18,555</td>
<td>18,449</td>
<td>18,678</td>
</tr>
<tr>
<td>Usual Care 50/10</td>
<td>12,172</td>
<td>53,727</td>
<td>51,022</td>
<td></td>
</tr>
<tr>
<td>FHS 40/10</td>
<td></td>
<td>896</td>
<td>27,455</td>
<td></td>
</tr>
<tr>
<td>FHS 50/5</td>
<td></td>
<td></td>
<td>47,411</td>
<td></td>
</tr>
<tr>
<td>FHS 40/5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FHS, family history screening.
*See text for the definition of Usual Care, 40/10, 50/5, and 40/5.
Real vs. Nominal Dollars

When costs are incurred over many years, one should adjust for inflation.

- Inflation is a rise in the general level of prices of goods and services in an economy over time.
- Even though the content of a history/exam office visit is the same in 2011 vs. 2006, the cost of the visit will be higher in 2011.
Economists track inflation using various different market baskets of goods and services.

- Prices for medical care tend to rise faster than for other items.
- But economic evaluation tends to be from a societal perspective.
  - Is it worthwhile to spend $ on a new treatment vs. new roads or more education?
  - Use a general price index rather than one for medical services.
## All Urban Consumers – Consumer Price Index; 1982-84=100

<table>
<thead>
<tr>
<th>Year</th>
<th>All Items</th>
<th>Medical Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>% change</td>
</tr>
<tr>
<td>2000</td>
<td>172.2</td>
<td>3.4</td>
</tr>
<tr>
<td>2001</td>
<td>177.1</td>
<td>2.8</td>
</tr>
<tr>
<td>2002</td>
<td>179.9</td>
<td>1.6</td>
</tr>
<tr>
<td>2003</td>
<td>184.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2004</td>
<td>188.9</td>
<td>2.7</td>
</tr>
<tr>
<td>2005</td>
<td>195.3</td>
<td>3.4</td>
</tr>
<tr>
<td>2006</td>
<td>201.6</td>
<td>3.2</td>
</tr>
<tr>
<td>2007</td>
<td>207.3</td>
<td>2.8</td>
</tr>
<tr>
<td>2008</td>
<td>215.3</td>
<td>3.8</td>
</tr>
<tr>
<td>2009</td>
<td>214.5</td>
<td>-0.4</td>
</tr>
<tr>
<td>2010</td>
<td>218.1</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Example: To convert $250 of costs incurred in 2005 to 2009 dollars:

$$250 \times \left\{ \frac{(\text{CPI}_{2009} - \text{CPI}_{2005})}{\text{CPI}_{2009}} \right\} + 1 \right\}$$

$$= 250 \times \left\{ \frac{(214.5 - 195.3)}{214.5} \right\} + 1 \right\} = $272.50$$
DISCOUNTING

- Required when costs are incurred in the future
  - Why? Individuals have a positive value of time preference
    - If $r = 10\%$, then $\$100$ invested today yields $\$110$ next year

- Spending $\$100$ one year from now is “cheaper” than spending $\$100$ today
DISCOUNTING

**CHOICES**

- Spend $100 today

- Invest $100 \(\frac{\text{\$100}}{1 + 0.10}\) = $90.91

  and

  have $9.09 left over
You can pay me now — or pay me later....

Health Care Spending
If costs occur over multiple time periods, we must calculate the present discounted value (PDV) of these costs:

\[ PDV = \sum_{t=0}^{T} \frac{1}{(1 + r)^t} \text{COSTS}_t \]

**Example:**

A project requires: $100 in year 1
$ 75 in year 2
$ 50 in year 3

\[ PDV = \$100 + \$ \frac{75}{(1 + .10)} + \$ \frac{50}{(1 + .10)^2} = \$209.50 \]
If we discount costs, we must also discount benefits.

Assume \( r = 10\% \)

Spend $990 to save 1 year of life today

$990

Invest $900 to save 1 year of life next year and have $90 left to spend this year
Why we discount cost AND benefits

Consider an intervention which costs $100 and saves 10 years of life

Also assume r = 10%

**Option 1:**
Spend $100 today: 
\[
\frac{C}{E} = \frac{100}{10} = 10
\]

**Option 2:**
Invest for 1 year → $110, saves 11 YOL. If we discount costs to present value, but don’t discount YOL:

\[
\frac{C}{E} = \frac{100}{11} = 9 \frac{1}{11}
\]

If we discount both costs and benefits:

\[
\frac{C}{E} = \frac{\frac{1}{(1+.10)}^{110}}{\frac{1}{(1+.10)}^{11}} = 10
\]
Sources of Cost Data

- **Direct Costs**
  - Medicare fee schedules.
  - Insurance claims data.
  - Hospital billing data from individual hospitals.
  - Charges deflated by a cost-to-charge ratio.

- **Indirect Costs**
  - Patient surveys.
  - Bureau of labor statistics/census data.
Fee schedules/claims data

- These may be the only data you have.
  - Although these do not capture all of society’s costs, they are likely to be a large share and are of interest to policymakers or insurers.

- Use hospital/physician payments in MedPAR & carrier files if available.
  - There is a way to estimate average physician prices using fiscal intermediary data combined with other sources.
Sources of Cost Data (cont.)

Hospital billing data from individual hospitals.

- Hospital costs associated with complications: a report from the private-sector National Surgical Quality Improvement Program.

- Came from a VA hospital, but private non-profit hospitals also have an internal accounting system that can pull billing data.
Charges deflated by a cost-to-charge ratio.


Charges in a hospital discharge abstract are multiplied by the hospital's average ratio of cost to charges as derived from its Medicare Cost Report.

ResDAC Technical Publication TN-008, 8-2009

Using Medicare Hospital Cost-to-Charge Ratios in Research.

AHRQ HCUP Cost-to-Charge Ratio Files
Final Thoughts

- An intervention that is not effective will never be cost-effective.

- Determining the effectiveness of an intervention is much harder than determining its costs.

- Estimating the cost-effectiveness of an intervention is likely to require data from multiple different sources.
Additional Readings


- M.R. Gold et al, Cost-Effectiveness in Health and Medicine, Oxford University Press.
