Economic evaluation: From “Does it work?” to “Is it worth it?”

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Disclaimer

The opinions expressed in this talk are mine and do not represent official positions of the people or groups with whom I work.
What is economic evaluation? (part 1)

THE ART OF “SMART SHOPPING”: WHAT YOU GET AND WHAT IT COSTS

BEFORE BUYING SOMETHING, IT MAKES SENSE TO KNOW

- What you will pay
- And
- What you will get
Smart shopping 101

- What you get
  - Quantity,
  - Quality,
  - Cost

Is the new thing worth it?
Smart shopping is looking at what you get and what it costs

Economic evaluation is the art of smart shopping (for populations)
Economic evaluations

- Cost Benefit Analysis (CBA)
- Cost Utility Analysis (CUA)
- Cost Effectiveness Analysis (CEA)
- Cost Minimization Analysis (CMA)
- Cost blah blah analysis (CBBA)

Must examine what it costs **and** what you get!!!
The Importance of Outcome (O)

- CBA: Many Outcomes (O) in $
- CUA: Two O's (Q&q) in one QALY
- CEA: One O in whatever
- CMA: Zero O's (NO OUTCOMES!)

!!!! The decision about how to treat outcome determines the type of economic evaluation

WHICH TYPE OF ECONOMIC EVALUATION TO USE?

- Effect data determines the technique:

<table>
<thead>
<tr>
<th>Technique</th>
<th>Costs</th>
<th>Effect(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Minimization Analysis</td>
<td>$</td>
<td>0 (equivalent)</td>
</tr>
<tr>
<td>Cost-Effectiveness Analysis</td>
<td>$</td>
<td>1 outcome not in $</td>
</tr>
<tr>
<td>Cost-Utility Analysis</td>
<td>$</td>
<td>2 outcomes: quality and length of life</td>
</tr>
<tr>
<td>Cost-Benefit Analysis</td>
<td>$</td>
<td>many outcomes in $</td>
</tr>
</tbody>
</table>
COST-MINIMIZATION: SCREENING

The Use of Registered Nurses to Perform Flexible Sigmoidoscopy Procedures in Ontario: A Cost Minimization Analysis

Abstract

Rationale: Rates of colorectal cancer (CRC) are on the rise in Canada. Flexible sigmoidoscopy (FS) is an initial screening test for CRC primarily used in adults aged 50 years and older at average risk for the disease. Physicians and registered nurses have been shown to have the same effectiveness in performing a FS procedure. This paper presents an analysis of the use of registered nurses (RN) compared to physicians in Ontario to assess costs to the healthcare system.

Objective: To evaluate whether FS performed by RNs is a less costly alternative to increase access to CRC screening capacity in Ontario.

Methodology: A cost minimization analysis was conducted from a health system perspective. Discussion: RN-performed FS is a viable alternative for increasing CRC screening capacity in Ontario. Remuneration schedules for on-call physicians must be taken into consideration if policies are developed for the implementation of RN screening procedures.

Results: The findings suggest that the use of RNs may be cost saving compared to physician-performed FS procedures, depending on physician remuneration.

CEA WITH QUALITY OF LIFE (CUA)


Cost-effectiveness of a health-social partnership transitional program for post-discharge medical patients

Abstract

Background: Readmissions are costly and have implications for quality of care. Studies have been reported to support the effectiveness of transitional care programs in reducing hospital readmissions and improving clinical outcomes. However, there is a paucity of studies evaluating full economic evaluation to assess the cost-effectiveness of these transitional care programs. This study is therefore launched to fill this knowledge gap.

Methods: Cost-effectiveness analysis was conducted alongside a randomized controlled trial that examined the effect of a health-social Transitional Care Management (HSTCM) for medical patients discharged from an acute regional hospital in Hong Kong. The cost and health outcomes were compared between the patients receiving the HSTCM and usual care. The total costs consisted of the pre-program, program, and healthservice utilization costs. Quality of life was measured with SF-36 and transformed to utility values between 0 and 1.

Results: The average cost was estimated at 28 days between the control group and 34 days for the study group. The study group had significantly higher QALY scores compared to the control group at 28 days (p < 0.001) and 54 days (p = 0.003). The study group also had a significantly higher QALY gain (p < 0.001) over time at 28 and 54 days when compared with the control group. The intervention had an 88% chance of being cost-effective at the threshold of £20,000/QALY.

Conclusion: Previous studies on transitional care focused mainly on clinical outcomes and not cost. This study is the first to examine the cost-effectiveness of a transitional care program that used nurse-led services provided by volunteers. Results have shown that a health-social partnership transitional care program is cost-effective in reducing healthcare costs and attaining QALY gains. Economic evaluation helps to inform funders and guide decisions for the effective use of competing healthcare resources.

Keywords: Health-social transitional care, Readmission, Cost-effective analysis
What is economic evaluation? (part 2)

THE ECONOMICS PART

Econ can help!

- Cost-effectiveness analysis (CEA) is a type of economic evaluation.
- Economic evaluation is a part of health economics.
- Health economics is a field of economics.
WHAT IS ECONOMIC EVALUATION?

“Methods such as ‘what we did last time,’ ‘gut feelings,’ and even ‘educated guesses’ are not always better than organized consideration of the factors involved in a decision to commit resources to one use instead of another.”


WHAT IS ECONOMIC EVALUATION?, CONT.

“Methods such as ‘what we did last time,’ ‘gut feelings,’ and even ‘educated guesses’ are not always better than organized consideration of the factors involved in a decision to commit resources to one use instead of another.”
WHAT MAKES IT “ECONOMIC EVALUATION”?

- organized consideration of
  the factors involved in a
decision to commit resources
to one use instead of
another.”

- Economic (1 use)
- Evaluation (organized)

ECONOMICS = SCARCITY AND TRADEOFFS

organized consideration of the factors involved in a decision to
commit resources to one use instead of another.”
PUTTING WHICH EGGS IN YOUR BASKET?

EVALUATION: DECISIONS, DATA, RESULTS

organized consideration of the factors involved in a decision to commit resources to one use instead of another.

Treatment choice for patient diagnosed with cancer

Drug A
- Gets Better
- Gets Worse

Drug B
- Gets Better
- Gets Worse

Decision (choice made by you)
Chance event (choice made by nature)
End point
Economic evaluation ≠ Menu without prices nor prices with no menu

Why do economic evaluation?
IT INFORMS DECISIONS WHEN YOU WANT TO SPEND WISELY
WHY DO ECONOMIC EVALUATION?

- “That’s nice, but how much does it cost?
- “Why should we pay more for this?”
- “Are there better ways to spend our resources?”

“Health economists are concerned... because the prices of cancer drugs appear to be rising faster than the health benefits associated with them... the increase in the cost of treatment exceeded the magnitude of improvement in efficacy... making each treatment advance less cost-effective than the one that preceded it.” Bach, 2009.
GO FOR WHICH DOT?

IF RESOURCES WERE SCARCE:
GO FOR WHICH DOT?
WHO DOES ECONOMIC EVALUATION?

- Typically, it is done
  - in multi-disciplinary teams
    by more than one group

Why do economic evaluation (again)?

RESULTS CAN VARY DEPENDING ON WHO DOES THE STUDY
WHO DOES ECONOMIC EVALUATION?

- Typically, it is done in multi-disciplinary teams by more than one group
  - Example where the groups with different financial incentives reach different conclusions
    - $10,000 vs. $100,000


NOTE: Make sure to review carefully.
Who uses economic evaluation results?

Decision makers can use the results to make sure they are spending efficiently.

Where is economic evaluation used?

- Used all over the world, e.g.,
  - Center for Drug Evaluation (Taiwan)
  - The National Institute for Health and Care Excellence (UK)
  - Pan Canadian Oncology Drug Review (Canada)
  - Committee to Evaluate Drugs (Ontario, Canada)

Why?

- Yields more than evidence-based decisions, it increases accountability for $ spent
  - More than does it work or will it work? Is it a good use of $?
BOTTOM LINE

Economic evaluation is sometimes required and always good for clarifying value
CEA is the most common type of economic evaluation (1 outcome)

When can you do cost-effectiveness analysis?

BEFORE, DURING OR AFTER THE TREATMENT IS FUNDED
WHEN IS ECONOMIC EVALUATION DONE?

- Economic evaluation can be done before or after a new treatment or intervention is in common use.
  - E.g.,
    - RCT of a new treatment shows it is effective, but is it cost-effective?
    - Clinicians use a new treatment in a way or on a different patient population from how it was originally studied.
      - Is this a good use of resources?
        - MRI for backache, PSA for women, cancer drug for 80+ year old patients, etc.

HOW IS ECONOMIC EVALUATION DONE?

- One studies either
  - real patients over a hypothetically useful amount of time
- Or
  - hypothetical patients over a real useful amount of time
- Comparing at least two alternatives with respect to their differences in costs and outcomes.
HOW DO WE GET ECONOMIC EVIDENCE?

- Two main options
  - Organic
    - Analyze your own
  - Synthetic
    - make some with what's around
EXAMPLES

- A medical journal publishes your study showing a new treatment is more effective than usual care.
  - Option 1 (trial-based): Using the clinical trial effectiveness of the new treatment compared
  - Option 2 (model-based): Using the trial data (published studies, clinical opinion, etc.) use a real extra cost and the extra effectiveness of the new treatment
  - Option 3 ("real world"): Using the data from an administrative database, estimate the extra cost and the extra effectiveness of the new treatment.

What if you only have 1 year of data?

WHY YOU SHOULD CARE?

01 Costs challenge patients and payers
02 Paying for value (not volume) is a popular solution
03 Cost-effectiveness analysis is a way to look at value

"First we’re going to run some tests to see how your insurance reacts."
WHAT IS VALUE?

“In most industries, “value” as defined by consumers is associated with four attributes:

- **Accessibility:** “can I get what I need or want from you?”
- **Service:** “is dealing with you a pleasant experience?”
- **Effectiveness:** “is what you’re providing going to satisfy my need or want?”
- **Costs:** “what’s the cost to me and my family and is it worth it?”

https://tinyurl.com/ow7rfl7

Using cost-effectiveness analysis in the real world?

KEEPING IN MIND WHAT’S IMPORTANT
TO USE CEA, YOU MUST HAVE ...

4 Quadrants
3 Findings
2 Items of interest
1 Thing

https://tinyurl.com/ycmqu724
WHERE ARE WE?

CEA tells you a tradeoff located in one of 4 areas

<table>
<thead>
<tr>
<th>2 dimensions x 2 directions</th>
<th>Less effective</th>
<th>More effective</th>
</tr>
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<tbody>
<tr>
<td>Costs more</td>
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<tr>
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4 potential outcomes
COUNT DOWN TO USE

4 Quadrants
3 Findings
2 Items of interest
1 Thing

4 potential outcomes

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</table>

Costs more

Costs less

Easy NO

Easy YES
4 potential outcomes

- 2 dimensions x 2 directions
  - Less effective
  - More effective
  - Costs more
  - Costs less
  - It Depends
  - It Depends

9 potential outcomes

- Costs more
- Similar Costs
- Costs less
3 potential findings

<table>
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COUNT DOWN TO USE

4 Quadrants
3 Findings
2 Items of interest
1 Thing

2 items of interest: 1) Estimate

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<th>Costs the same</th>
<th>Costs less</th>
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</thead>
<tbody>
<tr>
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<td>Same Effect</td>
<td>More effective</td>
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https://tinyurl.com/ycmqu724
Are we sure?

When someone yells "STOP", I never know if its in the name of love, it's Hammertime, or I should collaborate and listen...

2 items of interest: 2) Uncertainty

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2 ITEMS OF INTEREST:
1) ESTIMATE & 2) UNCERTAINTY

ESTIMATE
- How much extra cost?
- How much extra effect?
- How much extra cost per extra effect?
- How much more extra benefit than extra cost?

UNCERTAINTY
- What other values are possible?
- What is the 95% CI?

$75,000 extra cost and 6 more months of life
$75,000 / 0.5 years = $150,000 per year of life
From Effectiveness to Cost-Effectiveness Analysis (CEA)

Patient outcome

\[ \Delta E \]

Cost

\[ \Delta C = 75,000 \]

$75,000 extra cost and 6 more months of life

$75,000 / 0.5 years = $150,000 per year of life

\[ \Delta E = 6 \text{ months or } 0.5 \text{ year} \]
COST-EFFECTIVENESS PLANE

More Costly, \( \Delta C > 0 \)

Less Costly, \( \Delta C < 0 \)

More Effective, \( \Delta E > 0 \)

Less Effective, \( \Delta E < 0 \)

Lose-Lose

More Costly/More Effective

Less Costly/Less Effective

Win-Win

4 Quadrants, 3 Findings, 2 Items of interest, 1 Thing

More Effective, \( \Delta E > 0 \)

More Costly/More Effective

Less Costly/Less Effective

Win-Win

Less Costly, \( \Delta C < 0 \)

Less Costly/Less Effective

Lose-Lose
COST-EFFECTIVENESS PLANE

More Effective, \( \Delta E > 0 \)  
Less Effective, \( \Delta E < 0 \)  
More Costly, \( \Delta C > 0 \)  
Less Costly, \( \Delta C < 0 \)

Lose-Lose Outcome  
More Costly/More Effective  
Less Costly/Less Effective  
Win-Win Outcome

Less Costly/Less Effective

Less Effective, \( \Delta E < 0 \)  
More Effective, \( \Delta E > 0 \)  
Less Costly, \( \Delta C < 0 \)  
More Costly, \( \Delta C > 0 \)

4 Quadrants, 3 Findings, 2 Items of interest, 1 Thing

Extra cost per 1 extra effect (ICER)

More Costly/More Effective

More Costly, \( \Delta C > 0 \)  
Less Costly/Less Effective  
Less Costly, \( \Delta C < 0 \)  
More Costly, \( \Delta C > 0 \)

4 Quadrants, 3 Findings, 2 Items of interest, 1 Thing

jshoch@ucdavis.edu
Where to go from here?  
What should be done?

Is it cost-effective?  
Is it worth it?  
Is it value for money?

COUNT DOWN TO USE

4 Quadrants  
3 Findings  
2 Items of interest  
1 Thing

https://tinyurl.com/ycmqu724
CHOOSING IN THEORY VS. PRACTICE

IN THEORY: SPEND EFFICIENTLY!

I don't want to spend money, but I want to buy stuff.
There is something odd about the choreography of the CEA...

DEATH OF CEA ONLY

Cause of Death:
"Patient laid down the boogie and played that funky music til he died."

someecards user card
WHAT IS BEING CONSIDERED?

“Given the available evidence on comparative effectiveness and incremental cost-effectiveness, and considering other benefits, disadvantages, and contextual considerations, what is the long-term value for money of treatment with acupuncture and usual care versus usual care alone for patients with chronic low back pain?

4 Quadrants, 3 Findings, 2 Items of interest, 1 Thing

How to do economic evaluation “right”? 

THERE IS HELP
GUIDANCE DOCUMENTS: CHEERS TO HAVING 11 PUBS!

Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement

Doni Koutkias, Michael Smithsson, Davina Piris, Chris Conner, David Moher, Dan Greenberg, Federico Augusto, Anthony H. Briggs, Josephine Mauksch, Elisabeth Ludin and on behalf of the CHEERS Task Force.

Abstract

Economic evaluations of health interventions pose a particular challenge for reporting. There is also need to consolidate and update existing guidelines and promote their use in a more timely manner. The Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement is an attempt to consolidate and update previous health economic evaluation guidelines. If these are unclear, useful reporting guidance. The primary audience for the CHEERS statement are researchers reporting economic evaluations and the editors and peer reviewers assessing them for publication.

The need for new reporting guidance was identified by a survey of medical editors. A list of possible items based on a previous review was created. A two-round, modified Delphi panel consisting of members from academics, clinical practice, industry, government, and the editorial community was conducted. Out of 44 candidate items, 24 items and accompanying recommendations were developed. The recommendations are contained in a 10-item checklist. A copy of the statement, accompanying checklist, and this report can be found on the CHEERS Health Economic Evaluation Reporting Standards website (www.spaceys/spacesd/CHEERS/EconomicPublicationsGuide.html).

We hope CHEERS will lead to better operating, and ultimately, better health decisions. To facilitate dissemination and update, the CHEERS statement is being copublished across 11 Health economic and medical journals. We encourage other journals and editors to endorse CHEERS. The author team plans to reissue the checklist in five years.

http://tinyurl.com/y9ouds52s

GUIDANCE DOCUMENTS: CHEERS TO HAVING 11 PUBS!

Two Checklists

Table 1 CHEERS checklist—items to include when reporting economic evaluations of health interventions

<table>
<thead>
<tr>
<th>Item</th>
<th>Recommendation</th>
<th>Item</th>
<th>Recommendation</th>
</tr>
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<tbody>
<tr>
<td>...</td>
<td>...</td>
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</table>

Guidelines for authors and peer reviewers of economic submissions to the BMJ

M P Drummond, T O Jefferson on behalf of the BMJ Economic Evaluation Working Party

http://tinyurl.com/ybex9fp5

Table 2 BMJ checklist: items to include when reporting economic evaluations of health interventions

<table>
<thead>
<tr>
<th>Item</th>
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<tr>
<td>...</td>
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Referees' checklist (also to be used, implicitly, by authors)

<table>
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<tr>
<th>Item</th>
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<tr>
<td>...</td>
<td>...</td>
<td>...</td>
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</tr>
</tbody>
</table>
TEST QUESTIONS

Is this a CEA?

• “The costs of caring for dementia patients are enormous and impose a tremendous economic burden on the whole of our society. The total worldwide societal cost of dementia was estimated to be US$ 604 billion in 2010.

• “The costs of dementia dwarf those of other diseases such as stroke, heart disease, and cancer....
Estimate or Uncertainty?

Table 2 Incremental cost effectiveness of a genetic test for the apolipoprotein ε4 allele in combination with preventive donepezil treatment in patients with amnestic mild cognitive impairment

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Cost (Can$)</th>
<th>QALYs</th>
<th>Δ Can$/Δ QALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targeted therapy</td>
<td>132,105</td>
<td>4.980</td>
<td>–</td>
</tr>
<tr>
<td>Standard of care</td>
<td>131,090</td>
<td>4.953</td>
<td>–</td>
</tr>
<tr>
<td>Difference</td>
<td>1,015</td>
<td>0.027</td>
<td>38,016</td>
</tr>
</tbody>
</table>

Can$ 2009 Canadian dollars, QALYs quality-adjusted life-years

Estimate or Uncertainty?

Rate of progression to AD in patients with APOE ε4 receiving donepezil (treatment effectiveness)
- Utility in AMCI patients
- Donepezil treatment cost
- AD treatment cost
- Genetic testing cost
- AMCI surveillance cost
- Prevalence of APOE ε4 in AMCI patients
- Discount rate
- Rate of progression of AD patients to a more severe state
- Utility in AD

Cost-effectiveness ratio (Can$)
FINAL EXAM

- Is this cost-effective?

FINAL EXERCISE


- **Example**: Cost-effectiveness of epoetin-alpha (EPO) to augment preoperative autologous blood donation (PAD) in elective surgery

- **Concerns**:
  - Allogeneic (someone else’s) blood might have disease
  - Autologous (your own) blood is costly to get, and so is EPO
FEEDING DATA TO A MODEL

COST EFFECTIVENESS RESULTS

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Life Years</th>
<th>Cost</th>
<th>Average Cost per life year</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPO + PAD</td>
<td>13.037731</td>
<td>2903</td>
<td>$222.66 per life</td>
</tr>
</tbody>
</table>

Is EPO cost-effective?
### COST EFFECTIVENESS RESULTS

**BY HOMER SIMPSON**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Life Years</th>
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<tr>
<td>PAD</td>
<td>13.037725</td>
<td>968</td>
<td>$74.25 per life</td>
</tr>
<tr>
<td>EPO + PAD</td>
<td>13.037731</td>
<td>2903</td>
<td>$222.66 per life</td>
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Is EPO cost-effective?

What do we already know (what can we already achieve w/o EPO)?
## COST EFFECTIVENESS RESULTS

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### Incremental Cost-Effectiveness Ratio (ICER)

\[ \text{ICER} = \frac{\Delta C}{\Delta E} \]

\[ \Delta C = $1935 \quad \Delta E = 3 \text{ minutes} \]

\[ \frac{\Delta C}{\Delta E} = 330 \text{ mill per 1 YR} \]

NO uncertainty shown

---

**TO USE CEA, YOU MUST HAVE ...**

- **4 Quadrants**: More costly, more effective
- **3 Findings**: Easy no
- **2 Items of interest**: \( \Delta C = $1935 \) \( \Delta E = 3 \text{ minutes} \)
- **1 Thing**: \( \frac{\Delta C}{\Delta E} = 330 \text{ mill per 1 YR} \)

NO uncertainty shown

https://tineurl.com/ycmpq72r
AS HEALTHCARE BECOMES MORE EXPENSIVE…

There will be more focus on “value” (i.e., cost and effectiveness of new treatments). Cost-effectiveness analysis (CEA) is a tool used throughout the world to help inform policy. The questions you ask when “smart shopping” are the same ones users of CEA should ask.

Main point #1

CEA is smart shopping looking at costs and an outcome.
Main point #2
Collect evidence to compare what you get and what it costs

Main point #3
Help is available
Contact information

jshoch@ucdavis.edu

Where was the American Declaration of Independence signed?

At the bottom.

Solid  Liquid  Gas

22. In which state do the particles show the most movement?
California

23. In which state do the particles show the least movement?
New Jersey