Introduction to health economics – Part 1

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Director of Research, Office of Health Economics, London

ISPOR Dubai 2018, United Arab Emirates
September 19th 2018
The aim of this session is to give you an understanding of:

- The principal concepts and theoretical foundations of health economics
- The various market failures that can arise in healthcare
- The role of governments in regulating, funding and providing healthcare

In the following session we will introduce the methods of economic evaluation and their use in decision making.

There will be time for Q&A after both sessions.
Health economics

• The application of economic theory, models and empirical techniques to the analysis of decision making by individuals, health care providers and governments with respect to health and health care.

• Economics: a social science; the study of human behaviour when confronted with scarcity

• Health Economics is a sub-discipline of economics, and arguably one of the most impactful e.g., in terms of its influence of economics on policy and practice.
Something as important as health and health care shouldn’t involve economics – should it?

“Taking costs into account is unethical”

“Not taking costs into account is unethical”

“The word we normally use to describe people who behave without regard to the costs of their actions is not ‘ethical’ but ‘fanatical’”

- Professor Alan Williams
Opportunity cost

• Choices involve weighing up benefits and costs of each option

• Opportunity cost: the benefits from the next best opportunity foregone

• A particularly important principle in consumer choices – but also in decisions about the allocation of health care budgets
One NHS IVF course = £2,700

What is the opportunity cost?

One-third of a cochlear implant

1 heart bypass operation

11 cataract removals

150 vaccinations for Measles, Mumps and Rubella

Half a junior school teaching assistant for a year

2000 school dinners

One-thousandth of a Challenger 2 military tank
An overview of the field of health economics

Health Economics is a very broad field – more than cost effectiveness analysis and HTA.

Objectives: To analyze the cost-effectiveness of two common treatment strategies in Iran, comparing infliximab plus methotrexate with tocilizumab plus methotrexate in patients with rheumatoid arthritis with inadequate response to traditional disease-modifying anti- rheumatic drugs. Methods: A multistage Markov decision model was applied to assess the incremental cost-effectiveness ratio (ICER) of a tocilizumab-containing regimen versus an infliximab-containing regimen over a 5-year time period. In the case of no response, we assumed that patients switched to the next treatment (adalimumab, abatacept, or etanercept) in sequence for the least expensive regimens. A sensitivity analysis was performed to test ranges of the probability of response and the cost of infliximab and tocilizumab. Results: The cost-effectiveness analysis showed that the tocilizumab-containing regimen had a lower ICER than the infliximab-containing regimen. The annual ICER was US$30,244 per quality-adjusted life-year as compared to the infliximab-containing regimen. In the sensitivity analysis, changes in the price of the drugs by generic substitution, in utility scores, and in discount rate did not change our overall conclusions. Among all inputs to the primary study and the sensitivity analyses, however, the price of tocilizumab had the most impact on the ICER. Conclusions: Although tocilizumab and methotrexate provide a larger gain in quality-adjusted life-years, their current price is quite high as compared with those of our other interventions. Therefore, a regimen containing
Private markets for health care
The demand for and supply of liposuction

Economic Analysis in Health Care by Morris, Devlin and Parkin
© 2007 John Wiley & Sons Ltd
Public markets for health care: a stylised model of demand for and supply of health care in the NHS

- Price = 0 at the point of consumption
- Utilisation: observed met demands
- Observed unmet demands
- Supply
- Demand
- Number of procedures per month
Special features of health care and health insurance markets

- Demand = irregular and unpredictable
- Uncertainty
- Asymmetry of information
- Principal-agent relationship with physician
- Barriers to entry

KJ Arrow (1963)
THE NORMATIVE ECONOMICS OF HEALTH CARE FINANCE AND PROVISION

A. J. CULYER
University of York

I. INTRODUCTION

Whereas in many countries the ‘crisis’ in medical care has been seen in terms of ‘excess’ spending on health services, in the UK it has been seen (at least by most of those who manage and work in the NHS) as a crisis of ‘underfunding’. This has come about because of a number of factors: the increasing costs of providing care, the growing use of insurance, private finance of other kinds (such as out-of-pocket payments), and private provision of health care itself.

Few of these contributions have been informed by the work of health economists, particularly their normative work. There have been several reviews
Market failure and the role of government in health care

Market imperfections may lead to inefficient or inequitable distribution of resources.

- Imperfect consumer information
- Monopoly
- Externalities

Government intervenes to restore efficiency and/or equity.
- “Public interest theory.”
An opposing theory: The amount and types of government intervention are determined by supply and demand.

- Vote-maximizing politicians “supply” legislation.
- Wealth maximizing special interest groups are the buyers.
  ➔ Successful politicians stay in office by satisfying special interest groups.
- “special interest group theory”
Special interest group theory claims that special interest groups gain at the expense of the general public.

- The special interest group is well organized and motivated to pursue (e.g., via lobbying) their own interests.
- Consumers are diverse, fragmented, more costly for them to organize.

⇒ Inefficient, inequitable resource allocation by government.

- Which theory do you believe?
- Cost Benefit Analysis (CBA) has an important role in ensuring govt. intervention is evidence-based.
Public Goods

• >1 individual simultaneously receives benefits from the good.
  i.e., no rivalry in consumption.

• Costly (or impossible) to exclude non-payers from consumption of the good.
  ➔ Private firms unwilling to produce and sell public goods.

• Are most medical services public goods?
Negative externalities

Definition: An unpriced by-product of production or consumption that adversely affects another party not directly involved in the market transaction.

- Cigarette smoking
- Pollution
- Medical treatment for cyclists who don’t wear helmets
- Drunk drivers
Types of Government Intervention & examples

- Provide public goods.
- Correct for externalities
- Regulate markets
- Enforce antitrust laws.
- Funding health care
- Provide health care

- Fund medical research
- Tax cigarettes
- Vaccinations
- Pharmaceutical product Licensing
- Patents
- Competition and markets
- The NHS
- Public hospitals
## Mixed health care economies

<table>
<thead>
<tr>
<th>PROVISION</th>
<th>FUNDING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>public</td>
</tr>
<tr>
<td>public</td>
<td>fully public health care system</td>
</tr>
<tr>
<td>private</td>
<td>eg. fully subsidised visits to self-employed GPs</td>
</tr>
<tr>
<td>mixed</td>
<td>e.g. fully subsidised care, but contestable provision markets</td>
</tr>
</tbody>
</table>

- Even in predominantly private systems, there is a role for government in regulation e.g., licensing medical practitioners.

### Questions:

- How big is the problem of moral hazard in public systems? Can it be avoided? Can private insurance avoid cream skimming?
- Can reliance on private funding (e.g. out of pocket payments) achieve equity objectives?
- How big is the problem of moral hazard in public systems? Can it be avoided?
- Why is private health care provision dominated by not-for-profits?
### Table 2
Annual per capita total health expenditure by country in International Dollars (purchasing power parity)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>278</td>
<td>932</td>
<td>9.0</td>
</tr>
<tr>
<td>Bahrain</td>
<td>1256</td>
<td>2273</td>
<td>4.3</td>
</tr>
<tr>
<td>Egypt</td>
<td>325</td>
<td>594</td>
<td>4.4</td>
</tr>
<tr>
<td>Iraq</td>
<td>67</td>
<td>667</td>
<td>17.8</td>
</tr>
<tr>
<td>Jordan</td>
<td>593</td>
<td>798</td>
<td>2.1</td>
</tr>
<tr>
<td>Kuwait</td>
<td>1478</td>
<td>2320</td>
<td>3.3</td>
</tr>
<tr>
<td>Lebanon</td>
<td>1061</td>
<td>987</td>
<td>−0.5</td>
</tr>
<tr>
<td>Libya</td>
<td>699</td>
<td>806</td>
<td>1.0</td>
</tr>
<tr>
<td>Morocco</td>
<td>147</td>
<td>447</td>
<td>8.3</td>
</tr>
<tr>
<td>Oman</td>
<td>1081</td>
<td>1442</td>
<td>2.1</td>
</tr>
<tr>
<td>Qatar</td>
<td>1929</td>
<td>3071</td>
<td>3.4</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>1186</td>
<td>2466</td>
<td>5.4</td>
</tr>
<tr>
<td>Sudan</td>
<td>75</td>
<td>282</td>
<td>9.9</td>
</tr>
<tr>
<td>Syrian Arab Republic</td>
<td>157</td>
<td>376</td>
<td>6.4</td>
</tr>
<tr>
<td>Tunisia</td>
<td>314</td>
<td>785</td>
<td>6.8</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>2034</td>
<td>2405</td>
<td>1.2</td>
</tr>
<tr>
<td>Yemen</td>
<td>146</td>
<td>202</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Source of data: [16]
*AAGR average annual growth rate (%)
*Data is for 2003

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**Fig. 6**

Out of pocket payment as a percentage of total health expenditure, 2014, by country

Asbu et al (2017)
Life expectancy vs. healthcare expenditure, 2013
Life expectancy at birth vs. Total healthcare expenditure per capita (PPP 2011)

Recommended resources


Q&A Session
Introduction to the methods of economic evaluation and use in allocating resources – Part 2

Nancy Devlin
Director of Research, Office of Health Economics, London

ISPOR Dubai 2018, United Arab Emirates
September 19th 2018
The aims of this session are to:

- Provide you with an understanding of the principles that underpin economic evaluation in health care
- Familiarise you with the main methods of economic evaluation
- To consider how these can be used to inform decisions concerning the allocation of resources
- To highlight some remaining issues concerning the use of these methods and what ‘value’ means in health care.
Contents

1. Principles: efficiency, opportunity cost, marginal analysis
2. Methods: cost benefit analysis, cost effectiveness analysis
3. QALYs and patient reported outcomes
4. Judging value for money: cost effectiveness thresholds
5. The future of economic evaluation of health care
1. Key principles that underpin economic evaluation in health care

**Before we start:**
- We need to know how *effective* health care services are (to what extent do they improve patient health?)
- We need to ensure that the way they are produced avoids waste/costs are minimised (*technical* efficiency)

**How do we allocate resources *between* services?**

*Allocative efficiency* = maximising the achievement of aims from the available budget
- From any available budget, a decision to fund one treatment has an opportunity cost of the benefits foregone from the next best treatment.
- So we need to be able to ‘weigh up’ health gained versus health foregone from any given decision.
Economists focus ‘on the margin’: a worked example of the importance of marginal analysis

The Government says that it will earmark a sum for the prevention of two diseases (Disease A and Disease B) that are prevalent in your country. These diseases are sometimes fatal, but can be prevented by suitable procedures.

You are asked to advise on how to spend the money to maximise the number of premature deaths averted.
The Government hints that the sum will be $1 billion.

You ask public health experts, who tell you that the number of premature deaths averted by spending $1 billion would be:

49 for disease A  or  101 for disease B

What would you advise?

Disease B?
The Government now tells you that, because of a change in the budget, the sum will actually be $500m.

Again you ask public health experts, who tell you that the number of premature deaths averted by spending $500m would be

39 for disease A  or  81 for disease B

What would you now advise?

still Disease B?
Documents on this decision, including your advice, are debated by government.

The Government announces publicly that they will, after all, make $1 billion available.

What would you now advise about how to spend that budget?

*Is your answer still Disease B? Why/why not?*
<table>
<thead>
<tr>
<th></th>
<th>Deaths averted</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>$1b</td>
<td>49</td>
<td>101</td>
</tr>
<tr>
<td>$500 m</td>
<td>39</td>
<td>81</td>
</tr>
<tr>
<td>$1b</td>
<td>39</td>
<td>81</td>
</tr>
</tbody>
</table>

You get better ‘value for money’ from spending half on Disease B and half on Disease A.

Total deaths avoided = 120, which is more than the deaths avoided by spending all the money on B.
<table>
<thead>
<tr>
<th>Total cost (£)</th>
<th>Deaths averted</th>
<th>Disease A</th>
<th>Deaths averted</th>
<th>Disease B</th>
<th>Average cost per death averted</th>
<th>Average cost per death averted</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 000</td>
<td>10</td>
<td>10 000</td>
<td>26</td>
<td></td>
<td>3 846</td>
<td></td>
</tr>
<tr>
<td>200 000</td>
<td>19</td>
<td>10 526</td>
<td>43</td>
<td></td>
<td>4 651</td>
<td></td>
</tr>
<tr>
<td>300 000</td>
<td>27</td>
<td>11 111</td>
<td>58</td>
<td></td>
<td>5 172</td>
<td></td>
</tr>
<tr>
<td>400 000</td>
<td>34</td>
<td>11 765</td>
<td>70</td>
<td></td>
<td>5 714</td>
<td></td>
</tr>
<tr>
<td>500 000</td>
<td>39</td>
<td>12 821</td>
<td>81</td>
<td></td>
<td>6 173</td>
<td></td>
</tr>
<tr>
<td>600 000</td>
<td>43</td>
<td>13 953</td>
<td>87</td>
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<td>6 897</td>
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<tr>
<td>700 000</td>
<td>46</td>
<td>15 217</td>
<td>92</td>
<td></td>
<td>7 609</td>
<td></td>
</tr>
<tr>
<td>800 000</td>
<td>48</td>
<td>16 667</td>
<td>96</td>
<td></td>
<td>8 333</td>
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</tr>
<tr>
<td>900 000</td>
<td>49</td>
<td>18 367</td>
<td>99</td>
<td></td>
<td>9 091</td>
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</tr>
<tr>
<td>1 000 000</td>
<td>49</td>
<td>20 408</td>
<td>101</td>
<td></td>
<td>9 901</td>
<td></td>
</tr>
</tbody>
</table>

But oddly, the ‘average cost per death avoided’ is always lower for B than A. If you focused just on these ‘averages’ you would never choose to spend money on A.
<table>
<thead>
<tr>
<th>Cost</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>Marginal</td>
<td>Total</td>
</tr>
<tr>
<td>£0.5m</td>
<td>£0.5m</td>
<td>39</td>
</tr>
<tr>
<td>£1m</td>
<td>£0.5m</td>
<td>49</td>
</tr>
</tbody>
</table>

MC = Marginal cost per death averted

The reason is because we need to look at what is happening ‘at the margin’. Once you’ve already spent $500m on B, the MC of spending another $500m on B is greater than the MC of spending $500m on A.
<table>
<thead>
<tr>
<th>Total cost (£)</th>
<th>Deaths averted</th>
<th>Marginal cost per death averted</th>
<th>Deaths averted</th>
<th>Marginal cost per death averted</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 000</td>
<td>10</td>
<td>10 000</td>
<td>26</td>
<td>3 846</td>
</tr>
<tr>
<td>200 000</td>
<td>19</td>
<td>11 111</td>
<td>43</td>
<td>5 882</td>
</tr>
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<td>300 000</td>
<td>27</td>
<td>12 500</td>
<td>58</td>
<td>6 667</td>
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<tr>
<td>400 000</td>
<td>34</td>
<td>14 286</td>
<td>70</td>
<td>8 333</td>
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<tr>
<td>500 000</td>
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<td>20 000</td>
<td>81</td>
<td>9 091</td>
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<td>600 000</td>
<td>43</td>
<td>25 000</td>
<td>87</td>
<td>16 667</td>
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<td>700 000</td>
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<td>33 333</td>
<td>92</td>
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<tr>
<td>800 000</td>
<td>48</td>
<td>50 000</td>
<td>96</td>
<td>25 000</td>
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<tr>
<td>900 000</td>
<td>49</td>
<td>100 000</td>
<td>99</td>
<td>33 333</td>
</tr>
<tr>
<td>1 000 000</td>
<td>49</td>
<td>∞</td>
<td>101</td>
<td>50 000</td>
</tr>
</tbody>
</table>
The ‘optimal’ allocation of budget between A and B is where the marginal cost per death averted is identical.
# Importance of Marginal Cost and marginal benefit - Case of Detecting Colon Cancer

<table>
<thead>
<tr>
<th>No of Tests</th>
<th>Total Cases Detected</th>
<th>Additional cases Detected</th>
<th>Total Cost</th>
<th>Average Cost per Case</th>
<th>Marginal Cost per Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65.9469</td>
<td>65.9469</td>
<td>77,511</td>
<td>1,175</td>
<td>1,175</td>
</tr>
<tr>
<td>2</td>
<td>71.4424</td>
<td>5.4956</td>
<td>107,690</td>
<td>1,507</td>
<td>5,492</td>
</tr>
<tr>
<td>3</td>
<td>71.9004</td>
<td>0.4580</td>
<td>130,111</td>
<td>1,810</td>
<td>49,150</td>
</tr>
<tr>
<td>4</td>
<td>71.9385</td>
<td>0.0382</td>
<td>148,116</td>
<td>2,059</td>
<td>469,534</td>
</tr>
<tr>
<td>5</td>
<td>71.9417</td>
<td>0.0032</td>
<td>163,141</td>
<td>2,268</td>
<td>4,724,695</td>
</tr>
<tr>
<td>6</td>
<td>71.9420</td>
<td>0.0003</td>
<td>176,331</td>
<td>2,451</td>
<td>47,107,214</td>
</tr>
</tbody>
</table>
What should our measure of benefit be?

In the examples shown, these were
(a) deaths avoided
(b) cases of colon cancer detected.

But in (a)
• This could have been ‘years of life saved’.
• what about the quality of life for those lives?

And in (b)
• What happens when cancer is detected? Are treatments available? Are they effective at prolonging life/improving quality of life?
2. The main methods of economic evaluation

<table>
<thead>
<tr>
<th>method</th>
<th>How are costs measured?</th>
<th>How are benefits measured?</th>
<th>Theoretical foundations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost benefit analysis (CBA)</td>
<td>money</td>
<td>Money</td>
<td>Applied Welfare Economics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shadow pricing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stated preferences</td>
<td></td>
</tr>
<tr>
<td>Cost effectiveness analysis (CEA)</td>
<td>money</td>
<td>‘Natural units’</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>eg. per death averted</td>
<td></td>
</tr>
<tr>
<td>Cost consequences analysis</td>
<td>money</td>
<td>Multiple units of outcomes simultaneously considered</td>
<td></td>
</tr>
<tr>
<td>Cost utility analysis (CUA)</td>
<td>money</td>
<td>Quality adjusted life years (QALYs)</td>
<td>Associated with Extra Welfarism</td>
</tr>
</tbody>
</table>
3. Quality Adjusted Life Years (QALYs)

- Incorporates both quality and length of life.
- Quality of life is used to ‘weight’ length of life, where:
  - 1 = full health, 0 = dead, < 0 ‘worse than being dead’
  - 1 QALY = a year of perfect health
- Can capture changes in quality of life, length of life or both

Before: 20 years x 0.5 = 10 QALYs
After: 20 years x 0.9 = 18 QALYs
→ Δ QALYs = (18 - 10) = 8

In practice, complex economic models are used to describe probabilities of experiencing a given state, transitions between states, side effects, probability of adverse outcomes/treatment failures, etc.

- In cost utility analysis, the incremental cost effectiveness ratio
  \[ \text{ICER} = \frac{\Delta \text{cost}}{\Delta \text{QALYs}} \]
Measuring QoL via patient reported outcomes (PROs)

An example of a generic PRO: **EQ-5D**

Please indicate which statements best describe your own health state today. Tick one box for each group of statements.

**Mobility**
- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

**Self-Care**
- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

**Usual Activities**
- I have no problems with performing my usual activities (e.g. work, study, housework, family or leisure activities)
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

**Pain/Discomfort**
- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

**Anxiety/Depression**
- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed
Measuring health on a generic health related quality of life instrument: the EQ-5D

www.euroqol.org/
4. ICERS and decision rules

In contrast to CBA, there is no ‘absolute’ decision rule for ICERs.

To judge whether any given incremental cost per QALY gained (or incremental saving per QALY lost) is ‘worthwhile’, requires a ‘benchmark’ ‘cut-off point’ ICER

i.e “Cost effectiveness threshold”. But what does it represent?
(a) Society’s willingness to pay to gain a QALY
(b) The opportunity cost of a QALY within the health care system
Lack of consensus on which is relevant; & how best to generate evidence on it.
Using ICERs used to judge value for money

- Δ effect
- Δ cost
+ Δ cost
+ Δ effect

Intervention less effective and more costly

Intervention more effective and less costly
A stylised model of the opportunity cost-based “cost effectiveness threshold”

<table>
<thead>
<tr>
<th>Cost per weighted QALY gained</th>
<th>Health care service</th>
<th>Cumulative budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>£1</td>
<td>Service 1</td>
<td>£50,000</td>
</tr>
<tr>
<td>£1.50</td>
<td>Service 2</td>
<td>£80,000</td>
</tr>
<tr>
<td>$20k?</td>
<td></td>
<td>£100 billion</td>
</tr>
<tr>
<td>£30k?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£800,000</td>
<td>Service 32,000</td>
<td>£800 000 billion</td>
</tr>
</tbody>
</table>

NICE’s threshold is its ‘best guess’ about what this ‘shadow price’ is, given various (conflicting) evidence about that.
5. The future of economic evaluation in health care

Going beyond QALYs, for example

• E-QALYs
• US value frameworks
• Value based pricing/assessment
• Impact Inventories
• MCDA

Distributional issues and equity

Uncertainty

Going beyond new technologies: disinvestment; budget impact; priority-setting frameworks
6. Recommended resources


www.ispor.org
Lots of excellent HEOR resources eg best practice reports
Q&A Session