Health Services Research and Health Economics

Paul McCrone
Institute of Psychiatry,
King’s College London
Key Questions

• What is the rationale for considering health economics?
• What are the key components of economic evaluations?
  – Costs
  – Outcomes
• How are costs and outcomes combined?
• How are results of economic evaluations interpreted and used?
Importance of health economics
Rationale for Economic Evaluations

• Resources are scarce
• Demand is largely unlimited
  – Ageing population
  – Technological advances
  – High expectations
• Decisions between competing alternatives have to be made
Demand for Healthcare

Greater longevity  
Access to information  
Technological advancement  
High expectations

Demand for healthcare
Relationship between life expectancy and health spending
An Aging Population: Percentage of UK Population Aged Over 64
Limited Resources: Growth in GDP and Healthcare Prices

Year
Index (1978=100)

GDP

Healthcare Prices

Competing Demands for ‘Healthcare’ Resources

- Alzheimer's disease
- Leukaemia (lymphocytic)
- Rheumatoid arthritis and juvenile idiopathic arthritis
- Hearing disability
- Heart disease (ischaemic)
- Diabetes (type 2)
- Attention deficit hyperactivity disorder
- Colorectal cancer
- Asthma
- Cervical smear tests
- Pregnancy
- Knee joints (defective)
- Brain cancer
- Human Growth Hormone in Children
- Leukemia
- Smoking cessation
- Diabetes (type 2)
- Obesity
- Wound care
- Motor neurone disease
- Hearing disability
- Lung cancer
- Osteoarthritis and rheumatoid arthritis
- Ovarian cancer
- Multiple Sclerosis
- Schizophrenia
- Nerve massages
- Lung cancer
- Angina (unstable) and coronary syndromes
-ynecology
- Flu
- Colorectal cancer
- Mumps
- Brain cancer
- Smoking cessation
- Diabetes (type 2)
- Incontinence
- Hysterectomy
- Access to care
- Diabetes (type 2)
- Arrhythmias
- Dyspepsia
- Breast cancer
- Multiple Sclerosis
- Asthma
- Ovarian cancer
- Human Growth Hormone in Children
- Wound care
- Motor neurone disease
- Osteoarthritis and rheumatoid arthritis
- Ovarian cancer
- Schizophrenia
- Human Growth Hormone in Children
- Fibromyalgia
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- Nerve masses
- Lung cancer
- Angina (unstable) and coronary syndromes
- Leukemia
- Hearing disability
- Diabetes (type 2)
- Nerve masses
Cost analysis
What is Cost?

Activity undertaken → Activity foregone → Value
Whose Perspective?

Society

Healthcare sector
Insurance companies
Health and social care sector
Patient and family
Other agencies
Measuring Costs

Whose perspective?
- NHS
- government
- Society

What costs to include?
- Direct treatment costs
- Other services
- Productivity costs

How are costs measured?
- Period of measurement
- Patient recall vs provider administration systems
PACE study


PACE Study

- Randomised controlled study comparing:
  - Standardised medical care alone (SMC)
  - SMC + adaptive pacing therapy (APT)
  - SMC + cognitive behaviour therapy (CBT)
  - SMC + graded exercise therapy (GET)
- 641 participants recruited from CFS clinics
- Primary outcomes at 52 weeks
  - Fatigue (Chalder Fatigue Scale)
  - Physical functioning (SF36)
Objectives of Economic Evaluation

1. To compare health and societal costs between APT, CBT, GET and SMC

2. To assess the relative cost-effectiveness and cost-utility of APT, CBT, GET and SMC
Methods: Service Use

- Use of healthcare measured with Client Service Receipt Inventory (Beecham & Knapp, 2001)
  - Service used (Yes/No)
  - Number of contacts in previous 6 months
  - Duration of contacts
- Self-report from participant
- APT, CBT, GET and SMC contacts centrally recorded
## Healthcare Use (%)

<table>
<thead>
<tr>
<th>Service</th>
<th>APT</th>
<th>CBT</th>
<th>GET</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care</td>
<td>92</td>
<td>92</td>
<td>96</td>
<td>94</td>
</tr>
<tr>
<td>Other doctor</td>
<td>41</td>
<td>49</td>
<td>46</td>
<td>45</td>
</tr>
<tr>
<td>Health professional</td>
<td>75</td>
<td>76</td>
<td>82</td>
<td>80</td>
</tr>
<tr>
<td>Inpatient</td>
<td>12</td>
<td>11</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Accident and emergency</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Medication</td>
<td>77</td>
<td>81</td>
<td>77</td>
<td>84</td>
</tr>
<tr>
<td>Complementary healthcare</td>
<td>29</td>
<td>22</td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td>Other services</td>
<td>74</td>
<td>76</td>
<td>76</td>
<td>71</td>
</tr>
<tr>
<td>Therapy</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Standardised medical care</td>
<td>100</td>
<td>100</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>
# Healthcare Use (average contacts)

<table>
<thead>
<tr>
<th>Service</th>
<th>APT</th>
<th>CBT</th>
<th>GET</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care</td>
<td>7.1</td>
<td>6.6</td>
<td>6.3</td>
<td>7.0</td>
</tr>
<tr>
<td>Other doctor</td>
<td>2.4</td>
<td>2.5</td>
<td>3.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Health professional</td>
<td>5.3</td>
<td>4.4</td>
<td>5.6</td>
<td>4.7</td>
</tr>
<tr>
<td>Inpatient</td>
<td>3.2</td>
<td>1.4</td>
<td>2.2</td>
<td>2.2</td>
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<tr>
<td>Accident and emergency</td>
<td>1.1</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
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<tr>
<td>Complementary healthcare</td>
<td>8.5</td>
<td>10.0</td>
<td>12.3</td>
<td>10.2</td>
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<tr>
<td>Other services</td>
<td>6.3</td>
<td>6.3</td>
<td>7.3</td>
<td>7.6</td>
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<tr>
<td>Therapy</td>
<td>13.0</td>
<td>13.3</td>
<td>12.9</td>
<td>-</td>
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<tr>
<td>Standardised medical care</td>
<td>3.6</td>
<td>3.7</td>
<td>3.6</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Methods: Service Costs

• Service use data combined with unit costs
• APT, CBT, GET unit cost based on salary, overheads, supervision, ratio of contact to non-contact time
  – APT/GET £100 per hour of therapy
  – CBT £110 per hour of therapy
• Other unit costs from recognised national sources
  – University of Kent
  – NHS Reference Costs
<table>
<thead>
<tr>
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<th>APT</th>
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<th>SMC</th>
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</thead>
<tbody>
<tr>
<td>Primary care</td>
<td>178</td>
<td>165</td>
<td>170</td>
<td>198</td>
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<tr>
<td>Other doctor</td>
<td>177</td>
<td>169</td>
<td>188</td>
<td>238</td>
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<tr>
<td>Health professional</td>
<td>120</td>
<td>123</td>
<td>152</td>
<td>168</td>
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<tr>
<td>Inpatient</td>
<td>142</td>
<td>54</td>
<td>132</td>
<td>99</td>
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<tr>
<td>Accident and emergency</td>
<td>19</td>
<td>20</td>
<td>15</td>
<td>22</td>
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<tr>
<td>Medication</td>
<td>70</td>
<td>78</td>
<td>70</td>
<td>77</td>
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<tr>
<td>Complementary healthcare</td>
<td>98</td>
<td>89</td>
<td>137</td>
<td>129</td>
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<tr>
<td>Other services</td>
<td>141</td>
<td>111</td>
<td>146</td>
<td>118</td>
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<tr>
<td>Therapy</td>
<td>1040</td>
<td>1198</td>
<td>935</td>
<td>-</td>
</tr>
<tr>
<td>Standardised medical care</td>
<td>227</td>
<td>230</td>
<td>213</td>
<td>358</td>
</tr>
</tbody>
</table>
Methods: Societal Costs

- Hours per week of support from family/friends *because of fatigue* recorded
- Valued using average wage rates
- Days/hours lost from work recorded
- Valued using average wage rates
- Sensitivity analyses conducted
## Informal Care and Lost Employment

<table>
<thead>
<tr>
<th></th>
<th>APT</th>
<th>CBT</th>
<th>GET</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal care %</td>
<td>74</td>
<td>66</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td>Informal care hours per week</td>
<td>11.0</td>
<td>8.0</td>
<td>7.7</td>
<td>11.4</td>
</tr>
<tr>
<td>Informal care cost (2009/10 £s)</td>
<td>6196</td>
<td>4008</td>
<td>4073</td>
<td>6507</td>
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<tr>
<td>Lost employment %</td>
<td>86</td>
<td>84</td>
<td>86</td>
<td>89</td>
</tr>
<tr>
<td>Lost employment days</td>
<td>148.6</td>
<td>151.0</td>
<td>144.5</td>
<td>141.7</td>
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<tr>
<td>Lost employment cost (2009/10 £s)</td>
<td>14,865</td>
<td>13,958</td>
<td>14,638</td>
<td>14,157</td>
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</tbody>
</table>
Average Societal Cost

Mean cost (2009/10 £s)

- Lost employment
- Informal care
- Services

- APT
- CBT
- GET
- SMC
Types of economic evaluation
What is Economic Evaluation?

Needs → Inputs (costs) → Outcomes
## Types of Economic Evaluation

<table>
<thead>
<tr>
<th>Type of evaluation</th>
<th>Costs</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-minimisation analysis</td>
<td>£s</td>
<td>None</td>
</tr>
<tr>
<td>Cost-benefit analysis</td>
<td>£s</td>
<td>£s</td>
</tr>
<tr>
<td>Cost-effectiveness analysis</td>
<td>£s</td>
<td>Single, disease specific</td>
</tr>
<tr>
<td>Cost-consequences analysis</td>
<td>£s</td>
<td>Multiple</td>
</tr>
<tr>
<td>Cost-utility analysis</td>
<td>£s</td>
<td>Single, generic (e.g. QALYs)</td>
</tr>
</tbody>
</table>
## Cost-Effectiveness Plane

<table>
<thead>
<tr>
<th>Costs</th>
<th>Outcomes</th>
<th>Worse</th>
<th>‘Equal’</th>
<th>Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher</td>
<td>×</td>
<td>×</td>
<td>?</td>
<td>✗</td>
</tr>
<tr>
<td>‘Equal’</td>
<td>×</td>
<td>?</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Lower</td>
<td>?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Incremental Cost-Effectiveness Ratio

\[
\text{ICER} = \frac{\text{Cost of treatment A} - \text{Cost of treatment B}}{\text{Effect of treatment A} - \text{Effect of treatment B}}
\]
What is the most appropriate outcome measure?
Options for Outcome Measurement

• Don’t measure outcomes
• Monetary measures of outcome
• Condition specific measures
• Generic measures (QALYs)
Impact on Fatigue

Chalder Fatigue Score

APT | CBT | GET | SMC
---|---|---|---
Baseline | 22 (52w FU) | 22 (52w FU) | 22 (52w FU) | 22 (52w FU)

Orange: Baseline
Light Blue: 52w FU
Impact on Physical Functioning

![Bar Chart]

- **SF36 Physical Functioning Score**
- **APT**, **CBT**, **GET**, **SMC**
- **Baseline**
- **52w FU**
## Cost-Effectiveness Results: Healthcare Perspective

<table>
<thead>
<tr>
<th></th>
<th>APT v SMC</th>
<th>CBT v SMC</th>
<th>GET v SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue difference</td>
<td>0.64</td>
<td>3.00</td>
<td>2.92</td>
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<tr>
<td>Incremental cost</td>
<td>£861</td>
<td>£898</td>
<td>£823</td>
</tr>
<tr>
<td>ICER</td>
<td>£1345 per unit fatigue reduction</td>
<td>£299 per unit fatigue reduction</td>
<td>£282 per unit fatigue reduction</td>
</tr>
<tr>
<td>Disability difference</td>
<td>-3.7</td>
<td>6.8</td>
<td>9.1</td>
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<tr>
<td>Incremental cost</td>
<td>£847</td>
<td>£904</td>
<td>£829</td>
</tr>
<tr>
<td>ICER</td>
<td>SMC dominant</td>
<td>£133 per unit disability reduction</td>
<td>£91 per unit disability reduction</td>
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</table>
## Cost-Effectiveness Results: Societal Perspective

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<th>GET v SMC</th>
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</thead>
<tbody>
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<td>Fatigue difference</td>
<td>0.64</td>
<td>3.00</td>
<td>2.92</td>
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<tr>
<td>Incremental cost</td>
<td>£2127</td>
<td>-£745</td>
<td>-£383</td>
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<tr>
<td>ICER</td>
<td>£3323 per unit fatigue reduction</td>
<td>CBT dominant</td>
<td>GET dominant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability difference</td>
<td>-3.7</td>
<td>6.8</td>
<td>9.1</td>
</tr>
<tr>
<td>Incremental cost</td>
<td>£1902</td>
<td>-£748</td>
<td>-£384</td>
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<tr>
<td>ICER</td>
<td>SMC dominant</td>
<td>CBT dominant</td>
<td>GET dominant</td>
</tr>
</tbody>
</table>
QALYs

- Quality adjusted life years
- Composite measure of quality of life and quantity of life
- Quantity measured in years
- Quality measured on a scale anchored by 1 (full health) and 0 (death)
- Negative values allowed
- QALYs are favoured measure of NICE and similar organisations
QALY Example

Situation: Person with schizophrenia has been living in a long-stay hospital for 20 years. The life expectancy for this person is another 30 years.

Option 1: Continued residence in long stay ward where quality of life is rated at 0.6. The weekly cost is £700.

Option 2: Reprovision into high support group home in the community where quality of life is rated at 0.8. The weekly cost is £800.
QALY Example

Option 1:  QALYs gained = 30 x 0.6 = 18
            Cost per QALY = £700 x 1560 weeks / 18 = £60,667

Option 2:  QALYs gained = 30 x 0.8 = 24
            Cost per QALY = £800 x 1560 weeks / 24 = £52,000

Incremental cost per QALY of Option 2 = £156,000/6 = £26,000
How is Quality Measured?

• Scale of 0 (death) to 1 (full health)
• Rating scale
• Standard gamble
• Time trade off
• Multi-attribute scales
Standard Gamble

Two options are given:

Option 1: Remain in current state of health

Option 2: Take a gamble on a treatment that has a probability “P” of a total cure and 1-P of the worse possible outcome

P is varied until the individual is indifferent between Option 1 and Option 2. That value of P indicates the utility associated with the original health state.
Standard Gamble (continued)

Adapted from Kiebert et al (2001)
Time Trade Off

- Developed by Torrance et al (1972)

- Respondent states the number of years they would forego if they could be in a perfect state of health rather than their current one

- E.g. if someone with CFS would accept 9 months year in full health rather than 1 year with CFS then a value of 0.75 would be placed on their health

- Simpler than standard gamble but not as rooted in utility theory
Multi-attribute Scales

- Patients are asked to rate their quality of life in a number of domains (e.g. self-care, pain)
- ‘Off-the-shelf’ utility scores are then attached to health care states
- Examples: SF-36, EQ-5D (EuroQol)
- Concerns over sensitivity to change in specific conditions
EQ-5D (EuroQol)

- Very brief
- Consists of 5 attributes
  - Mobility
  - Self-care
  - Usual activity
  - Pain/discomfort
  - Anxiety/depression
- Three possible levels
  1 = no problem
  2 = some problems
  3 = major problems
- Combination gives 243 health states plus ‘unconscious and ‘dead’
- Preferences for health states obtained from a large community sample using the time trade-off technique
- Limited range of attributes and levels may make the EQ-5D insensitive to change for certain conditions, resulting biased comparisons
# Weighting of EQ-5D Scores

<table>
<thead>
<tr>
<th>EQ-5D score</th>
<th>Description</th>
<th>Utility weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>11111</td>
<td>Mobility – no problems, Self-care – no problems, Usual activities – no problems, Pain/discomfort – no problems, Anxiety depression – no problems</td>
<td>1.000</td>
</tr>
<tr>
<td>21121</td>
<td>Mobility – some problems, Self-care – no problems, Usual activities – no problems, Pain/discomfort – some problems, Anxiety depression – no problems</td>
<td>0.727</td>
</tr>
<tr>
<td>11223</td>
<td>Mobility – no problems, Self-care – no problems, Usual activities – some problems, Pain/discomfort – some problems, Anxiety depression – major problems</td>
<td>0.255</td>
</tr>
<tr>
<td>23323</td>
<td>Mobility – some problems, Self-care – major problems, Usual activities – major problems, Pain/discomfort – some problems, Anxiety depression – major problems</td>
<td>-0.086</td>
</tr>
</tbody>
</table>
QALY Gains in PACE Study

APT | CBT | GET | SMC
---|-----|-----|-----
0.53 | 0.60 | 0.57 | 0.52

QALY gain
## Cost-Utility Results

<table>
<thead>
<tr>
<th></th>
<th>APT v SMC</th>
<th>CBT v SMC</th>
<th>GET v SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>QALY difference</td>
<td>0.0149</td>
<td>0.0492</td>
<td>0.0343</td>
</tr>
<tr>
<td>Incremental healthcare cost</td>
<td>£823</td>
<td>£904</td>
<td>£810</td>
</tr>
<tr>
<td>ICER (healthcare)</td>
<td>£55,235 per QALY</td>
<td>£18,374 per QALY</td>
<td>£23,615 per QALY</td>
</tr>
<tr>
<td>Incremental societal cost</td>
<td>£1893</td>
<td>-£698</td>
<td>-£472</td>
</tr>
<tr>
<td>ICER (societal)</td>
<td>£127,047 per QALY</td>
<td>CBT dominant</td>
<td>GET dominant</td>
</tr>
</tbody>
</table>
Cost-Effectiveness Plane: APT v SMC (health perspective)
Cost-Effectiveness Plane: CBT v SMC (health perspective)
Cost-Effectiveness Plane: GET v SMC (health perspective)
Cost-Effectiveness Acceptability Curves (healthcare perspective)
Cost-Effectiveness Plane: APT v SMC (societal perspective)
Cost-Effectiveness Plane: CBT v SMC (societal perspective)
Cost-Effectiveness Acceptability Curves (societal perspective)
Criticisms of QALYs

- Overly complex
- Not complex enough
- Assumption of constant trade-off between quantity and quality of life may not be theoretically correct
- Focus is on health gain rather than health maintenance
- Emphasis on maximising quality of life rather than on producing an equitable distribution of quality of life
- Community values used but are these appropriate?
  - Do members of the public have enough knowledge of different conditions?
  - What if people adapt to their conditions?
- Specific problems for some conditions
  - Insensitivity?
  - Appropriateness of questions
  - Are questions understandable
How do we decide what to commission or provide?
What is the Correct Decision Rule?

- Adopt treatment if ICER < threshold (£20-30K)
- ‘League tables’
- Budget impact
- ‘Rule of rescue’
- Go back to implicit rationing (i.e. individual clinical decisions)