Using Health Economics to Inform the Development of Medical Devices

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Overview

• Background to MATCH
• Overview of health economics in product development
• Concepts relating to cost-effectiveness
• Demonstration of the MATCH health economics tool
MATCH

- Multidisciplinary Assessment of Technology Centre for Healthcare
- EPSRC-funded since 2003, with partner subscriptions
- Set up as Innovative Manufacturing Research Centre (IMRC)
- Aim to support both companies across the UK healthcare technology sector and user communities, delivering methods and tools to assess the value of medical devices from concept through to mature product
MATCH: Multidisciplinary Assessment of Technology Centre for Healthcare

Industry partners

NHS stakeholders and public organisations

Project 1: Tools for Industry
Project 2: Economic Evaluation
Project 3: User Needs
Project 4: Implementation Issues

MATCH

Brunel University, West London

University of Birmingham

University of Ulster

The University of Nottingham

BITECIC

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Product Development

• Manufacturers / vendors of new healthcare technology increasingly required to demonstrate value for money (e.g., NICE)
• Early-stage decisions often performed under pressure
• Value to users and service providers often poorly established
• Medical devices typically brought to market at high risk, often by small companies
• Risk: Technical, Clinical, Commercial...
MATCH: Economic Evaluation

Phase 1

A

Risk

Investment Pricing, etc

Phase 2

Phase 3

Uncertainty Evidence

Phase 4

Phase 5

C

D

Reimbursement uncertainties

Patient pathway

Business Plan

Health economics

C/E Gap
Health Economics

• Health economics examines how to improve the health of the population through the efficient use of resources

• Incorporation of good-quality health-economic evidence into clinical guidelines can help make clinical decisions less arbitrary and more consistent

• NICE have typically performed health economic evaluations using a cost-effectiveness analysis (CEA)

• A cost-effectiveness analysis provides a means of assessing both the costs and health benefits (measured using a non-monetary indicator) of a new medical device
Cost-effectiveness Analysis

- **Patient Benefit**
  - Worse
  - Better

- **Costs**
  - Higher
  - Lower

- **Willingness-to-pay threshold**

- **Quadrants**
  - **REJECT**
  - **TRADE-OFF**
  - **TRADE-OFF**
  - **ADOPT**
Utility

Andresen et al. Performance of a self-administered mailed version of the Quality of Well-Being (QWB-SA) questionnaire among older adults; Med Care 1998a
Michael et al. Health Values in Adolescents with or without Inflammatory Bowel Disease. The Journal of Pediatrics 2009b
Coffey et al. Valuing Health-Related Quality of Life in Diabetes; Diabetes Care 2002c

0 = Worst imaginable health state (Death)
0.5 = Man living with type-II diabetes
0.64 = Woman living with type-II diabetes
0.67 = Man living with type-II diabetes
0.704 = utility value for health older adult
0.98 = Adolescent control group

0.4 = e.g., woman living with type-II diabetes following amputation (e.g., reduced mobility and social interaction)

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Quality-Adjusted Life Years (QALY)

• QALY is the combination of quantity and quality of life generated by an intervention
• One QALY = one year of perfect health

Intervention A (existing): four years in health state 0.5 = 2 QALYs
Intervention B (new): four years in health state 0.75 = 3 QALYs

Additional number of QALYs generated by B = 1 QALY

This is a way of being able to numerically compare the benefit gained from a variety of interventions
Cost-effective?
Incremental Cost-Effectiveness Ratio (ICER)

• An ICER is the combination of the benefits gained from an intervention (QALY) combined with the costs
• An ICER is also known as cost-per-QALY
• QALY is the reference unit typically used by healthcare providers, hence its use to express additional costs
• Once the QALY of an intervention is known, it can be combined with costs
• An ICER is defined when comparing two different alternative technologies (A + B)
Incremental Cost-Effectiveness Ratio (ICER)

ICER Calculation:

\[
\text{ICER} = \frac{\text{Cost of intervention A (existing)} - \text{Cost of intervention B (alternative / new)}}{\text{No. of QALYs produced by Intervention A} - \text{No. of QALYs produced by Intervention B}}
\]

Calculates the cost to generate one additional year of perfect (one QALY) health if using intervention B in place of intervention A
Example of ICER calculation

<table>
<thead>
<tr>
<th></th>
<th>Treatment A (existing)</th>
<th>Treatment B (new device / treatment)</th>
<th>Difference (or Increment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = Mean cost of treatment per patient (£)</td>
<td>7,817</td>
<td>7,645</td>
<td>cd = 172</td>
</tr>
<tr>
<td>Y = Mean utility (QALYs) per patient</td>
<td>0.7347</td>
<td>0.6485</td>
<td>ud = 0.0863</td>
</tr>
<tr>
<td>Average cost per QALY</td>
<td>£10,640</td>
<td>£11,789</td>
<td>-----</td>
</tr>
<tr>
<td>Incremental cost per QALY of Treatment A (existing) vs. Treatment B (new / innovation) ( = cd / ud)</td>
<td>-----</td>
<td>-----</td>
<td>£1,995</td>
</tr>
</tbody>
</table>

Cost of treatment A (existing) – Cost of treatment B (new / innovation)

No. of QALYs from treatment A – No. of QALYs from treatment B

Incremental Cost = difference in cost / difference in QALY’s
Equates to additional cost of one QALY from treatment B
How can manufacturers use CEA?

• Industry and investors seeking informed product development decisions based on health technology assessment

• R&D Managers wishing to integrate health economic considerations into New Product Development Systems

• Marketing Managers seeking to differentiate products based on cost-effectiveness

• Sales Managers seeking to articulate the value proposition of innovative products
MATCH: The HE Tool

MATCH health economic (HE) evaluation tool

• From interviews with industry partners in 2004 and 2005:
  – Small / medium-sized enterprises and start-ups revealed no use of health economics in decision-making
  – Little understanding of formal health technology assessment (HTA) methods

• Decision aid for estimating the cost-effectiveness of specific medical innovations that translated into the health technology assessment used by healthcare organisations such as NICE
MATCH: The HE Tool

- The MATCH HE tool was developed in Microsoft Excel.
- Developed in consultation with health economists and through talks with manufacturers, health providers, business development executives and technologies transfer specialists.
- Developed alongside partnership with the National Innovation Centre (NIC) in 2007 as a partner project.
- There is an emphasis on graphical output and an element of sensitivity analysis.
- The tool requires a minimum amount of input variables (to reduce time and effort required for populating data) whilst maintaining features that allow for a meaningful comparison.
MATCH health economic tool

Demonstration

– What types of information are required for the tool?
  • Costs, outcome data, utility values, time horizon

– Examples of Decision Making Support
  • Is this new device likely to be cost-effectiveness?
  • Which variables will have the greatest influence over the cost-effectiveness of this device?

– Examples of Demonstrating Value for Purchasers
  • If this device is cost-effective, how big would the savings or additional costs be if it was used?
  • How does using the new device affect the population of patients requiring treatment?
  • How does a new device influence the overall cost per patient?
MATCH tools in product development

- Idea Generation
- Research Phase
- Concept Development
- Manufacturing Scale-up and Device (re-) Design and Prototype Development
- Prototype Trialling and Testing
- Device Deployment and Usability Testing
- Implementation in Clinical Service Delivery
- Economic Evaluation (HE tool)
  - Iterative update of data to refine a cost-effectiveness case
  - Reduced uncertainty / Presentation to purchasing

User Involvement

Research Question
Research Answers

Post-market Surveillance

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