Using Multiple Criteria Decision Analysis (MCDA) to make coverage decisions: an experimental case study on metastatic colorectal cancer

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http://www.advance-hta.eu/
Outline

- Motivation and Objective
- MCDA methodological framework
- Metastatic colorectal cancer adaptation
- Results from the case study
- Policy implications
Motivation

Economic evaluation (EE) does not adequately capture a number of value dimensions.

Increasing evidence that Decision Makers (DMs) are reluctant to base decisions on EE alone, seeking broader assessment.

Different stakeholders attach different value judgements to the criteria considered.

What additional benefits to incorporate, how to establish their relative importance, and whose preferences to consider?
Objective

Develop an alternative methodological approach for value assessment

Comprehensive and transparent framework potentially overcoming the previous limitations

Contribute to a more efficient resource allocation
MCDA as a means of eliciting value

Multiple Criteria Decision Analysis "is both an approach and a set of techniques, with the goal of providing an overall ordering of options" by looking at the extent to which a set of objectives are achieved.

Analyse complex situations characterised by a mix of objectives:
- disaggregate a complex problem into simpler components
- measure the extent to which certain options achieve the objectives
- weight these objectives
- re-assemble the components to show an overall picture
MCDA methodological framework in the context of HTA

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MCDA methodological framework in the context of HTA

**MCDA Phases**
- Problem Structuring
- Model Building
- Model Assessment
- Model Appraisal
- Action Plans

**Stakeholder Groups**
- MCDA researcher
- All stakeholders
- Decision-Makers

**MCDA Stages**
- Decision context is established:
  - Decision problem
  - Analysis aim
  - Decision makers & key stakeholders
- Construction of value judgments:
  - Criteria selection
  - Attribute selection
  - Performance of options
- Construction of value judgments:
  - Scoring
  - Weighting
- Preference elicitation:
  - Aggregation
  - Result analysis
  - Sensitivity analysis
- Implementation of results:
  - Resource allocation and coverage decisions

**Properties**
- Criteria properties:
  - Essential
  - Understandable
  - Operational
  - Non-redundant
  - Concise
  - Preference independence
- Attribute properties:
  - Unambiguous
  - Understandable
  - Operational
  - Comprehensive
  - Direct
  - Preference independence

**Methods**
- Value-based measurement methods:
  - Linear additive model
  - Multi-attribute value theory
  - Multi-attribute utility theory

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Problem structuring

**Decision problem:** Which metastatic colorectal cancer (mCRC) treatment to cover?

**Aim:** To assess (and rank) the overall value of second-line biological treatments for mCRC following prior oxaliplatin-based (i.e. first line) chemotherapy

- Adopt NICE past TAs scope

**Stakeholders:** a group of experts, including health care professionals, methodology experts, patients

- Replicate NICE past committees
MCDA methodological framework in the context of HTA

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Model building - generic value tree

Three-stage process for criteria selection:
1) Systematic review of the value assessment literature in the context of HTA was conducted for the case of eight EU countries
2) Consultation with experts (Advance-HTA meetings, external experts)
3) Dissemination activities (HTAi, ISPOR, Ad-HTA capacity building workshops)

- “Value focused thinking”: top-down approach, criteria selected prior to identifying the alternative options

...while ensuring criteria possess the right properties
Model building - generic value tree

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Model building – mCRC value tree

- **mCRC–specific value tree** outlining clusters of criteria and related attributes which capture the value of the chosen mCRC treatments falling under the scope of the exercise.

  - “alternative focused thinking”: bottom-up approach, criteria emerged following the comparison of the alternative treatments options.

- Alternatives to be assessed:
  - Cetuximab
  - Panitumumab
  - Aflibercept + FOLFIRI
  - Bevacizumab + non-oxaliplatin chemotherapy → no evidence
  - Regorafenib monotherapy → no evidence
Very often researchers applying MCDA do not pay sufficient attention to the theoretical foundations of MCDA

- Criteria and attributes should adhere to a number of properties for the analysis to be robust and meaningful;
  - Essential
  - Understandable
  - Operational
  - Non-redundant
  - Concise
  - Preference independent

- Recent evidence has shown that only one health care MCDA study explained that criteria were defined to meet MCDA requirements
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Model assessment – preferences and decision conferencing

- **Stakeholder preferences** used as the basis of value judgements

- **Working together as a group** is essential because the aim is to create a shared understanding of what constitutes value in mCRC treatment, while enabling learning from each other

- Participant preferences were elicited as part of a **decision conference** (facilitated workshop), assuming that are representative of their stakeholder group
Model assessment - workshop participants

- Ideal number of 7-15 participants: preserve individuality while also allowing for group processes to emerge
- Composition of the group: based on the structure of the past NICE committees

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Medical oncologist - CRC expert</td>
</tr>
<tr>
<td>2</td>
<td>Medical oncologist - CRC expert</td>
</tr>
<tr>
<td>3</td>
<td>Consultant - community paediatrician</td>
</tr>
<tr>
<td>4</td>
<td>Public health expert</td>
</tr>
<tr>
<td>5</td>
<td>Pharmacist</td>
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<td>6</td>
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<tr>
<td>12</td>
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</tr>
<tr>
<td>13</td>
<td>Patient advocate</td>
</tr>
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Model assessment - Value measurement methods

A variety of MCDA techniques are available with regards to scoring, weighing and aggregating, mainly relating to the value judgement and preference elicitation processes.

- **Indirect techniques** involve a series of questions aiming to uncover preferences by considering differences in the attribute scale and their relation to value scale.

- **MACBETH** is an indirect approach to elicit value functions and criteria weights.
MCDA methodological framework in the context of HTA

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Model appraisal – scores and weights aggregation

 Typically, an additive value aggregation approach is adopted, where the overall value $V(.)$ of an option is given by:

$$V(a) = \sum_{i=1}^{m} w iv_i(a)$$

Where $m$ is the number of criteria, and $w iv_i(a)$ the weighted partial value function of criterion $i$ for option $a$. This function $V(.)$ is a multi attribute value function.

Criteria need to be preferentially independent!
Day of the workshop

- Value tree presented and worked cluster by cluster
  - Value tree validation: some criteria were excluded because they were irrelevant or non-fundamental
  - Value functions were elicited for the different criteria
  - Relative weights were assigned within the clusters and across clusters
  - Overall value scores produced
Final Value Tree for mCRC (post-workshop)
Elicitation of value judgements within criteria and conversion into a value function (scoring)

What is the difference in value between $x$ and $y$: “very weak”, “weak”, “moderate”, “strong”, “very strong” or “extreme”?
Elicitation of value judgements across criteria (weighting)

“Of all the possible swings (changes) within these criteria ranges, which represents the biggest difference you care about?”
Performance of different options and overall value scores

- OS + Grade 4 AEs = 50% of total weight
- THE 0.47; SAF 0.23; INNOV 0.29; SOCIO 0.12
- Cetuximab scored the highest overall value score
Link to policy-making

The resulting aggregate metric of value emerging from the MCDA process is more encompassing in nature.

- **Value index** metric = benefit component
- Incorporate purchasing costs

- Incremental cost per incremental value ratio(s) (ICVR) as the basis of allocating resources
- Options with lower ICVRs would be interpreted as more valuable, would be prioritised and would provide efficient options
Cost benefit of overall value scores versus costs

- AFLI is dominated by PAN and CET
- PAN is dominated by CET
- CET is associated with the highest overall value score and the lowest cost
Cost benefit of overall value scores versus costs

- AFLI is dominated by PAN and CET
- PAN is dominated by CET
- CET is associated with the highest overall value score and the lowest cost

£348/ MCDA value unit
£598/ MCDA value unit
£1,698/ MCDA value unit
NICE comparison

- Technologies’ ranking based on their ICERs could be compared with their ranking based on their ICVRs

<table>
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<tr>
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<tr>
<td>AFLI + FOL</td>
<td>£51,000</td>
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<tr>
<td>CET</td>
<td>£90,000</td>
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<td>PAN</td>
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NICE comparison

- AFLI+FOL overall value score was greatly influenced by the combination of its poor performance in regards to Grade 4 AEs (-118), plus its relative large weight (0.23)
Conclusions and policy implications

- MCDA can generate a more holistic metric of value

- Incorporation of costs can then produce a metric of efficiency, involving incremental cost per incremental MCDA value unit, that can be used for reimbursement and coverage decisions

- Overall, the MCDA approach provides improved comprehensiveness, flexibility, and transparency

- Attention should be paid on the theoretical foundations of DA so that the results are meaningful and decision recommendations robust
Summary

- An MCDA value based assessment was completed for a set of mCRC treatments
- A disease-specific value tree was developed reflecting all the critical value dimensions as criteria
- A decision conference was organised with the involvement of all key stakeholders
- Stakeholders preferences were elicited to assess the performance of the technologies and the relative importance of the criteria
- Technologies were ranked based on their overall value scores and their costs
Thank you!

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