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/



Rethinking the future of Health Technology Assessment





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





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?





Develop an alternative methodological approach for value assessment



Comprehensive and transparent framework potentially overcoming the previous limitations

Contribute to a more efficient resource allocation



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





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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
- X Bevacizumab + non-oxaliplatin chemotherapy → no evidence
- X Regoratenib monotherapy \rightarrow no evidence

Model building – criteria properties



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

MCDA methodological framework in the context of HTA





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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

Stakeholders	Expertise
1	Medical oncologist - CRC expert
2	Medical oncologist - CRC expert
3	Consultant - community paediatrician
4	Public health expert
5	Pharmacist
6	Health economist
7	HTA expert
8	Health economist
9	HTA expert
10	Medical statistics
11	Patient
12	Patient carer
13	Patient advocate

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:

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

Where *m* is the number of criteria, and *wivi(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



Final Value Tree for mCRC (postworkshop)





LSE

Elicitation of value judgements within criteria and conversion into a value function (scoring)



strong" or "extreme"?



Elicitation of value judgements across criteria (weighting)



LSE

Performance of different options and overall value scores



I	Table of performances												
	Options	OS	HRQoL	PFS	Grade 4	Innov L4	Ph3	Market Auth.	Poso	Med costs impact			
	CET	9.5	0.78	3.7	2	1st	19	1	hr, 1/wk	4589			
_	PAN	8.1	0.78	3.1	2	2nd	7	0	hr, 1/two wks	1940			
_	AFLI	13.5	0.78	6.9	21	1st	18	3	hrs, 1/two wks	6738			
_	Upper	14.9	0.9	7.6	0	1st	21	3	hr, 1/two wks	0			
	Lower	6.2	0.75	1.9	10	2nd	0	0	hrs, 1/wk	7086			
Table of scores													
Opt	ions 🛛	Overall	OS		HRQoL	P	FS	Grade 4	Innov L4	Ph3	Market Auth.	Poso	Med costs impact
Up	per	100.00	10	0.00	100.0	0	100.00	100.00	100.00	100.00	100.00	100.00	100.00
[all u	pper]	100.00	10	0.00	100.0	0	100.00	100.00	100.00	100.00	100.00	100.00	100.00
C	ET	51.79	3	8.89	15.0	1	42.86	80.00	100.00	77.78	30.00	50.00	50.00
P/	AN	45.18	2	2.62	15.0	1	28.57	80.00	0.00	25.92	0.00	100.00	78.87
A	FLI	17.37	8	3.91	15.0	1	90.28	-117.86	100.00	66.67	100.00	37.50	6.97
Lo	wer	0.00		0.00	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[all I	ower]	0.00		0.00	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Weigh	ts :	0.2886	ì	0.1283	0.0	481	0.2325	0.0582	0.0233	0.0349	0.0698	0.1163

- > 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



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





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- PAN is dominated by CET
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 Technologies' ranking based on their ICERs could be compared with their ranking based on their ICVRs

Options	ICERs (£ per unit of QALY)	Options	ICERs (£ per MCDA value unit)
AFLI + FOL	£51,000	CET	£348
CET	£90,000	PAN	£598
PAN	> £110,000	AFLI + FOL	£1,698

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)

Table of scores									
Options	Overall	OS	HRQoL	PFS	Grade 4				
Upper	100.00	100.00	100.00	100.00	100.00				
[all upper]	100.00	100.00	100.00	100.00	100.00				
CET	51.79	38.89	15.01	42.86	80.00				
PAN	45.18	22.62	15.01	28.57	80.00				
AFLI	17.37	83.91	15.01	90.28	-117.86				
Lower	0.00	0.00	0.00	0.00	0.00				
[all lower]	0.00	0.00	0.00	0.00	0.00				
Weights :		0.2886	0.1283	0.0481	0.2325				

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





- 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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