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Integrating stakeholder preferences in comparative effectiveness research using multi-criteria decision analysis (MCDA) and Conjoint Analysis (CA)

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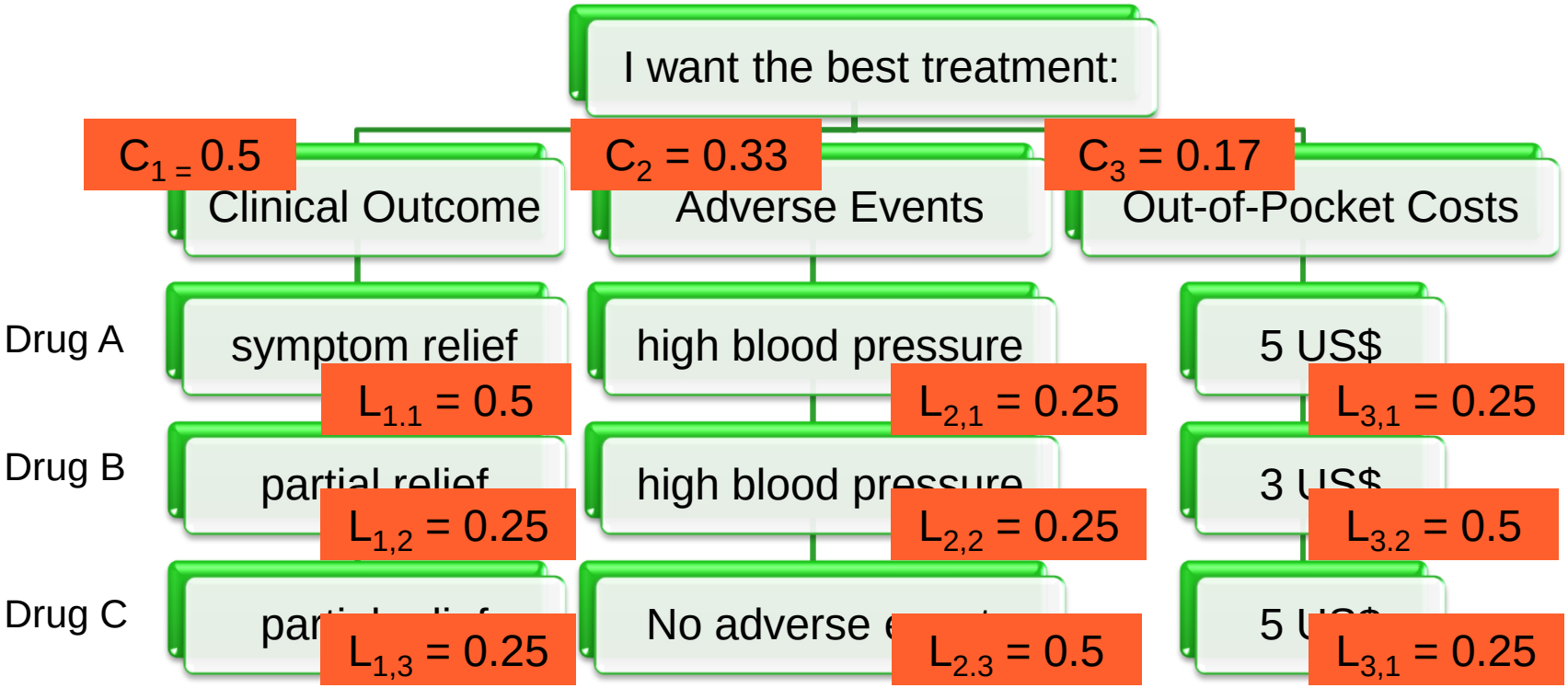
Multiple endpoints in comparative effectiveness research

- In CER we wish to make an informed decision based on available clinical evidence for multiple endpoints.
- Primary endpoints chosen in clinical trials may not be the most relevant endpoints for patients and other stakeholders.
- Also, process related factors contribute to the actual use by stakeholders and are usually neglected in decision making.
- Three approaches for including stakeholder preferences
  - Stakeholder representatives in appraisal committees
  - **Elicitation of preferences to guide deliberative process**
  - **Integration of preferences in quantitative framework**

All MCDA and CA methods decompose a decision problem into a set of criteria (attributes and levels):

And they use a linear additive value function to determine the relative preference for the alternatives:



drug A: $(C_1*L_{1,1} + C_2*L_{2,1} + C_3*L_{3,1}) = 0.375$

Multi-criteria decision analysis and Conjoint Analysis

- Multi-criteria Decision analysis (MCDA) is a subdiscipline of operations research that explicitly considers multiple criteria in decision making. MCDA methods enable the evaluation of many alternatives by explicit ranking, rating or pairwise comparison of criteria and alternatives. (See: Belton & Steward, 2002)
  - The Analytic Hierarchy Process (AHP) is one of the most widely used MCDA techniques available (Saaty, 1989)

- Conjoint Analysis (CA) methods offer subjects a series of choices among two or more product profiles. The pattern of choices reveals the implicit decision weights patients attach to therapeutic benefits, harms, processes and costs that describe the treatment profiles (ISPOR taskforce, 2012)

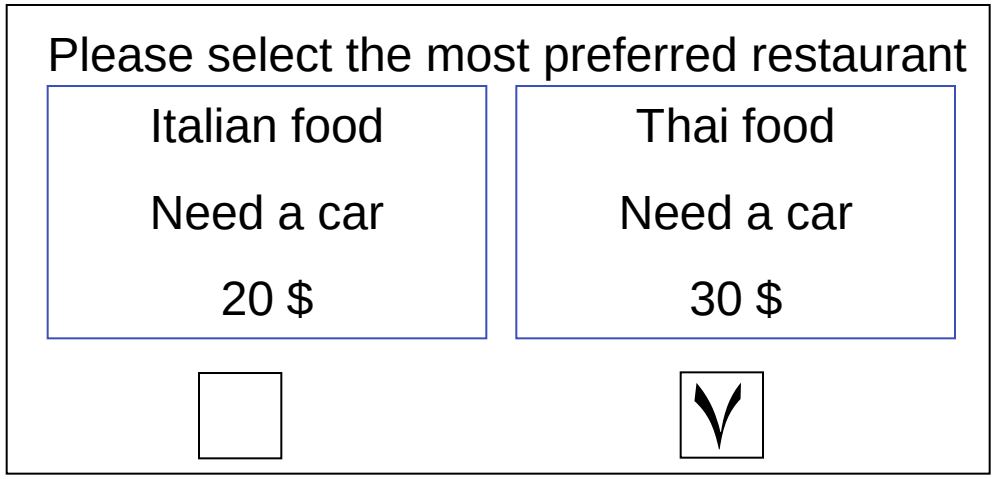
MCDA and CA: an example

- Suppose a study in which we will select a good restaurant for dinner. We have defined 3 criteria (C_i) and 3 levels (L_i)
  - Cooking style — Italian, Greek or Thai
  - Travel distance — need a car, walking or cycling
  - Price — 15$, 20$, 30$

- Conjoint analysis will generate scenarios based on the levels (L_i). In this case, 27 (3^3) scenario's describe all possible combinations in the decision space.

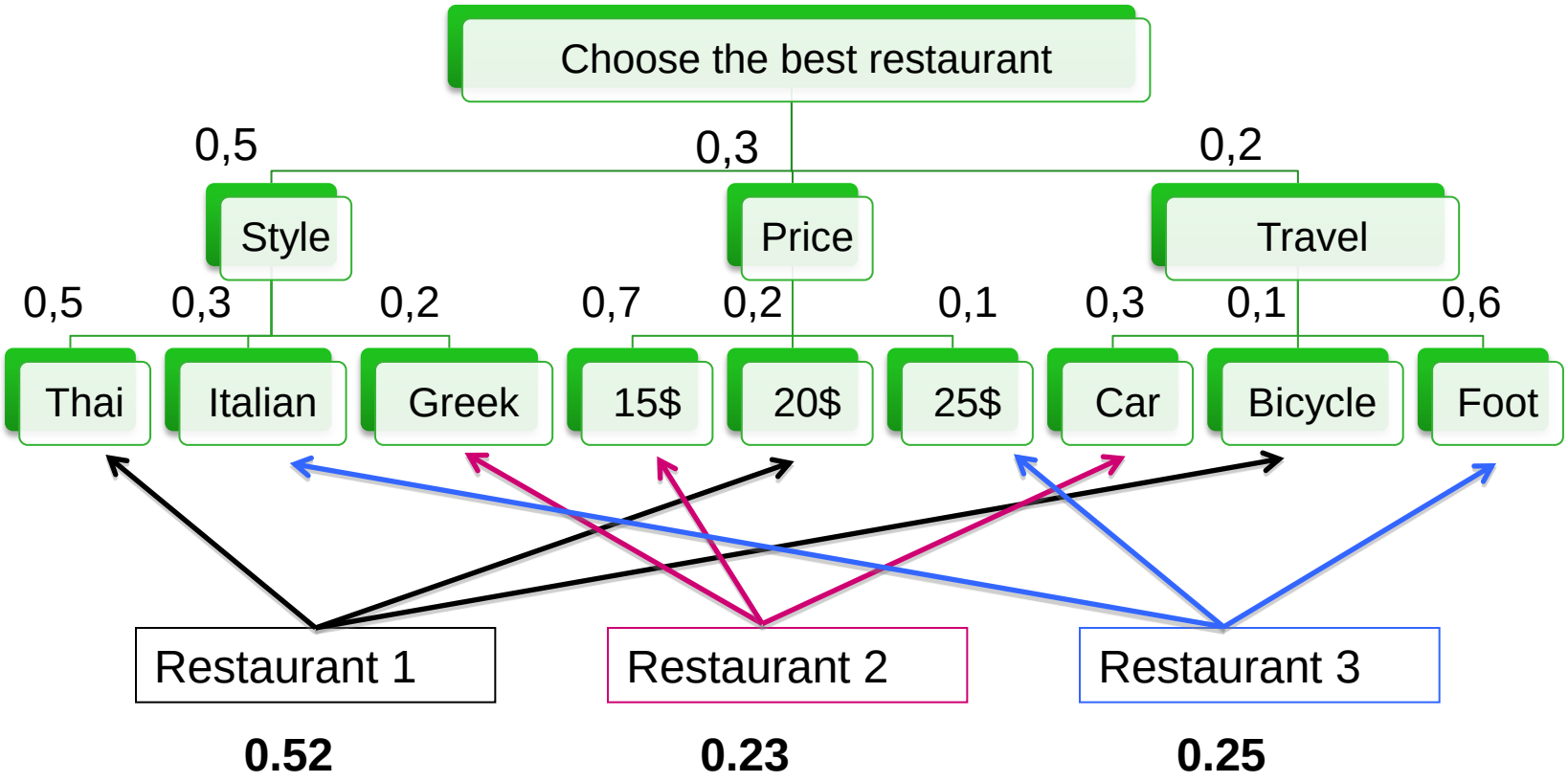
- MCDA will ask you which criteria and levels (C_i and L_i) are important using ranking, rating or pairwise comparisons. 12 comparisons can describe the complete decision space.

Conjoint analysis



- Each participant receives N choice sets.
- Based on their response it is possible to estimate the part-worth utility of the levels and to estimate attribute weights
- E.g. if Thai food is presented in X scenarios and if a respondent picks all these scenarios we can assume Thai food is an important factor

Analytic Hierarchy Process (MCDA)



MCDA vs. Conjoint analysis methods

MCDA (e.g. AHP)

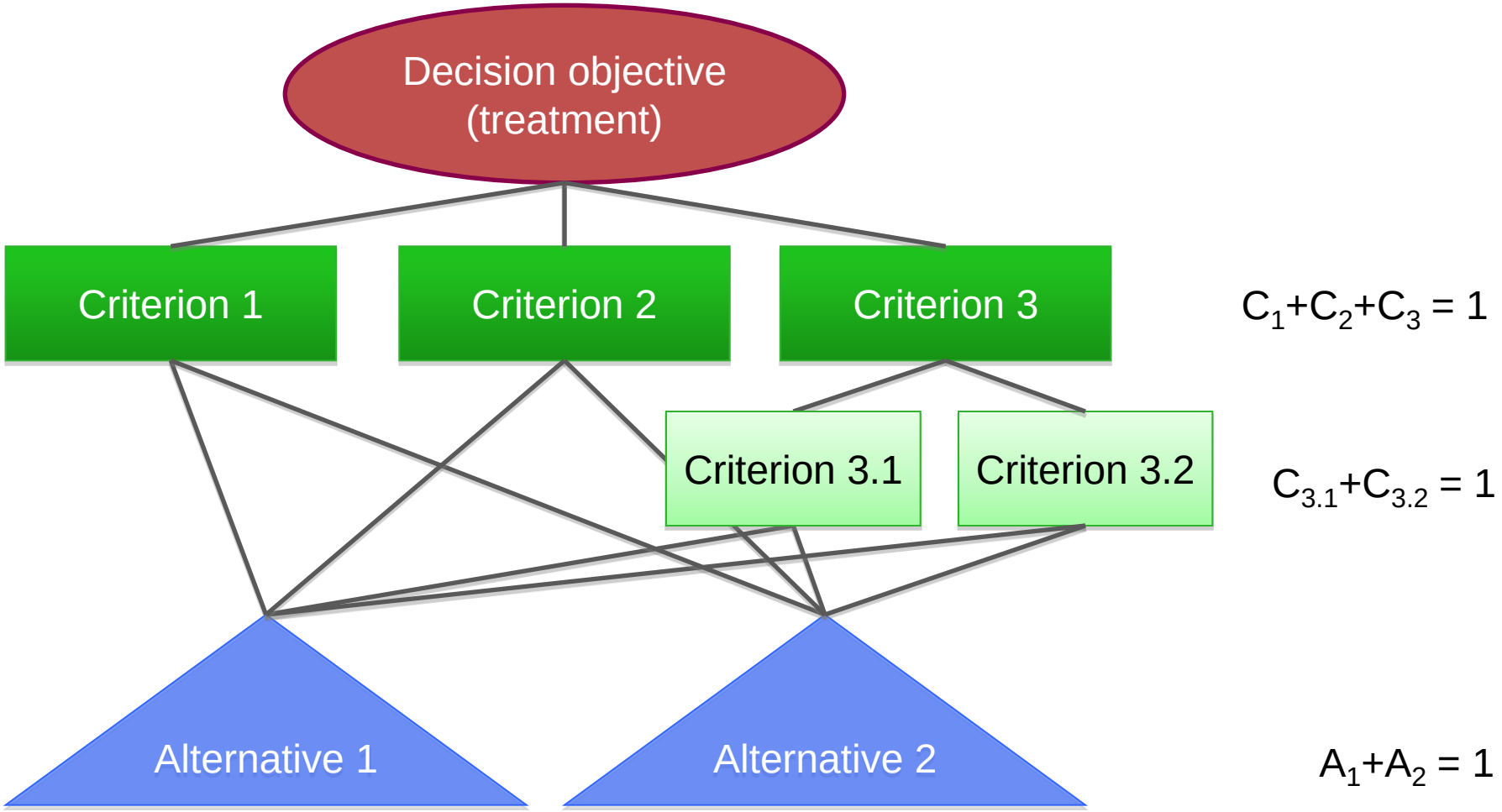
- Helps to improve judgment
- Decomposed
- Hierarchical
- Low cognitive stress
- Less realistic
- Flexible
- Not really used in marketing
- Decision sciences / OR
- Possible to use in N=1 or as consensus building tool (group-decision)

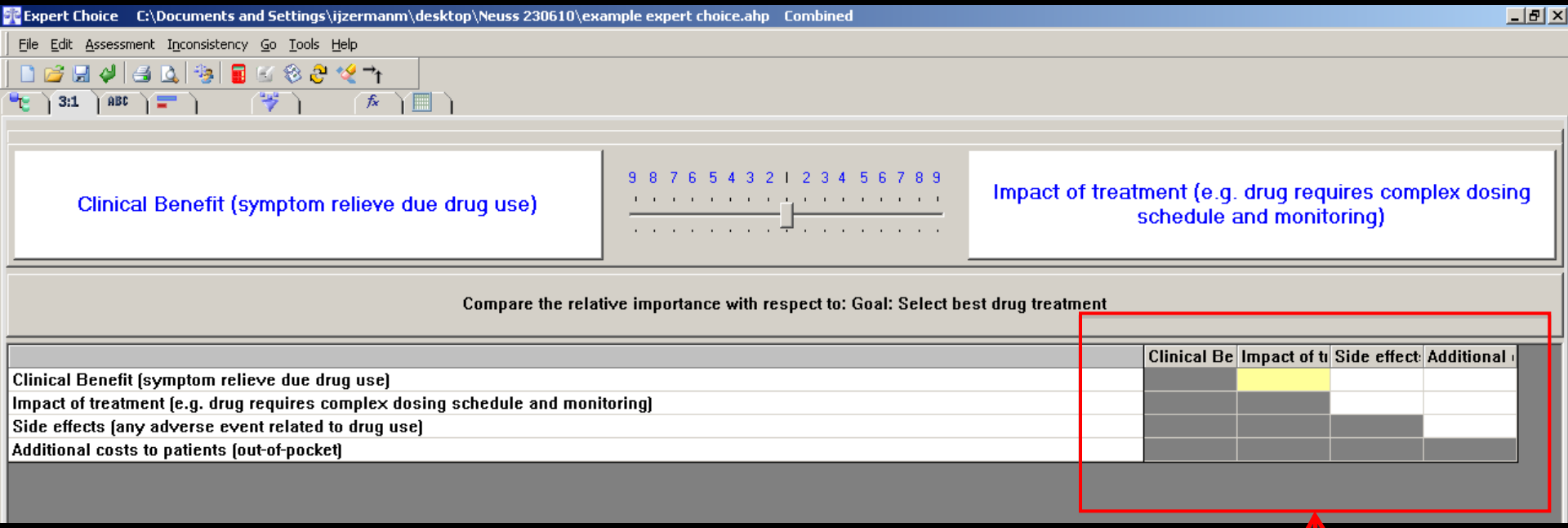
CA methods

- Imitates consumers' judgment
- Holistic evaluation
- Matrix structure
- Cognitive stress
- Realistic task
- Less flexible (e.g. design)
- Use in marketing (i.e. creates a hypothetical market)
- Large datasets required

Adapted from Mulye *et al*, J. Beh.Dec. Mak, 1998

MCDA methods: the Analytic Hierarchy Process





Decision matrix

Verbal scale of importance in pairwise comparisons:

1. Equal
2. Equal to moderate
3. Moderate
4. Moderate to Strong
5. Strong
6. Strong to very strong
7. Very strong
8. Very strong to extreme
9. Extreme

Eigenvalue to obtain criteria (C_i) and level (L_i) weights (1)

Matrix with pairwise comparisons
(4 criteria, 6 comparisons)

	Clinical benefit	Adverse event	Treatment impact	Co-payment
Clinical benefit	**1**	**3**	**5**	**7**
Adverse event	**1/3**	**1**	**1/3**	**1/5**
Treatment impact	**5**	**3**	**1**	**3**
Co-payment	**1/7**	**1/5**	**1/3**	**1**

Reciprocal scores of pairwise comparisons

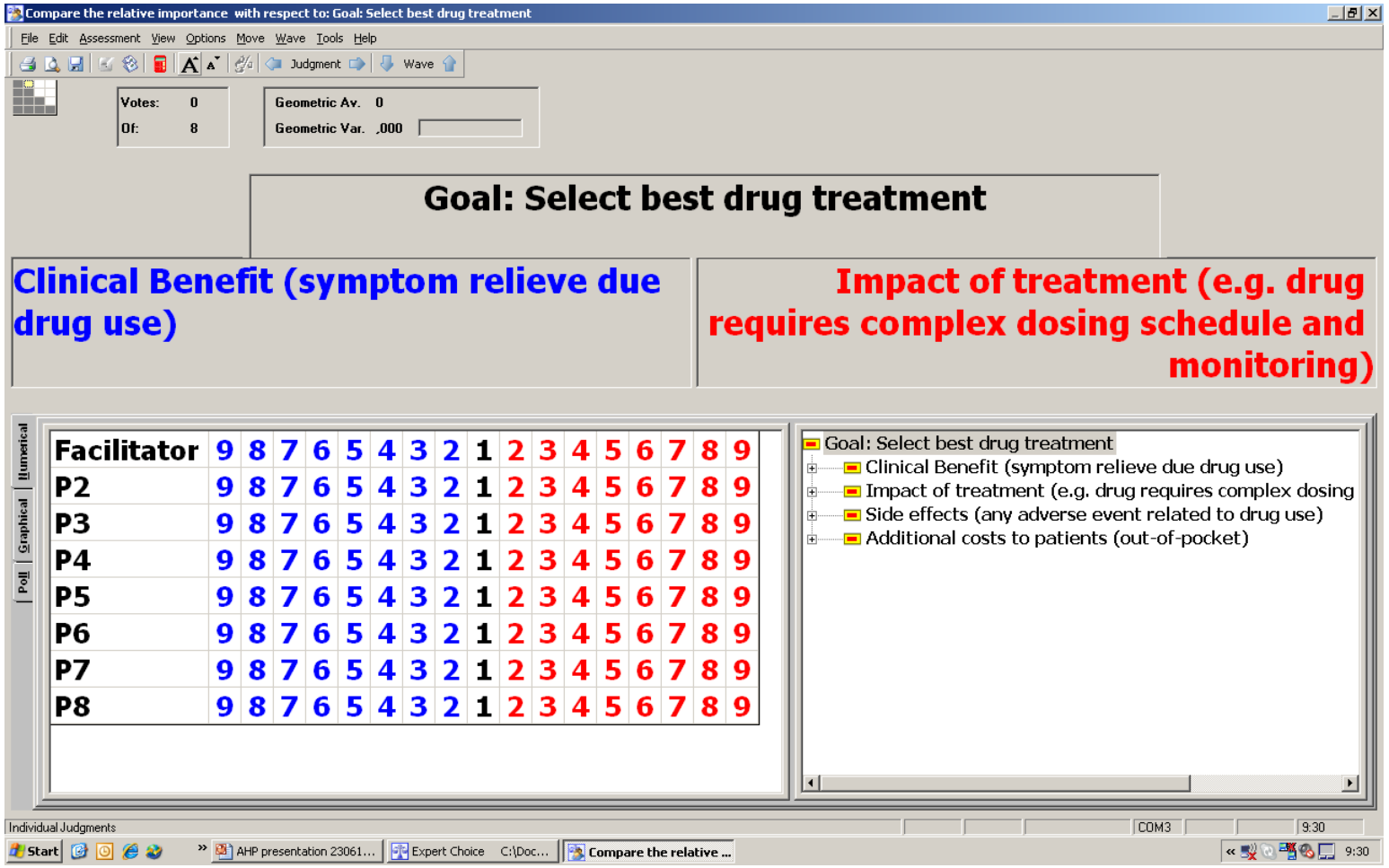
Sum score	6.48	7.20	6.67	11.20

Eigenvalue to obtain criteria (C_i) and level (L_i) weights (2)

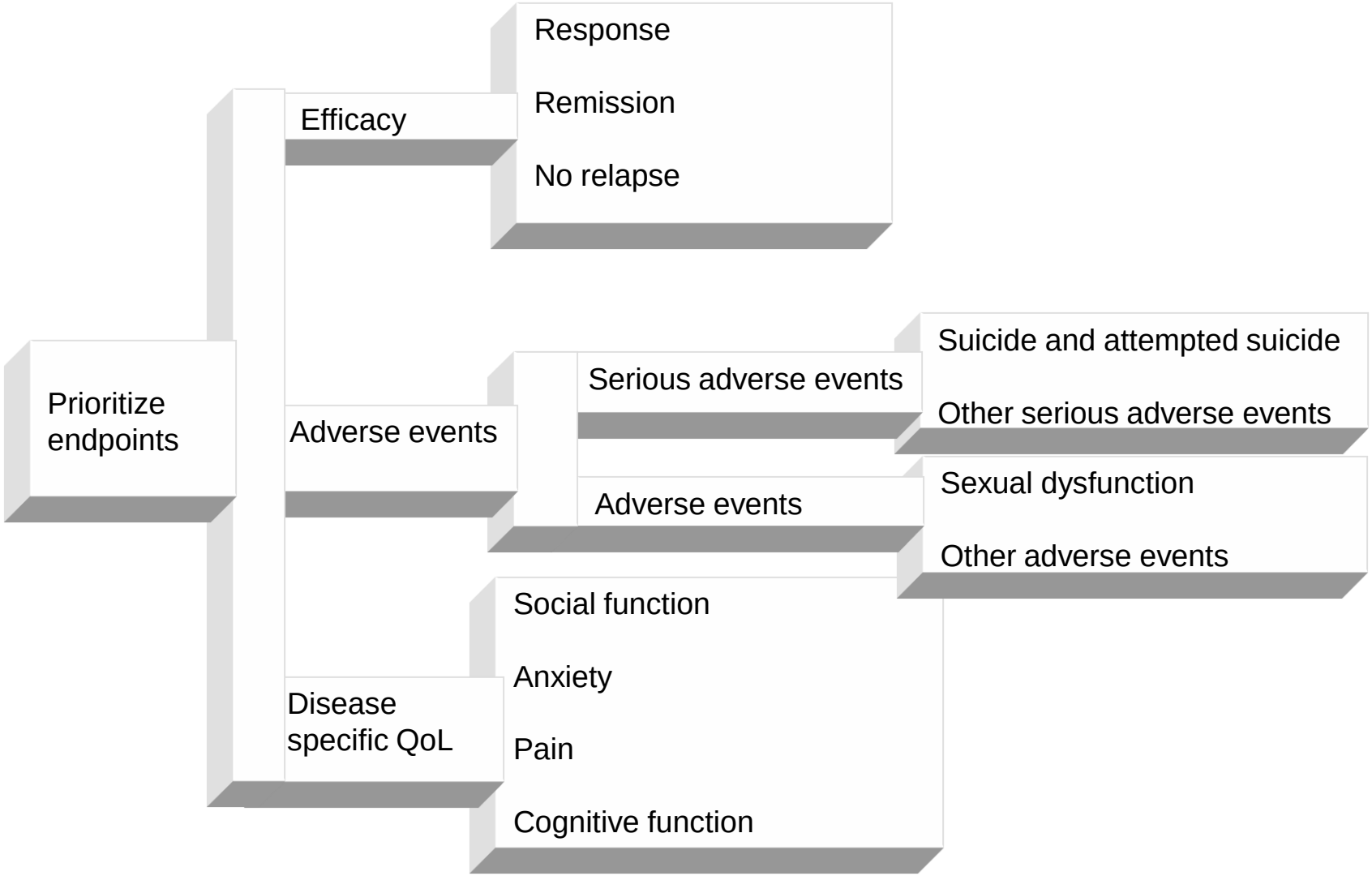
	Clinical benefit	Adverse event	Treatment impact	Co-payment	Average
Clinical benefit	0.15	0.42	0.75	0.63	**0.49**
Adverse event	0.05	0.14	0.05	0.02	**0.06**
Treatment impact	0.77	0.42	0.15	0.27	**0.40**
Co-payment	0.02	0.03	0.05	0.09	**0.05**

1. Obtain normalized scores for each cell using the sum score
2. The average for each row gives you the “priority scores”

Group decision support systems (GDSS)

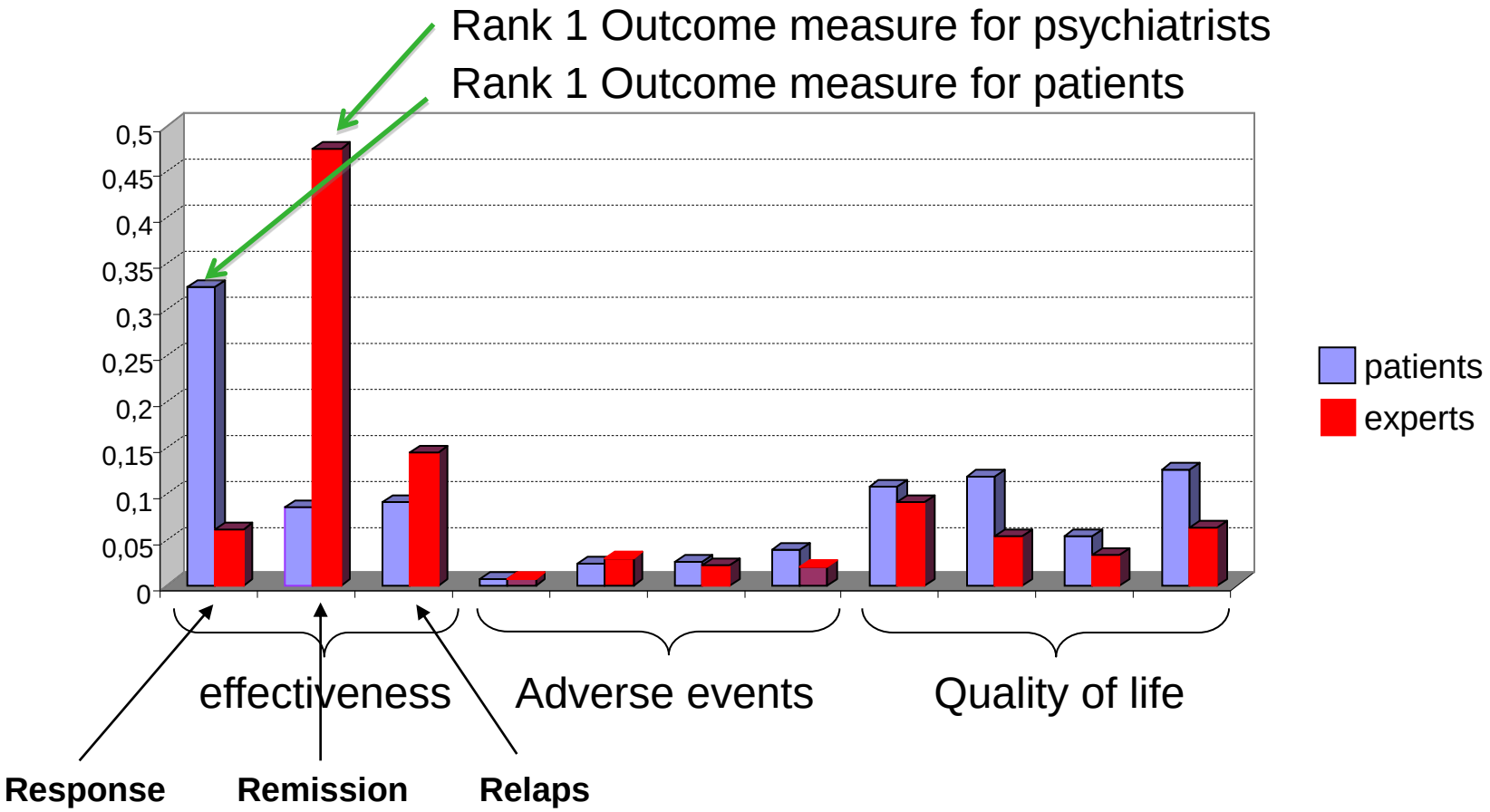


Decision structure in case of anti-depressants



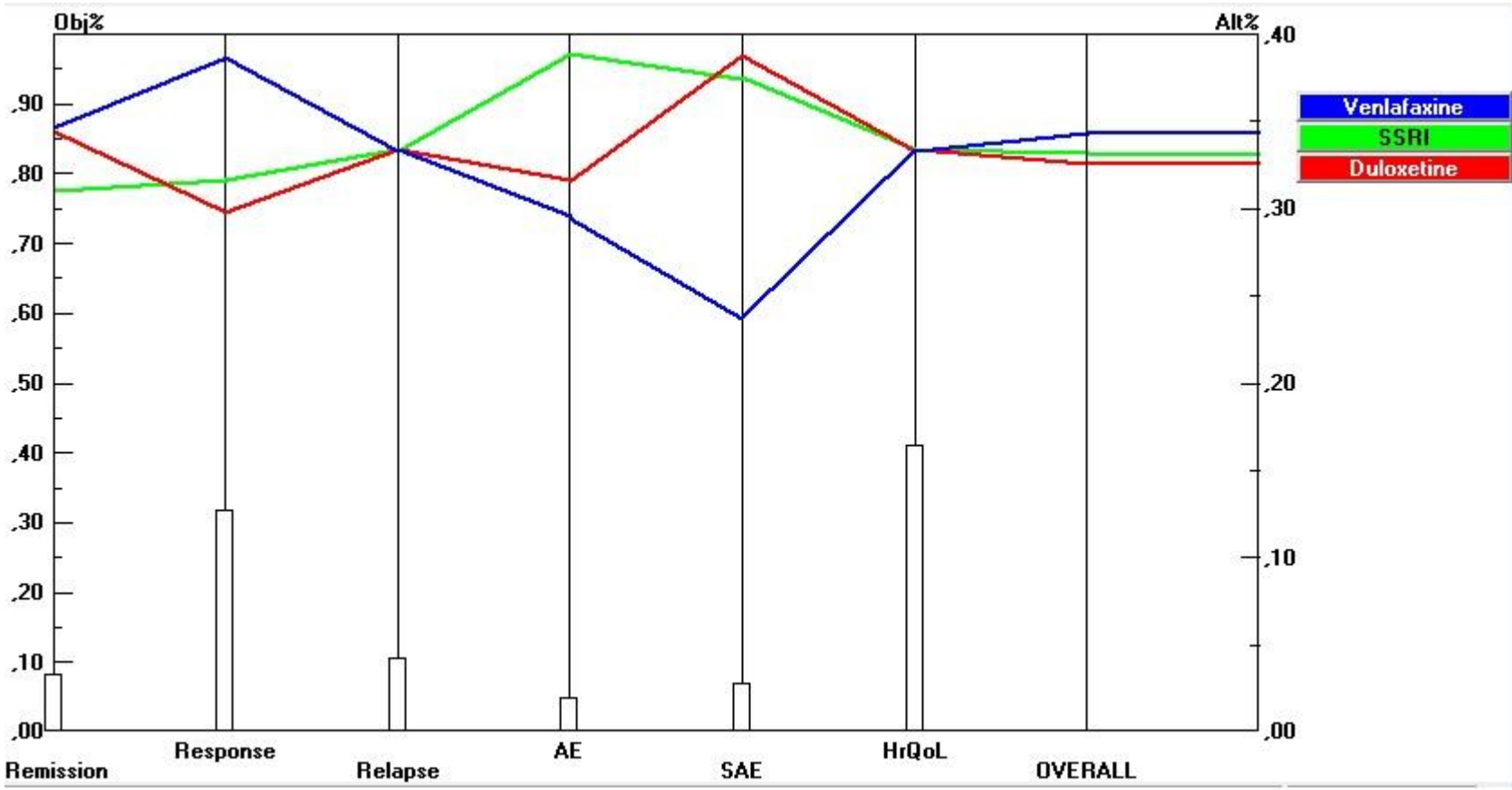
Danner, Hummel *et al.* Int. J. Techn. Assessm. Healthcare. 2011

How patients and experts value patient relevant endpoints



Danner, Hummel *et al.* Int. J. Techn. Assessm. Healthcare. 2011

Weighted preference for three antidepressants



General remarks on use of MCDA and CA methods

- MCDA or stated preference techniques do support decision making. They do not make the decision.
- Stated preference techniques are used to obtain stakeholder preferences over a range of treatment options. MCDA techniques, like AHP, can also support the process of decision making.
- The value of MCDA is not the decision algorithm itself but the process of making the decision problem more transparent and explicit.
- Preference data is to be used in conjunction with clinical data. They can not replace the original clinical evidence.