

# Multi-Criteria-Decision-Analysis (MCDA) tool for Rabies project managers

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# The background

- Research on the sustainability of rabies control programmes remains a critical gap (WHO, 2013; Rupprecht et al., 2017; Wallace et al., 2017).
- Tools to support efficient allocation of resources a recommendation by national programme managers (in PAHO)

# Another tool in the toolbox

- Premise: competition is good.
- We introduce a model-driven decision support system (DSS) to support resource allocation for capacity building and maintenance
  - The model was built using multi-criteria decision analysis (MCDA)
- Advantages:
  - Easy conceptualization
  - A type of expert driven models
  - Can capture 'soft' capacities (e.g. coordination)
    - Let's see what weights our SMEs allocate to these capacities
    - Capacities are weighted to reflect trade-offs

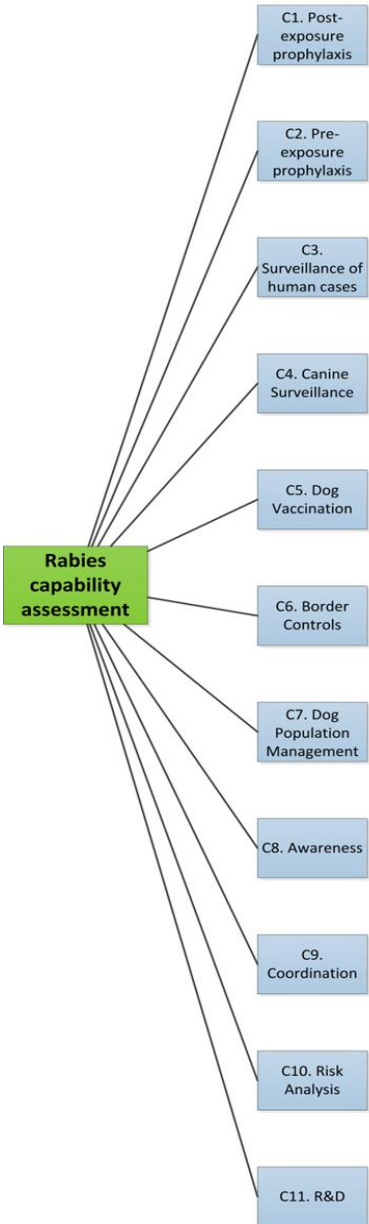
# The model

- To support decisions involving multiple conflicting objectives
- Our MCDA approach based upon Multi-Attribute Utility Theory (Keeney & Raiffa, 1993)
- Appropriate in generating an aggregated scoring of a health system's overall capability.
- MAUT builds upon decision theory and measurement theory (Keeney & Raiffa, 1993; von Winterfeldt & Edwards, 1986) and follows normative standards for rational decision making.
- MAUT models follow clearly prescribed and psychometrically valid protocols for the elicitation of preferences that minimize the effect of potential cognitive biases (von Winterfeldt & Edwards, 1986; Montibeller & von Winterfeldt, 2015).

# Model building

Stage #	Stage	Details
1	Definition of fundamental objectives and scenarios	Canine-mediated rabies control and elimination. Scenarios: <ol style="list-style-type: none"><li>1. Endemic vs. rabies free</li><li>2. Investment vs. de-investment.</li></ol>
2	Identification of experts	Six international rabies experts contributing to model development were identified.
3	Identification and definition of criteria	Construction of a value tree (see Figure 1) containing 11 capabilities and 30 sub-capabilities, which exhaustively reflect capabilities within a rabies control programme.
4	Characterization of criteria	Elicitation of criterion-specific value functions from experts using MACBETH (Bana e Costa et al., 2012)
5	Definition of weights	Elicitation of criterion-specific weights from experts using MACBETH (Bana e Costa et al., 2012)
6	Identification of alternatives	These are the options to assess or rank. In our rabies case: rabies control programmes at any administrative or geographical level, e.g. districts, countries.

# Model components



C1.1. Proportion of all exposed patients that receive Post-exposure prophylaxis (PEP)  
 C1.2. Timeliness of PEP application  
 C1.3. Proportion of PEP abandonment  
 C1.4. Vaccine effectiveness  
 C1.5. Adverse effects surveillance  
 C1.6. RIG administration

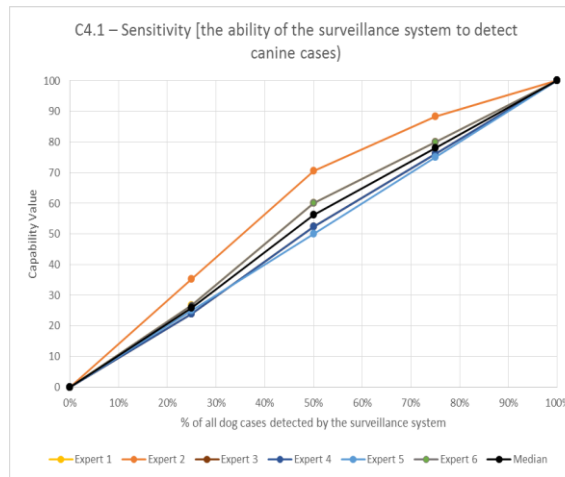
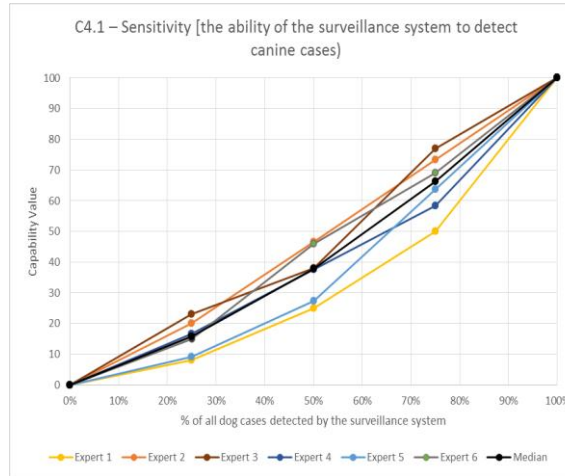
C3.1. Sensitivity [the ability of the surveillance system to detect human cases]  
 C3.2. Laboratory sensitivity from proficiency testing  
 C3.3. Timeliness  
 C3.4. Laboratory specificity from proficiency testing  
 C3.5. Antigenic characterization  
 C3.6. Genetic characterization

C4.1. Sensitivity [the ability of the surveillance system to detect canine cases]  
 C4.2. Proficiency Testing for Sensitivity  
 C4.3. Timeliness  
 C4.4. Proficiency Testing for Specificity  
 C4.5. Antigenic characterization  
 C4.6. Genetic characterization

C5.1. Vaccine coverage  
 C5.2. Vaccine effectiveness  
 C5.3. Adverse effects surveillance

C8.1. Educational activities/awareness leading to bite preventing behaviour by the community campaigns conducted  
 C8.2. Educational activities / awareness leading to PEP seeking behaviour by the community once exposed  
 C8.3. Educational activities / awareness campaigns conducted during the period leading to PEP prescribing behaviour  
 C8.4. Educational activities / awareness leading to canine vaccine seeking behaviour campaigns conducted during the  
 C8.5. Availability of continuing education for professionals and staff

C9.1. Coordination of activities in response to a rabies event  
 C9.2. Coordination among contiguous areas/countries for greater impact of initiatives (and efficiency)  
 C9.3. General programme coordination  
 C9.4. Coordination among actors



Capabilities	Weights (gains format & rabies endemic)	Weights (gains format & rabies-free)	Weights (losses format & rabies endemic)	Weights (losses format & rabies-free)
C1. Post-exposure Prophylaxis	16.67%	15.15%	17.65%	16.67%
C2. Pre-exposure Prophylaxis	4.54%	4.54%	7.35%	6.05%
C3. Surveillance of Human Cases	10.61%	12.13%	11.76%	12.13%
C4. Canine Surveillance	9.11%	13.64%	13.24%	13.63%
C5. Dog Vaccination	15.14%	16.65%	16.17%	15.15%
C6. Border Controls	1.52%	3.03%	1.47%	3.03%
C7. Dog Population Management	7.57%	7.57%	4.41%	4.54%
C8. Awareness	12.13%	9.11%	8.83%	9.1%
C9. Coordination	13.63%	10.60%	10.3%	10.61%
C10. Risk Analysis	3.03%	6.06%	2.94%	7.57%
C11. Research & Development	6.05%	1.52%	5.88%	1.52%

# What does it do?

Scenario Selection

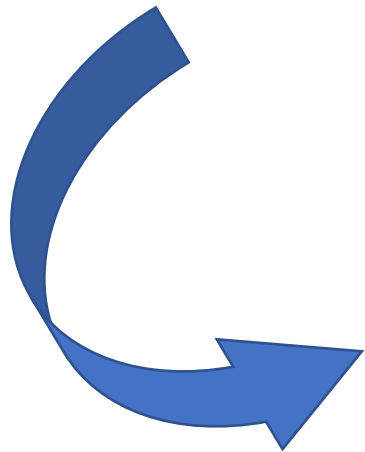
Please select the rabies status

Endemic       Free

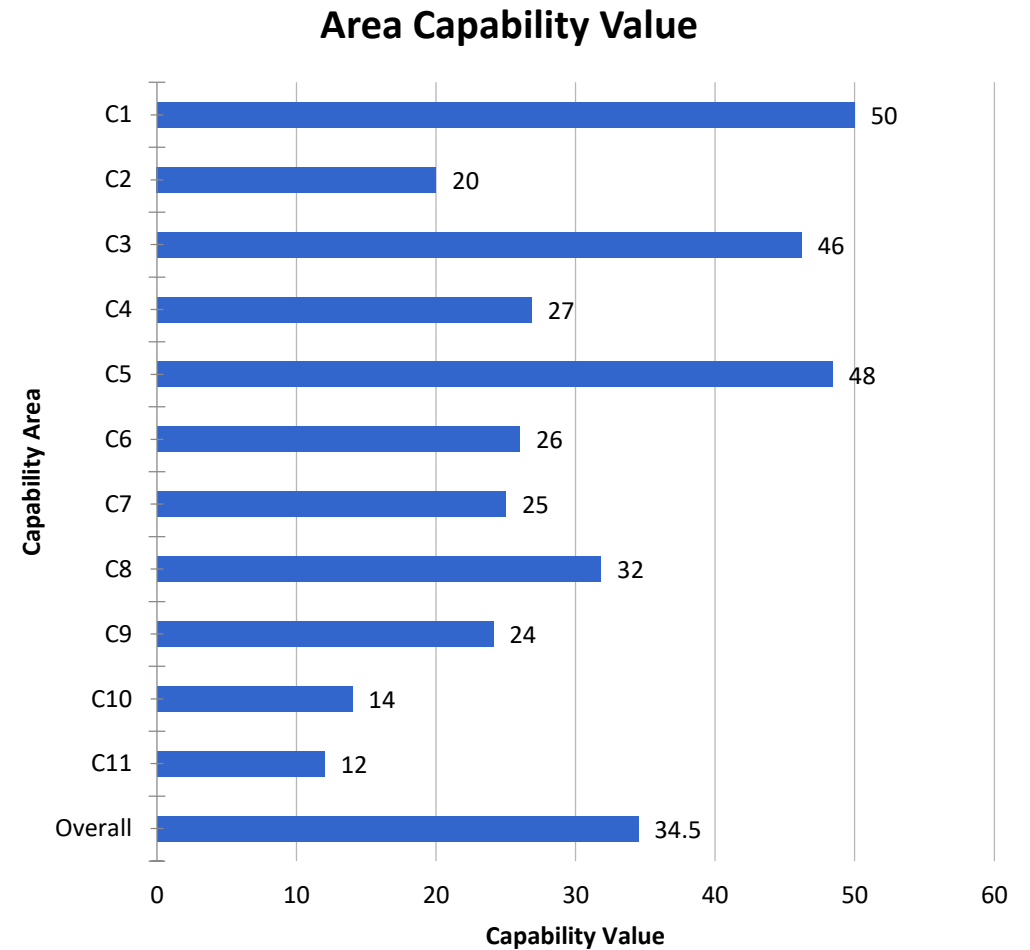
Please select the budgetary decision type

Investment       Budget cut

Confirm



- Returns
  - Country score
  - Capacity specific scores
  - Capacity specific contributions



# A simple portfolio DSS

Investment portfolio 1 <sup>a</sup>	Investment portfolio 2 <sup>b</sup>
<ul style="list-style-type: none"><li>• Increase proportion of exposed patients that receive PEP from 40% to 80%</li><li>• Increase dog vaccination coverage from 60% to 70%.</li><li>• Increase border controls from 10% to 50% of dogs</li></ul>	<ul style="list-style-type: none"><li>• Increase border controls from 10% to 50% of dogs</li><li>• Increase awareness leading to PEP seeking behaviour by the community from Level 3 to Level 5.</li><li>• Increase coordination among contiguous areas from Level 3 to Level 5</li></ul>
Implementation costs: US\$180,000	Implementation costs: US\$105,000

- Portfolio1 => capacity of 50.9 leading to a VFM=19.44
- Portfolio2 => capacity of 51.3 leading to a VFM= 37.14 (1.91 times more VFM)



Thank you