

# Structural Uncertainty in Health Economic Models: what is it and what can we do about it?

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**DO NOT REPRODUCE**

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# Why model?

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- RCTs and meta-analyses provide short term results in selected populations
- Need to include all relevant information
- Need to estimate long-term costs and benefits
- Framework to establish value of further research

BUT

- Reality is complicated!
  - Need for assumptions and judgements
  - Variable amount / validity of data
  - Need to acknowledge structural or model uncertainty
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# Sources of uncertainty

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## Parameter uncertainty

- how precisely a parameter has been estimated
- PSA

## Methodological uncertainty

- analytic method (Markov / decision tree / microsimulation)
- perspective
- time horizon, cycle length

## Structural uncertainty

- Expanded models with additional parameters
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# Sources of uncertainty

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## Parameter uncertainty

- parameter precision
- PSA

## Methodological uncertainty

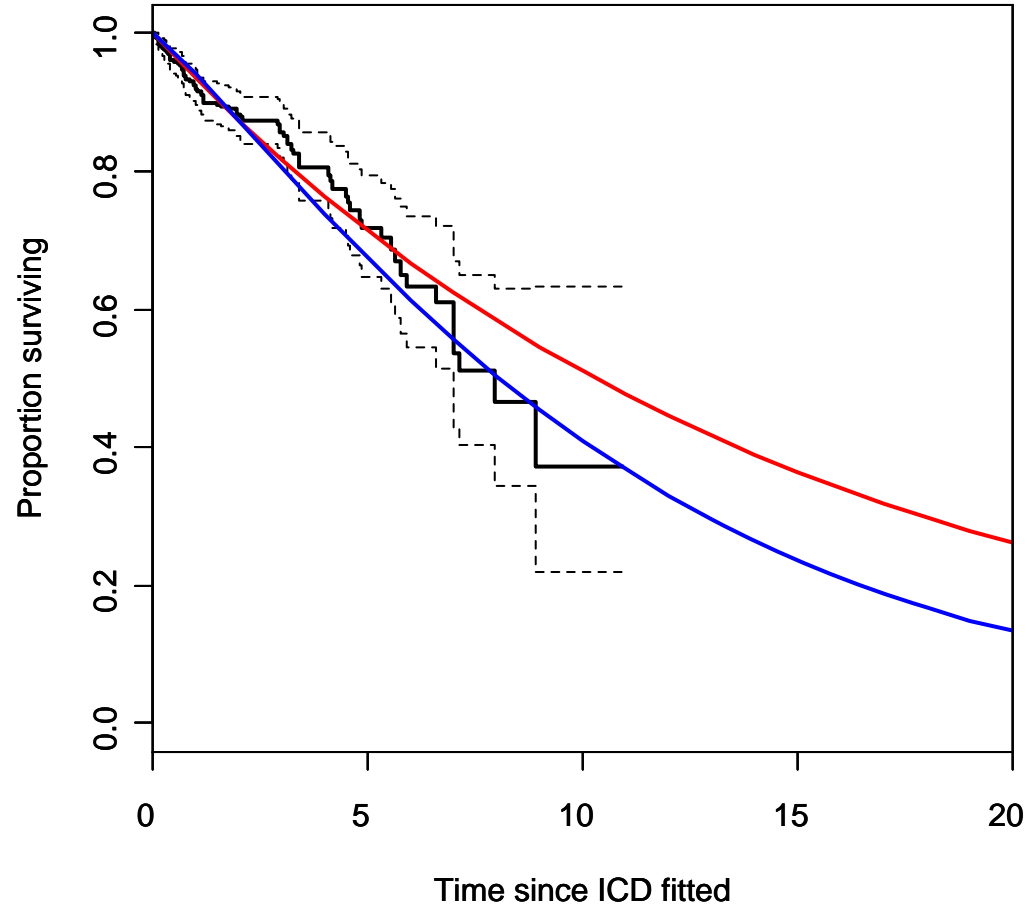
- analytic method
- perspective
- time horizon, cycle length

## Structural uncertainty

- Expanded models
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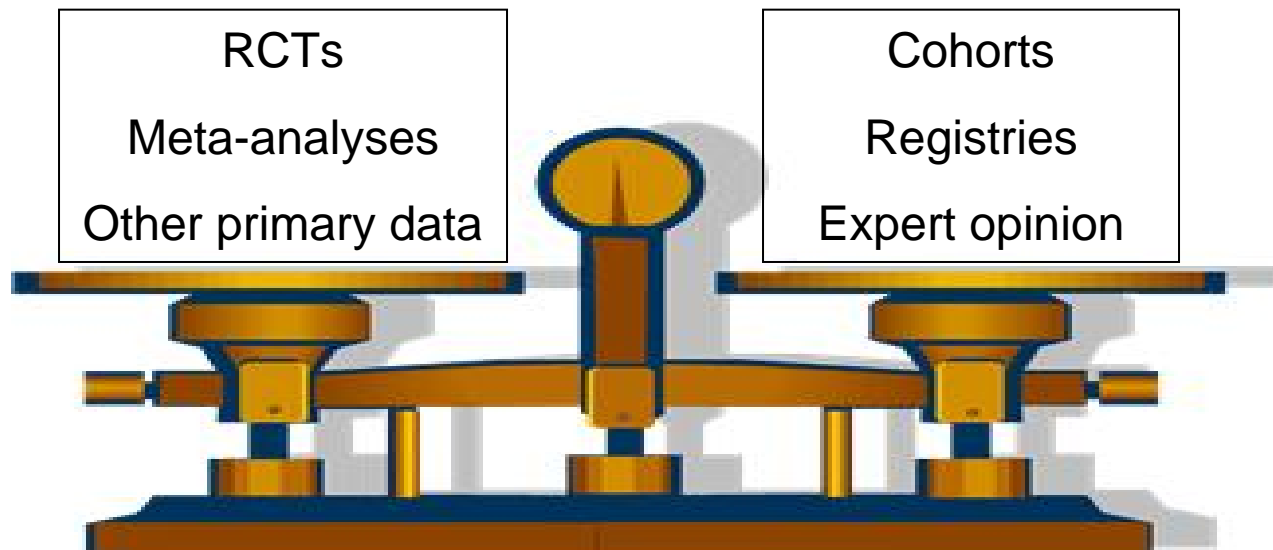
# Structural uncertainty: statistical models

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# Structural uncertainty: sources of evidence

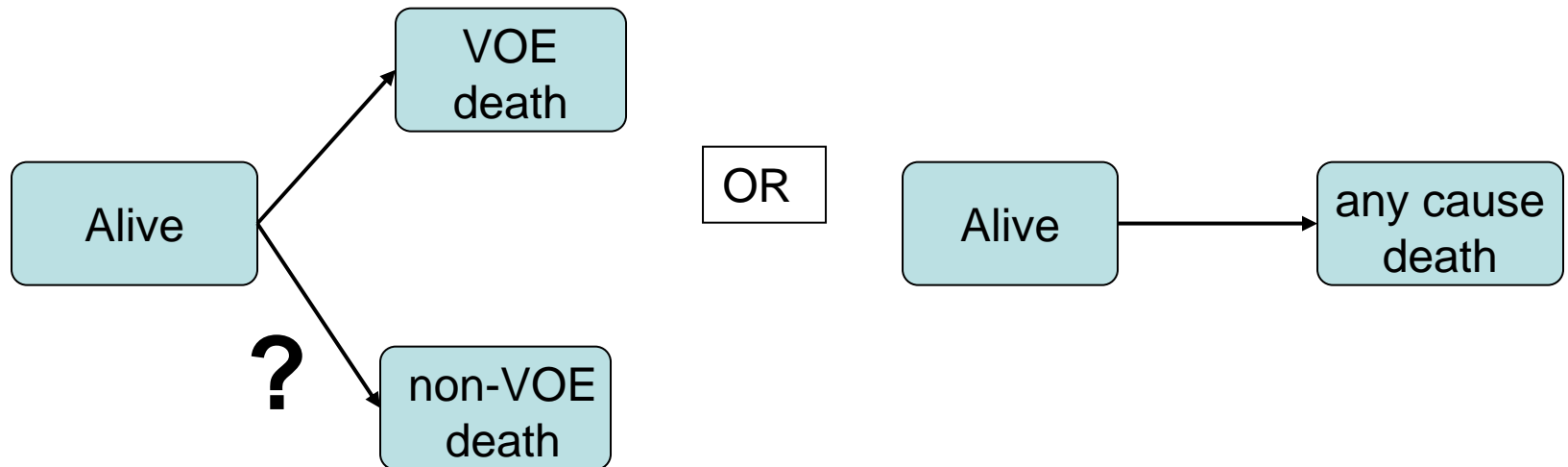
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# Structural uncertainty: state choices

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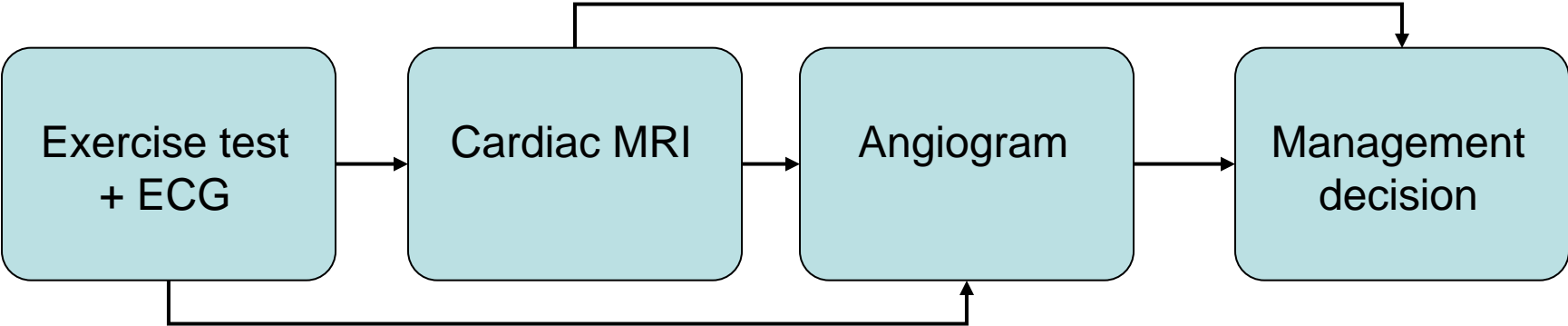
RCT comparing aspirin\_MR dipyridamole vs. aspirin for secondary prevention of vascular occlusive events



# Structural uncertainty: choice of comparators

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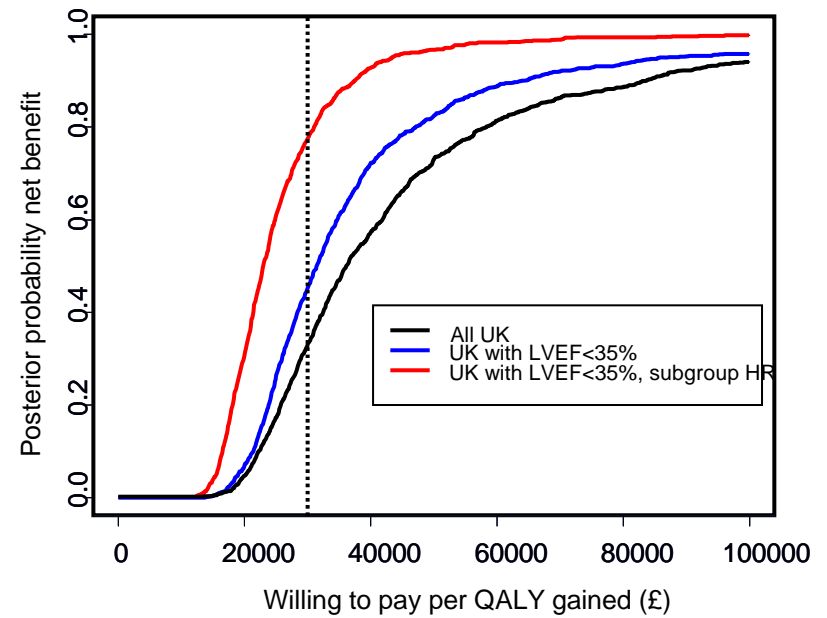
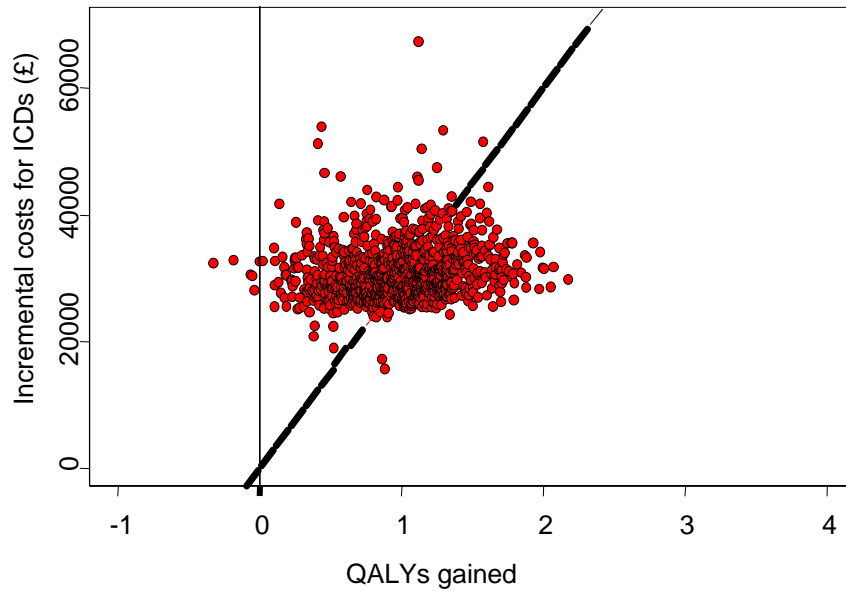
Comparison of diagnostic test strategies for suspected coronary artery disease





# Parameter uncertainty - PSA

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# Deterministic or scenario sensitivity analysis

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Scenario	ICER in thousands per QALY
Base case LVEF<35%	£31.3
Subgroup treatment effect	£23.0
Implant costs reduced to £16,250	£22.3
Repair and replacement episodes halved	£27.1
Utility for Amiodarone group 0.65	£18.8
Extrapolation over the lifetime of all patients	£24.0

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# Deterministic or scenario sensitivity analysis

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Scenario	ICER in thousands per QALY
Base case LVEF<35%	£31.3
Subgroup t	
<b>Which is most plausible?</b>	
Implant costs reduced to £16,250	£22.3
Repair and replacement episodes halved	£27.1
Utility for Amiodarone group 0.65	£18.8
Extrapolation over the lifetime of all patients	£24.0

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Framework for  
model  
development

# Message

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- Framework for accommodating uncertainty
  - Use model expansion
  - Model plausibility formally assessed from data or experts
  - If no clear winner can use model averaging
  - Interested in examples of structural uncertainty
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# Selected references

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Bojke L, Claxton K, Sculpher M, Palmer S. Characterising structural uncertainty in decision analytic models: a review and application of methods. *Value In Health* 2009;12(5):739-49.

Jackson CH, Sharples LD, Thompson SG. Structural and parameter uncertainty in Bayesian cost-effectiveness models. *Journal of the Royal Statistical Society: Series C (Applied Statistics)* 2009;59(2):233-53.

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