Art or science? Selecting utility evidence for decision-analytic models containing multiple health-states

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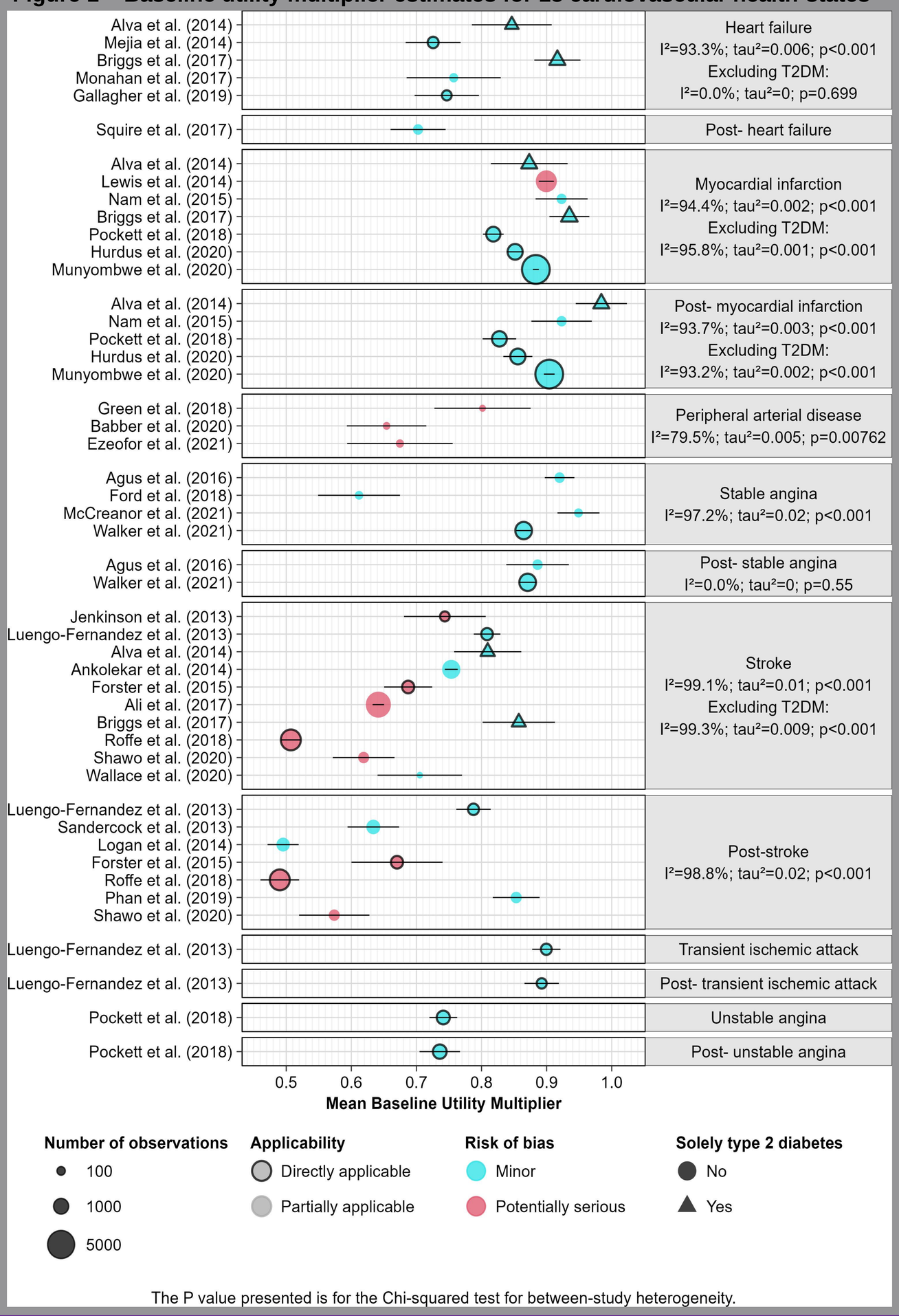
Background

Recommendations about reviewing utility evidence for decision-analytic models do not specify how modellers should select utility evidence from included studies. It is unclear whether and how modellers should incorporate their prior belief about the order of severity between health-states. We aimed to (1) select reliable and consistent utility sources for exemplar health-states from the results of a systematic review (2) establish a set of principles for other modellers selecting utility evidence for multiple health-states.

Methods

A systematic review following published guidelines identified 403 studies assessing utility for seven health-states related to cardiovascular disease (22/04/2021). We divided utility estimates for these health-states by utilities for equivalent populations without the conditions to calculate baseline utility multipliers. From UK-relevant studies using the Euroqol 5 Domain (EQ-5D) measure, we selected a set of baseline utility multipliers to produce a plausible severity ordering. We developed a tool to assess risk of bias and applicability (see Table 1). To mitigate against unreported sources of heterogeneity, we preferred studies ascertaining higher proportions of the target population. When possible, we sourced multiple estimates from a single study to preserve utility orderings.

Figure 1 – Baseline utility multiplier estimates for 13 cardiovascular health-states

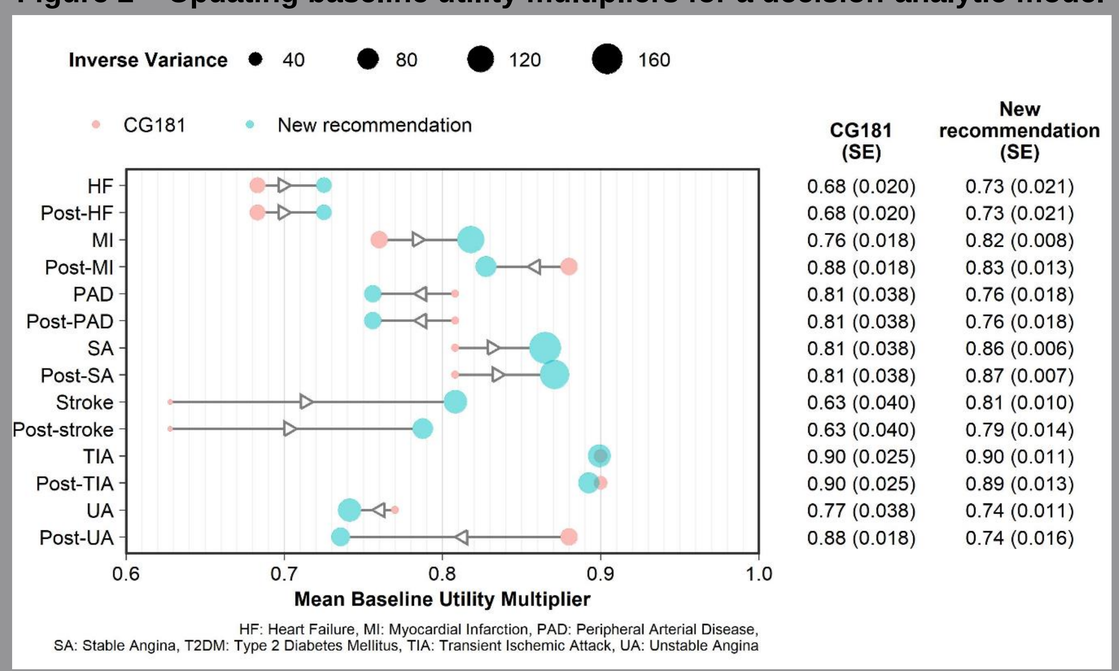


The P value presented is for the Chi-squared test for between-study heterogeneity.

Table 1 – Criteria for assessing quality of utility evidence (abridged)

SECTION A: APPLICABILITY		SECTION B: RISK OF BIAS	
A1. Are health-states for which HSUV(s) are presented representative of modelled states?	Yes Partially No*	B1. Could the selection of patients have introduced bias?	Yes No
A2. Are timepoints at which HSUV(s) are measured representative of modelled states?	Yes Partially No*	B2. Were all enrolled participants included in the analysis?	Yes No
A3. Are HSUVs presented for more than 1 state of interest?	Yes No	B3. Were participants with missing data handled appropriately?	Yes Partially No
A4. Are HSUVs presented for controls without the event(s) of interest?	Yes No	INDIRECT VALUATION	
A5. Are data presented with mean and an appropriate measure of dispersion?	Yes No	B4. Can HSUVs be extracted independently of investigators' focus, where necessary?	Yes No
INDIRECT VALUATION		B5. Was mapping between instruments undertaken appropriately?	Yes Partially No
A6. Is EQ5D-3L used?	Yes Via mapping No	B6. Are HSUVs measured directly by patients experiencing the event(s) of interest?	Yes No – carers No – clinician
A7. Are health-state descriptions provided by a UK population?	Yes Partially No	DIRECT VALUATION	
A8. Does valuation reflect UK societal preferences?	Yes No	B7. Were there clearly described, appropriate methods for generating the health-state descriptions that participants valued?	Yes No
DIRECT VALUATION		B8. Did preference elicitation use an established protocol?	Yes No
A9. Does valuation use a choice-based method?	Yes No	B9. Was the elicitation exercise piloted?	Yes No
A10. Does valuation reflect UK societal preferences?	Yes No	**Overall judgement on risk of bias** (Low – no major concerns. Potentially serious – unmet criteria might change conclusion. Serious – unmet criteria likely to change conclusions.)	Low Potentially serious Serious
Overall judgement on applicability (Directly applicable – no major concerns. Partially applicable – unmet criteria might change conclusions. Not applicable – does not meet essential criteria*.)	Directly applicable Partially applicable Not applicable		

Figure 2 – Updating baseline utility multipliers for a decision-analytic model



Results

We could select sources with low risk of bias for all seven health-states and directly relevant sources for all but one. We found single studies for closely-related conditions such as cerebrovascular events and acute coronary syndromes. In our base case decision-analytic model, we prioritised plausibility of severity ordering over population ascertainment. A sensitivity analysis prioritised population ascertainment over order plausibility.

Discussion

We recommend three general principles for selecting utility evidence to inform multi-state models: (1) minimising risk of bias (including from unreported participant selection criteria), (2) ensuring applicability to the decision problem and (3) respecting within-study relationships. Modellers must make value judgements about how to apply these principles to their particular context, balancing the need for a plausible ordering of utilities.

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