Transferring evaluation results for evidence based decision making in other contexts

A multilevel analysis and recommendations

for research and policy making

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Overview

1) *Health economic evaluation – brief introduction*
2) *Variability in clinical and cost-effectiveness data*
3) *Empirical study*
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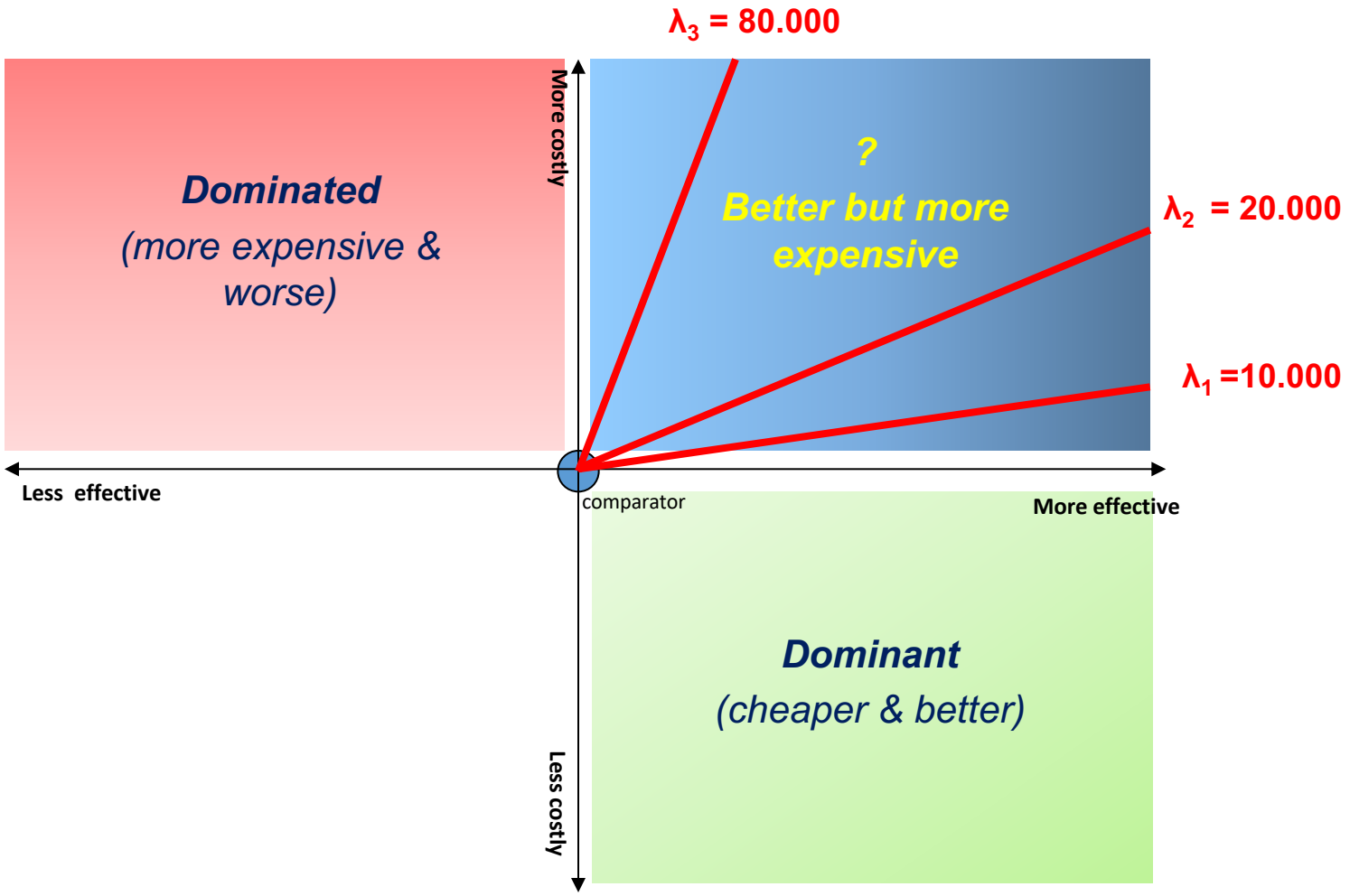
    - *Complex data structures*
    - *Model*
    - *Results*
4) *Conclusions*
    1) *For decision makers*
    2) *For research*

Health economic evaluation
- Brief introduction -



Health economic evaluation
- Brief introduction -

Economic evaluation in health....

....is the comparative analysis of alternative courses of action in terms of both...*

...their costs

$Cost_{intervention} - Cost_{comparator} = \Delta C$

...and consequences

$Effect_{intervention} - Effect_{comparator} = \Delta E$

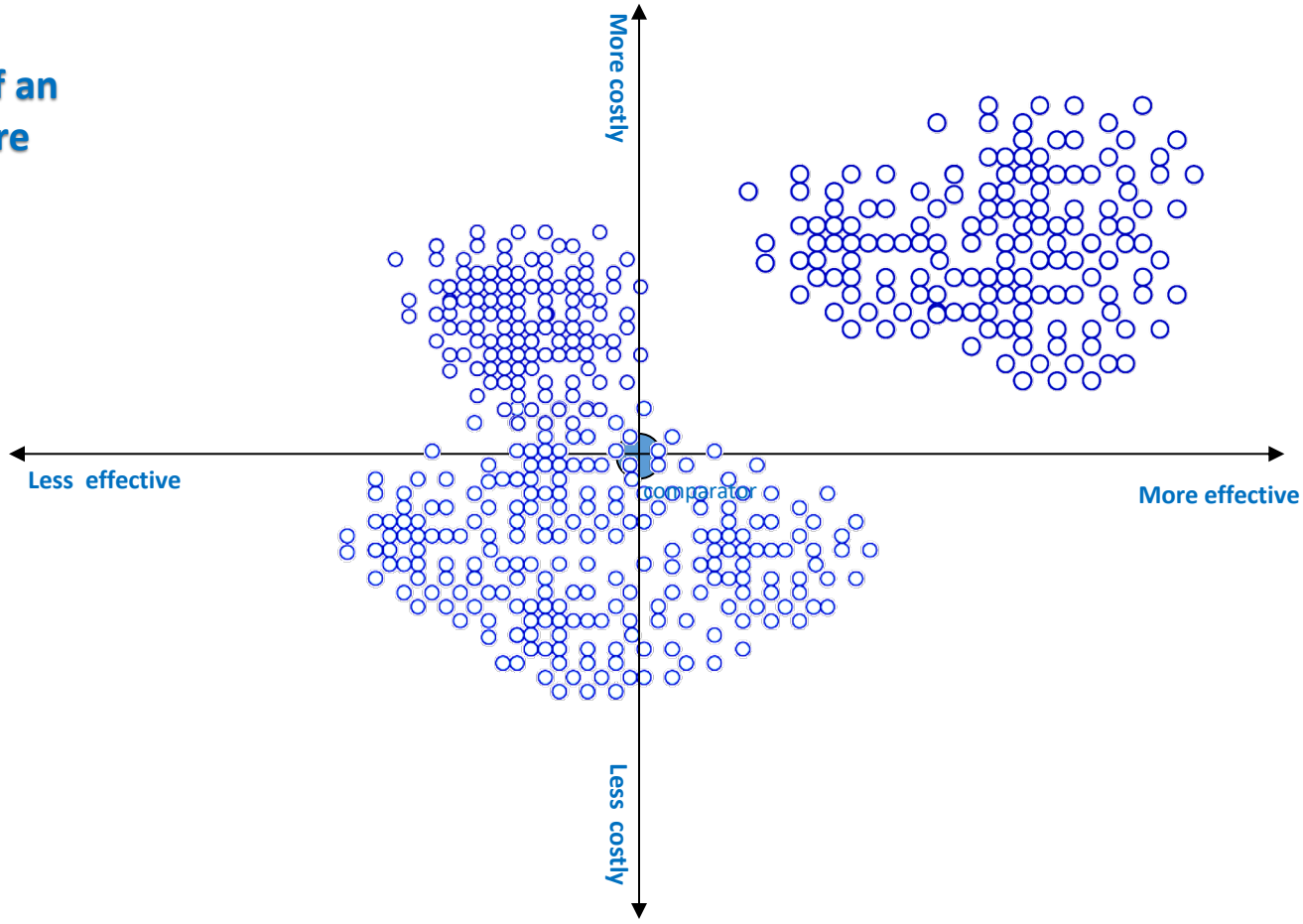
$$INMB = \Delta E^{*}\lambda - \Delta C$$

(Accept intervention if INMB >0)

*Drummond et al (2005) , Methods for the Economic Evaluation of Healthcare Programmes (3rd edt), Oxford University Press, Oxford, UK

Variability in clinical and cost-effectiveness data

Many characteristics of an economic evaluation are highly context-specific



For instance:

Patient characteristics
Demography
Macroeconomic Indicators
Healthcare System
Practice patterns
Epidemiology
Culture / attitudes
Study methods
Etc.

Variability in clinical and cost-effectiveness data

*"Research should provide evidence for decision makers to establish the relevance or to adjust the results of a study to their location of interest"**

*"If we identified the right set of attributes, and if the characteristics of the target setting are appropriately reflected in the data, then we can transfer from existing studies to other locations of interest"***

*Sculpher et al (2004) Generalisability in economic evaluation studies in healthcare: a review and case studies. HTA vol.8 No. 49 (available online)

**Drummond et al (2009) Transferability of Economic evaluations across jurisdictions: ISPOR good research practices task force report. Value in health, 12(4)

Empirical Study

General Approach:

Integration of secondary cost-effectiveness data from multiple studies and applicable to multiple geographic domains ('meta-regression')

Problem:

Complex data structures (no independence of residuals within groups)

Variability associated to different levels of data-hierarchy

Method

Multilevel statistical Modelling (MLM)

Dataset

Population: Adults with or without history of Cardiovascular Disease (CVD)

Intervention: Statins for the primary and secondary prevention of CVD

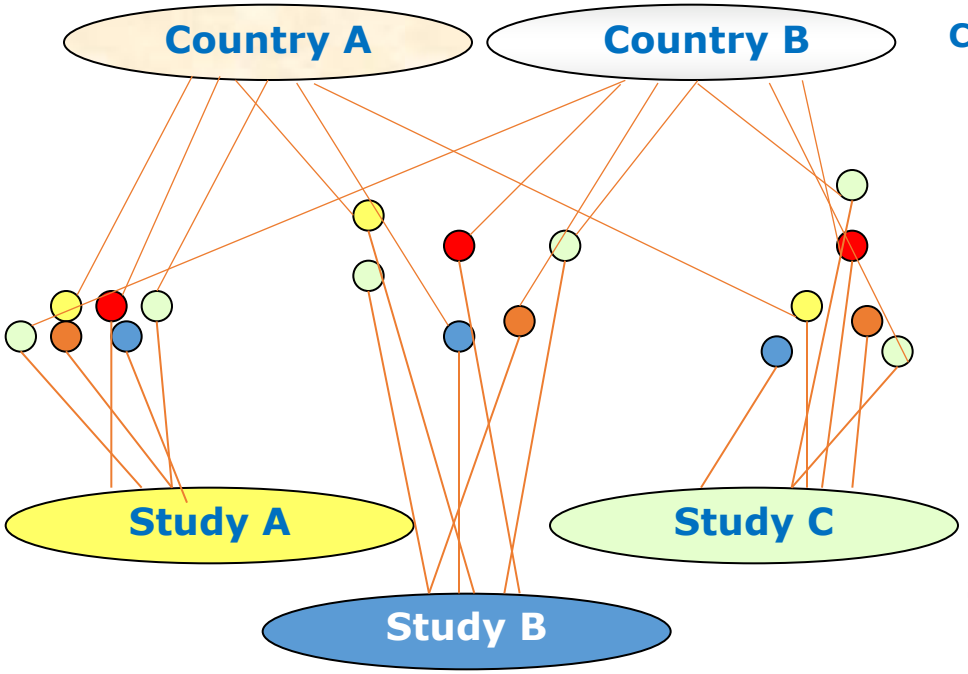
Comparator: No intervention /other statins / same statin but different dosage

Outcome: Cost per LYS / cost per QALY

2094 estimates of Incremental Net Monetary Benefit (INMB)

From 67 Studies and applicable to 23 countries

Complex data structures



Country Level

- GDP per capita
- % of public expenditure on HC
- Demographic factors
- etc.

INMB (ΔE*λ-ΔC)

- Patient characteristics (subpopulation)
- Intervention / comparator
- Discount rates
- etc.

Study Level

- Modelling type
- Funding organisation
- Timing
- etc.

Model

Multilevel approach

- Making explicit *correlation* between stochastic components of the INMB statistic whilst
- Showing *differential impact* of covariates on incremental costs and effects
- *Independence* from country specific WTP for health gain (threshold value λ)

$$\begin{bmatrix} Y_{1,i(jk)} \\ Y_{2,i(jk)} \end{bmatrix} \sim BVN(XB, \Omega)$$

$$y_{d,i(jk)} = (\beta_{0d} + \beta_{1d} x_{i(jk)} + \beta_{2d} x_j + \beta_{3d} x_k + u_{0dk} + u_{0dj} + e_{0di(jk)}) * r_{d,i(jk)}$$

$$r_{1,i(jk)} = \begin{Bmatrix} 1 \; if \; \Delta C \\ 0 \; if \; \Delta E \end{Bmatrix} \qquad r_{2,i(jk)} = 1 - r_1$$

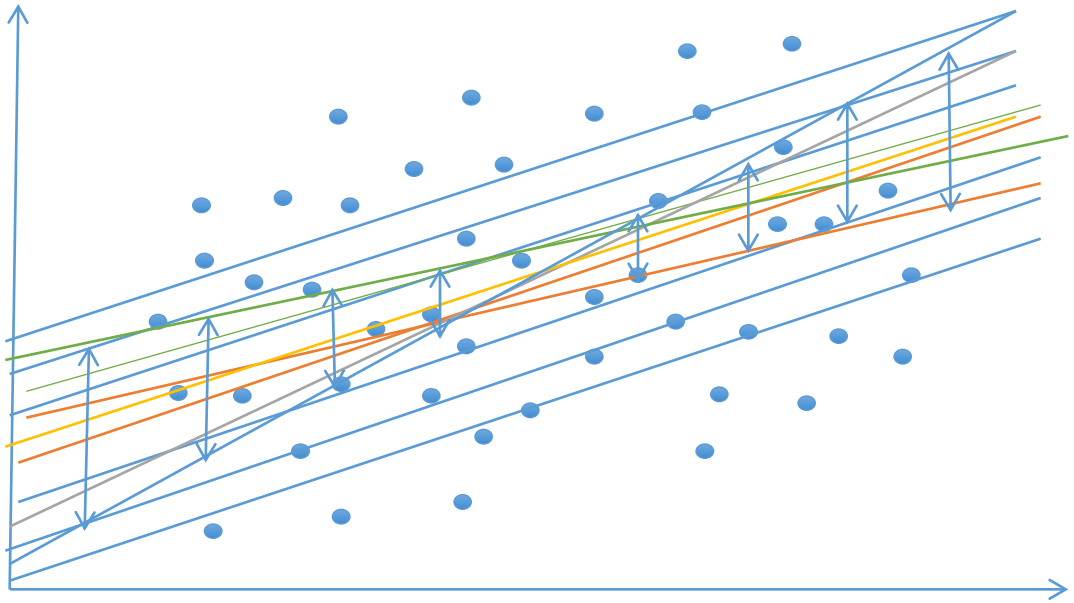
with:

$$\begin{bmatrix} u_{0,0,k} \\ u_{0,1,k} \end{bmatrix} \sim BVN\,(0, \Omega_{uk}) \quad \text{where} \quad \Omega_{uk} = \begin{bmatrix} \sigma^2_{u0,0k} & \\ \sigma_{u0,01k} & \sigma^2_{u0,1k} \end{bmatrix}$$

$$\begin{bmatrix} u_{0,0,j} \\ u_{0,1,j} \end{bmatrix} \sim BVN\,(0, \Omega_{uj}) \quad \text{where} \quad \Omega_{uj} = \begin{bmatrix} \sigma^2_{u0,0j} & \\ \sigma_{u0,01j} & \sigma^2_{u0,1j} \end{bmatrix}$$

$$\begin{bmatrix} e_{0,0,i(jk)} \\ e_{0,1,i(jk)} \end{bmatrix} \sim BVN\,(0, \Omega_e) \quad \text{where} \quad \Omega_e = \begin{bmatrix} \sigma^2_{e0,0} & \\ \sigma_{e0,01} & \sigma^2_{e0,1} \end{bmatrix}$$

MLM versus conventional regression methods

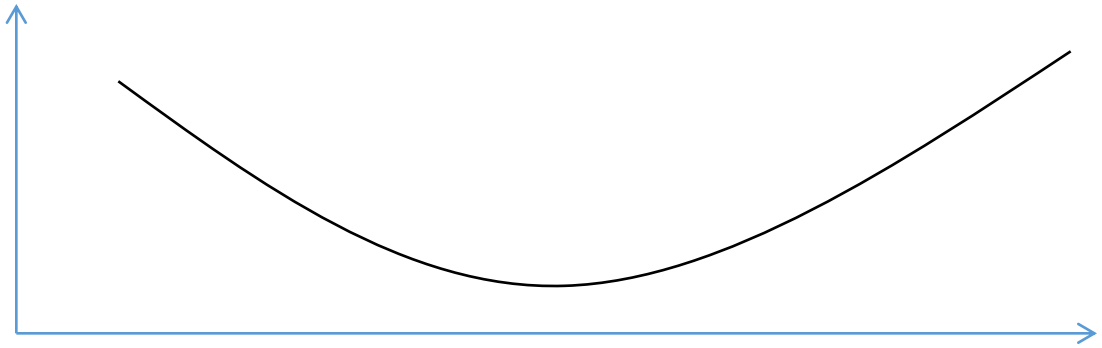


Random intercepts model

Random slopes model

$$Var(u_{0j} + u_{1j}x_{1ij}) = \sigma^2_{u0} + 2\sigma_{u01}x_{1ij} + \sigma^2_{u1}x^2_{1ij}$$

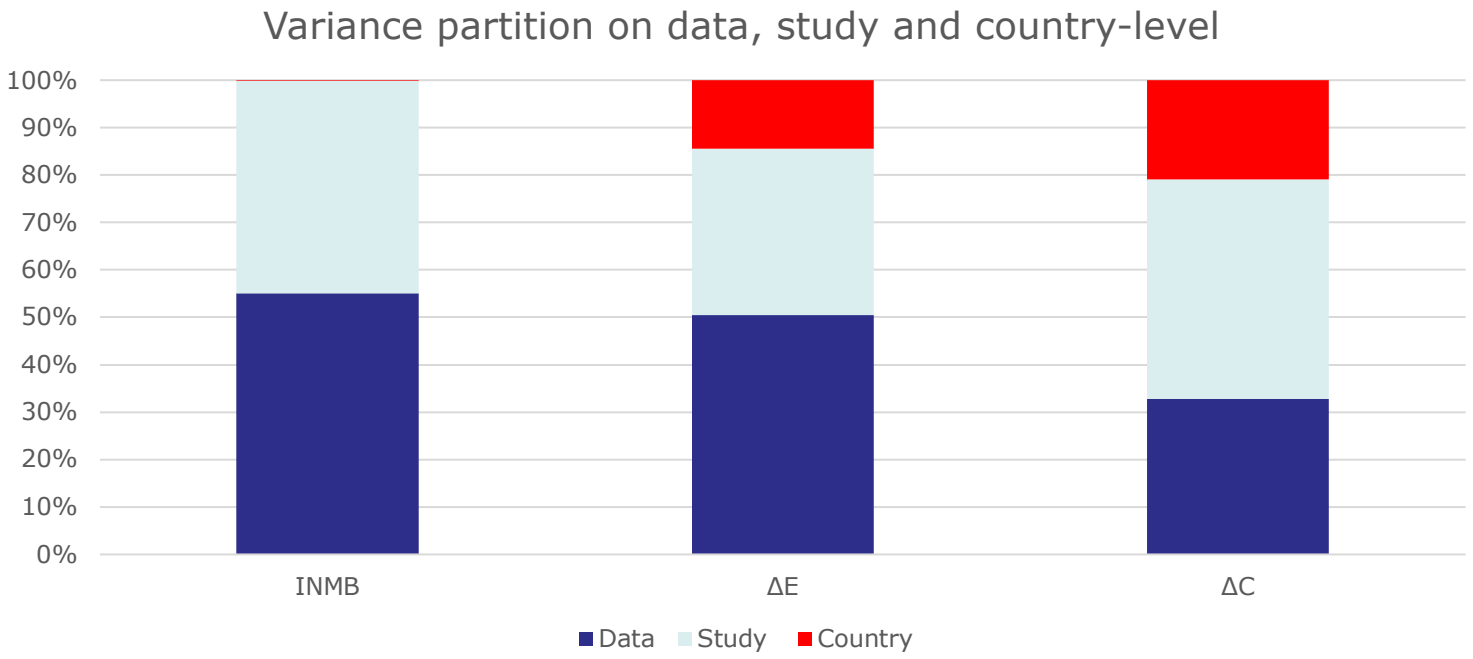
Variability in INMB between international studies



Variance as a function of TCL

Results

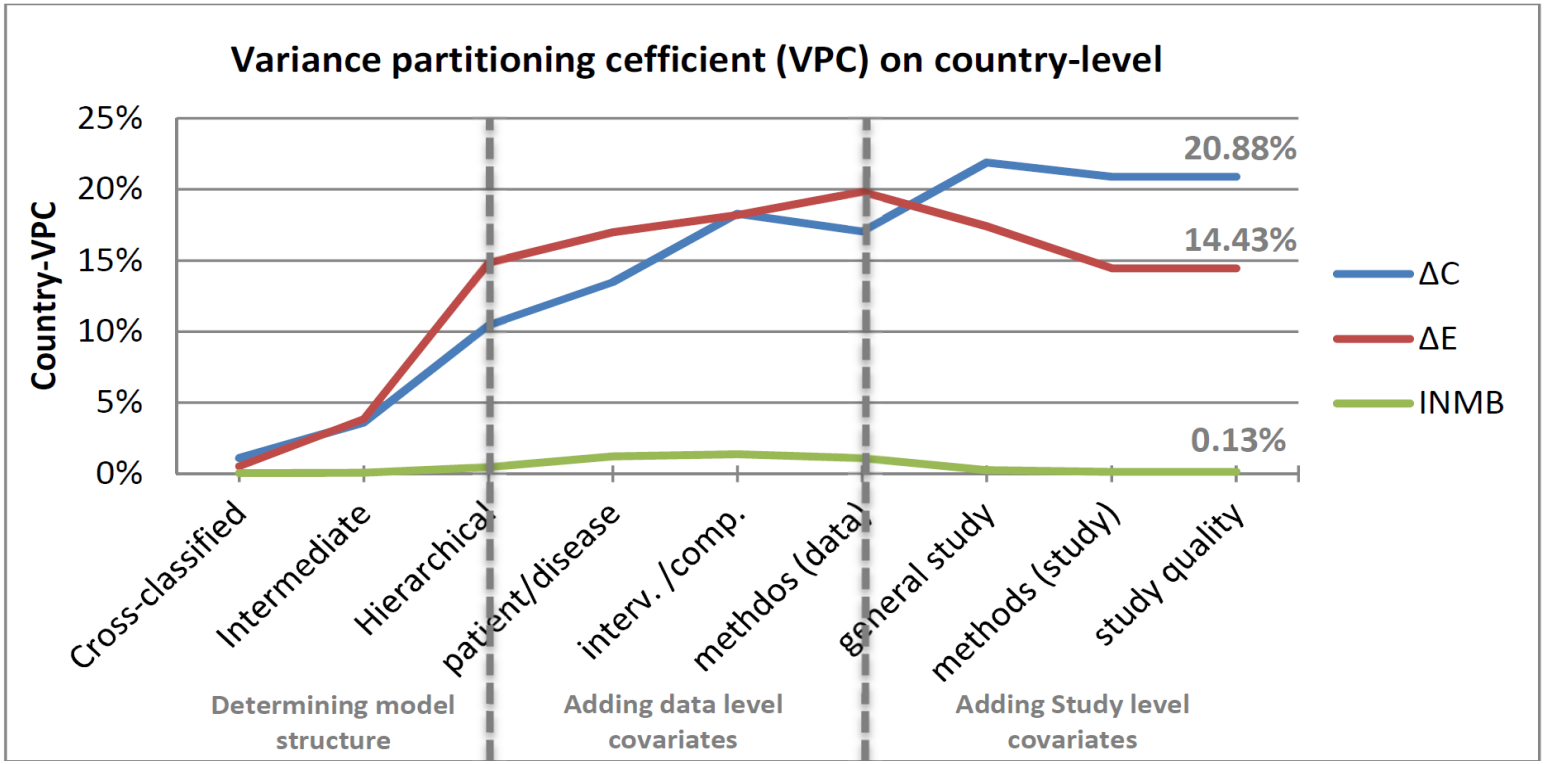
Variability within and between studies dominates!



→ Differences in study methods & population more important than differences between countries?

Results

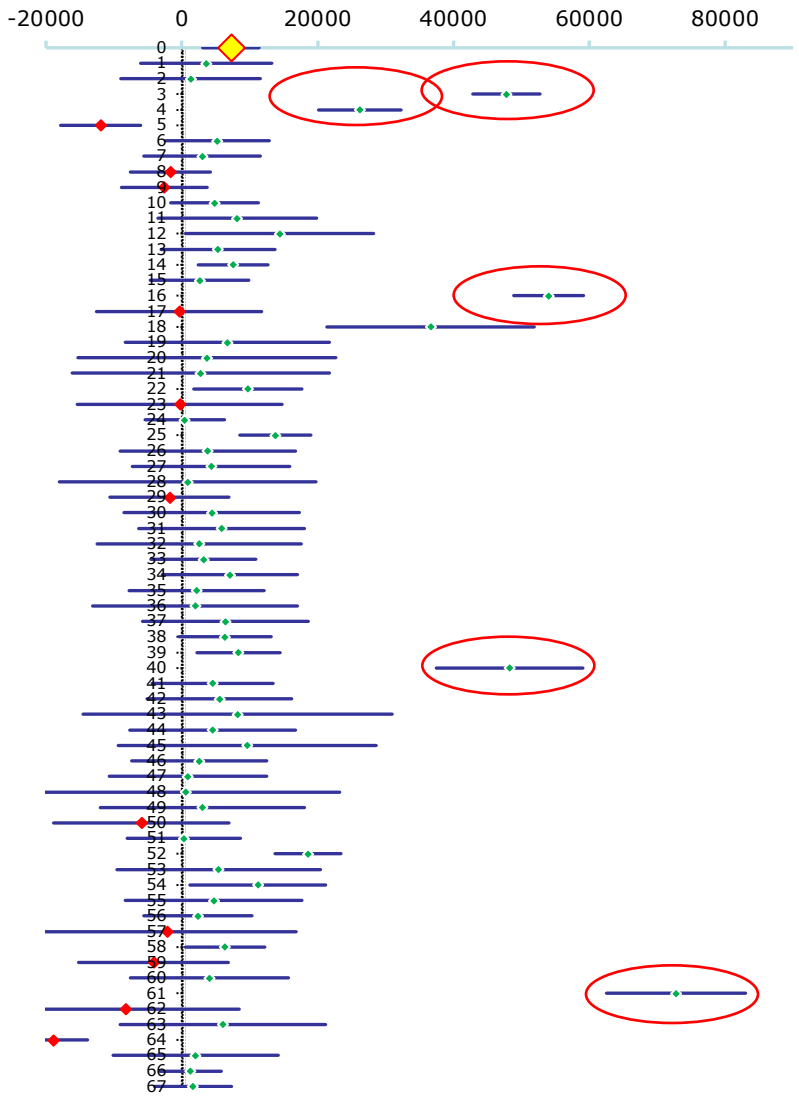
Observed country-level variability depends on model structure & assumptions



→ Multinational studies underestimate 'true' country-level variability?

Results

The 'genealogy' of economic evaluations matters!



Conclusions

For decision making:

Our approach provides a suitable method to assess factors related variation in international cost-effectiveness data.

It could help shed some light on the most important variability factors for the cost-effectiveness of statins.

Relevant country-level variables included measures of income and health care finance, health care resources, and population risks.

However, before we know more about the most important variability factors, it may be premature to use our models for prediction.

Decision makers should always be careful when adapting evidence to their context, and bear in mind potential reasons for variation in clinical and cost-effectiveness data

Conclusions

For research:

The analysis is based on a single case study and results may be atypical.

The genealogy of health economic evidence should be investigated further

The model, or variations thereoff, could be applied to various evaluation questions and / or datasets, e.g.:

- RCT data (Single RCTs with multiple centres or meta-regression of multiple RCTs)
- Utilisation data, to assess regional variation in the provision of policies / services. etc.
- Cost-, reimbursement or outcome information in different contexts

MLM allows explicitely modelling variability (variance function)

Further reading

Boehler C. & Lord J. (**2016**) Mind the Gap! A multilevel analysis of factors related to variation in published cost-effectiveness estimates within and between countries. Medical Decision Making, Vol. 36 (1), pp. 31-47 (open access)

Boehler C. (**2013**) Mind the Gap! – Geographic transferability of economic evaluations in health. Thesis submitted for the Degree of Doctor of Philosophy. Health Economics Research Group (HERG), Brunel University, London, (open access)

Our approach has also been discussed by:

Shemilt et al. on behalf of the Campbell & Cochrane Economics Methods Group (2013) Issues in the incorporation of economic perspectives and evidence into Cochrane reviews. Systematic Reviews, 2.83, doi:10.1186/2046-4053-2-83