

Additional file 1: Search strategy

Georgios F. Nikolaidis

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1 Scoping the literature

Our scoping review was used as a precursor to our systematic review with a view to informing its design and conduct. Its main aims were:

1. To clarify the working definitions and understand whether consistent terminology is used in the literature to describe methods that borrow strength.
2. To determine the range of research fields that have developed methods that borrow strength and assist the definition of appropriate and realistic inclusion and exclusion criteria in our systematic review.
3. To understand whether the most suitable way of systematically searching the literature is by using keyword-based or citation-mining methods.

To fulfil the aforementioned aims we used the citations and references of the most widely cited paper on the topic of “Borrowing of strength” [1] and conducted targeted searches in MEDLINE combining keywords on information-sharing (‘borrowing of strength’, ‘borrow strength’, ‘borrow-strength’, ‘information sharing’, ‘information-sharing’) with keywords on evidence synthesis (‘meta-analysis’, ‘network meta-analysis’, ‘mixed treatment comparison’, ‘multiple treatment comparison’, ‘indirect comparison’, ‘simultaneous treatment comparison’).

We found that there was no consistent terminology on the subject and although ‘borrowing strength’ was the term most often mentioned in relevant papers, there were still several papers that developed relevant methods and did not use that term or any other term referring to information-sharing or borrowing of strength. Furthermore, given that our review aimed to identify statistical methods, its research question could not be framed under the PICO format for which classical keyword-based methods are well suited. Therefore, we decided that a citation-mining review was the most appropriate way forward.

2 Determining the list of seminal papers

To identify our seminal papers, we used the results of our literature scoping process. Given that 1 was the most cited paper on the topic as explained in comment 4, it was directly included in our list of seminal papers. Amongst the other papers identified in the scoping process, we selected papers that not only were also widely cited, but also represented a variety of research fields. Specifically, 2 was selected to represent the field of multi-parameter evidence synthesis, 3 to represent the field of cost-effectiveness and policy-making, 4 to represent the field of NMA, 5 to represent the field of multi-variate synthesis of multiple outcomes, and 6 to represent the field of incorporating evidence from historical controls.

The list of those 6 papers was then discussed with two external experts in evidence synthesis. It was noted that 7 although not included in the list of papers cited by 1, was more widely cited (by n=148 papers by the end of 2018) than 5 (n = 47) and was perhaps a better option to represent the field of multivariate meta-analysis. As such, the proposed substitution was implemented. Finally, another paper that had not also cited 1 and related to the field of the incorporation of information from historical controls was brought to our attention by the panel 8. Given that our uncertainty in whether this paper should substitute 6, we decided to simply add it to the list of seminal papers without making any exclusions.

Overall, 7 seminal papers made the final list and were used for our systematic review and these are shown in Table 1.

Table 1: ‘Pearls’ (i.e. seminal papers) used for forwards and backwards citation-mining

#	‘Pearl’	Citations	Cited by
1	Higgins and Whitehead, 1996. <i>Borrowing strength from external trials in a meta-analysis</i>	33	309
2	Ades and Sutton 2006 <i>Multiparameter evidence synthesis in epidemiology and medical decision-making: current approaches</i>	109	82
3	Ades et al., 2006 <i>Bayesian methods for evidence synthesis in cost-effectiveness analysis</i>	79	210
4	Jackson et al., 2011 <i>Multivariate meta-analysis: Potential and promise</i>	74	148
5	Efthimiou et al., 2016 <i>GetReal in network meta-analysis: a review of the methodology</i>	193	37
6	Hobbs et al., 2011 <i>Hierarchical commensurate and power prior models for adaptive incorporation of historical information in clinical trials</i>	16	64
7	Schmidli et al., 2014 <i>Robust meta-analytic-predictive priors in clinical trials with historical control information</i>	50	42

3 Systematic review

Inclusion criteria

Papers were included if they described or mathematically specified meta-analytic or network meta-analytic methods that combine information from comparative studies that pertain to multiple populations, interventions, outcomes, study-designs or utilise evidence from an external source such as previous meta-analyses.

Exclusion criteria

Papers were excluded from the search if they fell in any of the categories below:

1. Methods or applications developed outside the health research field (e.g. ecology)
2. Applications of standard MA/NMA methods without any extensions or developments to accommodate the inclusion of indirect information
3. Irrelevant papers. Examples in that category include the following
 - Papers that developed graphical/presentational methods for MA/NMA
 - Papers that developed methods intended to assess consistency of the evidence
 - Papers that aimed to introduce basic concepts and methods of MA/NMA, without any focus on advanced methods that extend the standard models to accommodate the inclusion of indirect evidence
 - Reviews of the quality of the methods that are used in MA/NMA
 - Papers that develop methods to combine sources of information outside the field of MA/NMA. For example, methods that aim to utilise evidence from historical controls in the design of future trials or fall outside the field of comparative effectiveness research
4. Protocols for the conduct or analysis of a future study
5. The University of York could not provide access to the full-text article

References

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