

A methodological review to develop a list of bias items used to assess reviews incorporating network meta-analysis: Protocol and rationale

Carole Lunny (✉ carole.lunny@ubc.ca)

University of British Columbia <https://orcid.org/0000-0002-7825-6765>

Areti Angeliki Veroniki

University of Ioannina <https://orcid.org/0000-0001-6388-4825>

Andrea Tricco

University of Toronto <https://orcid.org/0000-0002-4114-8971>

Sofia Dias

University of York <https://orcid.org/0000-0002-2172-0221>

Brian Hutton

Ottawa University <https://orcid.org/0000-0001-5662-8647>

Georgia Salanti

University of Bern <https://orcid.org/0000-0002-3830-8508>

James M. Wright

University of British Columbia

Ian R. White

University College London <https://orcid.org/0000-0002-6718-7661>

Penny Whiting

University of Bristol <https://orcid.org/0000-0003-1138-5682>

Method Article

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Abstract

Introduction: Systematic reviews with network meta-analysis (NMA; i.e., multiple treatment comparisons, indirect comparisons) have gained popularity and grown in number due to their ability to provide comparative effectiveness of multiple treatments for the same condition. The methodological review aims to develop a list of items relating to biases in reviews with NMA. Such a list will inform a new tool to assess the risk of bias in NMAs, and potentially other reporting or quality checklists for NMAs which are being updated.

Methods and Analysis: We will include articles that present items related to bias, reporting, or methodological quality, articles assessing the methodological quality of reviews with NMA, or papers presenting methods for NMAs. We will search Ovid MEDLINE, the Cochrane library, and difficult to locate/unpublished literature. Once all items have been extracted, we will combine conceptually similar items, classifying them as referring to bias or to other aspects of quality (e.g. reporting). When relevant, reporting items will be re-worded into items related to bias in NMA review conclusions, and then re-worded as signalling questions.

Ethics and Dissemination: No ethics approval was required. Patients, healthcare providers and policy makers need the highest quality evidence to make decisions about which treatments should be used in healthcare practice. Being able to critically appraise the findings of systematic reviews that include NMA is central to informed decision-making in patient care.

Strengths And Limitations Of This Study

- No tool for assessment of biases in reviews with NMA currently exists
- Our research aims to develop a list of items related to bias in the goal of developing the first tool for assessing risk of bias in the findings of reviews with NMA.
- A comprehensive and systematic process will be followed to develop a risk of bias tool for assessing reviews with network meta-analyses (NMAs), as outlined in Whiting et al.'s "Framework for Developing Quality Assessment Tools", starting with a methodological review of articles describing NMA biases
- A methodological review is a knowledge synthesis product where evidence on a given methods topic is identified, described and synthesised
- Being able to critically appraise the findings of reviews with NMA is central to evidenced-based decision-making in patient care.

1. Introduction

Reviews with network meta-analysis (NMAs) have gained popularity due to their ability to provide comparative effectiveness of multiple treatments for the same condition [1]. Reviews with NMA have grown in number. Between 1997 and 2015, 771 NMAs were published in 336 journals from 3459 authors

and 1258 institutions in 49 countries [2]. More than three-quarters (n = 625; 81%) of these NMAs were published in the last 5-years. Many organisations such as the National Institute for Health and Care Excellence (NICE) in the UK, the World Health Organization (WHO), and Canadian Agency for Drugs and Technologies in Health (CADTH) conduct NMAs as they represent the best available evidence to inform clinical practice guidelines [3-5]. We adopt a broad definition of NMAs, specifically: a review that aims to, or intends to, simultaneously synthesise more than two health care interventions of interest. Reviews that intend to compare multiple treatments with an NMA but then find that the assumptions are violated (e.g. a disconnected network, or studies are too heterogeneous to combine) and that NMA is not feasible, will also be included in our definition.

Evidence shows that biased results from poorly designed and reported studies can mislead decision-making in healthcare at all levels [6-9]. If a review is at risk of bias and inappropriate methods are used, the validity of the findings can be compromised [10-12]. Evaluating how well a review has been conducted is essential to determining whether the findings are relevant to patient care and outcomes. Several empirical studies have shown that bias can obscure the real effects of a treatment [13-16]. Being able to appraise reviews with NMA is central to informed decision-making in patient care.

The systematic procedures required to conduct a systematic review (e.g. double and independent data extraction and comparison of the extractions) help mitigate the risk of bias. However, bias can also be introduced when interpreting the reviews findings. For example, review conclusions may not be supported by the evidence presented, the relevance of the included studies may not have been considered by review authors, and reviewers may inappropriately emphasise results on the basis of their statistical significance [17]. A well-conducted systematic review draws conclusions that are appropriate to the included evidence and can therefore be free of bias even when the primary studies included in the review have high risk of bias.

Tools are available for most study designs to make risk of bias assessment easier for a knowledge user (e.g., healthcare practitioners, policymakers, patients [18]). Many tools and checklists can be used either when conducting a systematic review (quality of conduct), when assessing how well a study has been described (reporting), or when knowledge users want to assess the risk of bias in the conclusions of a review. The methodological quality of studies (i.e., how well the study is conducted) is often confused with reporting quality (i.e., how well authors report their methodology and results). A risk of bias assessment is an assessment of review limitations, which focus on the potential of those methods to bias the study findings [17].

More than 40 tools have been identified [19, 20] for critically appraising the quality of reviews with pairwise meta-analysis. AMSTAR (A Measurement Tool to Assess the methodological quality of systematic Reviews) [21] and the OQAQ (Overview Quality Assessment Questionnaire [22]) have been identified as the most commonly used, and they follow a simple checklist format [20, 23]. AMSTAR has been recently updated to AMSTAR 2, which aims to evaluate how reviews are planned and conducted [24]. The ROBIS (Risk Of Bias In Systematic reviews) tool is designed to assess the risk of bias in systematic reviews with or without pairwise meta-analysis [23]. The ROBIS tool involves assessment of methodological features in reviews known to increase the risk of bias in review conclusions. Domain-based assessment tools require a careful reading and thoughtful analysis of the study to adequately rate risk of bias, instead of simply identifying keywords reported in the article, as usually made in a checklist type of assessment.

For critically appraising reviews with NMA, several checklists exist. To assess *reporting quality*, the PRISMA statement extension for reviews incorporating network meta-analysis (PRISMA-NMA) [25] or the National Institute for Health and Care Excellence Decision Support Unit checklist (NICE-DSU) [26] can be used. To assess *quality of conduct*, the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) checklist [27] can be used. However, many quality assessment tools are not created rigorously. To be rigorous, they must follow a series of systematic steps [28, 29]. As a *quality of conduct* tool, the ISPOR checklist [27] did not follow the methodology proposed by Whiting [29] for creating a systematically developed quality tool. Due to important methodological advances in the field of NMA, the ISPOR, published in 2014, is also outdated. As **Table 1** shows, several tools are designed with different purposes; some for assessing *reporting quality*, and some for assessing *quality of conduct* but none are designed to assess *risk of bias* in NMAs.

Table 1. Tools and checklists to aid in systematic review conduct, or to assess the reporting or methodological quality of a review

Tool purpose	Examples of tools or checklists	Description of the example checklist or tool	Available tool for reviews with NMA
Guidance for conducting systematic reviews	MECIR [30]	Detailed methodological guidance on how to conduct a systematic review with or without pairwise meta-analysis of effectiveness, diagnostic test accuracy, individual patient data reviews and reviews in public health and health promotion	No
Assess the quality of published reviews	AMSTAR-2 [24], OQAQ [22]	AMSTAR-2 is a critical appraisal tool to assess the quality of conduct of reviews of randomised controlled trials of interventions	ISPOR [27]
Assess the risk of bias of published reviews	ROBIS [17]	ROBIS is a tool for assessing the risk of bias in reviews. It is aimed at four broad categories of reviews mainly within health care settings: interventions, diagnosis, prognosis, and etiology.	No
Assess the certainty in evidence and the strength of recommendations	GRADE [31]	GRADE approach defines the certainty of a body of evidence as the extent to which one can be confident that a pooled effect estimate is close to the true effect of the intervention. Five domains assessed: risk of bias, inconsistency, indirectness, imprecision, and publication bias.	GRADE-NMA [32, 33], CINeMA, [34], Threshold method [35]
Guidelines for the complete reporting published reviews	PRISMA [36]	PRISMA is an evidence-based minimum set of items for reporting in reviews and meta-analyses. PRISMA focuses on the reporting of reviews evaluating randomized trials, but can also be used as a basis for reporting reviews of other types of research, particularly evaluations of interventions.	PRISMA-NMA [25], NICE-DSU[26]

AMSTAR-2: A Measurement Tool to Assess Systematic Reviews 2; CINeMA: Confidence in Network Meta-Analysis; GRADE: (Grading of Recommendations Assessment, Development and Evaluation; GRADE-NMA: Grading of Recommendations Assessment, Development and Evaluation for Network Meta-Analysis; MECIR: Methodological Expectations of Cochrane Intervention Reviews; OQAQ: Overview Quality Assessment Questionnaire; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PRISMA-NMA: PRISMA statement extension for reviews incorporating NMA.

A comprehensive and systematic process should be used to develop a rigorous risk of bias tool for assessing NMAs, as outlined in Whiting et al.'s "Framework for Developing Quality Assessment Tools" [29]. The first step is to: (1) conduct a systematic search of biases that can inform the assessment of the validity and reliability of NMAs and prepare a pilot list of items, (2) create a draft tool, (3) obtain expert opinion on the draft tool through Delphi exercises, and (4) pilot test and refine the tool [29]. No review has comprehensively and systematically listed and categorised all items related to quality of bias in NMAs.

Such a list will inform a new tool to assess the risk of bias in NMAs, and potentially other reporting or quality tools which are being updated.

2. Objective

Our objective is to conduct a methodological review to develop a list of items relating to bias in NMAs with the goal of developing a risk of bias tool to assess NMAs.

3. Methods And Analysis

We will follow the methodology proposed by Whiting [29], Sanderson [37] and Page [7] for creating systematically developed lists of quality items.

3.1 Eligibility criteria

There will be two types of studies included. Study type 1 are articles that present and describe items related to bias, reporting, or methodological quality of reviews with NMA. Items related to reporting will be retained because they can potentially be translated into a risk of bias item. For example, in the PRISMA-P guideline [38], one item asks whether study PICO [Population, Interventions, Comparisons, Outcomes] characteristics were used as criteria for determining study eligibility. Reporting of all outcomes in a protocol may prevent authors from only selecting outcomes that are statistically significant when publishing their systematic review. This PRISMA-P reporting item can then be translated into a bias item related to the “selective reporting” of outcomes [39]. Study type 2 are studies that assess the methodological quality in a sample of reviews with NMA.

Study Type 1 will meet any of these inclusion criterion:

- Articles describing items related to bias or methodological quality in reviews with NMA (e.g. Dias 2018 [40]); tools that only assess general aspects of systematic reviews without focusing specifically on NMA will be excluded (e.g. AMSTAR [21], AMSTAR 2 [24] or ROBIS [17]).
- Articles describing editorial standards for reviews with NMA (e.g. similar to the Cochrane MeCIR (Methodological standards for the conduct of new Cochrane Intervention Reviews) standards for systematic reviews [30]).
- Articles describing items related to reporting quality in reviews with NMA (e.g. PRISMA-NMA [25]).
- Articles identifying or addressing sources of bias and variation in NMA and published after PRISMA-NMA in 2014.

Study Type 2 will meet any of these inclusion criterion:

- Articles assessing the methodological quality (or risk of bias) of reviews with NMA (i.e. a sample of NMAs are assessed for methodological quality; e.g. Chambers 2015 [41]) using criteria that focus specifically on aspects of NMA not just on general aspects of systematic reviews.

We will include articles with any publication status and in any language, and where the co-authors are not fluent in the language, Google Translate will be used.

If through our main search, we identify a systematic review encompassing the eligible articles, or one aspect of the eligible article, we will use the results of the systematic review and only include primary studies published subsequent to the systematic review. For example, a review by Laws et al. in 2019 [5] identified all guidance documents for conducting an NMA from countries throughout the world. We therefore would not search for guidance documents published before the last search date of this review.

3.2 Search strategy

We will search Ovid MEDLINE (January 1946 to June 2020), the Cochrane library as well as the following grey literature databases: the EQUATOR Network (<http://www.equator-network.org/reportingguidelines/>), Dissertation Abstracts, websites of evidence synthesis organisations (Campbell Collaboration Cochrane Multiple Treatments Methods Group, CADTH, NICE-DSU, Health Technology Assessment International (HTAi), Pharmaceutical Benefits Advisory Committee, Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen, European Network for Health Technology Assessment, Guidelines International Network, ISPOR, International Network of Agencies for Health Technology Assessment, and JBI) as well as methods collections (i.e. Cochrane Methodology Register, AHRQ Effective Health Care Program). We will validate the MEDLINE strategy by using the PubMed IDs of ten included studies (identified by experts prior to our eligibility screening) and evaluating whether the strategy identified the PMIDs (**Appendix 1**).

A systematic search strategy will be developed by two methodologists (CL, PW) without limitations to publication type, status, language, or date to identify existing tools or articles. An information specialist will check the search strategy for MEDLINE Ovid and assess it using the PRESS (Peer Review Electronic Search Strategies) guidance [42]. The full search strategies for all databases and websites can be found in **Appendix 1**. To identify other potentially relevant studies, we will examine the reference lists of included studies. We will ask experts in methods for NMA to identify articles missed by our search. We will contact authors of abstracts to retrieve the full report or poster.

We will search the reference section of a bibliometric study of reviews with NMAs [43] and extract the name of the journals that publish NMAs. We will then contact their editors in chief and ask if they have any in-house editorial standards for reviews with NMA.

3.3 Process for screening, data extraction and analysis

The eligibility criteria will be piloted in Microsoft Excel by two reviewers independently on a sample of 25 citations retrieved from the search to ensure consistent application. After high agreement (>70%) is achieved, the Covidence [44] web-based tool (<https://www.covidence.org>) will be used by two reviewers to independently screen the citations based on the eligibility criteria. Disagreements will be discussed until consensus is reached. A third reviewer (CL) will arbitrate if disagreements cannot be resolved.

The data extraction form will be piloted by reviewers independently on a sample of five included papers to ensure consistent coding. Two independent authors will extract data on the characteristics of the studies, and items. Any disagreements will be arbitrated by a third author.

3.4 Data extraction

The sources will first be categorised by the type of article coded as per our inclusion criteria. A table of tool characteristics will be developed with the following headings: first author, year; type of tool (tool, scale, checklist, or domain-based tool); whether the tool is designed specific topic areas (specify); number of items; domains within the tool; whether the item relates to reporting or methodological quality (or other concepts such as precision, acceptability); how items and domains within the tool are rated; methods used to develop the tool (e.g. review of items, Delphi study, expert consensus meeting); and the availability of an “explanation and elaboration” [7].

Data will be extracted on items that are potentially relevant to the risk of bias or quality of reviews with NMAs. Items will be initially extracted verbatim.

3.5 Data analysis

The following steps will be used when analysing items:

1. Map to ROBIS domains

Items will be mapped to ROBIS domains (study eligibility criteria; identification and selection of studies; data collection and study appraisal; and synthesis and findings) and specific items within the domains. The rationale for mapping items to ROBIS is that it is the only tool to assess risk of bias in reviews. Items that do not clearly map to the existing ROBIS domains will be listed separately and grouped by similar concept. New domains may be created if items do not fit well into the established ROBIS domains.

2. Split items so that each item only covers a single concept

Two or more concepts grouped in one item will be split so that each item covers a single concept. A rationale as to why the item was split will be described. For example, PRISMA-NMA item 15 (“Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies)”) will be split into two items because this item is represented by two items in ROBIS in the synthesis and findings domain, namely “4.5 Were the findings robust, e.g. as demonstrated through funnel plot or sensitivity analyses?” and “4.6 Were biases in primary studies minimal or addressed in the synthesis?”.

3. Group similar items

Items that are conceptually similar will be grouped together and noted with the source. We will classify items as relating to bias or other aspect of quality (e.g. reporting). When relevant, items related to reporting will be reworded into items related to bias in NMA review conclusions.

4. Omit duplicate items (but keep these in a column in the table for transparency)

If items are worded vaguely or are unexplained, we will use an iterative process to interpret the item and ensure there is a mutual understanding of the item between authors when coding. The process will be iterative, and if any gaps in items related to bias in reviews of NMA are identified, a new item will be inferred.

The final list of items deemed unique will be retained. We will reword items as signalling questions, where an answer of “yes” suggests absence of bias. We will provide examples to illustrate the items and write a rationale and description of each item.

We will count the number of sources and unique items included. We will summarise the characteristics of included tools in tables and figures. We will calculate the median and interquartile range (IQR) of items across all tools and tabulate the frequency of different biases identified in the tools.

3.6 Patient and Public Involvement

Patients or the public were not involved in the design of our research protocol.

4. Ethics And Dissemination

No ethics approval was required as no human subjects were involved. Our research aims to develop a list of items related to bias in the goal of developing the first tool for assessing risk of bias in the findings of reviews with NMA. We plan to publish the full study in a peer reviewed journal, and disseminate the findings via social media (Twitter, Facebook, and author affiliated websites).

Patients, healthcare providers and policy makers need the highest quality evidence to make decisions about which treatments should be used in healthcare practice. Being able to critically appraise the findings of reviews with NMA is central to evidenced-based decision-making in patient care.

List Of Abbreviations

AMSTAR-2: A Measurement Tool to Assess Systematic Reviews 2; CADTH: Canadian Agency for Drugs and Technologies in Health; CINeMA: Confidence in Network Meta-Analysis; GRADE: Grading of Recommendations Assessment, Development and Evaluation; GRADE-NMA: Grading of Recommendations Assessment, Development and Evaluation for Network Meta-Analysis; ISPOR: International Society for Pharmacoeconomics and Outcomes Research; MECIR: Methodological Expectations of Cochrane Intervention Reviews; NICE: National Institute for Health and Care Excellence; NICE-DSU: NICE Decision Support Unit; NMA: network meta-analysis; OQAQ: Overview Quality Assessment Questionnaire; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PRISMA-NMA: Preferred Reporting Items for Systematic Reviews with Network Meta-Analysis; WHO: the World Health Organization.

Declarations

Nothing to declare.

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

CL conceived of the study; all authors contributed to the design the study; CL wrote the draft manuscript; CL, PW, ACT, BH, SD, GS, AV revised the manuscript; all authors edited the manuscript; and all authors read and approved the final manuscript.

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