

# A systematic review of meta-research studies finds substantial methodological heterogeneity in citation analyses to monitor evidence-based research

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## Abstract

**Objectives:** This systematic review aimed to identify the characteristics and application of citation analyses in evaluating the justification, design, and placement of the research results of clinical health studies in the context of earlier similar studies.

**Study Design and Setting:** We searched MEDLINE (Ovid), Embase (Ovid), and the Cochrane Methodology Register for meta-research studies. We included meta-research studies assessing whether researchers used earlier similar studies and/or systematic reviews

Systematic review registration number <https://osf.io/8759p/>.

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**Declaration of interests:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

**Availability of data and materials:** The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

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of such studies to inform the justification or design of a new study, whether researchers used systematic reviews to inform the interpretation of new results, and meta-research studies assessing whether redundant studies were published within a specific area. The results are presented as a narrative synthesis.

**Results:** A total of 27 studies were included. How authors of citation analyses define their outcomes appears rather arbitrary, as does how the reference of a landmark review or adherence to reporting guidelines was expected to contribute to the initiation, justification, design, or contextualization of relevant clinical trials.

**Conclusion:** Continued and improved efforts to promote evidence-based research are needed, including clearly defined and justified outcomes in meta-research studies to monitor the implementation of an evidence-based approach. © 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

**Keywords:** Systematic review; Citation analysis; Evidence-based research; EBR; Meta-research; Research redundancy

## 1. Introduction

Evidence-based research (EBR) has been defined as “*the use of prior research in a systematic and transparent way to inform a new study so that it is answering questions that matter in a valid, efficient, and accessible manner*” [1]. Besides considering an EBR approach when justifying and designing new studies, it is equally important to practice EBR when contextualizing new results with existing evidence [2].

The EBR approach, however, is still rather new [3] and far from wide implementation. The mean percentage of original studies using systematic reviews (SRs) as justification was estimated at 42% [4], study designs informed by SRs at 30% [5], and studies contextualizing their results with existing studies at 31% [6]. Implementing an EBR approach on a large scale may take time as it demands new knowledge and skills [1]. In addition, different implementation strategies should ideally be evaluated and implementation progress should be monitored via suitable outcomes. However, the best way to measure adherence to an EBR approach remains unclear.

A citation analysis has been identified as one way to monitor the use of an EBR approach [2,7] and has been defined as an examination of the frequency, patterns, and graphs of citations [8]. In the context of EBR, citation analysis can be used in different ways; for instance, to investigate the use of SRs to justify new trials as Engelking et al. have done in anaesthesiology [9] or to determine whether new clinical trial results were contextualized as Clarke and Hopewell have done [10].

Citation analysis seems to be used in a variety of ways and there is no consensus on how studies using this method should be conducted and reported. Hence, this SR was intended to empirically investigate the characteristics and applications of citation analyses that could be potentially be used to monitor the implementation of an EBR approach in health sciences and to provide guidance for its future use.

## 2. Methods

The protocol for this SR was registered in the Open Science Framework (<https://osf.io/8759p/>, also available as supplementary file) and followed rigorously during its

execution except for adjustments in the risk of bias assessment; the risk of bias tool was reduced from 13 to 10 items and the assessment of reporting quality was omitted. Furthermore, minor adjustments regarding the extraction of relevant study characteristics were made. This review is reported as per the preferred reporting items for systematic review and meta-analysis guidelines [11].

### 2.1. Eligibility criteria

We included meta-research studies, or studies performing research on research, defined by Ioannidis as “... *the study of research itself: its methods, reporting, reproducibility, evaluation, and incentives.*” [12]. Thus, we included studies that assessed whether researchers used earlier, similar studies or SRs of earlier, similar studies to inform the justification and design of a new study; whether researchers used SRs to inform the interpretation of new results; or whether redundant studies were published within a specific medical field. Regarding redundancy, we relied on the definitions applied by the authors of the included studies.

### 2.2. Information sources and search strategy

This study is one of six planned evidence syntheses (five SRs and a scoping review) to assess the implementation of EBR in health sciences. Given the common aim across the evidence syntheses, an overall search strategy was designed to identify eligible meta-research studies.

The initial search was performed in June 2015 and included MEDLINE (PubMed, Ovid), Embase (Ovid), CINAHL (EBSCO), Web of Science (Science Citation Index Expanded), the Social Sciences Citation Index, the Arts & Humanities Citation Index, and the Cochrane Methodology Register (Methods Studies) (Appendix 1). In addition, the reference lists of the included studies were screened for relevant articles and the experts’ literature, libraries, and abstracts from the Cochrane methodology reviews were screened. Publication year and language were not restricted but the search was limited to studies using human subjects.

Based on the results of the initial search, an updated and improved search strategy was developed and applied to MEDLINE and Embase via Ovid from January 2015 to June 2021 (Appendix 2). Again, the reference lists of the

**What is new?**

- This is the first study to investigate citation analysis in the context of evidence-based research.

**Key findings**

- Citation analyses are characterized by focusing on the citation of systematic reviews or meta-analyses and, to some extent, the citation of previous, similar trials or guideline adherence.

**What this adds to what was known?**

- How authors of meta-research citation analyses define their outcomes, that is, how the reference of a landmark review or adherence to reporting guidelines contributes to the justification, design, or contextualisation of relevant clinical trials, appears rather arbitrary.

**What is the implication and what should change now?**

- The overall lack of definition of relevant outcomes in meta-research studies conducting citation analyses is our most striking result.

new included studies were screened for relevant references and the experts' literature and abstracts from January 2015 to June 2021 of the Cochrane methodology reviews were screened.

### 2.3. Screening and study selection

The search results were uploaded to Rayyan (<https://rayyan.qcri.org/welcome>) for the initial screening.

The search results from the initial search (2015) were independently screened (title and abstract) by teams of two reviewers. A total of 20 screeners were paired and each pair included an experienced reviewer. To increase consistency among the reviewers, both reviewers initially screened 50 publications and discussed the results before the screening continued. Disagreements on study selection were resolved by consensus and discussion with a third reviewer, if necessary. The subsequent full-text screening was performed by four reviewers independently and in duplicate. Again, disagreements on study selection were resolved by consensus and discussion. This initial screening resulted in a gross list of studies relevant for all of the above-mentioned reviews and the scoping review.

For this specific SR, title and abstract screening and full-text screening were conducted independently by two authors (B.N. and D.P.) from the gross list using predetermined inclusion criteria. The reasons for not including studies were recorded and disagreements between the reviewers were resolved with discussion.

### 2.4. Data extraction

Before data extraction, a customized spreadsheet was developed, piloted, and refined to extract study characteristics and outcomes of interest. Two reviewers (D.P. and B.N.) independently extracted the data. Afterward, all remaining authors validated the extracted data and helped to resolve disagreements, if necessary.

The following study characteristics were extracted from each of the included studies: bibliographic information, study aim, study design, material (i.e., study types included), country (based on first author's affiliation), inclusion period, area of interest, results, and conclusion. The following details were then extracted to elucidate our aims: unit of analysis (what is analyzed); citations of interest or citation type; the number of units included; the rationale for the sample size; data extraction methods; the definition of using research articles in the context of justifications, design, or contextualization; and assessing whether redundant studies had been published within a specific area.

### 2.5. Risk of bias assessment

Because a thorough search did not identify any standard tool to evaluate the risk of bias of empirical meta-research studies, the Editorial Group of the Evidence-Based Research Network prepared a list of items considered important for evaluating the risk of bias in meta-research studies. The list was tested on a sample of included studies and, following a discussion, the list was adjusted to 10 items for which the risk of bias could be rated "low," "high," or "unclear" [5]. We added one or two prompts to each item defining a high risk of bias (Appendix 3). Two authors (B.N. and D.P.) determined the risk of bias of all of the included studies independently. Disagreements were solved through discussion. No study was excluded due to low quality.

### 2.6. Data synthesis and interpretation

First, we labelled the studies by their main focus, that is, the justification or design of a new study, whether researchers used SRs to contextualize new results, and studies assessing whether redundant studies were published within a specific area. Then, we identified different citation analysis methods and investigated patterns across the included studies. All results are presented descriptively and narratively.

## 3. Results

### 3.1. Study selection

After removing duplicates, 30,592 studies were identified with our search strategy and 27 studies were ultimately included in this SR [9,13–38] (Fig. 1).

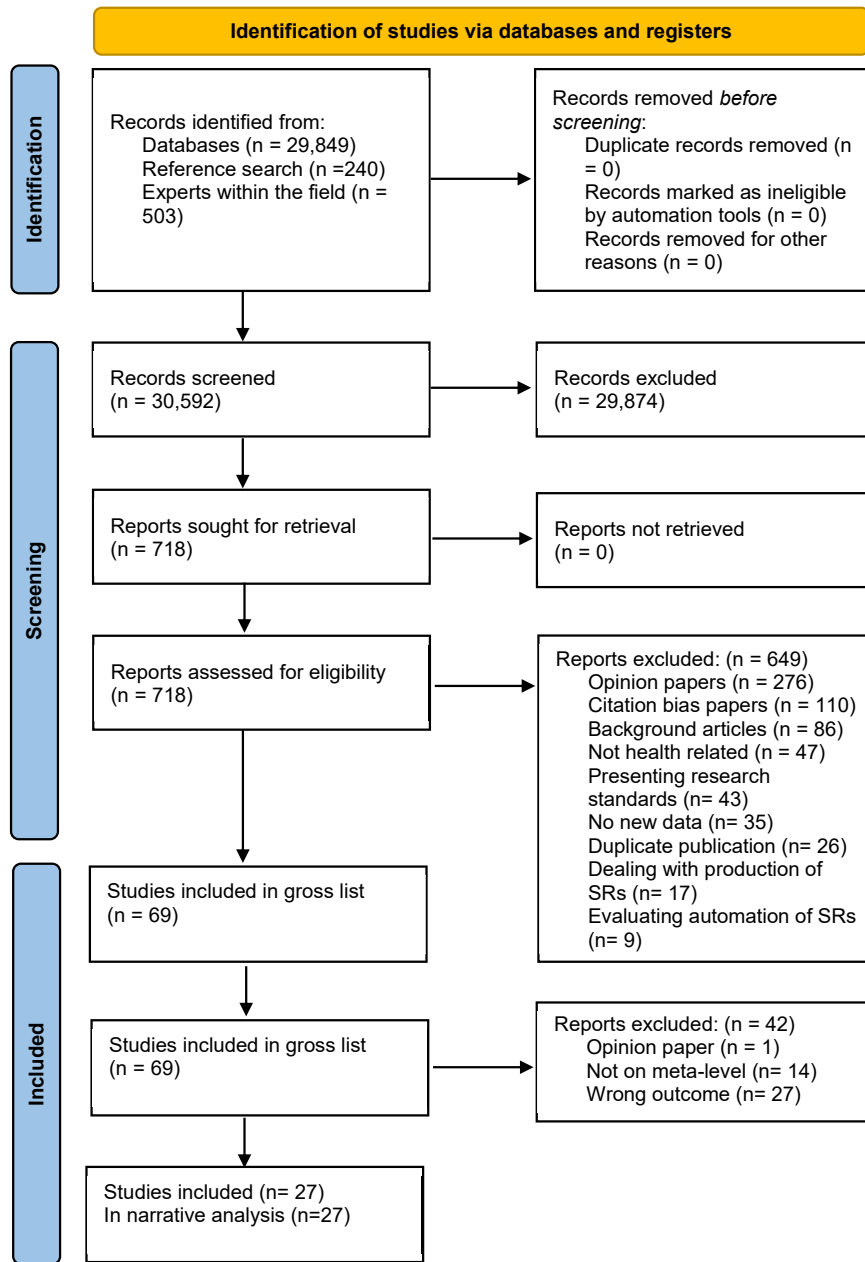


Fig. 1. Flowchart [11].

### 3.2. Study characteristics

The 27 included studies were published between 2011 and 2021. Nine studies originated from the United States [13,25,30,31,33,35–38], six from the United Kingdom [14,15,17,21,26,34], three from Switzerland [22,28,32], two from Germany [23,24] and Canada [18,20], respectively, and one study each from Spain [19], Croatia [9], New Zealand [16], the Republic of Korea [29], and Denmark [27].

All of the included studies conducted a literature review that applied a cross-sectional design, examining randomized controlled trial (RCT) protocols that were granted by

the National Institute for Health and Care Research [15,26], protocols approved by a research ethics committee [27], RCTs published in a specific range of journals [9,19–21,23,25,32,35,37,38], or RCTs from specific databases [13,16,17,22,24,28–31,33,34]. One study additionally included a survey of authors of RCT protocols [14], one focused on medical specialties [18], and one on genes and phenotypes [36]. Eight studies stated a specific clinical focus, covering surgery [13,17,32], orthopedics [25], cardiology [14,33], dermatology [19], anesthesiology [9,22], genetics [29,36], obstetrics [31], urology [35], ophthalmology [37], dental specialty [34], general medicine [38],

**Table 1.** Study characteristics

Study	Aim	Design	Material	Country	Inclusion period	Area of interest	Results	Conclusion
Andrade NS et al. 2013 [13]	To determine the effects of previous trials on the subsequent research agenda in the management of CNLBP	Cross-sectional	Published in PubMed and Web of Science	United States	1993 to 2012	Surgery	39 trials included	No substantial changes in research agenda in the last 20 yr despite published RCTs
Ban JW et al. 2017 [14]	To assess whether authors of cardiovascular clinical prediction rules (CPRs) cited existing CPRs, why some authors did not cite existing CPRs and why they thought existing CPRs were insufficient	Cross-sectional	The International Register of Clinical Prediction Rules for Primary Care	United Kingdom	1980 to 2009 Survey in November 2015	Cardiovascular	85 studies were included—48 (56.5%) cited at least one existing CPR 76 authors were contacted and 54 responded—46.3% were aware of existing CPRs	Cardiovascular CPRs are often developed without citing existing CPRs
Bhurke S et al. 2015 [15]	To investigate the use of SRs in the planning, design, and conduct of RCT	Cross-sectional	Proposals funded by the NIHR HTA Program	United Kingdom	Cohort 1: 2006–08 Cohort 2: 2013	No specific speciality	Cohort 1: 47 trials included—42 used SR to inform design Cohort 2: 34 trials included—all referenced a SR to inform trial design	49% of trials used one or more SR in design and planning
Bolland et al. (2018) [16]	To investigate waste attributable to RCTs and the citation of SRs in large RCTs and protocols.	Cross-sectional	RCTs, SRs, and quasi-randomized trials in four databases	New Zealand	None (search in December 2015)	No specific speciality	Three of 10 possible studies referred to a SR to justify.	Few large RCTs appeared to consider systematic reviews in their design.
Chapman et al. (2019) [17]	To quantify constituent components of waste in surgical RCTs and explore targets for improvement.	Cross-sectional	ClinicalTrials.gov was searched for RCTs registered and followed up by Serial systematic searches of PubMed and Scopus databases	United Kingdom	Registered between 2011 and 2012	Surgery	Of 219 RCTs available for full-text review, 104 (47.4 per cent) did not cite a relevant SR.	This study identified a considerable burden of research waste in surgical RCTs.
Chow JT et al. 2017 [18]	To quantify and summarize what types of evidence are cited in the	Cross-sectional	Randomly chosen RCTs within six medical	Canada	January 2014 to July 2015	Ophthalmology Otorhinolaryngology General surgery Psychiatry	<i>N</i> = 148 studies included; Ophthalmology = 25 studies Otorhinolaryngology = 20 studies	Justifications for RCTs vary widely within and between specialties and the justification

(Continued)

**Table 1.** Continued

Study	Aim	Design	Material	Country	Inclusion period	Area of interest	Results	Conclusion
	introduction section as the reason for the RCT to be performed		specialties			Obstetrics-gynecology Internal medicine	General surgery = 25 studies Psychiatry = 25 studies Obstetrics-gynecology = 25 studies Internal medicine = 28 studies. Review articles were in total number of studies cited 2.96, 1.05, 1.40, 1.16, 0.68, and 1.11 times, respectively	for conducting RCTs are not standardized
Conde-Taboada A et al. 2014 [19]	To describe the use of SR in clinical trials and narrative reviews in dermatology	Cross-sectional	Four journals of dermatology;	Spain	2010 and 2011 (narratives)	Dermatology	113 articles included—of those SR existed for 72 RCTs and 24 cited an SR. 49 narrative reviews included	Authors appear to use Cochrane reviews even less than non-Cochrane reviews
De Meulemeester J. et al. 2018 [20]	To assess whether recent RCTs meet scientific criteria, hypothesis use, and SR use	Cross-sectional	RCTs published in NEJM and JAMA in 2015	Canada	2015	No specific speciality	208 included studies and 199 protocols—54% cited a relevant MA or SR in either the study or the protocol.	Up to 56% of published RCTs may not be scientifically and hence ethically justified
Engelking A et al. 2018 [9]	To analyse whether existing SRs were mentioned in RCTs published in journals as a rationale for conducting trial and for discussing results	Cross-sectional and meta-analysis	RCTs published in four journals of anesthesiology	Croatia	2014 to 2016	Anaesthesia, Anaesthesia, and Analgesia, Anesthesiology	622 RCTs included—126 (20%) mentioned verbatim or cited one or more SRs as justification for conducting a trial.	Less than a fifth of trials mention a previous SR as a justification for conducting the trial.
Goudie AC et al. 2010 [21]	To assess the extent to which authors currently make use of previous trial evidence in the design, analysis, and reporting of RCTs	Cross-sectional and meta-analysis	Published in JAMA and Archives of Internal Medicine	United Kingdom	5 mo (January-May) 2007	No specific speciality	27 RCTs included—6 (22%) trials referred to a MA, 2 (7%) to a SR, and 1 (4%) referred to SR	Consulting previous research before embarking a new trial and basing it on the impact of an updated MA will make reporting and designing more efficient
Habre C et al. 2014 [22]	To examine whether the Picard review had had any	Cross-sectional	MEDLINE, Embase, and Cochrane	Switzerland	January 2002 –January 2013	Anaesthesia, Anaesthesia and Analgesia,	136 RCTs published at least 2 yr after the publication of the Picard review—72.8%	The impact of the Picard review on the design of subsequent

(Continued)

Table 1. Continued

Study	Aim	Design	Material	Country	Inclusion period	Area of interest	Results	Conclusion
	impact on subsequent research					Anaesthesiology,	cited the Picard review	research is low
Helfer B et al. 2015 [23]	To investigate whether MAs published in leading medical journals present an outline of available evidence by referring to previous MAs and SRs on the same topic.	Cross-sectional	NEJM, JAMA, BMJ, The Lancet, PLOS Medicine, Annals of internal medicine. PubMed was searched	Germany	Search completed in March 2013	No specific speciality	52 recent MAs and 242 previous MA and SRs. 48 studies could refer to previously published SRs and MAs. 45 of 48 referred to one or more previously published SR/MAs	MAs on pharmacological treatments do not consistently refer to findings of previous MAs.
Hoderlein X et al. 2017 [24]	To investigate the extent to which RCTs of clinical trials of physiotherapy interventions use high-quality clinical research to help justify the need for the trial in the introduction	Cross-sectional	Random selected sample from PeDRO (10% of all studies in year 2001 and 2015)	Germany	2001 and 2015	Physiotherapy	<i>N</i> = 70 in 2001 and 151 studies in 2015. 14 studies (20%) and 76 studies (50%) did cite a SR in 2001 and 2015. Overall, 91 of the 221 trial reports cited	Only 41% of reports of clinical trials of physiotherapy interventions cite a SR or other evidence in the introduction as part of the justification for the study.
Johnson et al. (2020) [25]	To evaluate the use of systematic reviews to justify RCTs	Cross-sectional	RCTs published in three high-ranking orthopedics journals and RCTs published in general orthopedics journals	United States	January 1, 2015 to November 30, 2018	Orthopaedics	128 RCTs included—Of the 128 RCTs, 91 (71.1%) cited an SR	Systematic reviews are frequently cited in orthopaedic trauma RCTs but are not commonly cited as justification for conducting a clinical trial.
Jones AP et al. 2013 [26]	To identify where existing research is used and to categorize ways in which SRs were used to inform the design of the trial	Cross-sectional	RCTs funded from NIHR HTA program	United Kingdom	2006, 2007, and 2008	No specific speciality	48 applications were examined 20 referenced an SR regarding the design	SRs are frequently referenced in successful applications for funding
Paludan-Müller et al. (2019)	To study whether the ethical approval	Cross-sectional	Trial protocols approved by	Denmark	October 1, 2012 to March 31,	No specific speciality	67 protocols included, Four cited an SR regarding the	A substantial minority of trials might lack a

(Continued)

**Table 1.** Continued

Study	Aim	Design	Material	Country	Inclusion period	Area of interest	Results	Conclusion
[27]	system ensures that trials justify their scientific rationale and use of comparators based on previous trials and take their results, whether positive or negative, into account		one of the five regional research ethics committees in Denmark		2013		intervention, population, or indication	sufficient evidence base.
Pandis N et al. 2016 [28]	To assess the extent to which published protocols of RCTs adhere to SPIRIT	Cross-sectional	PubMed	Switzerland	December 2015	No specific speciality	101 protocols included 41 used SR to inform trial design	41% of protocols involved citation of a SR or RCT to inform trial design
Park et al. (2017) [29]	To examine the nature of redundancies in genetic epidemiology research	Cross-sectional	MAs from PubMed	Republic of Korea	From inception to August 15, 2016	Genetics	94 published MAs included. Thirty one percent of the overlapping associations referenced a previous MA	Genetic association MAs were found to be redundant, erroneous, and lacking references
Robinson KA et al. 2011 [30]	To assess the extent to which reports of RCTs cite prior trials studying the same interventions	Cross-sectional and meta-analysis	Web of Science	United States	July 2004	No specific speciality	227 MAs comprising 1,523 RCTs included—3–58 prior citable RCTs (mean 9.7) of which an average of 1.9 were cited	Across health disciplines, less than 25% prior RCTs were cited
Rauh et al. (2020) [31]	To analyze published articles for citation of SRs for justification of conducting RCTs	Cross-sectional	PubMed	United States	January 1, 2014 –December 31, 2017	Obstetrics and Gynecology	458 included publications 279 (60.92%) cited an SR in the Introduction 34 (7.42%) cited an SR in the methods 207 (45.2%) cited an SR in the discussion	A large portion of the RCTs recently published in clinical obstetrics and gynecology journals are not citing SRs as justification for conducting their studies
Rosenthal R et al. 2017 [32]	To investigate the use of SRs to inform trial design and for overall evidence synthesis	Cross-sectional	RCTs in all issues of Annals of Surg., JAMA Surg., and British Journal of Surg in	Switzerland	2010	Surgical trials	51 studies included—8 (16%) referred to a SR in the Introduction.	Two-thirds of the included RCT referenced an SR but none to inform trial design



Table 1. Continued

Study	Aim	Design	Material	Country	Inclusion period	Area of interest	Results	Conclusion
2010								
Sawin et al. (2016) [33]	To examine citation within cohorts of trials across publication years	Cross-sectional	Meta-analyses, conducted within systematic reviews from ISI Web of Knowledge	United States	2011	Cardiovascular disease	86 MAs were included with 580 trials. Reports of trials cited 25% of prior trials, capturing 31% of trial participants.	Selective undercitation of prior research continues; three-quarters of existing evidence is ignored.
Seehra et al. (2021) [34]	To assess the extent to which reports of dental RCTs cite prior SRs to explain the rationale or justification of the trial.	Cross-sectional	An electronic database search was undertaken to identify dental RCTs	United Kingdom	between January 1, 2014 and December 31, 2019	Dental Specialty Journals	682 RCTs were included of which 37.5% did not cite a SR in the introduction to justify the rationale	A relatively high proportion of dental RCTs (37.5%) did not cite a SR in the Introduction section.
Shepard et al. (2021) [35]	To appraise the use of SRs as justification in RCTs	Cross-sectional	RCTs published in the top four urology Journals based on Google Scholar h5 index.	United States	November 30, 2014 –November 30, 2019	Urology	276 RCTs included with a total of 403 SR citations: 15 SR citations (3.7%) in methods	RCTs published in four high impact urology journals inconsistently referenced an SR as justification.
Sigurdson et al. (2020) [36]	To determine when two articles are investigating the same association	Cross-sectional	Meta-analyses evaluating all types of genes and phenotypes.	United States	2010	Genetic epidemiology	99 duplicate MA were included. Only 12 (32%) of the index MA were unambiguously unique.	Duplication is common in MA of genetic associations
Torgerson et al. (2020) [37]	To evaluate the use of systematic reviews to justify conducting a RCTs	Cross-sectional	RCTs published in the top five Google Scholar h-5 index journals	United States	December 5, 2018	Ophthalmology and Optometry	152 RCTs included of which none cited an SR regarding design Trials citing SR: 0 in methods	Less than one-quarter of phase III RCTs cited systematic reviews as justification for conducting the RCT.
Walters et al. (2020) [38]	To evaluate whether RCTs referenced SRs as the basis for conducting a trial.	Cross-sectional	RCTs published in three high impact factor	United States	January 1, 2016 –August 31, 2018	General medicine	637 RCTs included 728 SR citations 243 (38.1%) cited an SR for trial justification	Less than half of the analyzed clinical trials cited SRs as the basis for undertaking the trial.

*Abbreviations:* RCT, randomized controlled trial; SR, systematic review; CPR, cardiovascular clinical prediction rules; CNLBP, chronic nonspecific low back pain; HTA, health technology assessment; NIH, National Institute for Health and Care Research.

**Table 2.** Risk of bias (High; Low; Unclear)

Study	1. Clear and focused aim	2. Match between aim and method(s)	3. The best data source(s) chosen	4. All important variables considered	5. The same variables considered in all data sources	6. Data collection transparent and data unambiguously identified	7. Classification of the variables unaffected of prior knowledge about the results	8. Appropriate analysis method	9. Systematic error(s) or bias taken into consideration	10. Conclusion supported by data
Andrade NS et al. 2013 [13]	Low	Low	Unclear	Low (argued)	Low	Low	High	Low	Low	Low
Ban JW et al. 2017 [14]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Bhurke S et al. 2015 [15]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Bolland et al. 2018 [16]	Low	Low	Unclear	Unclear	Low	Low	High	Low	High	Low
Chapman et al. 2019 [17]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Chow JT et al. 2017 [18]	Low	Low	Unclear	Low	Low	Low	High	High	Low	Low
Conde-Taboada A et al. 2014 [19]	Low	Low	Low	Low	Low	Unclear	high	Low	Low	Low
De Meulemeester J. et al. 2018 [20]	Low	Low	Unclear	Low	Low	Low	High	Low	Low	Low
Engelking A et al. 2018 [9]	Low	Low	Unclear	Low	Low	Unclear	High	Low	Low	Low
Goudie AC et al. 2010 [21]	Low	Low	Unclear	Low	Low	Unclear	High	Low	Low	Low
Habre C et al. 2014 [22]	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Helfer B et al. 2015 [23]	Low	Low	Unclear	Low	Low	Low	High	Low	Low	Low
Hoderlein X et al. 2017 [24]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Johnson et al. 2020 [25]	Low	Low	Unclear	Low	Low	Low	Low	Low	Low	Low
Jones AP et al. 2013 [26]	Low	Low	Unclear	Low	Low	Low	High	Low	Low	Low
Paludan-Müller et al. (2019) [27]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Pandis N et al. 2016 [28]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Park et al. 2017 [29]	Low	Low	Unclear	Low	Low	Low	High	Low	High	Low
Robinson KA et al. 2011 [30]	Low	Low	Unclear	High	Low	Unclear	High	Low	Low	Low
Rauh et al. 2020 [31]	Low	Low	Unclear	Unclear	Low	Low	High	Low	High	Low
Rosenthal R et al. 2017 [32]	Low	Low	Unclear	Unclear	Low	Low	High	Low	High	Low
Sawin et al. 2016 [33]	Low	Low	Unclear	High	Low	Low	High	Low	High	Low

(Continued)

Table 2. Continued

Study	1. Clear and focused aim	2. Match between aim and method(s)	3. The best data source(s) chosen	4. All important variables considered	5. The same variables considered in all data sources	6. Data collection transparent and data unambiguously identified	7. Classification of the variables unaffected of prior knowledge about the results	8. Appropriate analysis method	9. Systematic error(s) or bias taken into consideration	10. Conclusion supported by data
Seehra et al. 2021 [34]	Low	Low	Unclear	Low	Low	Low	High	Low	Low	Low
Shepard et al. 2021 [35]	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Sigurdson et al. 2020 [36]	Low	Low	Unclear	Low	Low	High	Unclear	Low	Low	Low
Torgerson et al. 2020 [37]	Low	Low	Unclear	Low	Low	Low	High	Low	Low	Low
Walters et al. 2020 [38]	Low	Low	Unclear	Low	Low	Low	High	Low	High	Low

physiotherapy [24], or focusing across medical specialties [18]. The remaining nine studies [15,16,20,21,23,26–28,30] did not focus on a specific specialty.

The number of publications analyzed in the included studies varied considerably, ranging from 27 [22] to 637 [35]. Further details of the study characteristics are presented in Table 1.

### 3.3. Risk of bias assessment

All of the included studies presented a clear and focused aim and a good match between aim and methods; they considered the same variables from all sources and their conclusions were supported by data (Table 2). However, two-thirds (18/27) of the studies provided no or insufficient justification or explanation for selecting their sources and were given an unclear risk of bias rating and 89% (24/27) of the studies had no publicly available protocol registered before the study, resulting in a high risk of bias rating.

### 3.4. Narrative synthesis

Regarding citation analysis methods for monitoring the implementation of EBR, the majority ( $n = 19$ ) of the included studies examined whether SRs were cited in published trial reports [9,15–21,23–26,29,31,32,34,35,37,38], whereas the remaining studies examined whether earlier published trials influenced subsequent research questions [13], earlier published trials were cited in subsequent trials [14,30,33], a specific review was cited in subsequent research [22], ethically approved protocols justify their rationale based on previous trials [27], or published protocols adhered to a specific guideline (SPIRIT) [28]. One study investigated whether published meta-analyses were unique or redundant and one study added a survey to their

literature review to examine why some authors did not cite an existing SR [14].

### 3.5. Justifying new research

Most of the included studies ( $n = 19$ ) focused on the justification of new research (Table 3). Overall, the rationale was either to determine the effect of previous research on subsequent research or to understand why researchers initiate new trials when similar trials exist. The approach to citation analyses in the included studies was highly heterogeneous. Simple approaches involved investigating whether a reference to another study was made to provide a rationale and justify new research. In this context, most authors referred to SRs or meta-analyses to support their claims, while others also allowed primary studies as justification. In most cases, one reference was considered sufficient to justify new research. More elaborate approaches requested more than one reference as justification. For example, one study called for several criteria to be met: a clearly stated hypothesis, references to “equipoise” or “lack of consensus,” an indication of uncertainty, and a review supporting these claims [20]. Only two studies considered whether a citation related to a relevant SR as judged by the authors [20] or a specific SR, respectively [22].

### 3.6. Designing new studies

Ten studies addressed both the “justification of new research” and the “informed design of new studies,” while four studies focused only on the “informed design of new studies.” Two studies, Jones et al. (2013) and Bhurke et al. (2015), looked for citations to inform trial design [15,26], which can be regarded as another simple approach. Furthermore, one of the studies [15] replicated Jones et al.’s

Table 3. Results

Study	Unit of analysis (what is analysed)	Citations of interest/citation type (e.g., RCTs, SRs); definition (if reported)	Number of units included	Definition of using research articles in the context of Justifications, Design, and Placing in context
Andrade NS et al. 2013 [13]	RCT publications	The number of times RCTs from 2010 to 2011 cited four specific indication (index) RCTs. The number of indication trials published after the first four indication trials. Citation frequency as indication of the impact of the four indication trials	39 RCTs	To determine the effect of previous research on the subsequent research agenda (i.e., <b>justification</b> )
Ban JW et al. 2017 [14]	Primary studies publications	The citation of existing CPR (in the field)	85 CPRs	<b>Justification</b> (to understand why authors proceed to develop a new CPR when previous CPR exist)
Bhurke Set al. 2015 [15]	RCT publications	SRs (Cochrane review); other reviews if SR was mentioned in the title and methods	47 (cohort I) 34 (cohort II)	<b>Design</b> justification of design elements
Bolland et al. 2018 [16]	(Large) RCTs	SRs of RCTs (relevant to primary endpoint of the trial)	25 RCTs (18 published, seven ongoing or planned)	<b>Justification</b>
Chapman et al. 2019 [17]	RCT publications	SRs	221 RCTs	<b>Justification, design</b> (justification of design elements)
Chow JT et al. 2017 [18]	RCT publications	Any information relating to the justification for conducting RCTs	148 RCTs	<b>Justification</b> The use of previous evidence as the reason for conducting an RCT
Conde-Taboada A et al. 2014 [19]	RCT publications and narrative reviews	SRs	72 RCTs and 24 narrative reviews (for which a SR was available)	Not specifically stated but the risk of redundant studies is mentioned— <b>justification</b>
De Meulemeester J et al. 2018 [20]	RCT publications	SRs	208 RCTs (and 199 corresponding protocols)	<b>Justification and design</b> Three scientific criteria justifying an RCT. Protocol design
Engelking A et al. 2018 [9]	RCT publications	SRs/relevant SRs	622 RCTs	<b>Justification, design, and context</b> Whether a SR was mentioned to justify (introduction and methods) or when discussing
Goudie AC et al. 2010 [21]	RCT publications	SR with meta-analysis	27 RCTs	<b>Justification, design, and context</b> Consulting previous research before embarking a new trial and basing it on the impact of an updated MA will make reporting and designing more efficient
Habre C et al. 2014 [22]	RCT publications	SRs with meta-analysis (i.e., the Picard review)	136 RCTs	<b>Design</b> Whether the Picard review had influenced the design of subsequent trials
Helfer B et al. 2015 [23]	SR/MA publications	SR/MA	48 MAs	<b>Justification and context</b> Whether MAs present an outline of available evidence
Hoderlein X et al. 2017 [24]	RCT publications	SRs (should be part of a clinical guideline)	121 (70 trials published in 2001 and 151 trials published in 2015)	<b>Justification and context</b> To use high-quality clinical research to justify the need for the trial
Johnson et al. 2020 [25]	RCT publications	SRs	128 RCTs	<b>Justification</b>

(Continued)

Table 3. Continued

Study	Unit of analysis (what is analysed)	Citations of interest/citation type (e.g., RCTs, SRs); definition (if reported)	Number of units included	Definition of using research articles in the context of Justifications, Design, and Placing in context
Jones AP et al. 2013 [26]	RCT funding applications	SRs (85 SR referenced in 37 applications; SR cited and specific information how it was used in the study design and planning)	48 trials	<b>Design</b> (justification of design elements)
Paludan-Müller et al. (2019) [27]	RCT protocols submitted to ethics committees	SRs and RCTs	67 protocols	<b>Justification and design</b>
Pandis N et al. 2016 [28]	RCT protocol publications	RCTs	101 protocols	<b>Design</b> The extent to which published protocols of RCTs adhere to SPIRIT
Park et al. 2017 [29]	Meta-analyses publications	Meta-analyses	94 Meta-analyses	<b>Context</b>
Rauh et al. (2020) [31]	RCT publications	SRs	458 RCTs	<b>Design, justification, and context</b>
Robinson KA et al. 2011 [30]	RCT publications	RCTs, SRs (only in a small subset of 30 RCTs; citation of RCTs that were published more than 1 yr before the citing RCT.)	1,523 RCTs (in 257 SRs)	Not stated
Rosenthal R et al. 2017 [32]	RCT publications	RCTs (Citation of a SR on the same topic as the RCT)	51 RCTs	<b>Design, justification, and context</b> The use of SRs to inform trial design and for overall evidence synthesis (of results)
Sawin et al. 2016 [33]	Meta-analyses	Meta-analyses, conducted within systematic reviews	86 meta-analyses	Not stated citation of previous trials in the same cohort. A trial was determined to be citable if it was published at least 1 yr before the citing trial.
Seehra et al. 2021 [34]	RCT publications	SRs (citation of prior SRs in RCTs)	682 RCTs	<b>Justification</b> Citation of a SR used to justify the rationale of the trial and relevant to the primary trial Outcome (yes or no)
Shepard et al. 2021 [35]	RCT publications	SRs (citation SRs in RCTs)	276 RCTs	<b>Justification and design</b> Whether the RCT used these citations to justify the trial
Sigurdson et al. 2020 [36]	Meta-analyses publications	MA (citation of previous MAs in MAs)	99 meta-analyses	Not stated MAs citing previous MAs
Torgerson et al. 2020 [37]	RCT publications	SRs (citation SRs in RCTs)	152 RCTs	<b>Justification and design</b> RCTs that cited a systematic review as justification for conducting the RCT (verbatim or inferred)
Walters et al. 2020 [38]	RCT publications	SRs (citation SRs in RCTs)	637 RCTs	<b>Justification, design, and context</b> Whether SRs were cited as justification for conducting the RCT in the introduction, methods, and discussion/ conclusion

Abbreviations: RCT, randomized controlled trial; SR, systematic review; MA, meta-analysis.

[26] study to identify changes over time. Habre et al. (2014) took a more sophisticated approach, focusing on the citation of a specific review. However, this study operated on a clinical single-case scenario, comparing trials published before or after the landmark review. Finally, one study followed the SPIRIT guideline in which one item calls for the citation of prior research and justification based on gaps in the underlying evidence [28].

### 3.7. Putting research into context

None of the studies focused exclusively on contextualizing research. Five studies focused on justification, design, and context [9,21,31,32,38] and applied the same methodology to all three categories, while two studies used the same methods to elucidate justification and contextualization [23,24].

## 4. Discussion

This is the first study to investigate citation analysis in the context of EBR. This review has shown that citation analyses are characterized by focusing on the citation of SRs or meta-analyses and, to some extent, the citation of previous trials or guideline adherence. However, how authors of meta-research define their outcomes, that is, how the reference of a landmark review or adherence to reporting guidelines contribute to the justification, design, or contextualization of clinical trials appears rather arbitrary. Thus, our most striking result appears to be the overall lack of definition of relevant outcomes in meta-research studies conducting citation analyses.

The use of citation analysis in meta-research is rather new in health sciences. The oldest study in our review was published in 2010, while the number of citation analyses is rising steadily. Citation analysis, originally rooted in bibliometrics, has been used in other contexts for decades [39]. However, citation analyses are not necessarily strongly related to EBR but rather are considered a relevant proxy by which EBR may be monitored. This also explains why no similar studies were identified to compare and contextualize our results. As citation analyses are applied across disciplines, the sharing of knowledge and experiences is highly desirable to further develop citation analysis as a way to monitor EBR.

In our sample, we observed substantial heterogeneity in methodological approaches. While we acknowledge that some methodological differences might be explained by the different focuses of the analyzed studies, the main differences observed are general in nature. First, the citations of interest in the included studies were mostly SRs or meta-analyses. This is likely due to the general guidance that RCTs should be informed by SRs [40]. However, in areas with little research activity (i.e., no SRs and only a few primary studies), the citations of interest can also be primary studies, as was true in some of our included studies. We also observed

huge heterogeneity in sampling strategies, whose rationales were rarely given. Sample size also differed considerably across studies and was rarely explained. A lack of reporting guidance for methodological studies is known; however, reporting guidelines are currently being created [41]. Positively, data extraction methods often resembled the recommended SR methodology (e.g., data extraction by two independent reviewers) and may have contributed to reducing systematic biases and errors.

The methodological approaches applied in the included studies also varied widely in their complexity. Some studies simply assessed whether an SR was cited as a justification, resulting in yes or no answers (e.g., Engelking et al. [9]). The advantage of this approach is that it is widely applicable and thus a potentially feasible way to monitor the use of EBR. However, some questions need to be considered. First, the term “SR” is ill-defined in the scientific community [42]. Second, none to several published SRs could be cited and how authors should proceed in the latter case is unclear. Balancing the recentness and the methodological quality or risk of bias of SRs will pose a familiar challenge [43]. Citation cherry-picking might be an issue, particularly when SRs with discordant findings exist [44]. Third, simply looking for whether a citation is provided might be too simple. One might argue that this provides insufficient information for the reader to judge whether an RCT was justified. More sophisticated approaches might be needed to address this question. In one of our included studies, Helfer et al. [23] differentiated between citations that were cited, described, or discussed. This approach permits up-to-datedness and quality to be taken into account, improving on the simple approach. However, defining clear-cut guidance for differentiating between these categories (citing, describing, and discussing) might prove challenging.

### 4.1. Strengths and limitations

We applied a standard SR methodology for our study and specified the methods before starting the review (<https://osf.io/8759p/>). We included an international team of experts on the topic (EVBRES consortium) and conducted a comprehensive literature search. However, we must also acknowledge several limitations. First, despite relying on an extensive search strategy, we were likely unable to identify all citation analyses due to the broad concept (EBR) and vague terminology (citation analysis) we used. We also acknowledge that although we used a broad definition of citation analysis (examination of the frequency, patterns, and graphs of citations), while our included studies only reflect a narrow type of citation analysis (whether SRs or primary studies were cited to justify and/or design new research and/or to contextualize the results). Preparing the search strategy showed the complexity of searching for meta-research related to EBR, including the lack of unique search terms for both EBR and meta-research. Thus, our search strategy had a high sensitivity to capture the relevant studies

and, hence, a high degree of noise. Moreover, although the included meta-research studies were overall rated with a low risk of bias, this might not reflect the true variance among these studies but rather be a consequence of the checklist created to assess the risk of bias for this set of SRs. Despite being thoroughly discussed and continuously adjusted, the checklist still includes some challenges. However, a checklist or guidance appropriate for this study was not available and our checklist was continuously customized and adapted to fit our specific purpose. However, we fully acknowledge the need for a validated and reliable tool for evaluating the risk of bias in meta-research studies.

Finally, the analysis is limited to the application of citation analyses in biomedical and health sciences and should be expanded in future studies to cover more disciplines.

## 5. Conclusion

This review provides a starting point to further develop rigorous methods for citation analyses to make them useful for monitoring the implementation of EBR. We have highlighted some crucial points to seek consensus on and consider in future studies. Continued and improved efforts to promote EBR are needed, including a deliberate and systematic use of previous evidence when new clinical studies are justified, designed, or contextualized, to decrease potential research redundancy.

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## Appendix B

### Supplementary Data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclinepi.2022.06.021>.

## References

- [1] Robinson KA, Brunnhuber K, Ciliska D, Juhl CB, Christensen R, Lund H. Evidence-based research series-paper 1: what evidence-based research is and why is it important? *J Clin Epidemiol* 2021;129:151–7.
- [2] Lund H, Juhl CB, Nørgaard B, Draborg E, Henriksen M, Andreasen J, et al. Evidence-Based Research Series-Paper 3: using an Evidence-Based Research approach to place your results into context after the study is performed to ensure usefulness of the conclusion. *J Clin Epidemiol* 2021;129:167–71.
- [3] Lund H, Brunnhuber K, Juhl C, Robinson K, Leenaars M, Dorch BF, et al. Towards evidence based research. *BMJ* 2016;355:i5440.
- [4] Andreasen J, Nørgaard B, Draborg E, Juhl C, Yost J, Brunner EJ, et al. Justification of research using systematic reviews continues to be inconsistent in clinical health science - a systematic review and meta-analysis of meta-research studies 2022: (Submitted - in revision). (Accepted for publication in PLOS ONE, PONE-D-22-02383).
- [5] Nørgaard B, Draborg E, Andreasen J, Juhl CB, Yost J, Brunnhuber K, et al. Systematic reviews are rarely used to inform study design - a systematic review and meta-analysis. *J Clin Epidemiol* 2022;145:1–13.
- [6] Draborg E, Andreasen J, Nørgaard B, Juhl C, Yost J, Brunnhuber K, et al, editors. Authors hardly use existing evidence to contextualize new results - a systematic review and meta-analysis of clinical health meta-research studies. 2nd Evidence-Based Research Conference. EVBRES; 2021. 27-28 September; Online. Available at <https://evbres.eu/2nd-ebr-conf/>.
- [7] Lund H, Juhl CB, Nørgaard B, Draborg E, Henriksen M, Andreasen J, et al. Evidence-Based Research Series-Paper 2: using an Evidence-Based Research approach before a new study is conducted to ensure value. *J Clin Epidemiol* 2021;129:158–66.
- [8] van Wesel M. Evaluation by citation: trends in publication behavior, evaluation criteria, and the strive for high impact publications. *Sci Eng Ethics* 2016;22(1):199–225.
- [9] Engelking A, Cavar M, Puljak L. The use of systematic reviews to justify anaesthesiology trials: a meta-epidemiological study. *Eur J Pain* 2018;22(10):1844–9.
- [10] Clarke M, Hopewell S. Many reports of randomised trials still do not begin or end with a systematic review of the relevant evidence. *J Bahrain Med Soc* 2013;24:145–8.
- [11] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
- [12] Ioannidis JPA. Meta-research: why research on research matters. *PLoS Biol* 2018;16(3):e2005468.
- [13] Andrade NS, Flynn JP, Bartanusz V. Twenty-year perspective of randomized controlled trials for surgery of chronic nonspecific low back pain: citation bias and tangential knowledge. *Spine J* 2013;13(11):1698–704.
- [14] Ban JW, Wallace E, Stevens R, Perera R. Why do authors derive new cardiovascular clinical prediction rules in the presence of existing rules? A mixed methods study. *PLoS One* 2017;12:e0179102.
- [15] Bhurke S, Cook A, Tallant A, Young A, Williams E, Raftery J. Using systematic reviews to inform NIHR HTA trial planning and design: a retrospective cohort. *BMC Med Res Methodol* 2015;15:108.
- [16] Bolland MJ, Avenell A, Grey A. Assessment of research waste part 1: an exemplar from examining study design, surrogate and clinical endpoints in studies of calcium intake and vitamin D supplementation. *BMC Med Res Methodol* 2018;18:103.

- [17] Chapman S, Ragg M, McGeechan K. Citation bias in reported smoking prevalence in people with schizophrenia. *Aust N Z J Psychiatry* 2009;43(3):277–82.
- [18] Chow JT, Lam K, Naeem A, Akanda ZZ, Si FF, Hodge W. The pathway to RCTs: how many roads are there? Examining the homogeneity of RCT justification. *Trials* 2017;18(1):51.
- [19] Conde-Taboada A, Aranegui B, Garcia-Doval I, Davila-Seijo P, Gonzalez-Castro U. The use of systematic reviews in clinical trials and narrative reviews in dermatology: is the best evidence being used? *Actas Dermosifiliogr* 2014;105(3):295–9.
- [20] De Meulemeester J, Fedyk M, Jurkovic L, Reaume M, Dowlatshahi D, Stotts G, et al. Many randomized clinical trials may not be justified: a cross-sectional analysis of the ethics and science of randomized clinical trials. *J Clin Epidemiol* 2018;97:20–5.
- [21] Goudie AC, Sutton AJ, Jones DR, Donald A. Empirical assessment suggests that existing evidence could be used more fully in designing randomized controlled trials. *J Clin Epidemiol* 2010;63:983–91.
- [22] Habre C, Tramer MR, Popping DM, Elia N. Ability of a meta-analysis to prevent redundant research: systematic review of studies on pain from propofol injection. *BMJ* 2014;348:g5219.
- [23] Helfer B, Prosser A, Samara MT, Geddes JR, Cipriani A, Davis JM, et al. Recent meta-analyses neglect previous systematic reviews and meta-analyses about the same topic: a systematic examination. *BMC Med* 2015;13:82.
- [24] Hoderlein X, Moseley AM, Elkins MR. Citation of prior research has increased in introduction and discussion sections with time: a survey of clinical trials in physiotherapy. *Clin Trials* 2017;14:372–80.
- [25] Johnson AL, Walters C, Gray H, Torgerson T, Checketts JX, Boose M, et al. The use of systematic reviews to justify orthopaedic trauma randomized controlled trials: a cross-sectional analysis. *Injury* 2020;51:212–7.
- [26] Jones AP, Conroy E, Williamson PR, Clarke M, Gamble C. The use of systematic reviews in the planning, design and conduct of randomised trials: a retrospective cohort of NIHR HTA funded trials. *BMC Med Res Methodol* 2013;13:50.
- [27] Paludan-Müller AS, Ogden MC, Marquardsen M, Vive J, Jørgensen KJ, Gøtzsche PC. Do protocols for new randomised trials take previous similar trials into account? Cohort study of contemporary trial protocols. *BMJ Open* 2019;9(11):e026661.
- [28] Pandis N, Fleming PS, Koletsis D, Hopewell S. The citation of relevant systematic reviews and randomised trials in published reports of trial protocols. *Trials* 2016;17(1):581.
- [29] Park JH, Eisenhut M, van der Vliet HJ, Shin JI. Statistical controversies in clinical research: overlap and errors in the meta-analyses of microRNA genetic association studies in cancers. *Ann Oncol* 2017;28:1169–82.
- [30] Robinson KA, Goodman SN. A systematic examination of the citation of prior research in reports of randomized, controlled trials. *Ann Intern Med* 2011;154:50–5.
- [31] Rauh S, Nigro T, Sims M, Vassar M. The use of systematic reviews to justify randomized controlled trials in obstetrics & gynecology publications. *Eur J Obstet Gynecol Reprod Biol* 2020;252:627–8.
- [32] Rosenthal R, Bucher HC, Dwan K. The use of systematic reviews when designing and reporting surgical trials. *Ann Surg* 2017;265(4):e35–6.
- [33] Sawin VI, Robinson KA. Biased and inadequate citation of prior research in reports of cardiovascular trials is a continuing source of waste in research. *J Clin Epidemiol* 2016;69:174–8.
- [34] Seehra J, Liu C, Pandis N. Citation of prior systematic reviews in reports of randomized controlled trials published in dental speciality journals. *J Dent* 2021;109:103658.
- [35] Shepard S, Wise A, Johnson BS, Sajjadi NB, Hartwell M, Vassar M. Are randomized controlled trials in urology being conducted with justification? *J Osteopath Med* 2021;121(8):665–71.
- [36] Sigurdson MK, Khoury MJ, Ioannidis JPA. Redundant meta-analyses are common in genetic epidemiology. *J Clin Epidemiol* 2020;127:40–8.
- [37] Torgerson T, Evans S, Johnson BS, Vassar M. The use of systematic reviews to justify phase III ophthalmology trials: an analysis. *Eye (Lond)* 2020;34(11):2041–7.
- [38] Walters C, Torgerson T, Fladie I, Clifton A, Meyer C, Vassar M. Are randomized controlled trials being conducted with the right justification? *J Evid Based Med* 2020;13(3):181–2.
- [39] Smith LC. Citation analysis. *Libr Trends* 1981;30(1):83–106.
- [40] Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, et al. CONSORT 2010 Explanation and Elaboration: updated guidelines for reporting parallel group randomised trials. *BMJ* 2010;340:c869.
- [41] Lawson DO, Puljak L, Pieper D, Schandelmaier S, Collins GS, Brignardello-Petersen R, et al. Reporting of methodological studies in health research: a protocol for the development of the Methodological STudy reportIng Checklist (MISTIC). *BMJ Open* 2020;10(12):e040478.
- [42] Krnic Martinic M, Pieper D, Glatt A, Puljak L. Definition of a systematic review used in overviews of systematic reviews, meta-epidemiological studies and textbooks. *BMC Med Res Methodol* 2019;19:203.
- [43] Jo CL, Burchett H, Bastías M, Campbell P, Gamage D, Henaff L, et al. Using existing systematic reviews for developing vaccination recommendations: results of an international expert workshop. *Vaccine* 2021;39(23):3103–10.
- [44] Jadad AR, Cook DJ, Browman GP. A guide to interpreting discordant systematic reviews. *CMAJ* 1997;156(10):1411–6.