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Decisions about lumping vs. splitting of the scope of systematic reviews of complex interventions are not well justified: A case study in systematic reviews of health care professional reminders

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Abstract

Objectives: Lumping and splitting refer to the scope of a systematic review question, where lumped reviews are broad and split are narrow. The objective was to determine the frequency of lumping and splitting in systematic reviews of reminder interventions, assess how review authors justified their decisions about the scope of their reviews, and explore how review authors cited other systematic reviews in the field.

Study Design and Setting: A descriptive approach involving a content analysis and citation bibliometric study of an overview of 31 systematic reviews of reminder interventions.

Results: Twenty-four of 31 reminder reviews were split, most frequently across one category (population, intervention, study design, outcome). Review authors poorly justified their decisions about the scope of their reviews and tended not to cite other similar reviews.

Conclusion: This study demonstrates that for systematic reviews of reminder interventions, splitting is more common than lumping, with most reviews split by condition or targeted behavior. Review authors poorly justify the need for their review and do not cite relevant literature to put their reviews in the context of the available evidence. These factors may have contributed to a proliferation of systematic reviews of reminders and an overall disorganization of the literature.

Keywords: Systematic reviews; Research methodology; Reminder systems; Bibliometrics; Standards; Publishing

1. Introduction

A key issue for systematic review authors when planning their review is to decide the review's scope, specifically how broad or narrow the question should be, as this will have a substantial impact on the conduct and generalizability of the review [1]. The methodological rationale for undertaking a review with a broad scope (lumping) is that systematic reviews aim to identify the common generalizable features within similar interventions and minor differences in study characteristics may not be important. Whereas the methodological rationale for undertaking a review with a narrower scope (splitting) is that it is only appropriate to include studies which are highly similar in design, study population, intervention characteristics, and outcome recording [1]. Lumping allows the generalizability and consistency of research findings to be assessed across a wider range of settings and study populations which may reduce chance results by increasing the number of studies considered and allowing better judgments about the consistency of observed effects across studies. Lumping also allows for exploration of effects across different interventions, settings, and study populations [1,2]. However, split reviews have fewer included studies that are likely more homogeneous, which leads to a more manageable review with a higher likelihood of meta-analysis. This allows for a numerical interpretation of the data and a more specific research question (Table 1).

Systematic reviews may be split for feasibility issues if review authors have limited resources or because review authors are interested in a relatively narrow question. Although every systematic review is ''split'' to a certain degree, the decisions

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What is new?

Key finding:

- Systematic reviews of reminder interventions are frequently ''split'' with poor justification and do not adequately cite previous systematic reviews.

What this adds to what was known?

- Lumping and splitting have been discussed in the literature, but this is the first known investigation of lumping and splitting in a specific area.

What is the implication, what should change now?

- Systematic review authors and journal editors should be more aware of lumping and splitting. Authors should properly justify the conduct of their review and provide appropriate rationale for lumping or splitting their review question.

on the extent to which it will be split are sometimes more logical than others. For example, systematic reviews of the effects of clinical treatments could be split by population (e.g., children vs. adults), intervention (e.g., pharmaceutical vs. surgical), comparison (e.g., usual care vs. placebo), and outcome (e.g., mortality vs. quality of life). Usually the choice to split a review is based on considerations that the effects of the intervention would likely vary across the chosen factors and that the expected variation in effect is likely to be clinically significant; thus the results of a lumped review could be potentially misleading. Review authors are commonly able to justify their decision about the scope of their review based on the understanding of: the mechanisms of action of the interventions (e.g., a single drug vs. a class of drugs); the underlying disease processes (aetiological, epidemiological, or prognostic factors); methodological considerations/study designs (e.g., exclusion of nonrandomized studies); or outcomes of interest (e.g., evaluating health outcomes vs. social outcomes). Whereas systematic reviews of complex interventions, such as professional behavior change interventions, can similarly be split (Table 2), there is commonly a weaker theoretical or empirical basis to justify the choice of the factors that are appropriate to split on.

Table 1. Arguments for lumping and splitting

Arguments for lumping	Arguments for splitting
Greater potential to reduce chance findings	More feasible to conduct in terms of resources
Allows generalizability and consistency of research findings across wider range of settings, populations, and behaviors	More specific research question and targeted to area of interest
Ability to test a priori ideas of subgroup effects	Increased homogeneity of included studies

Despite the importance of deciding the scope of a review, there has been relatively little methodological consideration of this nor empirical investigation into how authors choose to lump or split and how they justify their decisions. In this study, we explore current lumping and splitting practices in the context of an overview of systematic reviews of reminder interventions to improve quality of care. The following research questions are addressed:

1. How are systematic reviews of reminder interventions ''lumped'' or ''split'' according to population, intervention, study design, and outcome?
2. How do review authors justify the framing of their research question?
3. Are authors putting their reviews in the context of the evidence by citing previously conducted reviews in the same areas?

2. Methods

2.1. Inclusion criteria

Systematic reviews were included if they had explicit methods and selection criteria and had a primary focus to evaluate reminder interventions targeting health professionals. Reminder interventions were defined as ''patient or encounter specific information, provided verbally, on paper or on a computer screen, designed or intended to prompt a health professional to recall information'' [3].

2.2. Selection of systematic reviews

As part of an overview of systematic reviews of health care professional behavior change interventions (www.rxforchange.ca), we undertook highly sensitive searches of various databases, including MEDLINE, EMBASE, DARE, and the Cochrane Library (see Appendix for all databases searched). All reviews were independently screened by two individuals, with disagreements resolved by consensus. For this study, systematic reviews of reminder interventions were identified for analysis.

Table 2. Clinical and nonclinical examples of lumping and splitting

Lumping and splitting: clinical example	Lumping and splitting: nonclinical example
• Interventions for the treatment of hypertension (lumped) • Pharmaceutical interventions for the treatment of hypertension (split on intervention) • Effects of beta-blockers for hypertension (further split on intervention)	• Effects of audit and feedback to health professionals on health care (lumped) • Effects of audit and feedback to improve diabetes care (split on patient population) • Effects of audit and feedback to improve diabetes care within primary care (split on patient population and setting)

2.3. Data analysis

Systematic reviews were categorized as lumped or split on population, study design, outcomes, setting, and condition/targeted behavior. A lumped review was defined as a systematic review that assessed the effect of reminder interventions for all health professionals on all outcomes, settings, conditions, and study designs, and a split review was defined as one that specified a certain subgroup in any of the five categories. For example, the title ''Improving preventive care by prompting physicians,'' would be considered split by population (physicians) and condition or targeted behavior (preventive care).

Two individuals independently made an assessment on whether an appropriate justification was provided for the investigation of the specific research question, with disagreements resolved by consensus. To assess this, each review was categorized on their level of justification provided. ''Clear justification'' included reviews that provided supporting theoretical arguments (e.g., strong theoretical argument that the splitting factor [e.g., targeted professional, setting, or type of behavior] was an important effect modifier) or empirical data (e.g., differential effects were observed in studies with the splitting factor compared with other studies) for splitting. ''Partial justification'' included reviews that stated differences in effects likely existed but provided no clear theoretical or empirical rationale. ''No justification'' included those that did not provide any rationale or justification for their review question.

In addition to the justification of the conduct of the review, we assessed whether review authors were putting their review findings in the context of other systematic reviews of reminders by examining the reference list of each review to see if previously published systematic reviews were cited.

If a review was an update to a previous systematic review, both versions were included and treated as two separate reviews.

3. Results

3.1. Description of systematic reviews

We identified 19,265 citations that included 183 systematic reviews evaluating health professional behavior change interventions and 31 evaluating the effectiveness of reminder interventions (Fig. 1). These 31 reviews were published between July 1987 and May 2008 in 19 different journals, ranging from having seven included studies to over 250 included studies in the review and with the contact author most likely being from the United States [4–34].

3.2. Frequency of lumping and splitting in reminder reviews

Seven systematic reviews were categorized as lumped (not split in any category) [10,15,17,18,21,26,30], including the following: four reviews that were part of a series of updated reviews on computerized clinical decision support systems [15,17,18,21]; a conference proceeding on computerized decision support systems (CDSSs) embedded in computerized physician order entry [26]; a review of all health information technologies [10]; and a review of computer-based guideline implementation [30].

Twenty-four reviews were categorized as split. Seventeen were split in one category [5,9,13,14,16,19,20,22–25,27,28,31–34], five were split in two categories [6–8,11,12], and two were split in three categories [4,29] (Table 3).

Half of the systematic reviews were split according to condition or targeted behavior, with preventive care and medication management/prescribing being the most commonly targeted behavior (Table 4). Seven systematic reviews were split by study design: six reviews only included randomized controlled trials and one review only included ''field evaluation studies.'' Three systematic reviews limited to physician-targeted interventions, with one limited to interventions targeting nurses. Only one review was split by outcome, which assessed the effect of clinical decision support systems on patient outcomes [31]. Five limited their reviews by setting, including ambulatory care, primary care, and outpatient settings.

To investigate numbers of included studies in the systematic reviews over time, the type of review (lumped or split) was plotted against the number of studies that were included in the review and grouped according to year of publication (Fig. 2). The lumped reviews showed increasing numbers of included studies with time, correlating with the cumulative increase in systematic reviews on reminder interventions. The reviews that were split in one and two categories had smaller numbers of included studies than lumped reviews.

3.3. Justification of decisions about scope of reviews

When justifying the conduct of their systematic review, authors often stated that their specific research question had not been investigated but did not provide evidence that their subset of studies warranted investigation in isolation of all reminder studies. Of the 24 split reviews, one provided full justification for their decision, seven provided partial justification, and 16 reviews provided no justification for their decision. Of the seven lumped reviews, two provided partial justification, with five providing no justification; however, the authors may have thought that there was an implicit assumption that the lumped question was appropriate to study.

Sintchenko et al. [31] was the only review to provide full justification for the scope of their research question, which assessed the effect of computerized decision support on patient outcomes and stated that it was more valid to measure patient outcomes than the usually evaluated health professional behavior outcomes. Of the reviews that provided partial justification, Eslami et al. [13] stated that the outpatient setting was more disorganized than other medical settings

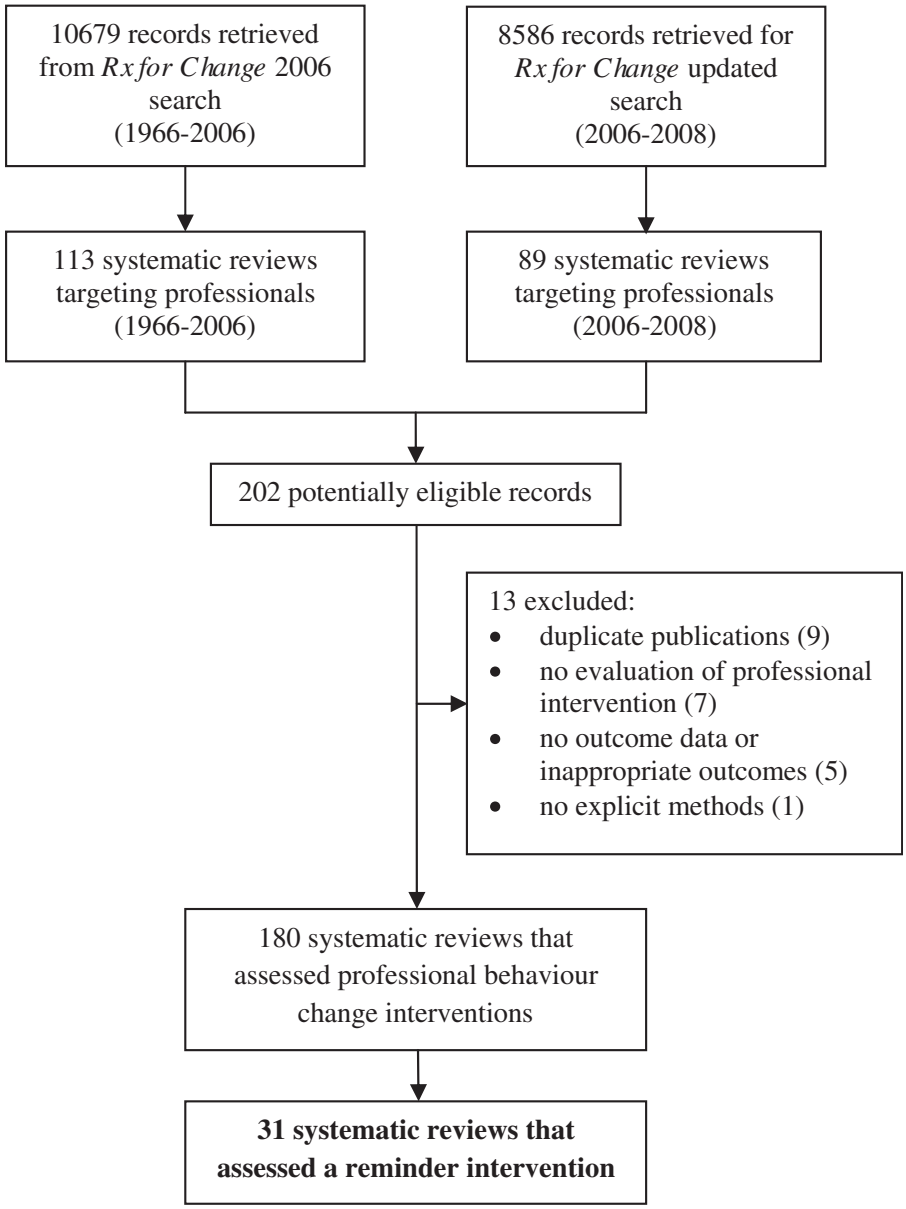

Fig. 1. Flow diagram for selected studies.

and thus reminders in that setting might prove to be more effective in improving patient care.

Reviews that provided no clear justification for the conduct of their review included Randell et al. [27], which looked at CDSSs for nurses but did not provide supporting arguments or rationale for why nurses needed to be analyzed separately from the general health professional population. Others assessed the effects of CDSSs for a specific clinical outcome, such as oral anticoagulation management but only stated that a review had not been completed in that area without justifying why it might have different results [14]. Authors such as Kawamoto et al. [23] conducted specific analyses that had not been done before, such as conducting a meta-analysis; however, given that they did not justify the conduct of a review in their specific topic area, they were still classified as having "no justification."

3.4. Citation of previous reminder reviews

Fig. 3 illustrates citations of previously published reminder systematic reviews for each of the 31 reminder reviews. Allowing for a 1-year lag in publication, the median number of prior cited reviews was two and the median percentage of prior cited systematic reviews per publication was 21%. Six systematic reviews did not cite any of the previous reminder reviews, and four cited one previous review. The review that was cited most frequently by other reviews was Johnston et al. [21] published in 1994, which continued to be cited up until 2006, even though it was

Table 3. Combinations of splits in systematic reviews of reminder interventions

Number of splits	Characteristic of split	No.		%
One	Condition [9,14,16,20,22,25,28,33,34]	9		
	Setting [13,19,24]	3		
	Study design [5,23]	2		
	Population [27,32]	2		
	Outcome [31]	1		
	Total		**17**	**54.8**
Two	Condition + study design [7,11,12]	3		
	Population + condition [6]	1		
	Setting + condition [8]	1		
	Total		**5**	**16.1**
Three	Population + condition + study design [4]	1		
	Setting + condition + study design [29]	1		
	Total		**2**	**6.5**

updated by subsequent publications in 1998 [18] and 2005 [15]. Five of the 31 systematic reviews were updates; three in the area of CDSS [15,18,21], one in the area of primary care [24], and one in the area of preventive care [12]. In some cases, authors cited a review when an updated version existed. Balas et al. [6] and Mitchell [24] cited the Johnston et al. [21] review in their 2000 and 2001 publications when this had been updated by Hunt et al. [18] approximately 2 years earlier, and Georgiou et al. [16] cited the Hunt et al. review when it had been updated by Garg et al. [15] 2 years before.

Table 4. Characteristics of splits in systematic reviews of reminder interventions

Level of split	Characteristic of split	No.	%
Population	Physicians [4,6]	2	
	Physicians—general practitioners only [32]	1	
	Nurses [27]	1	
	Total	**4**	**12.9**
Study design	RCTs [29,4,5,7,12,23]	6	
	Field evaluation studies [11]	1	
	Total	**7**	**22.6**
Outcomes	Patient outcomes [31]	1	
	Total	**1**	**3.2**
Setting	Outpatient care [13,19]	2	
	Ambulatory care [29,8]	2	
	Primary care [24]	1	
	Total	**5**	**16.1**
Condition or targeted behavior	Preventive care [29,4,6,8,12]	5	
	Medication management or prescribing [7,22,33,34]	4	
	Anticoagulation therapy [9,14]	2	
	Cancer [20]	1	
	Hypertension [25]	1	
	Asthma [28]	1	
	Chest pain [11]	1	
	Pathology services [16]	1	
	Total	**16**	**51.6**

Abbreviation: RCT, randomized controlled trial.

4. Discussion

This descriptive analysis demonstrates that for systematic reviews of reminder interventions, splitting is more common than lumping and most split reviews are split by type of reminder or condition. Review authors poorly justify their decisions about the scope of their review and do not cite relevant literature to put their split reviews in the context of the available research. This leads to a poorly organized field of research.

The issue of lumping and splitting of systematic reviews has been discussed in the medical literature but not empirically assessed. This is the first known investigation into the frequency of lumping and splitting in a group of systematic reviews. With the increase in publication of systematic reviews over the years, this study provides a unique examination into the issue of citing previous reviews in the same topic area. Through a careful search of all systematic reviews of reminder interventions, this study shows that although a popular and frequently published topic of research, literature on reminder interventions is not organized in a way that makes it easy to access or understand.

Limitations of this study exist. Although the analyses conducted in the study were as objective as possible, they were based on a subjective conception of lumping and

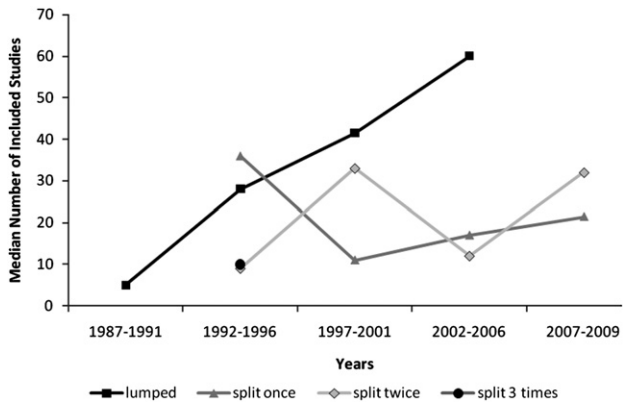

Fig. 2. Median number of included studies according to year and number of times split.

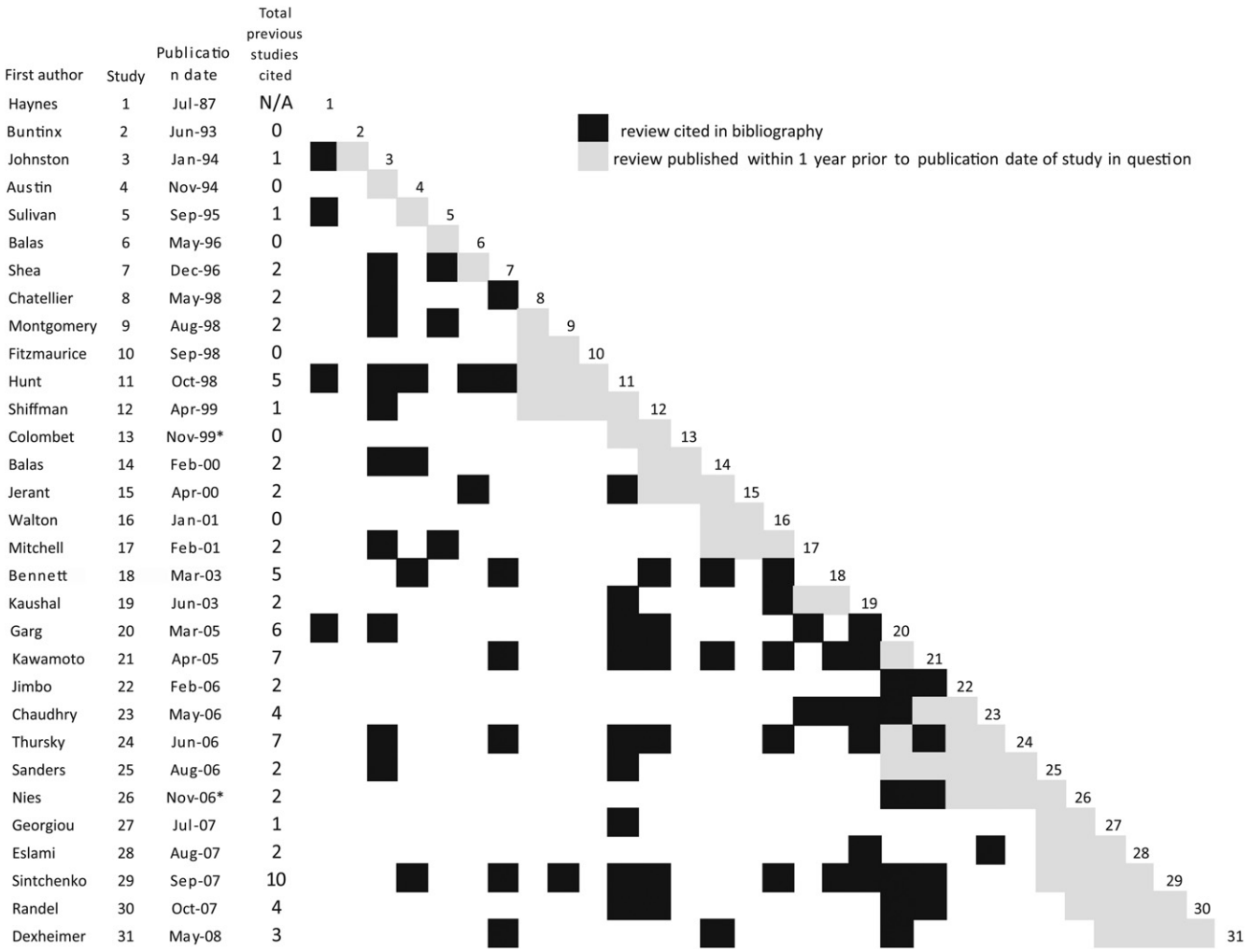

Fig. 3. Citations of previous reminder systematic reviews.

splitting categories. Also, it is possible that authors of systematic reviews were aware of previous publications but did not cite them. Furthermore, deletions from the manuscript may have been the result of the peer review or the editorial process of publication. This analysis should be repeated in other fields of study to see if this disorganization is consistent across other medical and scientific subject areas.

This study will hopefully lead to the awareness that decisions on lumping or splitting in a systematic review is an important methodological consideration and impacts the usability of the review. Similar to subgroup analyses, review questions based on smaller split groups should be based on an a priori justification that the group in question may differ from the whole. Furthermore, this justification should be clearly stated in the text. Given that most systematic reviews do not report working from a protocol [35], it is difficult for a reader to know whether decisions to split were made post hoc and are a result of inappropriate ''data dredging.'' When systematic reviews are conducted on certain subgroups, then reasonable justification should be provided to support the authors' decision to split, instead of only the judgment of authors, which seems to be the current practice.

The results of this study show that reminder reviews have been published that address review questions that have previously been evaluated suggesting potential inappropriate duplicate of effort and inefficient use of resources. Journals and journal editors should encourage review authors to put their reviews in the context of the existing literature of systematic reviews to justify resource utilization and prevent redundant publications on the same topic area. Furthermore, it is recommended that journal editors be cautious when they are presented with highly split or overlapping reviews and they should encourage review authors to justify the need for a subspecialized review question that might have been answered through a larger, more generalizable systematic review. Currently, guidelines, such as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) state that authors need to provide rationale for their review in the context of the existing research; however, guidelines could potentially expand on this recommendation and state that authors consider other existing

systematic reviews and provide more substantial justification for their reviews [36]. The issue of lumping and splitting is far from clear, but the more that review authors consider how their review will be interpreted, the more useable the reviews will be and the better the overall organization of the field of systematic reviews will be.

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Appendix

Databases searched

- MEDLINE
- Cochrane EPOC (Effective Practice and Organisation of Care) review database
- DARE (Database of Abstracts of Reviews of Effects)
- NHS (National Health Service) Economic Evaluation Database
- EMBASE
- Econlit
- ABI/Inform
- Proquest Digital Dissertations and Theses (formerly known as Dissertation Abstracts
- PsycINFO
- CINAHL (Cumulative Index to Nursing & Allied Health)
- ERIC (Education Resources Information Center)
- IPA (International Pharmaceutical Abstracts)

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