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The efficiency of database searches for creating systematic reviews was improved by search filters

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Abstract

Objectives: To compare Clinical Queries (CQs) for randomized trials of therapy 'methods' and 'NOT' limits search filters with Cochrane methods filters.

Study Design and Setting: Analytic survey of Cochrane reviews as the reference standard for retrieving studies included in the reviews (''included studies [ISs]''). The sensitivity and precision of Cochrane content terms + Cochrane methods terms were compared in MEDLINE and Embase with Cochrane content terms + CQs maximally sensitive filter for therapy studies, without and with additional 'NOT' limits (CQ-S [CQ sensitive]; CQ-S + limits) and a balanced filter without and with additional NOT limits (CQ-B [CQ balanced]; CQ-B + limits).

Results: Cochrane or CQ methods terms reduced, by 64–96%, the overall retrieval of articles with minimal loss of ISs. Sensitivity was high and similar for the 4 filters. However, CQ-B + limits had the highest precision (2.64%, number needed to be read to find one eligible study [NNR] 38) followed by the CQ-B (1.05%, NNR 95), Cochrane search (0.51%, NNR 198), CQ-S + limits (0.34%, NNR 296), and CQ-S filters (0.31%, NNR 325).

Conclusion: For systematic reviews of therapeutic interventions, the efficiency of searches in MEDLINE and Embase was better served by the CQs for therapy studies with balanced methods filter and NOT limits.

Keywords: MEDLINE; Embase; Cochrane review; Clinical queries; Sensitivity; Precision; Information retrieval

1. Introduction

Finding all articles that meet criteria for a systematic review (SR) of the medical literature is a painstaking task that typically begins with online searching of large bibliographic databases such as MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Central Register of Controlled Trials, and others. The sine qua non of such a review is to find all on-topic studies, but efficiency is important as well if reviews are to be done in an economical and timely fashion or at all.

Cochrane Reviews (CRs) are considered the reference standard for rigor for SRs and make use of search filters for online bibliographic databases [1]. These filters typically have two or three components, including ''content'' terms for detecting all potentially eligible studies that address the review's question, ''methods'' filters including a few terms for selecting studies with appropriate research designs (e.g., randomized controlled trials), and exclusionary NOT limits to filter out articles reporting suboptimal research designs for the review question, for example, NOT studies in animals and NOT observational studies in humans, when the study question has to do with the efficacy of a human health care intervention. The prime goal for all filters is high sensitivity (the proportion of all eligible studies that are retrieved), but this typically results in low specificity (the proportion of off topic or low quality studies that are not retrieved) and low precision (the proportion of retrieved studies that are eligible for the review). The proportion of

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What is new?

Key Findings

- In literature database searches for systematic reviews of interventions, the use of methods search terms and NOT limits substantially reduced, by 64% to 96%, the overall yield of articles with minimal loss of included studies.
- Absolute sensitivities for both Clinical Queries (CQs) filters and Cochrane filters were virtually identical.
- None of the filters was very precise, but the balanced CQs filter with limits was most precise and the sensitive Clinical Queries filter was least precise.

What this adds to what was known?

- Methods filters and NOT limits greatly reduce the number of articles from bibliographic databases that reviewers need to read to find eligible studies.

What is the implication and what should change now?

- The CQs balanced filter with NOT limits should be considered for systematic review searches for health care interventions.

off-topic articles that are retrieved in SR searches averages 97% [2] but this varies for methods search filters, depending heavily on the cutoff used for sensitivity: the higher the sensitivity, the lower will be the specificity and precision [3]. In any event, all retrieved articles must be assessed by human experts, preferably in duplicate, to find the tiny fraction of eligible studies. Further, even the best search filter may fall short of retrieving all eligible studies and must be supplemented by seeking unpublished studies, manual review of nonindexed journals, reviewing citations in retrieved studies and related reviews, polling researchers in the field, and so on.

The sensitivity of search filters is rightly of highest priority, but if there were ways of filtering out studies that are off topic or of too low quality in their research methods, without losing eligible studies, then the specificity and precision of searching, and therefore efficiency, would be of interest.

Clinical Queries (CQs) [4] are validated methods filters and may or may not include NOT limits, mainly to exclude animal studies and nonresearch reports such as editorials. CQs were originally developed to assist clinicians with efficient searches for higher quality clinical studies such as randomized trials and SRs. CQs typically have high sensitivity but also relatively high specificity, and thus may also help those conducting SRs. CQs have been created with various trade-offs of sensitivity and specificity, providing the user with options. The CQ sensitive filter (CQ-S) is designed to maximize the number of relevant articles retrieved in the literature search, whereas the CQ balanced strategy (CQ-B) is designed to achieve the best balance between the sensitivity and specificity.

This study compared CQs for studies testing interventions for human health care (prevention or therapy) with the methods filter component of search strategies in a sample of CRs, treating the studies meeting all review criteria (‘‘included studies [ISs]’’) in these reviews as the reference standard for sensitivity and determining the precision of CQ therapy filters relative to the methods filters in a sample of CRs (Cochrane search [CS]). The study also assessed the trade-off between sensitivity and precision for CQs, with and without NOT limits.

2. Methods

We conducted an analytic survey of CRs and their ISs, to address these questions:

1. In CRs of interventions for prevention or treatment, what is the performance of searches (as measured by sensitivity and precision) with Cochrane content terms + Cochrane methods filter terms (CS) compared with Cochrane content terms + (a) CQs sensitive filter (CQ-S) for therapy studies or (b) CQs balanced filter for therapy studies (CQ-B)?
2. What is the effect on sensitivity and precision of adding NOT filters (limits) to the CQ methods filters?

2.1. Literature search and study selection

We searched the term ‘‘intervention’’ in the titles, abstracts, or keywords in the Cochrane Database of Systematic Reviews to retrieve all CRs that met our inclusion criteria. CRs were reviewed sequentially in reverse chronological order of publication, to meet our sample size of at least 377 ISs with the following inclusion criteria: (a) CR for treatment published before our study inception date, September 30, 2015; (b) CR must have a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study flow diagram; (c) CR must have an explicit, reproducible search strategy that can be executed, as published, in at least one of Ovid MEDLINE or Ovid Embase; (d) CR must not use a CQ filter to complete the searches (to avoid incorporation bias in which our CQ filters are already part of their process); and (e) CR must include a Characteristics of ISs section including information regarding the methods of the ISs. For reviews that were updates, we excluded studies from the previous versions of the review (totaling 12 ISs), as searches or searching circumstances for the prior version may have differed.

The sample size for this study was based on the article by Yao et al. [5], which provides guidance for determining sample size when estimating proportional yields for search