Searching the literature for studies for a systematic review. Part 1: Identifying search concepts in a question

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Searching the literature for studies that meet the inclusion criteria is one of the first stages of a systematic review.[1] A quality literature search is a systematic survey of the literature on a specific topic or clinical question. It goes beyond a cursory search of the literature to a series of steps that are well organized and planned before the search itself: selecting relevant databases, formulating a structured question, applying specific criteria before executing the search to reduce selection bias, creating a series of search queries using relevant keywords, and reviewing each result for suitability. The end goal is to perform a critical appraisal of the selected relevant literature to understand the context of a topic or to answer a clinical question. Constructing a thorough and appropriate search strategy is a core skill in the practice of evidence-based medicine, and it is essential to a high-quality systematic review. It is advisable to consult with an expert searcher, medical librarian, or information specialist before undertaking a search.

A systematic search is a balancing act between sensitivity and specificity.[2] If a review is to be as rigorous as possible, then all possible evidence should be retrieved in a search. However, if the search is too sensitive, the volume of studies retrieved that are not relevant will be overwhelming. Cochrane systematic reviews aim for maximum sensitivity, but this might not be appropriate for all types of review. Deciding the amount of uncertainty that is acceptable is be an important factor to consider in designing the search.

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DOCUMENTING THE SEARCH

Regardless of whether a search is basic or advanced, stages of the search procedures, such as specifying the key terms, databases used and the date range used within each, fields selected, dates of access, a history of search sets, and the justification for excluding data, should be documented to provide an audit trail, reduce the time needed for future searches, and yield a list of terminologies. Another researcher should be able to replicate the search strategy exactly in the databases specified to verify the reliability of the research.

QUESTIONS TO CONSIDER

The Cochrane Handbook of Systematic Reviews of Interventions gives the following initial questions to answer when starting to think about a search strategy for a systematic review:[3]

- What type of study designs will be included? Will it only be one type of study (for example, randomized controlled trials) or all types?
- Will the data to be extracted from the studies include adverse events data? If so, will a separate search be needed?
- Are there any geographic considerations to take into account (for example, Is the condition more prevalent in certain parts of the world? Is the intervention practiced only in certain areas of the world?)
- Will data from unpublished studies be included?
- How will the search concepts be identified in a review question?

A search strategy is the representation of a clinical question broken down into searchable concepts, which are then applied to a bibliographic database or search engine. The formulation of an appropriate clinical question for a systematic review is vital, and the step of breaking a question down into concepts can be a strong indication of the suitability of the question itself.[4] For example, if the question is very broad and there is difficulty in formulating search terms as a result, the

researcher may want to rethink the question and focus on a particular aspect.

Several frameworks exist to guide thinking around creating a question for systematic review. Search terms can then be developed from the framework and built into a search strategy.

PICO

PICO is the most popular framework for systematic reviews of interventions, and is the usual format of a Cochrane review.[4] A PICO formula concentrates on 4 aspects:

P. Patients, Population, or Problem: What are the important characteristics of the patients or problem?

I. Intervention: What do you plan to do for the patient or problem?

C. Comparison: What, if anything, is the alternative to the intervention?

O. Outcome: What is the outcome that you would like to measure?

An example of a well formulated PICO question might be: "In orthodontic patients, are self-ligating brackets more effective than conventional brackets for correction of crowding?"

The PICO elements of this question are:

Patients, population, or problem: orthodontic patients

Intervention: self-ligating brackets

Comparison: conventional brackets

Outcome: correction of crowding

Search terms are built around these concepts. It is worth noting that although outcomes are included in the PICO framework, search strategies rarely contain terms concerning outcomes. This is because outcomes are not generally well described in the literature. Instead, outcomes are used when the search is complete to screen the studies for suitability for inclusion in the review. Depending on the question, the comparator may also be excluded from the search, for example, if the review were to look at all interventions for a particular condition or disease or the comparator was no intervention at all.

ALTERNATIVES TO PICO

Although the PICO framework is generally used for the majority of questions of effectiveness in health, there are research questions that fall outside the framework; and alternatives have been developed. These include:

- PICOS and PICOT: The PICOS framework builds on the PICO framework, by adding the concept of study design. For example, if the review were to include only randomized controlled trials and no other study design, these might become the "S" in the formula. Similarly, PICOT adds time as a dimension, for example, a review that included only studies where the participants were studied within 1 year of diagnosis.[5]
- PECO: PECO reviews are nonintervention reviews, which substitute "Exposure" for "Intervention." These are normally reviews of cohort studies, where one population has been exposed to a variable and another has not.[6]
- SPIDER: The SPIDER framework applies to qualitative research questions and considers the sample, the phenomenon of interest, design, evaluation, and research type. It is particularly helpful in public health research.[7]

LIMITING SEARCHES BY STUDY DESIGN

If only one type of study is of interest for a systematic review, then the search can be limited to particular study designs. This is commonly done in Cochrane reviews to limit the search to randomized controlled trials. In Medline, indexers assign a study design to each record, and Pubmed has a built in feature to search for clinical trials. Clicking on the heading "clinical trial" under "article type" when a search is complete will retrieve these records. Cochrane has found that this approach is not sensitive enough and developed their own filter.[3] There are numerous study design filters available to try out. The InterTASC Search Filter Resource (https://sites.google.com/a/york.ac.uk/issg-search-filters-resource/home) has many critically appraised examples for adverse events, diagnostic studies, guidelines, economic evaluations, nonrandomized studies, clinical trials, systematic reviews, and many others, which can be added to the search strategy and joined to the search with the use of an "AND" operator.

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