Searching the literature for studies for a systematic review. Part 4: Searching with the use of text words

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In this series on searching the literature, we have considered how to develop a search question, where to search, and the use of controlled vocabulary in a search strategy. This article will look at how to further develop a search strategy by adding free text terms to controlled vocabulary.

SEARCHING WITH THE USE OF FREE TEXT

The use of controlled vocabulary in a search has limitations. Authors may not describe their methods or objectives accurately, and indexers are not always experts in the subject areas or methodologic aspects of the articles that they are indexing. In addition, the available indexing terms might not correspond to the terms the searcher wishes to use.[1] A further issue is that newer articles may not yet have been assigned indexing terms, and so would not be retrievable with the use of controlled vocabulary alone. An effective search strategy combines controlled vocabulary with free text word searching, searching for terms that may appear in the title or abstract of the record.[1] A free text search can be applied anywhere across a database record: author, title, abstract, key words (if available), journal name or any other field. The key is to direct the database's search engine to the fields in the record that are to be searched. The fields are generally coded, and the database's help files will give an indication of how to direct the search. For example, to search the title and abstract fields in MEDLINE via PubMed, [tiab] should be added after the term in square brackets. In MEDLINE via Ovid, the search uses .ti,ab. to perform the same function.

Finding key words to add to the search is relatively straightforward. The search concepts that have been identified from PICO (population, intervention, comparison, outcome) or another framework should be the starting point. Synonyms should be developed for each term. Expert knowledge, internet searching, and looking at papers on the topic can all help to build the search. The controlled vocabulary terms that have been identified are also helpful. The MeSH browser has a series of entry terms for each controlled vocabulary term, which can be used as free text terms. A checklist for defining key words is presented in the Table.

BOOLEAN LOGIC

Most electronic databases support the combining of search terms with the use of boolean operators. AND, OR, and NOT are the most frequently used.[2] The OR command is used when the records retrieved in the search can contain either of the search terms whether or not they appear together in the record. Two terms connected by "OR" result in retrieval of all citations that are matched to either of the two terms. All of the involved citation sets are included, and the resulting total retrieved is larger than that retrieved by either term alone. The NOT command is for searches where one term can be retrieved but the other must not be, even if it appears alongside the included term. "NOT" is rarely used and has the effect of excluding a subset of citations found by the primary term that has been selected (Fig). Connecting terms by "AND" effectively restricts the search to citations that are matched to both. This may be seen as a new, smaller set representing the intersection of the citation sets corresponding to the individual terms.

TRUNCATION AND PROXIMITY OPERATORS

Many databases support truncation, which allows searching on the stem of a word. This is very useful when a term could be a plural, or when there is a variant spelling, because it avoids typing in all variations of a word. For example, searching for "remov*" will retrieve not only remove, but also removing and removal.[3] You

Table. Checklist for defining key words
What alternative vocabulary is used in the discussion of my topic?
Are there American and British variants of spelling or vocabulary?
Can I identify a word-stem for truncation? For example, orthodont* to find orthodontic, orthodontics, orthodontically, orthodontist, etc.
Are common abbreviations, acronyms or formulas used? For example, CBCT or Cone Beam CT or tomography, for Cone Beam Computed Tomography.

can also search with the use of quote marks for phrases such as "dental caries" to find circumstances where 2 or more words appear alongside one another, making your search more precise. Some databases allow the searching of terms that appear near to one another. This makes the search more precise than just using "AND" but gives more flexibility than just using a phrase search.[3] Searching "orthodontic treatment" as a phrase would retrieve only articles where those 2 words appear next to each other. However, if a search is done for "orthodontic near/6 treatment" in the Cochrane Central database, articles would be retrieved where "orthodontic" appears within 6 words of the word "treatment." This is helpful if there are too many hits from a search where "AND" is used as a boolean operator. This function is not available in PubMed, but Ovid uses "adj" (adjacent to), the Cochane Library uses "NEAR" and the Ebsco databases, such as CINAHL, use "N." This is then followed by the number of words you want to specify as proximity, eg, "adj5."

PUTTING IT ALL TOGETHER

The search lines should be combined together, both free text terms and controlled vocabulary, to create the search strategy. Synonyms are combined with the use of "OR," and the different concepts are brought together at the end of the searching with the use of "AND." Here is an example of a complete search, for the question of orthodontic treatment for prominent upper front teeth.[4] The population or participants are people with Class II malocclusion, and the intervention is orthodontic treatment. The search has been designed for MEDLINE via Ovid and uses the truncation symbol "$" and the proximity operator "adj" (adjacent to). Lines 9 and 16 combine the previous lines with an "OR" search. The search is brought together at the end using an "AND" search. The controlled vocabulary is in bold:

1. **exp Orthodontics/**
2. ((appliance$ or device$) adj5 (function$ or remov$ or fix$ or intraoral or "intra oral" or extraoral or "extra oral")).ti,ab.

3. (orthodontic$ and (brace$ or band$ or wire$ or extract$ or remov$ or headgear or "head gear")).ti,ab.
4. "activator appliance$.".ti,ab.
5. (Frankel or "twin$ block$" or FR-II).ti,ab.
6. ((growth adj3 modif$) and (jaw$ or maxilla$ or mandible$ or mandibular)).ti,ab.
7. (two-phase and (treatment or therapy) and (orthodontic$ or malocclusion$)).ti,ab.
8. ((orthopedic$ or orthopaedic$) and (dental or orthodontic$ or facial)).ti,ab.
9. or/1-8
10. **Malocclusion, Angle Class II/**
11. **Retrognathism/**
12. (("class II" or "class 2") adj3 malocclusion$).ti,ab.
13. (posterior adj3 occlusion$).mp.
14. (distoclusion$ or disto-occlusion$ or distocclusion$ or retrognath$ or overjet$ or "over jet$").mp.
15. (prominent adj3 upper adj3 teeth).mp.
16. or/10-15
17. 9 and 16

SEARCH TIPS

Too many results?

- A systematic review will usually generate many hundreds, or even thousands, of records to screen. It is not uncommon to have to screen through well over 500 results to find the articles you might include. However, if the search is becoming unmanageable there are some ways to reduce the number of hits: Find a specific standardized term (for example MeSH term in PubMed) and search with it; can you reduce the number of key words? limit the search with the use of search limits, such as article types, publication dates, or species; limit the search results with the "AND" operator (eg, in PICO format, try P+I or P+C or P+O or P+I+C and then try combinations of them); use free text search only in title or abstract of published papers (eg, use search fields at the end of your search term: [ti] for word in title, [tiab] for word in title or abstract).

Not enough results?

- If there aren't enough hits, then check the following: Can you paraphrase or reword the query? was correct spelling used? are the boolean operators being used correctly? are there any other key words based on natural language to consider for the query? reduce the use of the "AND"
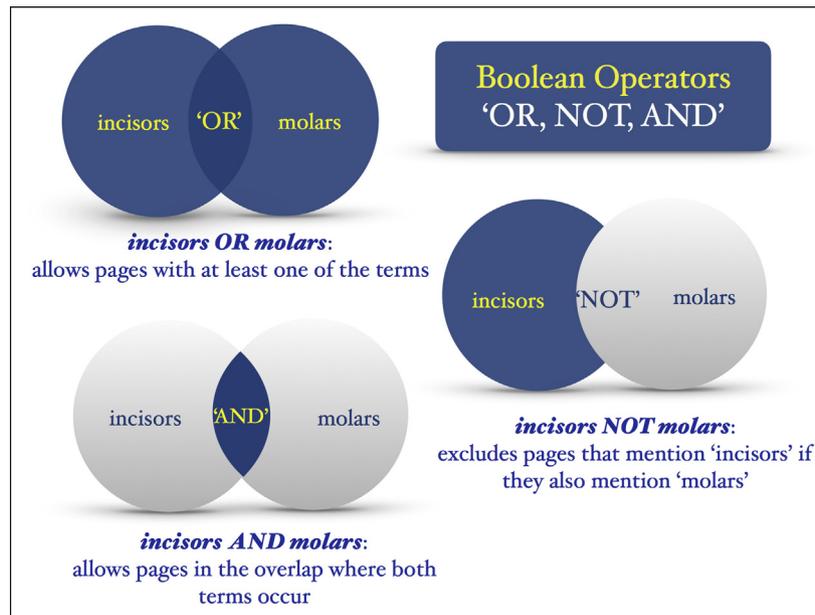
Fig. Boolean operators.

operator; use MeSH terms without subheadings; try to find more synonyms; and remember to truncate anything that could be pluralized.

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