

Improving efficiency and confidence in systematic literature searching

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1. Examining the research question

A good answerable research question should be clear and focused.

Not too vague, too specific or too broad

An important step to start is:

Which articles can answer your research question?

A database cannot answer a research question, articles can, and a database can find articles

It can be wise to include certain study types in your search strategy, not as a separate filter to exclude articles, but for instance additional to an element of outcome.

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(evaluation studies OR barriers OR facilitators) AND (preconception care)

When an idea is formed on what the articles you want to find look like, you determine what they have in common.

Determine elements

Watch out for bias

Including very specific characteristics or judgements can bring bias into your search strategy because these might not be mentioned in the title / abstract / thesaurus terms. Only those articles that find what you expect might mention this. Searching for the bold terms below will cause the search to miss relevant articles.

Duration of breast feeding

Poor family functioning or harsh parenting and bullying behaviour

Watch out for duplicates

Elements often overlap. An intervention can be only used for a certain disease, or a disease can be present only in a certain population. In that case search for the most specific element:

Pre-eclampsia ~~AND pregnant AND women~~

Lichtenstein therapy ~~AND inguinal hernias~~

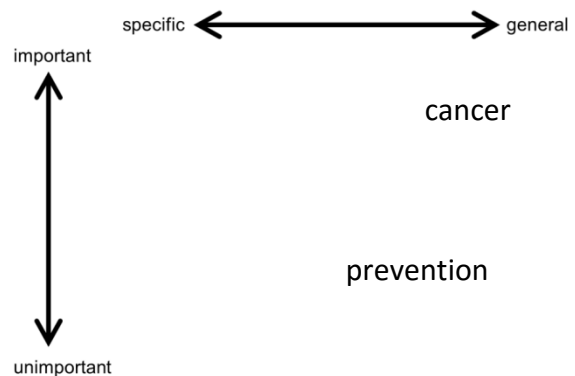
PICO(S) / SPIDER or any other acronym is not necessary for a good search strategy

Determine which elements are the best to use:

An element is specific if not much hits are observed or expected. An element is general if much hits are retrieved. This is independent of the research question.

Depending on the research question an element can be important or unimportant. An element is unimportant if you can find an article that can answer your research question that does not have that element in title / abstract or thesaurus terms. This is always dependent of the research question.

Now use only the important elements, and start with the most specific one. Do not use more elements than necessary, if the number of hits is acceptable, do not add an extra element, because adding more elements means you have a higher chance of missing relevant articles.



2. Identifying key terms for each element

There are two major thesauri: MeSH for Medline and Emtree for Embase

Emtree has almost three times as much terms as MeSH, and often finds much more specific terms. Although sometimes Emtree provides only a very general alternative for a specific MeSH term.

Emtree has much more synonyms listed than MeSH, also because many synonyms (entry terms) in MeSH are just inversions (with a comma) that will never be used in an abstract. They are just remnants of the time when MeSH was a printed version.

Emtree is somewhat less consistent than MeSH as indexers for embase can add candidate terms to the list ad hoc.

There are three interfaces to view thesauri, each has their own downside:

PubMed (MeSH)

The clearest interface for thesaurus terms. All entry terms (synonyms) and narrower terms in one screen. But be aware that MeSH terms might not be found if the search words are not truncate (compare temperature change to temperature* change*)

Ovid (MeSH and Emtree)

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The Ovid interface is more difficult to overview, the tree structure will be shown in full, though only part of it is needed and entry terms are only visible after a click. Also terms will be missed (such as subheadings)

Embase.com (Emtree)

Truncation is impossible

Conclusion: even when you are searching Medline in Ovid, it is better to search MeSH terms in PubMed, and use truncation when doing so. For Emtree the interface of the thesaurus is determined by the interface for the Embase database itself.

a. Thesaurus terms

Important!

- Always copy the exact thesaurus terms, including commas
- There might be more thesaurus terms relevant for your element
- Especially in Emtree often one thesaurus term combined two elements
in that case: add such a term under all elements for which it is relevant (when not already found by explosion)
- Sometimes an element can only (or also) be translated by a combination of two separate thesaurus terms.
You need to work with parentheses to combine this properly
- In MeSH you can find additional terms: previous indexing, see also, which Emtree lacks

When no thesaurus terms are found bit.ly/pubreminer can be used on a simple PubMed search to see the most frequently used MeSH terms

The field [tt] can be used in PubMed to find articles in your native language and check the translation

Google / Wikipedia (for translation) can find additional terms, even when a good thesaurus term can be found

b. Free text terms

Optimal sensitivity can only be reached by adding for each element in the search strategy words in title and or abstract. Words can be found in the thesauri:

- Words or phrases from the entry terms (MeSH) or synonyms (Emtree)
 - Don't use the inversions that are overrepresented in MeSH (anything with a comma in it)
 - Often only one or a combination of two words is enough to capture many entry terms
 - Often one term will be enough to capture entry terms or synonyms of more thesaurus terms
- Words or phrases from narrower terms
Although articles that have been indexed with a certain narrower term will be retrieved when searching for the broader thesaurus term, extra relevant articles can be found by searching the narrower terms in title and or abstract
- Also search for the thesaurus term itself in title abstract

Add for yourself: abbreviations, and spelling differences between USA and UK spelling

3. Database / interface choice

a. Which database to start in?

It is wise to always use a certain database as your start database, for ease of workflow. An ideal starting database should contain a large set of articles on many different topics and has a good thesaurus. That leaves only two choices: Medline or embase

The embase thesaurus is more complex, therefore it is easier to translate Emtree to MeSH than vice versa.

Recommendation: **If you have embase, start in embase, otherwise start in Medline**

Interface choice

Ideally an interface allows for proximity search and can search multiple fields simultaneously for multiple synonyms.

PubMed does not allow proximity, and [tiab] has to be repeated after each synonym. Not ideal!

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EBSCO / ProQuest cannot search multiple fields simultaneously but search TI(...) OR AB(...). Not ideal!

Embase.com has relevance ranking, and syntax matches Cochrane, preferred over Ovid

Preference order:

Embase.com → Ovid → EBSCO / ProQuest → PubMed

b. Which databases to use?

The databases Erasmus MC uses are

Database	Used in % of SRs
Embase.com	100%
Medline (OvidSP)	99%
(PubMed	the other 1%)
Cochrane central	98%
Web-of-Science	95%
Google Scholar	92%
PubMed (publisher[sb])	91%
Scopus	36%
Cinahl	25%
PsycINFO	19%
Others (ProQuest, lilacs, scielo, sportdiscus, eric, amed etc)	9%

Do they add value?

Out of 5048 tracked included references from 111 systematic reviews the number of articles retrieved by only one database was 1179. The unique articles were retrieved in the following databases.

embase	509
Web-of-Science	244
Medline	195
Google Scholar	139
Other databases	92

4. Creating a basic search strategy

a. In embase.com

Open an empty MS Word document to create your search strategy in

Start with typing parentheses

()

Add quotes and the field code for thesaurus terms within the parentheses

(''/exp)

Copy the desired thesaurus term into the quotes

('hip osteoarthritis'/exp)

Add parentheses and field code for title abstract

('hip osteoarthritis'/exp OR ():ab,ti)

Add single word synonyms from the list of synonyms or entry terms to the title abstract section

('hip osteoarthritis'/exp OR (coxarth*):ab,ti)

Somewhere in the word document type syntax for proximity, without filling in the words so that it can be reused when necessary

(() NEAR/3 ())

Within the title abstract section type OR and then copy paste the proximity statement

('hip osteoarthritis'/exp OR (coxarth* OR (() NEAR/3 ())) :ab,ti)

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Within the proximity statement add the words that make up phrases in the synonyms list, making sure to group synonyms in the consecutive parentheses

```
('hip osteoarthritis'/exp OR (coxarth* OR ((cox OR hip*) NEAR/3 (arthrit* OR arthros* OR osteoarth*))) :ab,ti)
```

Repeat this process for each element putting an AND between the syntaxes

b. In Ovid (here with MeSH terms for Medline)

Open an empty MS Word document to create your search strategy in

Do notice that the normal settings of MS Word cause errors in Ovid, because of the automatic smart quotes (") are replaced with "). Turn this off in file > options > proofing > Autocorrect options > AutoFormat as you type > untick "straight quotes" with "smart quotes"

Start with typing parentheses

```
( )
```

Add quotes and the field code for thesaurus terms within the parentheses

```
(exp ""/)
```

Copy the desired thesaurus term into the quotes

```
(exp "osteoarthritis, hip"/)
```

Add parentheses and field code for title abstract

```
(exp "osteoarthritis, hip"/ OR () .ab,ti.)
```

Add single word synonyms from the list of synonyms or entry terms to the title abstract section

```
(exp "osteoarthritis, hip"/ OR (Coxarthr*) .ab,ti.)
```

Somewhere in the word document type syntax for proximity, without filling in the words so that it can be reused when necessary

```
( () ADJ3 () )
```

Within the title abstract section type OR and then copy paste the proximity statement

```
(exp "osteoarthritis, hip"/ OR (Coxarthr* OR ( () ADJ3 ( ) ) ) .ab,ti.)
```

Within the proximity statement add the words that make up phrases in the synonyms list, making sure to group synonyms in the consecutive parentheses

```
(exp "osteoarthritis, hip"/ OR (Coxarthr* OR ((hip*) ADJ3 (Osteoarthrit*))) .ab,ti.)
```

Repeat this process for each element putting an AND between the syntaxes

c. In ebSCO (here with MeSH terms for Medline)

Open an empty MS Word document to create your search strategy in.

Start with typing parentheses

```
( )
```

Add quotes and the field code for thesaurus terms within the parentheses

```
(MH "+" )
```

Copy the desired thesaurus term into the quotes

```
(MH "osteoarthritis, hip+" )
```

Add parentheses and field code for abstract.

Note: Ideally a search would encompass both words in title and/or abstract. However, EBSCOhost cannot search those fields concurrently. Alternatives are TI() OR AB(), or using SU(). The first option is very cumbersome to create, and the second option interferes with the optimization described in the next chapter. Therefore we choose to use AB to start with, and later, when optimization is done copy for all elements the AB part and also add that in that element preceded by TI.

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```
(MH "osteoarthritis, hip+" OR AB())
```

Add single word synonyms from the list of synonyms or entry terms to the title abstract section

```
(MH "osteoarthritis, hip+" OR AB(Coxarthr*))
```

Somewhere in the word document type syntax for proximity, without filling in the words so that it can be reused when necessary

```
(() N3 ())
```

Within the title abstract section type OR and then copy paste the proximity statement

```
(MH "osteoarthritis, hip+" AB(Coxarthr* OR (() N3 ())))
```

Within the proximity statement add the words that make up phrases in the synonyms list, making sure to group synonyms in the consecutive parentheses

```
(MH "osteoarthritis, hip+" OR AB(Coxarthr* OR ((hip*) N3 (osteoarthrit*))))
```

Repeat this process for each element putting an AND between the syntaxes

Remember after optimization to copy all AB parts of alle elements to repeat them as TI as well (since ebsco cannot search AB,TI simultaneously).

```
(MH "osteoarthritis, hip+" OR AB(Coxarthr* OR ((hip*) N3 (osteoarthrit*)))  
OR TI(Coxarthr* OR ((hip*) N3 (osteoarthrit*)))) AND ...
```

(Only do that after your search is finalized, and you are done with optimization)

d. In PubMed

Open an empty MS Word document to create your search strategy in

Start with typing parentheses

```
()
```

Add quotes and the field code for thesaurus terms within the parentheses

```
("" [mh])
```

Copy the desired thesaurus term into the quotes

```
("osteoarthritis, hip" [mh])
```

Add parentheses for title abstract

although the field code needs to be repeated for every term, therefore the parentheses are redundant here. The parentheses are useful at a later stage for optimization.

```
("osteoarthritis, hip" [mh] OR ())
```

Add single word synonyms from the list of synonyms or entry terms to the title abstract parentheses and add the field [tiab] after each word

```
("osteoarthritis, hip" [mh] OR (Coxarthr*[tiab]))
```

Now two options exist : a sensitive approach, which will not miss many articles, but will retrieve much noise, and a specific approach, which will not retrieve too much noise, but will probably miss relevant articles.

Sensitive approach

Somewhere in the word document type a syntax for combined terms (because proximity is not possible, AND is used), without filling in the words so that it can be reused when necessary

```
(() AND ())
```

Within the title abstract section type OR and then copy paste the proximity statement

```
("osteoarthritis, hip" [mh] OR (Coxarthr*[tiab] OR (() AND ())))
```

Within the proximity statement add the words that make up phrases in the synonyms list, making sure to group synonyms in the consecutive parentheses

```
("osteoarthritis, hip" [mh] OR (Coxarthr*[tiab] OR ((hip*) AND  
(osteoarthr*))))
```

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Specific approach

Write out every phrase mentioned in the entry terms and truncate the last word of it, followed by [tiab].
If one of the words earlier in the phrase has more variants, do not truncate in the middle of the phrase, but write out all variants.

Also do not put quotes around truncated phrases or the truncation will be ignored.

```
("osteoarthritis, hip"[mh] OR (Coxarthr*[tiab] OR Hip Osteoarthritis*[tiab] OR Osteoarthritis Of Hip*[tiab]))
```

Repeat this process for each element putting an AND between the syntaxes

e. General rules for creating a search strategy

1. Work in a word document, not the interface

The word document is your search history, can be used as supplementary material to the ultimately published article, and is a good way to save many mediated searches (folders: customer > research question > date)

2. Create single line search strategies

Multi line search strategies are harder to optimize, since extra words appear at the end of the strategy, thus needing a full restructuring. They are hard to repeat, as every line has to be entered in that specific order, without errors. And they are hard to translate between databases, since the number of thesaurus terms can differ.

Single line search strategies can be more difficult to create, and to read but easy to optimize (just add an extra word at the right place) easy to repeat (one copy and paste) and easy to translate (see further)

Downside of the single line search strategy is the number of parentheses needed (but the solution given is to type parentheses before adding the words) and the fact that it is harder to identify typing errors (to find those easily in multiline searches one would have to use one line per term, which is hardly the practice, but with the single line searches' optimization spelling errors will be found quickly).

3. Type code before adding the words
4. After opening parentheses, immediately close them

Parentheses are only typed manually on two occasions: when starting an element, and when starting the title abstract section of an element.

5. Never remove parentheses, only add
6. Prepare proximity statement for reuse
7. Copy terms from thesaurus instead of typing them
8. Use arrow keys and Ctrl- shortcuts

See supplement 3 for frequently used short cuts.

9. Use ab,ti to create the strategy, final syntax can be broad

For optimization ab,ti is needed. After optimization extra fields can be added. If you change the field codes before optimization, the optimization strategies as described below will not work properly.

5. Optimizing the basic strategy

In the above steps we created a basic search strategy that will possibly retrieve a rather limited set of relevant articles. To ensure we retrieved all relevant articles optimization is needed.

In the examples below the syntax used is that of Medline in Ovid and embase.com, but these steps can be used in any interface and syntax

a. Thesaurus NOT free text

Scan abstracts of articles with one of the thesaurus terms but without the title / abstract terms. Do this for one element at a time, while keeping the rest of the search strategy unchanged.

Copy the complete search strategy and paste it directly below

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For each element, but one at a time: Instead of OR between the thesaurus terms type NOT

```
('kinesiotherapy'/exp NOT (kinesiotherap* OR kinesitherap* OR ((exercis*) NEAR/3 (technique* OR treat* OR therap*)):ab,ti) AND ('hip osteoarthritis'/exp OR (coxarth* OR ((cox OR hip*) NEAR/3 (arthrit* OR arthros* OR osteoarth*)):ab,ti)
```

Cut the altered syntax from the word document (this prevents you from adding the new words to the altered search strategy) and paste it in the database.

Read the abstracts and titles of relevant articles and scan them for extra relevant words that are not highlighted. Add those relevant words in the title abstract part of the element. And then decide whether this is a useful addition: does the search retrieve extra articles that we had missed in the earlier version.

In our case we found: physical exercises, physiotherapeutic treatment, conservative therapy, paramedical treatment

```
('kinesiotherapy'/exp OR (kinesiotherap* OR kinesitherap* OR physiotherap* OR ((exercis* OR conservativ* OR paramedical*) NEAR/3 (technique* OR treat* OR therap* OR physical*)):ab,ti) AND ('hip osteoarthritis'/exp OR (coxarth* OR ((cox OR hip*) NEAR/3 (arthrit* OR arthros* OR osteoarth*)):ab,ti)
```

Repeat this process several times, until there are no more relevant words found in the remaining articles.

b. Free text NOT thesaurus

Scan abstracts of articles with one of the title / abstract terms but without a thesaurus term for one element at a time

Copy the complete search strategy and paste it directly below

For the first element: Cut all thesaurus terms from that element, go to the end of the search strategy, type NOT () and paste the terms between the parentheses.

```
((Coxarthr* OR ((hip*) ADJ3 (Osteoarthrit*))).ab,ti.) AND (exp "Exercise Therapy"/ OR ((Exercis*) ADJ3 (Therap*))).ab,ti.) NOT (exp "osteoarthritis, hip"/)
```

Because Ovid sorts only by date, and the most recent articles do not have MeSH terms yet it is wise to temporarily add AND humans/ to the search strategy, to see only articles that have MeSH terms (or AND animals/ of course, if you need veterinary studies)

Scan thesaurus terms of relevant articles for missed relevant terms. Add those to the original search string

In our case we found: Osteoarthritis (most often involving the hip and knee), Arthroplasty, Replacement, Hip (a therapy often used for hip OA)

```
(exp "osteoarthritis, hip"/ OR Osteoarthrit* OR "Arthroplasty, Replacement, Hip"/ OR (Coxarthr* OR ((hip*) ADJ3 (Osteoarthrit*))).ab,ti.) AND (exp "Exercise Therapy"/ OR ((Exercis*) ADJ3 (Therap*))).ab,ti.)
```

When in a database that has filters on the results page that show the most frequently occurring thesaurus terms, use input from that list to find relevant terms.

6. Increase specificity or sensitivity

Always start with a sensitive search. Your most important goal is to find all relevant articles. The most important question from the researcher is: did we miss relevant articles. This is also the hardest question. The only answer is, no matter how good we searched, we will always miss articles that can answer our research question.

Start searching sensitively and while doing so save retrieved relevant articles on the clipboard or other facilities in the interface.

When after optimizing sensitivity, the number of hits is too high for the researchers to scan on title abstract (remember, depending on the topic this might take much less time than sometimes is thought)

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When the number is indeed reduced compare the results that were added to the clipboard with the results of the final search strategy. (In PubMed easy by comparing #0, which by default contains the contents of the clipboard, to the final query). Is everything that was found to be relevant still in the search results.

For optimization a set with at least 100 references is needed, otherwise the set contains too little articles to find words in. If one element is reducing the number of hits too much, you can temporarily remove that element to optimize the others, and then later reintroduce that element.

Only if you can afford to miss relevant references you can as a last resort use the major thesaurus terms and words in title. Do this only for one of your elements, and for the most important one. If you do it, do it for the whole element, all thesaurus and free text words.

Increase Sensitivity (always)	Increase Specificity (if necessary)
<p>Add extra synonyms or thesaurus terms</p> <p>Extra words can be found in the already retrieved articles as described in the articles body</p>	<p>Delete irrelevant synonyms or thesaurus terms</p> <p>When in doubt whether a synonym adds value, look at the extra retrieved articles. Do they seem relevant?</p>
<p>Generalize specific elements</p> <p>Potential relevant articles might have used a more broader thesaurus term, because they give an overview of related topics</p>	<p>Specify more general elements</p> <p>Maybe narrower terms from the thesaurus cause noise. See if using a no explode function solves this problem</p>
<p>Drop unimportant elements</p> <p>Check for each element what happens if it is deleted from the search strategy. If the number of hits does not increase to above what can be handled it is unnecessary and can be deleted. If the number is too high scan the extra articles for potentially relevant words.</p>	<p>Add an extra element</p> <p>Extra elements will reduce the number of hits, but will increase the chance of missed relevant articles. Always check the articles that are missed by this element for extra relevant terms. This might be very time consuming.</p>
<p>Use floating subheadings</p> <p>Searching with a combination of thesaurus terms and subheading (such as "neoplasms/prevention and control"[mh]) is more specific than searching with subheadings as a separate element ("neoplasms"[mh] AND "prevention and control"[sh]). The latter will also retrieve articles where the subheading is used with other thesaurus terms.</p>	<p>Combine a floating subheading with thesaurus</p> <p>Floating subheadings can retrieve irrelevant results. This can be reduced by combining thesaurus terms with subheadings. When this method is used, it is wise to also use the next method, combining the free text words of these elements to phrases or proximity instead of AND.</p>
<p>Broaden proximity (or replace with AND)</p> <p>It can be determined with great precision whether to use 3, 4 or 5 words in proximity. Changes are often minimal. At Erasmus MC we start with 3, and then broaden to 6, then to 9 etc. and check the extra retrieved articles.</p>	<p>Narrower proximity or phrases (instead of AND)</p> <p>A combination of two or more free text words with AND is very sensitive. This can be reduced by combining words of two elements into exact phrases or proximity searches.</p>
<p>Add (phrase) truncation or shorten word stems</p> <p>Truncation will hardly retrieve irrelevant articles. Always add truncation and use as short stems as possible to start with</p>	<p>Remove truncation or lengthen word stems</p> <p>Sometimes truncated words or phrases result in noise. In that case lengthen the word stem or do not truncate.</p>
<p>Remove filters</p> <p>Filters should only be applied in the end of the search strategy, if the number of hits retrieved is too high. No filter is 100% safe, the most optimal method is often to categorize the retrieved articles by hand.</p>	<p>Add filters</p> <p>Filters on Language should be applied with caution. Best results are found using any language. Never restrict to languages spoken by the team member, but only to English. Limit on date only in 2 cases: 1) updating good existing review; 2) one of the elements in the research question did not exist before a date</p>

7. Finding errors

Most common mistakes:

Forgetting an OR

→ Solution: search (Ctrl-H) in the webpage showing the search details for ' AND '. check whether these were put in on purpose, or that they were added by the database

Unmatching parentheses

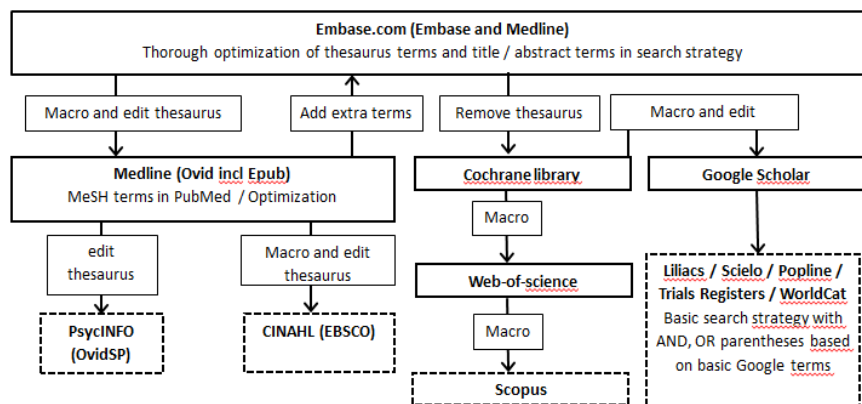
→ Best solution is to prevent this from happening. When typing an opening parenthesis, immediately type the corresponding closing parenthesis. For proximity, prepare the statement with all parentheses in advance.

→ Or use Notepad Plus, which color marks all parentheses so that you can easily see the problems

→ And never use the interface to place the parentheses.

8. Translating the strategy between databases

At Erasmus MC we use the following schedule to translate between databases



The ease and success of automatic translation between databases depends on the order in which the databases and interfaces are searched.

Searching Embase before Medline eases the translation of thesaurus terms, as there are more Emtree terms than MeSH terms. If all Emtree terms are found it is easier to find all corresponding MeSH terms.

Translation from embase.com to Medline in Ovid is easier than the other way around. Embase.com syntax is somewhat more limiting (no phrase truncation, limited options for nested proximity and no truncation for 0 or 1 character). Work-arounds for embase.com (respectively: using proximity, separating the nested proximity from unnested, and writing out all variants) do work just as well in the Ovid interface.

Starting in PubMed means that automatic translation is almost impossible. Because PubMed does not allow proximity all phrases must be written out or you must use () AND (), and PubMed requires each word or phrase searched in title abstract to end with [tiab].

Also starting in the EBSCO interface makes automatic translation very hard, because there is no single field code for title or abstract all words need to be repeated, and the fact that field codes are placed before the terms, unlike any other major interface.

a. Semi-automatic translation using Ctrl-H

In Erasmus MC we used translation tables to translate syntax between databases. By closely comparing the syntax differences between interfaces we were able to create tables for most translations. Use the function Find and Replace (Ctrl-H) in word to replace one syntax with the other

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For example the translation table between embase.com and Medline Ovid is:

'	[nothing]	/exp	/
NEXT/1	ADJ	/de	/
NEXT/	ADJ	:lnk	.xs.
NEAR/	ADJ	/dm_	[nothing]
:ab,ti	.ab,ti.	/dd_	[nothing]

Using the tables in supplement 1, you can see the corresponding syntaxes of the major databases and interfaces and create your own translation.

Not for every translation find and replace is necessary: The syntax for the Cochrane Library is equal to that of embase.com. Only for thesaurus terms it is completely different. But since Cochrane does not add thesaurus terms themselves, searching Cochrane with thesaurus terms will not retrieve extra articles compared to searching Medline in Ovid.

Therefore at Erasmus MC to create a Cochrane search strategy we remove the Emtree terms from the embase.com query.

b. Full-automatic translation using Macros

For Erasmus MC, both the information specialists and participants in the in house workshops use custom designed macros to translate between databases. These macros were designed by recording several steps in the Ctrl-H functions.

The Erasmus MC macros can be found at bit.ly/emcmacros

To install the macros

- In word go to View > Macros > View macros
- Click on Create
- If you don't have other macros that you want to keep Press Ctrl-A, otherwise be careful not to delete other macros
- Paste the contents of the webpage and save and close.

To use the macros

- Copy the source search strategy (for instance embase.com) into a new Word document (Ctrl-N)
- Put the cursor at the home position of the document (Ctrl-HOME)
- Go to View > Macros > View macros and run the desired macro (for instance changeEmbase2Medline)

To alter the macros for your own database preference

Copy one of the macros below the complete list and edit the find and replace characters that you see in the macro. Remove any excess find and replace statements. (This might require some trial and error).

9. Final remarks / evaluation

Whether your search is successful depends on many factors

- Coverage of accessible databases
- Features of search engine of used interfaces
- Quality of indexing
- Presence and quality of abstract

And only one of the factors is:

- Quality of search and experience of searcher

What are Success factors and Time savers in our method:

- Optimization techniques
- Macros for syntax translation
- Direct feedback by researcher
- Database order and interface choice
- Single-line search strategies
- Create query in Word and paste in database
- Experience (be pro-active)
- Having two screens on your computer
- Computer literacy

At Erasmus MC the researcher sits next to the information specialist through almost the complete search process, reviewing relevancy of proposed words and thesaurus terms, and of the retrieved articles.

Quality is the norm not speed

The method is not a blue print for speed as this differs with experience, but it gives beginners a step-by-step approach on how to start an extensive search, and allows more experienced searchers to gain speed by focusing on the contents and results of the search strategy instead of the process.

If you gain speed more customers can be helped with a good thorough systematic search. If you don't help them, they will still publish their review, but then do the search themselves, which costs them much extra time, and will result in missing relevant hits.

10. Supplements

a. Supplement 1 – syntax comparison between major interfaces

Fields	PubMed	Embase.com	OvidSP Medline/PsycInfo	Cochrane
Title/ abstract	[tiab]	() :ab,ti	() .ab,ti.	() :ab,ti
Meaningful text	[tw]	() :de,ab,ti	() .mp. (.tw,kf,ot.)	() :ab,ti,kw
Including subheadings	"	() :de,lnk,ab,ti	"	"
Keyword	"Mesh term"[mesh]	'emtree term'/exp	exp term/	[mh "mesh term"] ¹
No explode	"Mesh term"[mesh:noexp]	'Emtree term'/de	term/	[mh ^"mesh term"]
with subheading(s)	"Mesh term"/sh[mesh]	'emtree term'/exp/dm_sh	exp term/sh	[mh "mesh term"/SH,SH]
just subheading	[sh]	:lnk	.xs. (exp) of .fs. (noexp)	[mh /SH]
synonyms	-	'emtree term'/syn	-	-
Proximity (n terms)	-	NEAR/n - NEXT/n	ADJn	NEAR/n - NEXT/n
Phrases	MeSH with "double quotes", free text without quotes	'single quotes'	No quotes needed	"double quotes"
Phrase truncation	No quote*	(use NEXT/1 proximit*)	No quote*	"use quote*"
Truncation	End	End/ mid	End/ mid	End/ mid
endless	*	*	*	*
0 or 1 character			?	
1 character		?	#	?
Filters				
Limit humans	NOT (animals[mesh] NOT humans[mesh])	NOT ([animals]/lim NOT [humans]/lim)	NOT (animals NOT humans).sh.	(Not necessary)
Added since	yyyy/mm/dd:3000 [mhda]	[dd-mm-yyyy]/sd	limit 1 to rd=yyyymmdd- yyyymmdd	AND ("yyyy, Issue m" OR "yyyy Issue m+1" etc...) ²
Publication date		[yyyy-yyyy]/py	limit 1 to yr=yyyy-yyyy	
Recordset-numbers	#1	#1	1 ³	#1
Thesaurus	MeSH	Emtree	MeSH / own thesaurus	MeSH
Geographical data ⁴	[all fields]	:ca,ta,cy,ad	.jn,cp,in	

¹ Cochrane doesn't add MeSH terms to records but instead only uses those that have been added by Medline. Searching for MeSH terms will not retrieve extra hits compared to the Medline search.

² There is no update date searchable. Cochrane library has issue numbers that can be found using free text search. Search for all issues for each month since your last search.

³ Every number is treated as a recordset: if you want to search for a number in the text: use quotes "1". You can also search on ranges: OR/1-10

⁴ Geographical data may be present in the journal title, institution of the author or the country of the journal, and thus can lead to relevant extra hits.

Improving efficiency and confidence in systematic literature searching

Fields	EBSCO	Web of Science	Scopus
Title/ abstract	TI () OR AB ()		TITLE-ABS()
Meaningful text	TX ()	TS=()	TITLE-ABS-KEY()
Including subheadings			
Keyword	MH <i>cinahl heading</i>	⁵	⁶
explode	MH <i>cinahl heading</i> +		
with subheading			
just subheading	MW		
synonyms			
Proximity	Nn - Wn ⁶	NEAR/n ⁶	W/n - PRE/n ⁶
Phrases	No quotes needed	"double quotes"	"double quotes"
Phrase truncation	No quote*	"use quote*"	"use quote*"
Truncation	End/ mid ⁷	End/ mid/ start	End/ mid/ start
endless	*	*	*
0 or 1 character	#	\$	
1 character	?	?	?
Filters			
Limit humans	NOT (MH animals+ NOT MH humans)	NOT (animal* NOT human*) ⁸	AND NOT (animal* AND NOT human*) ⁹
Added since	EM yyyy(mm)(dd)-	(advanced search > processing date)	AND RECENT(number of days since last search)
Recordsets	S1	#1	#1
Thesaurus	Cinahl headings	Geen	Geen

⁵ Web-of-Science and Scopus don't use a controlled vocabulary, only author keywords. They can only be search as free text.

⁶ Contrary to other databases n is the maximum number of words between the searched words, so one less than in embase and OvidSP for the same phrases.

⁷ But you cannot truncate multiple times within on term.

⁸ Because of WoS en Scopus lack of a thesaurus this filter does not suffice. To be exhaustive one needs to add the most frequent free text words.

NOT ((animal OR plant* OR rats OR mice OR pigs) NOT (human* OR patient*))* (and maybe add some extra that you come across. Tip: search in embase for AND ([animals]/lim NOT [humans]/lim) and see what animals are mentioned in the thesaurus terms. Those that you find you add to the filter for web-of-science, and subtract them from the test query in embase: (your search query) AND ([animals]/lim NOT [humans]/lim) NOT (mouse OR rat OR dog OR rabbit)

⁹ Pay attention that Scopus doesn't use the operator NOT, but requires AND NOT.

b. Supplement 2 – Google Scholar tips

Google scholar: scholar.google.com can find extra relevant articles that were not found in other databases, often because the desired search terms were not present in title and or abstract but only in full text. However the search options in google scholar are somewhat limited. At Erasmus MC we use it almost for every systematic review. Here are some tips on how to use it efficiently and as systematically as possible.

Limitations of the search engine:

- No truncation
- Number of characters in search limited to 256
- No proximity
- Only 1000 references visible

Tips: instead of truncation, write out the most important variants. Until a few months ago the ~ (tilde) did find extra related terms, but that is now obsolete. It was never very useful since it could only be used as a single term element, not in an OR with other terms.

To reduce the number of characters, replace every ' OR ' including the spaces with |.

Don't use AND, as that is the default Boolean operator.

Don't use parentheses as they will be ignored.

Google scholar does not allow proximity, but it has a NEXT/1 option using word variants or synonyms in quoted phrases.

```
"myocardial|heart attack|infarct"
```

will find myocardial attack, myocardial infarct, heart attack and heart infarct.

There is an option to broaden the proximity, by adding an * within the phrase. Sadly this is exactly one character, so it is more like NEXT/2 NOT NEXT/1 making it less useful. However:

```
"serious|severe * infection| infections"
```

will retrieve serious bacterial infection, severe viral infections and any other variation thinkable.

A systematic search strategy in google scholar for the example topic might look like:

```
Coxarthrosis|"hip|cox arthritis|Osteoarthritis"|"arthritis|Osteoarthritis  
** hip|hps" "Exercise therapy|treatment"|"therapeutic exercise"
```

Downloading references in to reference manager

With the standard settings only one citations at a time can be downloaded.

Using Harzing's Publish or Perish (www.harzing.com/pop.htm) a search strategy can be sent to google scholar and all 1000 references will be downloaded. From PoP the desired references can be exported to other reference software.

c. Supplement 3 – Useful Keyboard Short cuts

Shortcuts used in MS Word	
Ctrl-N	Create a new blank document
Ctrl-C	Copy the selected text to the clipboard
Ctrl-V	Paste the contents of the clipboard
Ctrl-X	Cut the selected text
Ctrl-A	Select all
Ctrl-H	Find and Replace (Use ^p and ^t to replace or introduce a line break or tab)
Ctrl-Z	Undo last action
Ctrl-Y	Redo last undone action
(Ctrl-)Home	To start of the line, or start of the document (Ctrl)
(Ctrl-)End	To end of the line, or end of the document (Ctrl)
(Ctrl-)Shift-Home	Select everything before this point to start of the line, or to the start of the document (Ctrl)
(Ctrl-)Shift-End	Select everything after this point to end of the line, or to the end of the document (Ctrl)
Ctrl-Arrow Keys	One complete word to the left or right
Ctrl-Shift-Arrow Keys	Select one complete word to the left or right
Double Click	Select a word
Triple Click	Select a paragraph
General Windows shortcuts	
Alt-Tab	Switch between programs (hold Alt pressed and click Tab to scroll between programs)
Windows – Arrow key	Move the open window to left (left arrow) right (right arrow) maximize (up arrow), minimize (down arrow)