Workshop
Systematic Literature Retrieval in PubMed

Erasmus MC, Medical Library
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Contact us for individual assistance in

- *literature searching for (systematic) reviews, grants, critical appraisals, scoping*
- *assistance with the use of EndNote*

Aim of this workshop

You will learn how to search in a systematic way based on your own research or clinical question. For this we will use PubMed. However this is not a basic workshop PubMed. Instead we will focus on the systematicity of the search, rather than the interface of PubMed. The purpose is to retrieve the optimal set of relevant records, not too many and not too few, for your publication, presentation or evidence based care.

Preparation/homework - Introduction to PubMed

The first part of this document is an introduction to PubMed that you should prepare before the workshop. Paragraphs 1 to 4 describe the basics of PubMed that are considered familiar to the participants. These topics will not (or just briefly) be explained during the workshop. Read this in advance of the workshop. After that you are asked to do a short homework assignment, with which we can assess your current knowledge about PubMed and systematic searching. You can find that as a separate document on our website. Return that document to info.mb@erasmusmc.nl prior to the workshop.

HOMEWORK

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HOMEWORK

1. General introduction to PubMed

1.1. Tutorial

If you are less familiar with the basics of PubMed, the online tutorial made by our colleagues at the VUmc in Amsterdam will be of great help for you: http://libguides.vu.nl/PMroadmap.

1.2. Added value of databases

You might wonder why bibliographic databases like PubMed (and others such as Embase, the Cochrane Library CINAHL etc.) are used, since everything can be found on Google Scholar these days. One of the differences is that bibliographic databases perform quality check. A journal that is indexed in Medline (the database behind PubMed) is known to be of a certain quality, whereas Google Scholar indexes everything that seems scientific to their algorithm, including so-called predatory journals. Apart from that a database allows you to focus your search. PubMed contains mostly medical literature, the Cochrane Library contains references with a high level of evidence, CINAHL contains nursing. Databases such as Scopus or web of Science contain references from other disciplines, and therefore can be of use when searching for non-medical topics.

1.3. MeSH terms

One of the most important aspects of databases, such as PubMed, is the thesaurus (MeSH terms in PubMed). The National Library of Medicine keeps a controlled vocabulary of terms for medicine and other more general scientific topics. The terms are grouped in large trees where specific terms are placed in branches beneath the broader terms. NLM employees assisted with AI will add MeSH terms to the articles in PubMed based on the content of the article. This contextual enrichment ensures that when you search for articles on cancer (MeSH term Neoplasms) an article with a more specific form of cancer (Melanoma or Leukemia) will also be found.
Many MeSH terms are made more specific with subheadings. An article about cancer prevention will often be assigned the term Neoplasms/prevention and control, where "prevention and control" is the so-called subheading. If you open an article in PubMed to see the details, scroll down to the bottom of the page to see the MeSH terms assigned to that article.

2. Basic PubMed tips and tricks

2.1. Open PubMed

The database PubMed can be reached easily via www.pubmed.gov
However, when you open PubMed via the website of the Medical Library, you will be provided with additional features: medbib.erasmusmc.nl/ → Quicklinks → PubMed. If you are working from home (and are not logged in via the "mijnwerkplek" application) we recommend to use the Proxyserver to login to the Erasmus MC network prior to accessing PubMed to be able to download relevant articles in full text.

2.2. Check the Search details

Many people will use PubMed as if it were a medical Google. They type in some terms into the search box and expect the database to find the best articles related to those terms. Performing a simple search means that your search terms will be matched with MeSH terms by Automatic Term Mapping (ATM). This can be helpful, but be aware that it also can have undesired effects, such as noise (retrieving unimportant references) or missing important references. If you use Automatic Term Mapping, make sure to always check the Search details, especially if you find too many irrelevant references, or find too many or too few results. Go to the Advanced search page and click on the > sign in the table with the search history.

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2.3. Change display settings to abstracts

To see the abstract of each article in the results, choose Format: Abstract. In this format you can click on the links for full text access if available. You can save the Display setting > Abstract as default in your MyNCBI account (see paragraph 3.3).

2.4. Use the Clipboard to gather results from multiple queries

By clicking Send to > Clipboard you can add multiple articles to a temporary clipboard set. For instance you can use the clipboard to compare a set of collected known relevant articles with the results of your present search. The clipboard set will appear as Search #0 in the History and will be saved for eight hours.

2.5. Use the special MB-filters for humans, children or RCTs

The standard PubMed filters (on the left side) for Humans, Children, or study types (such as RCT) use MeSH terms only, so you will miss the most recent references that do not have MeSH terms yet. By opening PubMed via the Medical Library website (either internet or Agora intranet), our improved filters can be used. Those are shown on the right side of the PubMed homepage. It is also possible to add filters in your own MyNCBI account (see paragraph 3.4).

3. MyNCBI account

By opening PubMed via the Medical Library website you get some useful default settings in the shared MyNCBI for Erasmus MC, like highlighting search terms, and improved filters as described above. By creating your own MyNCBI account (for free) you can store your search strategies (including e-mail alerts) and article collections. In addition, some settings can be personalized.

3.1. Creating an account

You can create an NCBI-account by using the button [Log in] in the top right corner of the PubMed website. You can login wth your Erasmus MC or Erasmus University credentials by clicking on [more login options] at the bottom. At the top of the screen where it says [start typing …] start typing Erasmus and select Erasmus MC or Erasmus University. Login with you Erasmus credentials and follow the steps to create a MyNCBI account.

3.2. Save search and set E-mail alerts

After you performed a search, click: *Create alert*. You will be asked to give the search a name, and to create the settings for E-mail alerts.

3.3. Set personalized preferences for result page

Click on the box in the upper-right corner with your account name on it and click Account Settings. In the top menu click *Site Preferences* (also in the upper-right corner). Choose for instance:

- Highlighting: Yellow
- Result Display Settings: Abstract
- Click: Outside Tool: click on [E] and tick the box before Erasmus MC

3.4. Adding special filters (humans, children or RCTs)

On MyNCBI Filters you can add and customize filters yourself [Create custom filter]. Some general filters can be found on the Medical Library website: medbib.erasmusmc.nl/workshops/pubmed.asp.

4. Obtaining the Full Text of an article

4.1. Full text links

Visit PubMed via the Quicklink on the website of the Medical Library to get an Erasmus MC Library Icon to the full text if available. If the full text is not directly available the link will forward to an application form to request a copy from the EUR University Library. We

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recommend before requesting the copy to check access via Google Scholar (scholar.google.com). Type or paste the title of the article you are looking for in the search box. When you have found the right article click on 'All [n] versions'. Maybe one of the versions refers to a pdf or html document. Another option is to email the author (if the article was published recently you have a good chance to obtain a copy).
If there is no subscription to the journal, Erasmus MC employees (anyone with a microsection number) can request a copy of an article via the University Library of the Erasmus University. More information about that procedure can be found on our intranet pages:
medbib.erasmusmc.nl/en/searching/request-articles-and-books/

Please fill out the pre workshop assignment (you can find this online on medbib.erasmusmc.nl/workshops/pubmed.asp) and return the document to info.mb@erasmusmc.nl prior to the workshop.

The rest of this documents contain the handouts for the workshop, both part 1 and part 2. You don't have to prepare this before the workshop.

--- Hand-outs workshop systematic literature retrieval ---
How to search systematically

5. Determine a good research question

A systematic search starts with a good research question. Research questions should be answerable (do you expect to find the answer in the literature), clear and focused. Research questions should not be too broad, too specific or too vague. You are also advised to act cautiously searching for different research questions simultaneously. Chances are the for one research question many results appear, and few for another. The high total will then likely trigger the need to reduce the numbers, which might mean the few articles on the more specific question are all lost.

6. Identify concepts in the research question

Elements are distinguishable concepts in your research question, such as, but not limited to: Substances; Actions; Diseases; Symptoms; Persons; Features; Characterizations; Locations; Settings; Domains (such as therapy, diagnosis, prognosis…) etc.
Many basic workshops in searching will discuss PICO as a tool to determine elements in your research question. PICO is likely to urge the searcher to add too many elements to the search. Especially given that the P often already includes multiple elements (for example Postmenopausal Women with Diabetes). We propose a different method to determine which elements to use, see paragraph: 8.1 Are elements specific/general, important/unimportant.

7. Group concepts into elements

Concepts in your question are often related and can be used intechageably. Whenever you want to find articles either on one concept or on another concept they together form one element. For example Palliative Care is an action, Terminal illness a disease, Terminally ill are persons and Hospice is a location, but together they are about end of life, forming one element consisting of four concepts. Very often you will recognize this as the research question stating and and. In that case your search strategy should often contain an OR between concepts. Anything that can be combined with OR is one element. If you are interested in Vitamins and hormones, you are interested in articles about vitamins, and you are interested in articles about hormones. This means this is one element: vitamins OR hormones

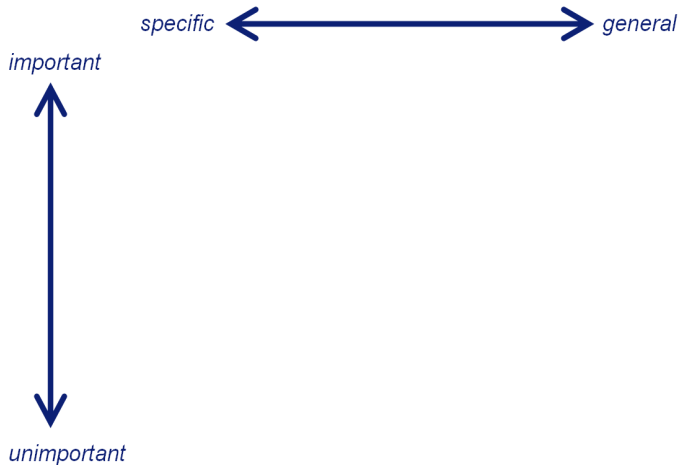
8. Determine which elements to use

There are various reasons not to use an element in your search:
The element is too specific: If something is only mentioned in full text
Negative elements: A without B. Also not recommended to use "NOT", as exclusion criteria are mentioned in the abstract
Order between elements: You will search both elements and determine the order from the full text (unless there is a specific word for the order: "preoperative", "neoadjuvant")
Too many elements: You don't want to add more than 4 elements in your search.
Bias in your elements
A bibligraphic database such as PubMed is not able to search the full text of articles. Instead it will search titles and abstracts, and thesaurus (MeSH) terms. Titles and abstract are most likely focused on the most interesting results from the article. Negative results or not significant outcomes will less likely be mentioned in a title or abstract. Therefore including very specific characteristics or subjective opinions such as judgements might introduce a bias.

Potential duplication in your elements
Sometimes an element overlaps almost completely with another, for instance when a certain disease is only present in a certain population, or when a therapy is only applied to a certain disease. Choose only the most specific term.

8.1. Are elements specific/general, important/unimportant

There may be many elements in your research question but not all should be used in your search. Prior to searching one should determine which elements should be used. A good way to determine which elements in your question you should use in the search is with specificity/ importance. A graph as pictured to the right here can be used to plot elements.



- If the element has not been researched and published about often, it will probably result in fewer articles. The element is then specific compared to the more often used elements, which will find a broad range of articles.
- If you can think of articles without a certain element, that still can answer your research question, the element is less important.

8.2. Use only important elements, work from specific to general

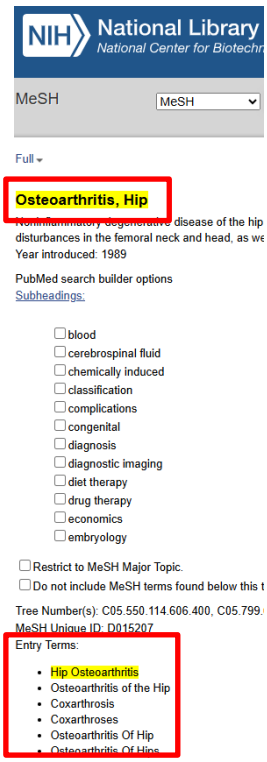
- If there are very specific elements that are important, use only one or two of them. Review the number of hits. If it is too many, you add more general important elements.
- Unimportant elements should be ignored in the query. They only need to be used when the combination of important elements generates too many hits. But be careful and translate them thoroughly, and always check those articles you have missed. But the process is time consuming and when the element is sensitive enough it will hardly ever result in a significant reduction of search results.

More elements result in a higher possibility of missing relevant articles
Each element you add might cause the loss of relevant articles in your results. For each element you add you should check if the articles not retrieved by that element might be relevant, especially with unimportant elements.

9. Build your documentation: prepare your search

- Begin your search with creating a log document in MS Word
- Write down the date, your research question and the databases used
- Build the complete search in the Word document, not in the interface of the database.

9.1. Find search terms in the MeSH database



When creating a search for an element, you start in the MeSH database: Click the second link MeSH Database in the fourth column of the PubMed homepage. Search MeSH terms for one element at a time. In this phase you chose only the terms that are directly relevant for your elements. Do not use too general terms for they will create noise.

The MeSH terms itself (succeeded by [mesh])

At the top of the details page you find the MeSH term. Copy and paste the MeSH term in your word document to prevent typos. You should use the exact phrasing that PubMed uses including commas. Use only the most relevant MeSH term, don't use too broad and too general terms. Add [mesh] in your word document behind the term to indicate that it is a mesh term.

Entry terms

Scrolling down the page you will find Entry terms. Entry terms can be considered synonyms. Use the relevant entry terms (in natural word order, so ignore the terms with commas) to search for in title and abstract. You don't have to mind small differences such as plurals or spaces. Searching with truncation (*) searches for every word or phrase starting with a certain beginning. Between words in a phrase we advise to use hyphens to keep the phrase together (-).

Hip osteoarthritis ← The name of the element
Osteoarthritis, Hip[mesh] ← The MeSH term with the field code
Hip-Osteoarthrit* ← Truncated terms from the entry terms
Osteoarthritis-of-Hip*
Coxarthros*
Osteoarthritis-of-the-Hip*

9.2. Finding more search terms

Relevant terms lower in the tree

When searching with a MeSH term each term found lower in the hierarchical tree of that MeSH term will automatically be searched. However, for exhaustiveness you should use the relevant terms and their respective entry terms as title/abstract searches too if these terms are not already covered by the terms you already have on your list.

Previous indexing

If a MeSH term has been added to the database recently, no articles indexed before that year will have the MeSH term. Previous indexing shows how the same term was indexed before this MeSH term was used. Use it only when the term is relevant and not too broad!

See Also

MeSH terms sometimes overlap partially. "See Also" shows related MeSH terms.

Broader terms

Sometimes you can choose to use a broader MeSH term than you originally selected.

Not every meaningful variation can be found in the MeSH database. Always consider:

- Spelling differences (UK/ USA)
- Abbreviations (also partial abbreviations)
- Opposites (Sometimes opposites are suggested in MeSH, but often not)

9.3. Possible complications

One element - Combination of multiple MeSH terms in AND (specific elements)

An element is too specific to be found by one MeSH term. You need to combine two or more MeSH terms with an AND relation to describe your element.

Bennet's fracture: (Fractures, Bone[mesh] AND Thumb[mesh] AND (Metacarpus[mesh] OR Metacarpal Bones[mesh]))

MeSH terms too broad for a specific topic

Sometimes when you search for a specific topic the topic appears as an entry term for a (much) broader MeSH term. For example Right Ventricle is an entry term of Heart Ventricles but so is Left Ventricle. Using the MeSH terms can result in too much noise. It depends on the goal of your research if you will accept that noise.

9.4. What to do if MeSH terms cannot be found

Sometimes relevant MeSH terms cannot be found immediately. Several solutions exist:

Split an element in two separate elements

Maybe there is no MeSH term for what you think was one element, but your element is a combination of two elements, and you can find MeSH terms and synonyms for those separate elements.

For general topics: find a few specific MeSH terms

If your term for a broad topic does not retrieve a good broad MeSH term, search for specific MeSH terms. Possibly you can find an overlapping MeSH term that fits your element. Otherwise just make sure to gather all specific MeSH terms.

PubReminer

Use pubreminer (bit.ly/amcpubreminer) to see what other articles that have identical words in title and abstract have been indexed with (see also later in these handouts)

If all fails: Use your own words

If this still does not result in useable MeSH terms you can always resort to using only your own words or phrases, but be aware that this is very tricky.

9.5. Special MeSH terms

When searching MeSH terms you might find special terms which require special instructions and special field names. Use these field names only when you find these special terms!

You will recognize this when you see certain terms in square brackets after the MeSH term:

[Subheading]

[Pharmacological Action]

[Supplementary Concept]

[Publication Type]

The easiest way to use these special terms is to just treat them as normal MeSH terms, only do not add [mesh] behind it in your list, but just copy the term including what it shows between the brackets

Subheadings

Subheadings are specifications of certain aspects of MeSH terms. For example "Neoplasms/prevention and control" will be added to articles on the prevention of cancer. Adding prevention and control[subheading] to your element of prevention will find that subheading in any MeSH terms of an article and is the most sensitive and easiest way to search.

Pharmacological actions

For general drug types (such as anticoagulants/ vitamins). The regular MeSH term will retrieve reference about that drug type, the pharmacological action will retrieve studies that have used those type of drugs.

Supplementary concept
Additonal to the standard MeSH terms (25000) there are 140000 supplementary concepts. Use the terms mentioned with *heading mapped to* as alternative (combine relevant MeSH terms with AND). Search for the supplementary concept if *Heading mapped to* is too broad .
Publication type
Study types can be defined as publication type [Publication Type] or MeSH term. Examples of publication types are:
- Case Reports [Publication Type]
- Clinical Trial [Publication Type]

An example a study type as MeSH term is:
- Cohort studies[mesh]

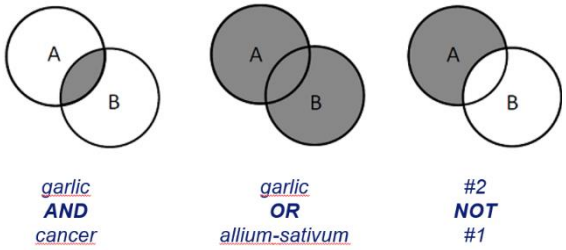
Those study types can be used to limit your results to a certain type of publication, but never use it alone, always in combination with words in title and abstract. In fact these special MeSH terms can be treated as any other element in your search. Only the field code is different from a regular MeSH term.

---- PART 2 OF THE WORKSHOP -----

10.Combine synonyms to search strategy

10.1. Boolean operators/ Parentheses

There are three Boolean operators: AND in between elements, OR between synonyms in one element, and NOT to exclude terms from the search.



- Always use capitals for Boolean operators
- Don't use NOT unless for comparing adapted search strategies (see under paragraph 11.3.2 "Too many results: increase specificity" for safe use of NOT)
- Control priority with parentheses: (broccoli OR brassica) AND (cancer OR neoplasm)
- For exhaustive searches we advise not to use the interface to build search strategies (such as the 'Query Builder'). This will often result in errors or too complicated searches

10.2. Field codes

MeSH terms:
[mesh] exact MeSH term (including any more specific term in subbranches)
Other terms:
[tiab] the exact word or phrase in title or abstract or author keywords
[all fields] is not preferred as it will generate much noise.

10.3. Two ways of creating search strategies from a list of terms

To create a search from a list of terms there are a few adaptations that have to be made. You can do this in a manual way, which is more labor intensive but works fine for short lists. If your lists are longer you easily make errors and the semi-automatic method is recommended.

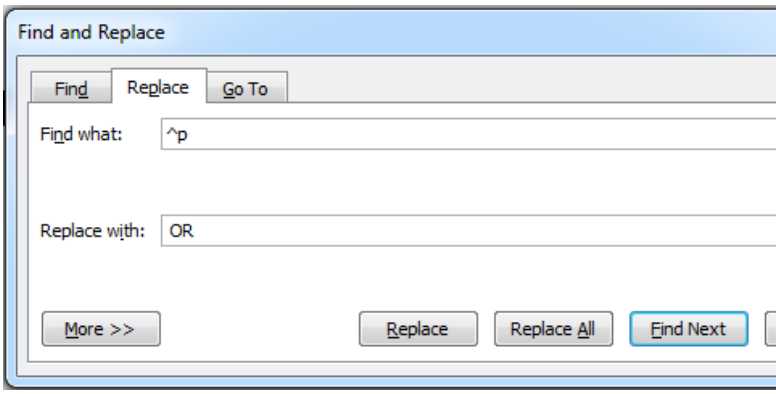
10.3.1. Manual method

In the manual method you just type [tiab] after each term that is not a (special) mesh term. Remoce all line breaks withing all elements and put an OR between the terms. Put parentheses around your search terms and place an AND between the elements. See the table below for an example.

10.3.2. Semi-automatic method using find and replace

A very convenient and easy way to create a search strategy from a longer list of search terms as created with the directions in these handouts uses the MS Word option Find and Replace (Ctrl-H).
This method works best in MS Word under Windows. Work in a word document with only your list of terms.

1. On the whole document: Replace "*" with "*[tiab]"
    - Check for untruncated lines and manually add [tiab] where necessary
    - If you have used inline truncation: Replace [tiab]- with -
2. Select one element at a time:
   Replace "^p" with " OR ".
   Repeat this for all elements in your search.
3. Place an opening parenthesis "(" at the beginning of the search strategy and an ")" at the end.
4. Place AND between the elements. It is advised to place these ANDs on separate lines so elements can be easily recognized.



Example of search strategy developing:

Search terms	After step 2	End Result
Attitude "Attitude"[Mesh] opinion* **Children** "Child"[Mesh] child* **Smoking** "Smoking"[Mesh] cigarette*	**Attitude** "Attitude"[Mesh] OR opinion* [tiab] **Children** "Child"[Mesh] OR child* [tiab] **Smoking** "Smoking"[Mesh] OR cigarette*[tiab]	("Attitude"[Mesh] OR opinion*[tiab]) AND ("Child"[Mesh] OR child*[tiab]) AND ("Smoking"[Mesh] OR cigarette*[tiab])

11.Analyse the results and optimize your query

11.1. Check for errors

How do you know an error occurred? Too often you don't realize this.
Sometimes: Too many or too little hits (more or fewer than expected)
Always check your query for mistakes

Go to Advanced search page, open the Search details clicking on > in the table and use Ctrl-F to search:

Search for ' and ' → compare the number in your search (top) to what pubmed translated it into (bottom)
Search for 'all fields' → Each one is one too many → check if you forgot a field code (e.g. [tiab]) or a truncated phrase was not found and split.

Missing parentheses:
PubMed only checks the total number of opening and closing parentheses and highlights them in the search details. Split the query in elements to paste every element on by one in pubmed to check for marked errors in parentheses.

11.2. Too many/ too few: Sensitive versus specific search

What is too many, what is too few?
No clear borders. Sometimes 100 is more than enough, sometimes 5000 is too few. You don't always have to be absolutely complete. Only for true systematic reviews you cannot afford to miss any relevant reference. For any other search you should not worry that you miss a few potentially relevant papers, as long as you find the most important ones. In general for more background types of searches, somwhere between 200 and 500 references is a good number. Not too much to read, but also not too few that you are likely missing many relevant references. The lower the chance of missing relevant references (high sensitivity) the higher the number of (irrelevant) references (low specificity).

11.3. Optimization

Don't take your first search for granted. Your first search effort will often not give the most optimal result. You want to be sure that you don't miss too many relevant references, but on the other hand, you do not want to find too many irrelevant references.

11.3.1. Too few results: increase sensitivity

You want to be sure you did not miss important articles. You can only be sure if you know what articles might have been relevant that you missed.

- Add extra terms
    - Check the first results for not highlighted relevant terms
    - Add the complete search to PubReminer and check the list of MeSH terms.
    - Consider adding study type in an OR to find difficult to find articles
    - Use broad filters
        - Sensitive clinical queries
          On Startpage of PubMed, in the column PubMed Tools, click Clinical Queries.
          In the text under *Clinical Study Categories*, click on the link filter information
        - Most published and validated filters
          Search PubMed for search-filter* AND *general medicine*
        - Queries from other (good) systematic reviews that overlap with one of your elements.
- Generalize specific elements (maybe a specific element is too narrow, and you can broaden your research topic). A good way to generalize is to move up one level in the MeSH database.
- Drop unimportant elements (don't include unimportant elements to begin with)
- 2 elements → 1 element
  (I) AND (C) → (I OR C)
  If not enough articles can be found comparing the intervention (I) with the control (C) search for articles comparing the intervention, and compare with articles that used the control yourself

- 1 element → 2 elements
  If you used phrases in one of your elements you might find more articles searching the words in those phrases separately
- Use Proximity
  With proximity you can search for words occuring within a certain distance from eachother. For example "hip osteoarthritis"[tiab:~5] will also find osteoarthritis of the knee and hip. This only works with phrases between quotes. The phrases cannot be truncated. The number indicates the maximum number of words found between the words in the phrase.

While increasing sensitivity, save the relevant records you found on the clipboard. Then you can check later whether the more specific search did retrieve those relevant results that you encountered while searching.
Compare those articles on your clipboard with your result set:
Collect multiple articles on your clipboard (Send to > Clipboard)
compare record-set in your history #0 with your final record set (#0 NOT #N)

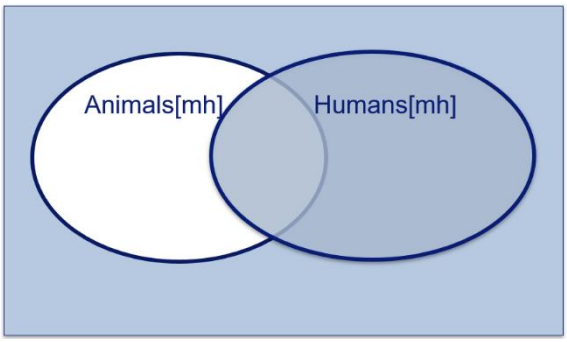
11.3.2. Too many results: increase specificity

Partially these are just the opposite of what you would do to increase sensitivity:

- Remove too general terms
- Specifiy general elements
- Add an extra element (but be careful with the unimportant ones)
  - You can add study type with and AND (but do not use the filter on the left side, but treat the new element as any element in your search and go to the MeSH database to select the correct [publication type] and to add terms in title abstract
  - Add a narrow filter with an AND
- 1 element → 2 elements
  (I OR C) → (I) AND (C)
- 2 elements → 1 element
  (A) AND (B) → (A-B* OR “A B”[tiab:~3])
  If you searched elements with an AND you might find them to be far apart, resulting in much noise. In certain cases you could try create phrases combining these elements. This will not work on all element combinations.
- Use [mesh:noexp] to prevent including irrelevant narrower terms
- Add Filters (but be warned)
  Most filters on the left side of PubMed results are either useless or dangerous. You can miss many relevant articles using the standard filters on the left side.
  - Publication Date → only systematic when a certain part of your research question was not present before a certain date, because the treatment or device developed recently. Use the custom range, add a rounded starting date (e.g. 2015) and no end date.
  - Text availability is useless. Free full text is too small, Full text is too broad.
  - Article type is based on mesh terms. You will miss the most recent articles. Better use the mesh database to find the mesh terms for publication types and add your own terms in title abstract
  - Language → for SRs you choice is to not restrict to any language, or to use only english articles. Otherwise the research would not be repeatable by someone with different language skills than the original researchers.
  - Species humans can be search with the double NOT: NOT (animals[mh] OR humans[mh])

- Sex / Age: treat this as normal elements in your search, find mesh terms and add terms in title and absract

- For the most important element: use [mj] and [ti] instead of [mh] and [tiab]
  If you can afford missing relevant references, for systematic reviews this is not recommended.
- Use NOT to exclude irrelevant terms (but cautiously)
  Be specific in using a general NOT element:
  NOT (neoplasms/therapy[majr] OR cancer-therap*[ti])
  NOT out noise only on a specific term:
  … hiv[tiab] OR (aids[tiab] NOT hearing-aids[tiab]) …
  Or use a double NOT
  NOT (animals[mh] NOT humans[mh])



12.Adapt the query to other databases

Which databases are available?

PubMed (Medline)
Freely accessible, no advanced searches

Embase
Aimed at professionals, proximity search and good relevance ranking

Medline (Ovid)
Medline with advanced searching

Cochrane Central
Clinical trials not in Medline / Embase

Web-of-Science
General scientific, also citation analysis

Google Scholar
Searches full text

Search by Medical Library
(PsycInfo / Cinahl / Scopus and many more)

Not one of them is the absolute best, to capture all articles you need to search multiple databases (and even more)

13.Was the search successful?

The success of your literature search depends on, many thing you cannot control, and only few that you can actually control:

1. The absolute number of relevant articles
2. The contents of the databases available and used
3. The quality of indexing by the databases
4. The quality and characteristics of the search engine
5. The quality and presence of an abstract
6. The quality of the search and experience of the searcher

14.Summarized: the best way to search systematically in PubMed

1. Open a **text document** (MS-Word)
2. Write down your **clear and focused** research question
3. Write down the **date** of the search
4. List the **databases** used
5. Decide which **elements (key concepts)** the articles have in common
6. Decide whether elements are **important or unimportant** and **specific or general**
7. Decide **which elements you should** use for the best search results

8. Open the **MeSH database** and search for the best MeSH term(s) for those elements
9. For those MeSH terms use at least the **MeSH term** and a selection of the **entry terms**, including **narrower terms** as free text search terms and paste them in Word
10. Also use **your own words**, especially if no good MeSH is available
11. Create the syntax with **field codes** [mesh], [tiab] and others, **parentheses** around the elements and **Boolean operators**
12. After you have translated all important elements into a search strategy in this way, open the **PubMed database** and perform you first test search for references
13. Try to **optimize** your search by evaluating and comparing the results until satisfied
14. Check for **errors**

If you really want to be exhaustive, we recommend you to attend the workshop Systematic Literature Retrieval in embase and other databases, in which we will teach you to translate your PubMed search into a wide variety of other databases (see 12 Adapt the query to other databases).
If you want to write a systematic review, you should make an appointment with an information specialist via *info.mb@erasmusmc.nl*

15.Field codes / syntax in PubMed

Field Code	**Description**
[mh] or [mesh]	Mesh terms with exploded subbranches
[mh:noexp]	Mesh term without exploded subbranches
[mj] or [majr]	Major mesh term: the few most important MeSH terms for an article Use only for focusing a search that generates too many results.
[tiab]	Words or phrases in title, abstract or author keywords IMPORTANT: use hyphens to combine words into phrases
[ti]	Words or phrases only in title Use only for focusing when needed for orientation on a subject
[sh]	[subheading] in a separate element
[nm]	[supplementary concept] Name of a specific cubstance or a rare disease
[pt]	[publication type]
[pa]	[pharmacological action] a generic type of drugs
[au]	Author
[1au]	First Author
[pg]	First page number
[dp]	Date of publication. For a range: *2000:2013[dp]*
[ad]	Author's address *erasmus[ad]*

English language	English[la]
Human studies	NOT (animals[mh] NOT humans[mh])
Adults	NOT ((child[mh] OR infant[mh] OR adolescent[mh]) NOT adult[mh])