ELSEVIER

EMBASE 201

SYSTEMATIC REVIEWS

INTRODUCTION

Embase allows you to build comprehensive systematic reviews so that you can thoroughly review all of the published literature on a particular topic and make the best-informed evidence-based medicine decisions. The Cochrane Collaboration recommends Embase as a key database for such systematic reviews because it is so highly suited to this task thanks to the large, comprehensive and deeply indexed database and the flexibility of the search strategy.

In this guide, you will learn the fundamentals of creating systematic reviews. We'll discuss the PICO framework and how it supports systematic search construction. We'll also give you some tips and tricks for getting the most out of Embase.

The fundamentals of the PICO framework

PICO stands for **P**atient or **P**roblem; **I**ntervention; **C**omparison or **C**ontrol; and **O**utcome. It is a recommended framework for structuring and focusing searches that address clinical questions. As such, it is central to systematic reviews for evidence-based medicine.

Applying the PICO framework means structuring your search in such a way that it retrieves reports of studies indexed with terms for a certain condition (patient or problem), therapeutic measure or diagnostic (intervention), appropriate control (comparison or control) and expected measurable outcome (outcome). You start a systematic review by identifying the P, I, C and O elements for your search. In addition to PICO, you can apply study type hedges to improve the recall (see definition on page 2 for more details).

Figure 1 visualizes the application of PICO in structuring a search. Table 1 gives examples of the relationships between question types and the elements of PICO.

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Tips for applying PICO

- In addition to being at risk for a health problem, the patient is a member of a population. Therefore, age, sex, ethnicity, socioeconomic status and other demographic variables may need to be taken into consideration when structuring the search and considering the retrieved evidence.

- It is not always possible to define a comparison or control for a PICO analysis.

- Outcomes must be measurable (i.e., the study must have been rigorous with statistically significant findings) and ideally should measure quality of life and clinical well-being, not laboratory test results.
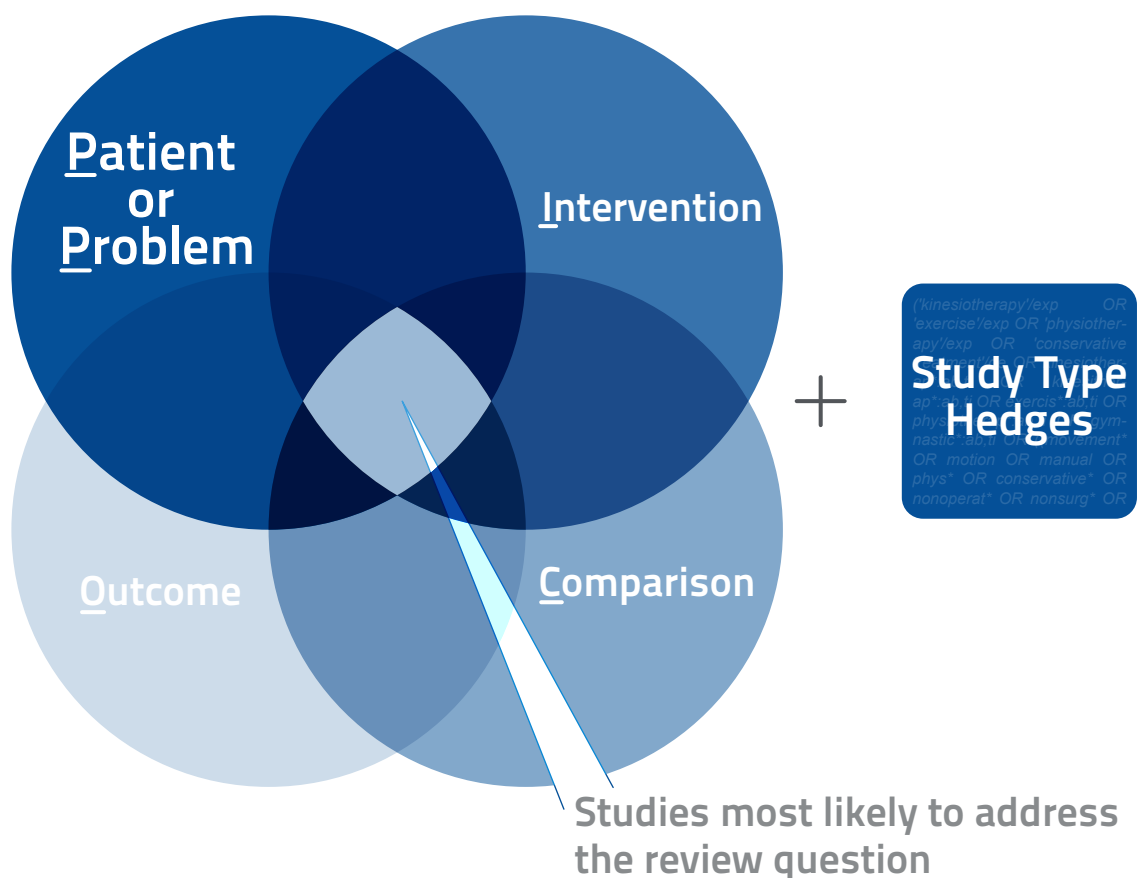

Figure 1. Search structure = PICO + Study Type. Studies most likely to address the review question will be found with a search structured to find a particular patient or problem, intervention, comparison or control, and outcome. Study type limits can also be applied.

WHAT ARE HEDGES AND STUDY TYPE HEDGES?

Hedges are standardized searches (sometimes called filters) that use a combination of controlled vocabulary and natural language words and phrases to search for frequently required concepts. Study hedges may be applied to improve the recall of various search types, such as randomized controlled trials (RCTs), systematic reviews and meta-analyses, and to identify clinical concepts, such as diagnosis, prevention, prognosis and treatment.

Table 1. Relationship between question type and problems, interventions, comparisons and outcomes.

Question Type	Patient or Problem	Intervention	Comparison	Outcome
Treatment (Therapy)	The patient's disease or condition (e.g., diabetes mellitus, constipation or meningitis)	A therapeutic measure (e.g., drug, surgery or lifestyle modification)	An alternative intervention or a placebo; could also be the standard of care	Examples: mortality, productivity, pain, disability or employment
Prevention	The patient's risk factors and overall state of health	A preventive measure (e.g., drug or lifestyle modification)	May not be applicable	Examples: morbidity, mortality, pain, disability
Diagnosis	The target disease or condition	A diagnostic test or procedure	The current reference standard test for the problem	Measures of the test's utility (e.g., sensitivity, specificity or odds ratio)
Prognosis (natural history)	Prognosis in terms of severity and duration of the clinical problem	Usually time, sometimes expressed as "watchful waiting"	Usually not applicable. In cases of "watchful waiting", identify the standard treatment	Examples: survival rates, mortality rates or rates of disease progression
Etiology or harm (causation)	The patient's risk factors, current diseases and conditions, and overall state of health	The intervention of interest, including some indication of the strength (dose) of the risk factor and the duration of the exposure	May not be applicable	Examples: disease incidence, rates of disease progression or mortality rates

Adapted from http://libguides.mssm.edu/ebm/ebp_pico

Constructing a Search using the PICO Framework

With each element of the PICO framework, you need to identify the best terms to use so that you retrieve all the relevant data. Therefore, you should always start with Emtree to identify a preferred term (subject heading) for searching, provided one is available. Take note of any Synonyms listed in Emtree and consider searching for these synonyms in the title or abstract. Then read the entry provided from Dorland's dictionary, when available and consider searching for additional terms defined therein.

WHAT ARE PREFERRED TERMS AND SYNONYMS?

Our experts use the Emtree thesaurus for deep, full-text indexing of all journal articles. Emtree includes preferred terms as well as their synonyms. Articles are indexed using Emtree preferred terms and all synonyms are mapped to the corresponding preferred term. Therefore, if 'Map to preferred term in Emtree' is selected, searching by synonym will give the same results as searching using the preferred term. For example, 'heart infarction' is the preferred term; 'myocardial infarction' and 'heart attack' are mapped to it as synonyms. 'Prozac' maps to the preferred generic name 'fluoxetine'.

Browse Emtree

Query Builder
Build a multi-term search query

Find Term | Browse by Facet

Type word or phrase (without quotes)
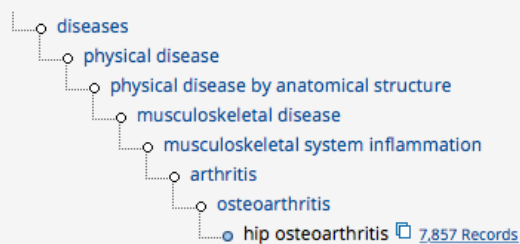
hip osteoarthritis

Find Term

For term: **'hip osteoarthritis'**
Extend your search: ☑ Explosion   ☐ As major focus
or

Take this query to Disease Search | Add to Query Builder

Emtree
└─○ diseases
 └─○ physical disease
  └─○ physical disease by etiology and pathogenesis
   └─○ inflammation
    └─○ musculoskeletal system inflammation
     └─○ arthritis
      └─○ osteoarthritis
       └─○ hip osteoarthritis 🗍 7,857 Records

└─○ diseases
 └─○ physical disease
  └─○ physical disease by etiology and pathogenesis
   └─○ degeneration
    └─○ degenerative disease
     └─○ osteoarthritis
      └─○ hip osteoarthritis 🗍 7,857 Records

└─○ diseases
 └─○ physical disease
  └─○ physical disease by anatomical structure
   └─○ musculoskeletal disease
    └─○ musculoskeletal system inflammation
     └─○ arthritis
      └─○ osteoarthritis
       └─○ hip osteoarthritis 🗍 7,857 Records

History
This term was added to Emtree in 2003

Synonyms
arthrosis, hip; arthrosis, hip joint; cox arthrosis; coxartherosis; coxarthroses; coxarthrosis; hip arthrosis; hip joint arthrosis; hip osteo-arthritis; hip osteo-arthrosis; hip osteoarthrosis; malum coxae senilis; osteoarthritis, hip

Dorland's dictionary
coxarthrosis = degenerative joint disease or osteoarthritis of the hip joint.

Definition from *Dorland's Medical Dictionary*, 32nd edition, copyright © 2011 by Elsevier. For more information please go to www.dorlands.com

Figure 2. Browse Emtree to identify the preferred term for your search. In this case, "hip osteoarthritis" is the preferred term. Then check the synonyms mapped to "hip osteoarthritis" and the definition in Dorland's dictionary.

When you've identified the terms for your four elements, you can structure them into your search strategy. The formula for using the Boolean logical operators to search the inter-relationship between the concepts is:

P-elements AND I-elements AND C-elements AND O-elements

The Boolean OR operator is used to search the inter-relationship within each individual concept.

Let's look at this in more detail using a specific question:

"Is exercise therapy an effective treatment for hip osteoarthritis?"

P – **Patient or Problem**
The aspects of this concept are determined from the review question. They may include the disease or condition, stage, severity, demographic characteristics and other clinically relevant factors.

A generic formula for this search strategy is:

1. Disease Emtree preferred term
   'name of the disease'/de (or :de if a candidate term is identified; depending on the narrower terms, you may also chose to perform an explosion search /exp)

2. Disease term Field search of Article title and Abstract
   'name of the disease' OR 'synonyms for the disease':ti,ab

3. #1 OR #2

For example, to answer the question "Is exercise therapy an effective treatment for hip osteoarthritis?" a suitable search could be:

- Patient or Problem =

  'hip osteoarthritis'/exp OR ('arthritis'/de OR 'osteoarthritis'/de AND 'hip'/de) OR coxarth*:ab,ti OR ((hip OR cox) NEAR/6 (arthrit* OR arthrosis* OR arthroses* OR osteoarth* OR oa)):ab,ti OR 'malum coxae senilis':ab,ti

I – **Intervention**
The aspects of this concept may include type of intervention, drug dose and duration, timing, and route of administration.

A generic formula for a drug search strategy is:

1. Drug Emtree preferred term
   'name of the drug'/de (or :de if a candidate term is identified)

2. Drug term Field search of Article title, Abstract and Drug trade name
   'name of the drug' OR 'synonyms for the drug':ti,ab,tn

3. Drug CAS registry number Field search
   'CAS number':rn

4. #1 OR #2 OR #3

For example, to answer the question "Is exercise therapy an effective treatment for hip osteoarthritis?", a suitable search could be:

- Intervention =

  ('kinesiotherapy'/exp OR 'exercise'/exp OR 'physiotherapy'/exp OR 'conservative treatment'/de OR kinesiotherap*:ab,ti OR kinesitherap*:ab,ti OR exercis*:ab,ti OR physiotherap*:ab,ti OR gymnastic*:ab,ti OR ((movement* OR motion OR manual OR phys* OR conservative* OR nonoperat* OR nonsurg* OR 'non operative' OR 'non surgical' OR paramedic* OR 'para medical') NEAR/3 (technique* OR therap* OR treat* OR isokinet* OR isomet* OR water OR management*)):ab,ti OR ((muscle* OR muscul*) NEAR/3 train*):ab,ti

C – Comparison or Control

The aspects of this concept may include absence of risk or treatment, placebo or alternative therapy. This component may not apply to all review questions. It does not apply in our example.

O – Outcome

The aspects of this concept may include risk, mortality, morbidity, quality of life and utilities. Sometimes this component is not searchable and/or it is advisable to ignore it in the search process, but it does apply in our example.

For example, to answer the question "Is exercise therapy an effective treatment for hip osteoarthritis?", a suitable search could be:

- Outcome =

  'clinical effectiveness'/exp OR 'comparative effectiveness'/exp OR 'cost effectiveness analysis '/exp OR 'program cost effectiveness'/exp OR 'program effectiveness'/exp OR (effectiv*):ab,ti

After you have identified the PI(CO) terms and combined the search results, you can apply the **study type hedges** to improve recall. Several sources are available for therapy hedges. For example, http://hiru.mcmaster.ca/hiru/HIRU_Hedges_EMBASE_Strategies.aspx suggests a therapy hedge that maximizes sensitivity. When expressed in Embase.com syntax, it becomes:

random*:ab,ti OR (clinical NEXT/1 trial*) OR 'health care quality'/exp.

Alternatively, users may consider designing their own therapy hedge using terms such as: therap* OR treatment*

For example, the full search strategy for the question "Is exercise therapy an effective treatment for hip osteoarthritis?" could be:

P 'hip osteoarthritis'/exp OR ('arthritis'/de OR 'osteoarthritis'/de AND 'hip'/de) OR coxarth*:ab,ti OR ((hip OR cox) NEAR/6 (arthrit* OR arthrosis* OR arthroses* OR osteoarth* OR oa)):ab,ti OR 'malum coxae senilis':ab,ti **AND** ('kinesiotherapy'/exp OR 'exercise'/exp OR 'physiotherapy'/exp OR 'conservative treatment'/de OR kinesiotherap*:ab,ti OR kinesitherap*:ab,ti OR exercis*:ab,ti OR physiotherap*:ab,ti OR

I gymnastic*:ab,ti OR ((movement* OR motion OR manual OR phys* OR conservative* OR nonoperat* OR nonsurg* OR 'non operative' OR 'non surgical' OR paramedic* OR 'para medical') NEAR/3 (technique* OR therap* OR treat* OR isokinet* OR isomet* OR water OR management*)):ab,ti OR ((muscle* OR muscul*) NEAR/3 train*):ab,ti) **AND**

O ('clinical effectiveness'/exp OR 'comparative effectiveness'/exp OR 'cost effectiveness analysis'/exp OR 'program cost effectiveness'/exp OR 'program effectiveness'/exp OR effectiv*:ab,ti)

Figure 3. Performing the example systematic review retrieves over 600 results.

TIPS AND TRICKS FOR SYSTEMATIC REVIEWS

Plan the search strategy in advance

- Choose keywords, i.e., identify and use the appropriate Emtree subject headings and free-text terms, using truncation and proximity operators (NEXT, NEAR) where appropriate.

- Group like keywords together, i.e., apply Boolean logic using the OR operator.

- Decide how groups of keywords are related, i.e., apply Boolean logic using the AND operator

Conduct a scoping search

Scoping searches are used to gain an overview of previous work and to identify a Cochrane review or systematic review. Scoping searches can be conducted quite quickly and can be based on a simple search strategy. Apply the 'EBM' limits Cochrane Review and/or Systematic Review (see Embase Help for more information on applying limits).

Figure 4. Apply the limits 'Cochrane Review' and 'Systematic Review' to conduct a scoping search.

Use previous work

If you find a Cochrane review or systematic review, look for the search strategy published in the review.

- Assess its relevance for adaptation

- Translate search syntax, when necessary

- Consider subject headings and free-text terms used

- Convert subject terms, where needed

Get more from Emtree

If the Emtree term is new or was recently added (as determined from the History note in the Emtree record), perform a Field search of article title (:ti) using the known term. For example, if your term was 'hip osteoarthritis', you would enter 'hip osteoarthritis':ti into the search bar and look at the Emtree index terms in the results to identify synonyms and preferred terms (see Embase Help for more information on Field searches).

Review the Emtree terms used to identify alternate ways of indexing the concept and consider adding these subject headings to the search strategy.

Figure 5. History shows when the term was added to Emtree. You can also see the different subject headings used with that term.

When _NO_ Emtree Term is identified

Perform a Field search of article title (:ti) using your search term. Look through the resulting list of records and use "Add to Clipboard" link for any articles that you deem relevant.

Then, from the Clipboard, you can review the Emtree terms of the selected records to identify any pertinent preferred terms and/or candidate terms for use. To search a candidate term, perform a Field search of the Index term (:de).

Finally, review the abstracts to identify any expressions used by authors for performing free-text searches. Conduct a Field search of article title (:ti) and abstract (:ab)

Other tips and tricks

- When performing a Field search of article title (:ti) and abstract (:ab) for any synonyms listed in an Emtree record, consider using truncation or wildcard characters (*, ?) as needed (see Embase Help for more information).

- When conducting a Field search of article title (:ti) and abstract (:ab) for author free-text expressions, consider using proximity operators (NEXT, NEAR) as appropriate (see Embase Help for more information).

- When performing free-text searches, remember to consider variant spellings, including British and American spellings and terminology:

  * Examples: tumor vs. tumour; diaper vs. nappy; pediatric vs. paediatric; otorhinolaryngology vs. ear, nose and throat; overuse injury vs. repetitive strain injury

- In Embase, consider saving searches for regular use of repeated search strategies or set up an email alert

Document your Search Process

It is a very good idea to export the session history so that you can use it in a document for inclusion in any review documentation.

Go to Embase Help for more information

You'll find it by clicking on the question mark icon at the top right of any Embase page. It has detailed information on Field searches, proximity operators, truncation and wildcard characters and more.

Embase Help also has information about our Embase webinar series and instructional videos. These will give you more detailed tips on searching, using PICO search strategies and more.

Figure 6. Click the question mark icon to open Embase Help.