“Extreme searching”: How to conduct a systematic search in MEDLINE

Genevieve Gore • Liaison Librarian
genevieve.gore@mcgill.ca • 514 398 3472

Schulich Library of Science and Engineering
By the end of today’s class, you will:
► Understand what MEDLINE is
► Understand what MeSH (subject heading) is
► Construct a search strategy using subject headings and textwords
► Run your search using MEDLINE on Ovid
► Export your results to EndNote
Library course guide

http://libraryguides.mcgill.ca/epib-600-002
What’s a review?

- Generic term
- Summarizes the literature on a subject
- Does not necessarily employ scientific methods to identify/assess/synthesize the literature
- More info: 50 Shades of Review (Dr. Andrew Booth)
What’s a systematic review?

A review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review.

What's a systematic review?

- One form of research synthesis
- Uses strategies to limit bias
- Other research synthesis methods include:
  - Health technology assessments
  - Mixed studies reviews
  - Rapid reviews
  - Realist reviews
  - Scoping reviews...
Flow of information through the different phases of a systematic review

**Identification**
- No of records identified through database searching
- No of additional records identified through other sources

**Screening**
- No of records after duplicates removed
- No of records screened
- No of records excluded

**Eligibility**
- No of full-text articles assessed for eligibility
- No of full-text articles excluded, with reasons

**Included**
- No of studies included in qualitative synthesis
- No of studies included in quantitative synthesis (meta-analysis)
What's a systematic search?

Systematic reviews of interventions require a thorough, objective and *reproducible* search of a range of sources to identify as many relevant studies as possible (within resource limits).

Can be used beyond systematic reviews

1. Develop a research question
2. Identify databases, search engines, trial registries, etc. in which to run your search
3. Develop a search strategy
4. Run the search in your first database
5. Apply filters if applicable
6. Export references to a citation manager
7. Translate and run the search in your subsequent databases
Develop a Research Question
Scenario

You’re applying for a grant to support your research on infections in rheumatoid arthritis patients

Think of a question related to this topic...
How questions influence search results

- **Broad Questions**: High = lots of articles; Low = mostly irrelevant articles
- **Narrow Questions**: High = directly relevant articles; Low = very few articles

Relevancy:
- High = directly relevant articles
- Low = mostly irrelevant articles

Retrieval (# of search results):
- High = lots of articles
- Low = very few articles
Possible Questions

Broad:
- What is the prevalence of serious infections in arthritis patients?

Narrow:
- What is the risk of tuberculosis for rheumatoid arthritis patients treated with TNF alpha antagonists?

Very Narrow:
- What is the annual incidence of Caplan’s Syndrome for asbestos workers in Quebec?
What is the risk of tuberculosis for rheumatoid arthritis patients treated with TNF alpha antagonists?
Decide where to search

- Consult library subject guides
  http://www.mcgill.ca/library/find/subjects/health

- Talk to a librarian
What We Are Searching Today

MEDLINE:

- Biomedical database containing bibliographic information (doesn’t search full-text)
- Over 22 million references, mostly of articles
- Can be searched via PubMed or other platforms like Ovid (we will use the latter)
- Uses MeSH (subject headings), a controlled, hierarchical vocabulary used to consistently describe the subject of articles included in MEDLINE and to facilitate their retrieval

MEDLINE, PubMed, and PMC (PubMed Central): How are they different?
Accessing MEDLINE (Ovid)

Use the MEDLINE (Ovid) link on the Library site:

http://www.mcgill.ca/library/
Develop a Search Strategy
1. Break your question down into concepts
2. Identify subject headings for each concept
3. Identify text words for each concept

Tips:
- Use a "target article" to help identify search terms
- Use a worksheet to keep track of your terms
What is the risk of tuberculosis for rheumatoid arthritis patients treated with TNF alpha antagonists?
Patients with rheumatoid arthritis

TNF alpha antagonists

Risk of tuberculosis
What is MeSH?
Why bother with MeSH?

There are 27,883 descriptors in 2016 MeSH

- cancer
- tumor(s)
- tumour(s)
- neoplasm(s)
- neoplastic

Neoplasms/
Another MeSH Example

Poverty/

- poverty
- social disparity
- poor
- breadline
- financially disadvantaged

- financial distress
- extreme need
- social inequity
- low income
- destitute
Dental Caries in MeSH

- Stomatognathic Diseases
  - Tooth Diseases
    - Tooth Demineralization
      - Dental Caries
        - Dental Fissures
        - Root Caries

Special Techniques in MEDLINE on Ovid: https://www.brainshark.com/wkovid/vu?pi=zFvzXHuX2z34XJz0&cmpid=Brainshark:MedlineSpecialTechniques
Which subject heading explodes?
Which subject heading explodes?

<table>
<thead>
<tr>
<th>Select Term(s)</th>
<th>Subject Heading</th>
<th>Hits</th>
<th>Explode</th>
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</thead>
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<td>☐</td>
<td></td>
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<tr>
<td>☑️ Latent Tuberculosis</td>
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<td>☐</td>
<td></td>
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<td>☑️ Tuberculosis, Pulmonary</td>
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<td>☑️ Tuberculosis, Urogenital</td>
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<td>117201</td>
<td>☐</td>
<td></td>
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<tr>
<td>☑️ Immunoglobulin Gamma-Chains</td>
<td>1100</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Immunoglobulins, Intravenous</td>
<td>10941</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Long-Acting Thyroid Stimulator</td>
<td>853</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Muromonab-CD3</td>
<td>1784</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Rho(D) Immune Globulin</td>
<td>1213</td>
<td>☐</td>
<td></td>
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<td>☑️ Immunoglobulin M</td>
<td>48223</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Immunoglobulins, Intravenous</td>
<td>10941</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Insulin Antibodies</td>
<td>2904</td>
<td>☐</td>
<td></td>
</tr>
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<td>☑️ Isotopes</td>
<td>12181</td>
<td>☐</td>
<td></td>
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<td>☑️ Oligoclonal Bands</td>
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<td>☑️ Opsonin Proteins</td>
<td>4012</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Plantibodies</td>
<td>67</td>
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<td></td>
</tr>
<tr>
<td>☑️ Precipitins</td>
<td>1810</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>☑️ Reagins</td>
<td>637</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>
Activity: Identify subject headings

Identify MeSH terms for these three concepts using MEDLINE on Ovid.

- **P**
  - Patients with rheumatoid arthritis

- **I**
  - TNF alpha antagonists

- **C**
  - Risk of tuberculosis
Other ways to identify MeSH
Look at MeSH for known articles

Article title:
“Drug-specific risk of tuberculosis in patients with rheumatoid arthritis treated with anti-TNF therapy: results from the British Society for Rheumatology Biologics Register (BSRBR)”

Citation:
Record in MEDLINE (Ovid)

Unique Identifier: 18854715
Record Owner: From MEDLINE, a database of the U.S. National Library of Medicine.

Institution: Dixon W C. ARQ Epidemiology Unit, University of Manchester, Manchester M13 9PT, UK


Title: Drug-specific risk of tuberculosis in patients with rheumatoid arthritis treated with anti-TNF therapy: results from the British Society for Rheumatology Biologics Register (BSRBR).


NLM Journal Name: Annals of the rheumatic diseases

Publishing Model: Journal available in: Print-Electronic

Citation processed from: Internet

NLM Journal Code: 0372355, 62w

Other ID: Source: NLM. PMC2927681

Journal Subset: Index Medicus

Country of Publication: England

MeSH Subject Headings: Adalimumab
Antibodies, Monoclonal / ae [Adverse Effects]
Antibodies, Monoclonal, Humanized
"Antirheumatic Agents / ae [Adverse Effects]
"Antirheumatic Agents / et [Drug Therapy]
Arthritis, Rheumatoid / et [Drug Therapy]
Arthritis, Rheumatoid / ep [Epidemiology]
Epidemiologic Methods
Etanercept
Female
Humans
Immunoglobulin G / ae [Adverse Effects]
Infliximab
Male
Middle Aged
Receptors, Tumor Necrosis Factor
Registries
"Tuberculosis, Pulmonary / et [Chemically Induced]
Tuberculosis, Pulmonary / ep [Epidemiology]
"Tumor Necrosis Factor-alpha / ai [Antagonists & Inhibitors]
MeSH indexing used

MeSH Subject Headings:

- Adalimumab
- Antibodies, Monoclonal / ae [Adverse Effects]
- Antibodies, Monoclonal, Humanized
- *Antirheumatic Agents / ae [Adverse Effects]
- *Arthritis, Rheumatoid / dt [Drug Therapy]
- Arthritis, Rheumatoid / ep [Epidemiology]
- Epidemiologic Methods
- Etanercept
- Female
- Humans
- Immunoglobulin G / ae [Adverse Effects]
- Infliximab
- Male
- Middle Aged
- Receptors, Tumor Necrosis Factor
- Registries
- *Tuberculosis, Pulmonary / ci [Chemically Induced]
- Tuberculosis, Pulmonary / ep [Epidemiology]
- *Tumor Necrosis Factor-alpha / ai [Antagonists & Inhibitors]
<table>
<thead>
<tr>
<th>Subject Headings</th>
<th>Concept #1</th>
<th>Concept #2</th>
<th>Concept #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>exp Arthritis, Rheumatoid/</td>
<td>AND</td>
<td>Tumor Necrosis Factor-alpha/</td>
<td>exp Tuberculosis/</td>
</tr>
<tr>
<td>Etanercept/ or Infliximab/ or Adalimumab/</td>
<td>OR</td>
<td></td>
<td>Mycobacterium tuberculosis/</td>
</tr>
<tr>
<td></td>
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<tr>
<td>OR</td>
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</tr>
</tbody>
</table>
BREAK – 15 mins
**Boolean Operators: AND/OR**

**AND** directs the computer to search for every reference that **contains all** of the search terms specified. Each term **must** be present in every reference.

**OR** = tells the computer to retrieve **every** reference that has **at least one** of the search terms -- all terms **do not** have to be present in every reference.
Why?

► Not all citations have subject headings
  ➤ Delay in indexing
  ➤ Some articles will never get indexed
► Indexers are only human (they make mistakes)
### Search strategy

<table>
<thead>
<tr>
<th>Concept #1</th>
<th>AND</th>
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<th>AND</th>
<th>Concept #3</th>
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<tbody>
<tr>
<td><strong>Subject Headings</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>exp Arthritis, Rheumatoid/</td>
<td>AND</td>
<td>Tumor Necrosis Factor-alpha/</td>
<td>AND</td>
<td>exp Tuberculosis/</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td>Etanercept/ or Infliximab/ or Adalimumab/ or Certolizumab Pegol/</td>
<td></td>
<td>Mycobacterium tuberculosis/</td>
</tr>
<tr>
<td>OR</td>
<td>Arthriti*.mp.</td>
<td>(tumo?r necrosis factor a or tumo?r necrosis factor alpha or TNF A or TNF alpha or TNFA or TNFalpha).mp.</td>
<td></td>
<td>tuberculosis.mp.</td>
</tr>
<tr>
<td>OR</td>
<td>Biologic* or bdmard*.ti.</td>
<td></td>
<td>TB.mp.</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
<td></td>
<td>(Etanercept or Infliximab or Adalimumab or certolizumab or czp or golimumab).mp.</td>
</tr>
</tbody>
</table>
How to search

► Start with your first concept
  ► Search for the subject headings first
  ► Then search text words
  ► Combine these synonymous searches with OR using your search history

► Repeat for your second, third, and subsequent concepts

► Finally, combine your different concept sets with AND
Run the search
## Search strategy

<table>
<thead>
<tr>
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<tr>
<td>OR</td>
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</tr>
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<td>OR</td>
<td>Arthriti*.mp.</td>
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</tr>
<tr>
<td>OR</td>
<td>(Biologic* or bdmard*).ti.</td>
<td>TB.mp.</td>
</tr>
<tr>
<td>OR</td>
<td>(Etanercept or Infliximab or Adalimumab or certolizumab or czp or golimumab).mp.</td>
<td></td>
</tr>
</tbody>
</table>
Applying filters
Common MEDLINE filters:

1. Date of publication
   - Only studies conducted between 2000 and 2017
   - Should have a valid justification for it

2. Publication language
   - Only materials written in English or French
Practice: Apply basic filters

Apply to your combined search result set:

» English or French Language
Advanced filters

Example:

► **Cochrane Highly Sensitive Search Strategy for identifying randomized trials in MEDLINE (Ovid format)**
Add this line to your search history:

[line #of your final search set] NOT (Animals[mesh] NOT Humans[mesh])

What does this advanced filter do? Why not just use the basic PubMed filter for human studies?
To play it safe, have your EndNote library already open
In Ovid Online: Export in batches of <= 1000
Save your Ovid search

Select only one record to avoid creating a huge Word document! The point here is not to save the records, but rather the search strategy.

http://screencast.com/t/r98iRkZZa86w
Moving to other databases

- Retain as much of your original strategy as possible
- Recognize that subject headings will be different (or non-existent)
- Keep track of your search terms using new worksheets
EMBASE example
Search one database at a time to take advantage of subject headings.
Export References to a Citation Manager

Available to McGill students, faculty, staff.

EndNote

Mendeley

RefWorks

zotero

Available to McGill students, faculty, staff.
Citation Managers

What they do:

- Identify and remove duplicate references
- Format your bibliography
- Organize references into groups
- Share your references with colleagues
- Automatically find full-text articles
- Provide location for article screening

Information and workshops:
http://www.mcgill.ca/library/services/citation/software
Remove duplicates

https://www.flickr.com/photos/fortcollinschiropractor/6169824610
Next steps
Next steps

Identification
- No of records identified through database searching
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Screening
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Eligibility
- No of full-text articles assessed for eligibility
- No of full-text articles excluded, with reasons

Included
- No of studies included in qualitative synthesis
- No of studies included in quantitative synthesis (meta-analysis)

Other ways of identifying studies

- Clinical trials registers
- Reference list searching
- Grey literature searching
  - Unpublished reports on the web, conference presentations, theses/dissertations...
- Hand searching
  - Looking through Table of Contents of journals specifically related to research topic
Document your search
#7) Describe all information sources (e.g. databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.

#8) Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.

**Literature Search**

Document updated: 2015-04-03 by Genevieve Gore

Search strategy peer reviewed: 2015-03-09 by Angella Lambrou

Database searches conducted: 2015-03-24 by Genevieve Gore

Database searches updated: by

Grey Literature searches conducted [date] by [name(s)]

<table>
<thead>
<tr>
<th>Databases/Trial registry</th>
<th>Platform</th>
<th>Dates</th>
<th>Notes</th>
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<tbody>
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<td>Earliest available date-present</td>
<td>Did not include records in other Cochrane Library database segments</td>
</tr>
<tr>
<td>MEDLINE, MEDLINE In-Process &amp; Other Non-Indexed Citations, OLDMEDLINE</td>
<td>OvidSP</td>
<td>1946-present</td>
<td></td>
</tr>
<tr>
<td>EMBASE Classic + EMBASE</td>
<td>OvidSP</td>
<td>1947-present</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

Searches in MEDLINE and Embase limited to English and French

Search in MEDLINE included search filter to remove animal-only indexed studies and records indexed as pediatric-only
## Searches conducted:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Database(s)</th>
<th># Results</th>
<th>Search Date</th>
<th>Saved (account)</th>
<th>Remarks</th>
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<tbody>
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<td>3091</td>
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<td>G. Gore’s account</td>
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<tr>
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</tr>
</tbody>
</table>

Records identified through database searching: 3091 + 3063 + 493 = 6647 records before removal of duplicates

Records after duplicates removed: 3930 records
Next steps
Next steps

**Identification**
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Anesthesia, Cardiology, Dermatology, Endocrinology & Metabolism, Gastroenterology, Hematology, Internal Medicine, Medical Education, Nephrology, Neurology & Neurosurgery, Obstetrics & Gynecology, Oncology, Ophthalmology, Orthopedics, Otolaryngology, Respiratory Medicine, Surgery, Undergraduate Medicine, Urology

Psychiatry

Epidemiology, Family Medicine, Infectious Diseases, Occupational Heath, Pediatrics, Public Health, Sports Medicine

Clinical & Health Informatics, Dentistry, Diagnostic Radiology, Emergency Medicine, Experimental Medicine, Geriatric Medicine, Indigenous Health, Medical Physics, Palliative Care, Pathology
Questions?

Genevieve Gore  
Liaison Librarian  
genevieve.gore@mcgill.ca  
514.398.3472
Resources

Systematic review guides and information:

Systematic Reviews: A Guide to Library Resources at McGill

Systematic Review Service

Rayyan for Systematic Reviews

PRISMA (Preferred Reporting Items of Systematic Reviews and Meta-Analyses)
http://www.prisma-statement.org/statement.htm

Citation management:

Getting help with EndNote
Additional references