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SEARCHING THE LITERATURE: SEARCH TECHNIQUES & CONSTRUCTION TO IDENTIFY STUDIES FOR A SYSTEMATIC REVIEW

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Overview

- Why Search?

- Search construction
  - Concept building
  - Boolean logic
  - Vocabulary
  - Techniques

- Sources
  - PubMed
  - Ovid MEDLINE
  - EMBASE
  - ISI Web of Knowledge
  - Scopus
  - Grey literature

- Search completion
  - Documentation
  - Reporting
  - Citation management
Why search?

- A high-quality lit search is essential for a successful meta-analysis
- It is from the search results that data is gathered for analysis
- Failure to locate important studies can significantly affect results
- Remember the goal is to capture every relevant study
- Important to report search so your methodology can be reproduced
What to expect?

- Expect 1000s of results
- Expect to search multiple databases
  - Ovid, EMBASE, Cochrane, PubMed, etc.
  - Expect that full text may not always be available*
- Expect the search process to take weeks or months
- Expect to publish search strategy and search methodology
- Expect to consult a professional with search expertise (health sciences librarian)
- Expect that even refined search strategies will locate some irrelevant articles
Search construction

- Concept building
- Boolean logic
- Vocabulary
- Techniques
- Evaluating searches
Search construction: Concept building

- Identify major concepts of topic
- PICO helps for clinical questions
  - Patient/problem; Intervention; Comparison Intervention; Outcome

- Example: Is the incidence of breast cancer greater in people who are obese?

- What are the major concepts?
  - Breast cancer
  - Obesity
  - Incidence
  - People
Search construction: Concept building

- Alternate words / Synonyms
  - Obesity, obese, overweight, BMI, etc.
  - Breast cancer, breast neoplasms, breast tumors, etc.
  - Incidence, epidemiology
Search construction: Boolean Logic

- **AND**
- **OR**
- **NOT**
Search construction: Boolean Logic

Resulting search built as:

(Concept 1a OR 1b OR 1c) AND (Concept 2a OR 2b OR 2c OR 2d) AND (Concept 3a OR 3b)
Search construction: Vocabulary

Keywords

Controlled vocabularies
Search construction: Vocabulary

What are they?
- Literal search
- Looks for occurrences of words

When to use?
- Current topics
- Not easy to describe concepts
- No vocabulary exists in database

Examples
- Drug names (Lipitor, Prozac)
- Slang
- Concepts (Swine flu, oil spill)
**Search construction: Vocabulary**

**Keywords**

- **Pros**
  - Very current projects/topics
  - No knowledge of controlled vocabulary necessary
  - Slang
  - Broad, difficult to describe concepts

- **Cons**
  - Not consistent (many variations)
  - Burden on end-user to discover synonyms (might miss some)
  - Too many (irrelevant) results
  - Difficult to limit results
Search construction: Vocabulary

Keywords

What are they?
- Set of words or phrases used to describe concepts
- Dictionary of accepted terms for a database

When to use?
- Searching a database that uses one

Examples
- MeSH (Medical Subject Headings)
- EMTREE (Embase)
Search construction: Vocabulary

Pros
- Burden on database to discover variations in terms
- Consistency & reproducible searches
- Specific & targeted (increased relevancy)

Cons
- Restrictive
- Burden on end-user to learn vocabulary
- Vocabularies differ between databases (no consistency)
Search construction: Vocabulary

Controlled vocabularies

Keywords

All MeSH Categories
Chemicals and Drugs Category
Complex Mixtures
Biological Products
Vaccines

Alzheimer Vaccines
Bacterial Vaccines
Anthrax Vaccines
Autovaccines
Brucella Vaccine
Cholera Vaccines
Diphtheria-Tetanus-acellular Pertussis Vaccines
Diphtheria-Tetanus-Pertussis Vaccine
Diphtheria-Tetanus Vaccine
Escherichia coli Vaccines
Haemophilus Vaccines
Lyme Disease Vaccines
Meningococcal Vaccines
Pertussis Vaccine +
Plague Vaccine
Pseudomonas Vaccines
Rickettsial Vaccines
Salmonella Vaccines +
Shigella Vaccines
Staphylococcal Vaccines
Streptococcal Vaccines +
Tuberculosis Vaccines +
Cancer Vaccines
Fungal Vaccines
## Search construction: Techniques

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<thead>
<tr>
<th>Technique</th>
<th>Example</th>
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<tr>
<td>Truncation</td>
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<tr>
<td>Wild cards</td>
<td>an?sthesiology</td>
</tr>
<tr>
<td>Adjacency</td>
<td>screen* adj10 cancer*</td>
</tr>
<tr>
<td>Phrases</td>
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</tr>
<tr>
<td>Boolean</td>
<td>“vitamin d” AND cancer</td>
</tr>
<tr>
<td>Parentheses</td>
<td>(“breast cancer” OR “breast neoplasms”) AND obes*</td>
</tr>
</tbody>
</table>

Note: Techniques vary from database to database
Limits – use sparingly (language, species, publication type)

- Limits remain on search unless deactivated
Search construction: Techniques

- Exploding subject headings
  - Use differs across databases

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<td>Meningococcal Vaccines</td>
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<td>[+ ]</td>
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<td>Salmonella Vaccines</td>
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</table>
Search construction: Techniques

Subheadings

- Vaccines

Suspending or killed or attenuated microorganisms (bacteria, viruses, fungi, protozoa, or rickettsiae), antigenic proteins derived from them, or synthetic constructs, administered for the prevention, amelioration, or treatment of infectious and other diseases.

PubMed search builder options

- Vaccines/economics[majr] AND public health[majr]
Floating subheadings

Ovid MEDLINE (part of a search)
1. exp Arthritis, Rheumatoid/
2. exp Inflammatory Bowel Diseases/
3. cuc.tw.
4. chronic ulcerative colitis.tw.
5. crohn*.tw.
6. ibd.tw.
7. rheumatoid arthritis.tw.
8. or/1-7
9. exp Postoperative Complications/
10. exp Perioperative Care/
11. su.fs.
12. or/9-11
13. 8 and 12

PubMed (part of a search)
Search construction: Filters

- A predefined search designed to target specific study methodologies (RCTs, Cohort, Systematic Reviews)
- Use a validated filter (whenever possible)

- Example: PubMed Clinical Queries – Specific, Therapy
  - (randomized controlled trial[Publication Type] OR (randomized>Title/Abstract] AND controlled>Title/Abstract] AND trial>Title/Abstract]))
  - 93% Sensitive
  - 97% Specific
Search construction: Evaluation

- Important to validate your search in each database
- Make sure search captures all seminal articles
  - Err on the side of overinclusion – once a study is eliminated from the search process, it is unlikely to be reconsidered
- How:
  - Cross search set of sentinel papers with your final search
  - (Set of Papers) NOT (Final Search) Dfis
- Save searches for reporting
  - Many databases have the option to create accounts to save searches/article collections
Sources

- PubMed
- Ovid MEDLINE
- EMBASE
- Scopus
- ISI Web of Knowledge
- PsycINFO
- CINAHL
- Cochrane Database of Systematic Reviews
- Conference Papers Index
- ClinicalTrials.gov
- Proquest Theses & Dissertations
- CABI
- Google Scholar
- Sociological Abstracts
- And others…
Sources: Things to Consider

- Database coverage in terms of:
  - Dates and currency
  - Language(s)
  - Geographic area(s)
  - Material types (journals, books, reports)
  - Sources Indexed
Sources: PubMed (pubmed.gov)

- Primary biomedical database
- 20+ million citations
- Native interface for MEDLINE dataset
- Citations indexed with MeSH
Results: 1 to 20 of 179559

1. The role of cardiac magnetic resonance in the evaluation of patients presenting with suspected or confirmed acute coronary syndrome.
   Budge LP, Salerno M.
   PMID: 22029981 [PubMed - in process]

2. Neighborhood Variation in Rate of Revascularization among Acute Myocardial Infarction Patients in New York City.
   Negassa A, Fang J.
   PMID: 22023980 [PubMed - in process]

3. Hypertension as a risk factor: is it different in ischemic stroke and acute myocardial infarction: comparative cross-sectional study?
   Hasan ZN, Hussein MG, Haji GF.
   PMID: 22023953 [PubMed - in process]

   Simpson CR, Buckley BS, McLernon DJ, Sheikh A, Murphy A, Hannaford PC.
   PMID: 22029911 [PubMed - in process]

5. Quantifying the evolution of vascular barrier disruption in advanced atherosclerosis with semi-permeant nanoparticle contrast agents.
Screening and brief interventions for alcohol use in college health centers: a review.

Seigars DK, Carey KE.
Center for Health and Behavior, Syracuse University, Syracuse, New York 13244-2340, USA, dksiegars@syr.edu

Abstract

OBJECTIVES: to provide a critical review of the efficacy of brief interventions for alcohol use in college health centers.

METHODS: studies were included if (a) they examined brief intervention trials that were conducted in college- or university-based student health centers or emergency departments, and (b) they provided pre-post data to estimate change.

RESULTS: twelve studies suggested that screening and brief interventions in these settings are acceptable, feasible, and promote risk reduction.

CONCLUSIONS: findings support continued use of time-limited, single-session interventions with motivational interviewing and feedback components.

PMID: 21183444 [PubMed - indexed for MEDLINE]
Results: 2

Alcoholism
1. A primary, chronic disease with genetic, psychosocial, and environmental factors influencing its development and manifestations. The disease is often progressive and fatal. It is characterized by impaired control over drinking, preoccupation with the drug alcohol, use of alcohol despite adverse consequences, and distortions in thinking, most notably denial. Each of these symptoms may be continuous or periodic. (Morse & Flavin for the Joint Commission of the National Council on Alcoholism and Drug Dependence and the American Society of Addiction Medicine to Study the Definition and Criteria for the Diagnosis of Alcoholism: in JAMA 1992;268:1012-4)

National Institute on Alcohol Abuse and Alcoholism (U.S.)
2. Component of the NATIONAL INSTITUTES OF HEALTH. It conducts research focused on improving the treatment and prevention of alcoholism and alcohol-related problems to reduce the health, social, and economic consequences of this disease. NIAAA, NIMH, and NIDA were created as coequal institutes within the Alcohol, Drug Abuse and Mental Health Administration in 1974. It was established within the NATIONAL INSTITUTES OF HEALTH in 1992. Year introduced: 2008
Sources: Ovid MEDLINE

- Different interface to search MEDLINE dataset
- Heavily used for systematic reviews
- Provides additional search functionality (adjacency)
- Uses MeSH (like PubMed)
Your term mapped to the following Subject Headings:
Click on a subject heading to view more general and more specific terms within the tree.

- Any term you select will automatically be exploded to include all narrower terms. To select a term without exploding, clear the Explode checkbox for that term.

Term mapped through permuted index

- Include All Subheadings
- Combine selections with: OR

<table>
<thead>
<tr>
<th>Select</th>
<th>Subject Heading</th>
<th>Auto Explode</th>
<th>Focus</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑</td>
<td>Alcoholism</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;National Institute on Alcohol Abuse and Alcoholism (U.S.)&quot;</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>alcoholism mp. search as Keyword</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hints:
- Click on a Subject Heading to view its tree-related terms that are more general and more specific.
- Select the Explode box if you wish to retrieve results using the selected term and all of its more specific terms.
- Select the Focus box if you wish to limit your search to those documents in which your subject heading is considered the major point of the article.
- If your search did not map to a desirable subject heading, select the box Search as Keyword.
- If you select more than one term, you can combine them using a boolean operator (AND or OR).
- If you wish to see the scope note for any term or heading, click on the information icon, when available.
Sources: EMBASE

- Similar to PubMed, Ovid
- Indexes many more international journals than MEDLINE
- Uses EMTREE
- Includes MEDLINE, unless you NOT out
Sources: ISI Web of Knowledge

- Includes Science Citation Index*, Social Science Citation Index, and Arts & Humanities Citation Index
- Includes conference proceedings for Science and Social Science
- Includes 38 million + citations from 1900 – present
- Good for searches expanding beyond medical field
Sources: ISI Web of Knowledge

Results: Topic=(exercise) AND Topic=(jogging) AND Topic=(health) Timespan=All Years.

Note: Alternative forms of your search term (for example, tooth and teeth) may have been applied, in particular for Topic or Title searches that do not contain quotation marks around the terms. To find only exact matches for your terms, turn off the “Lemmatization” option on the search page.

Results: 282

141. Title: Testing the reliability and validity of the Self-Efficacy for Exercise Scale
Author(s): Renick B; Jenkins LB
Source: NURSING RESEARCH Volume: 40 Issue: 3 Pages: 154-155 DOI: 10.1007/0006199-2000050000007
Published: MAY JUN 2000
Times Cited: 57 (from All Databases)

142. Title: Exercise related injuries among women: Strategies for prevention from civilian and military studies
Author(s): Gilchrist Julia; Jones Bruce H.; Stelz David A.; et al.
Times Cited: 14 (from All Databases)
Sources: Scopus

- Nearly 19,000 titles
  - 18,000 peer-reviewed
  - 1,800+ open access
  - 400 trade publications
- 45.5 million records
  - 24.5 million with references dating to 1996
  - 21 million dating back to 1823
- Updated daily
- MeSH and Emtree keyword searching
- Citation Tracker
- Author Identifier
  - Affiliation search
- 4.6 million conference papers
<table>
<thead>
<tr>
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<th>Author(s)</th>
<th>Date</th>
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<tbody>
<tr>
<td>Isoforms of the heteropteran Nezara viridula ecysone receptor: Protein characterisation, RH5992 insecticide binding and homology modelling</td>
<td>Tohidi-Esfahani, D., Lawrence, M.C., Graham, L.D., Hannan, G.N., Simpson, A.M., Hill, R.J.</td>
<td>2011</td>
<td>Pesti Management Science 67 (11), pp. 1457-1467</td>
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<td>Wisdom of group forecasts: Does role-playing play a role?</td>
<td>Onkal, D., Zeynep Sayim, K., Lawrence, M.</td>
<td>2011</td>
<td>Omega</td>
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<tr>
<td>Lipopolyplex ternary delivery systems incorporating C14 glycerol-based lipids</td>
<td>Kirdsinova, I., Fridrich, B., Ho, J., Mustapa, M.F.M., Campbell, F., Velsler, K., Kepoler, M., (-), Lawrence, M.J.</td>
<td>2011</td>
<td>Molecular Pharmaceutics 8 (5), pp. 1831-1847</td>
<td>0</td>
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<td>Manipulations of the relationship between response alternatives and exogenous saccade latencies</td>
<td>Lawrence, B.M., Weaver, J.S.</td>
<td>2011</td>
<td>Experimental Brain Research 214 (2), pp. 214-217</td>
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### Affiliation results: 33

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<th>Country</th>
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<td>University Michigan Ann Arbor</td>
<td>113077</td>
<td>Ann Arbor</td>
<td>United States</td>
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<tr>
<td>Michigan State University</td>
<td>71929</td>
<td>East Lansing</td>
<td>United States</td>
</tr>
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<td>University of Michigan Medical School</td>
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<td>Ann Arbor</td>
<td>United States</td>
</tr>
<tr>
<td>University of Michigan Hospital</td>
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<td>United States</td>
</tr>
<tr>
<td>University of Michigan</td>
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<td>Ann Arbor</td>
<td>United States</td>
</tr>
</tbody>
</table>
Sources: Grey literature

- “Information produced on all levels of government, academic, business and industry in electronic and print formats not controlled by commercial publishing, i.e., where publishing is not the primary activity of the producing body”

- Types
  - Conference abstracts (Conference Papers Index)
  - Clinical trials (ClinicalTrials.gov)
  - Government reports, documents (.gov, CABI)
  - Dissertations (ProQuest Dissertations and Theses)
  - Unpublished manuscripts

  - Unpublished studies can be a good source of unreported negative results
Sources: Other options

- Examine the references of articles of relevance
  - Included studies and relevant reviews
- Use cited by features
- Contact authors
- Snowballing (esp for complex questions or interventions)
- Contact companies, organizations, societies, etc
- Hand search important journals (by Impact Factor, perhaps)
- Search for ongoing studies (prelim data)
  - Clinicaltrials.gov ; controlled-trials.com (ISRCTN)
- Citation tracking
Search Completion

- Documentation
- Reporting
- Citation Management
Search Completion: Documentation

- Important to document exact search terms
- MeSH Terms?
- Keywords?
- Limits?
- Filters?
- Databases?
- Dates?
- Save strategy

<table>
<thead>
<tr>
<th>#</th>
<th>Concept 1 / Term(s)</th>
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</table>
See PRISMA statement

“The aim of the PRISMA Statement is to help authors report a wide array of systematic reviews to assess the benefits and harms of a health care intervention. PRISMA focuses on ways in which authors can ensure the transparent and complete reporting of systematic reviews and meta-analyses.”

<table>
<thead>
<tr>
<th>Section/topic</th>
<th>#</th>
<th>Checklist item</th>
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<tr>
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<td>7</td>
<td>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.</td>
</tr>
<tr>
<td>Search</td>
<td>8</td>
<td>Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.</td>
</tr>
</tbody>
</table>
See Cochrane Handbook

http://www.cochrane-handbook.org/

Part 2, Chapter 6, Section 6.1: “Documenting the Search Process”:

“It should be borne in mind at the outset that the full search strategies for each database will need to be included in an Appendix of the review.”
Search completion: Reporting

- See Cochrane Handbook
    - Section 6.6

- **In study flow diagram:**
  - number of unique records identified by the searches;
  - number of records excluded after preliminary screening (e.g. of titles and abstracts); and
  - number of records retrieved in full text
Search completion: Reporting

- See Cochrane Handbook
  - Section 6.6

- In abstract:
  - List all databases searched.
  - Note the dates of the last search for each database or the period searched.
  - Note any language or publication status restrictions (but refer to Section 6.4.9).
  - List individuals or organizations contacted.”
Search completion: Reporting

- See Cochrane Handbook
    - Section 6.6

- In methods:
  - List all databases searched.
  - Note the dates of the last search for each database AND the period searched.
  - Note any language or publication status restrictions
  - List grey literature sources.
  - List individuals or organizations contacted.
  - List any journals and conference proceedings specifically handsearched for the review.
  - List any other sources searched (e.g. reference lists, the internet).
## Search completion: Citation mgmt

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<th>Endnote</th>
<th>Refworks</th>
<th>Zotero</th>
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<td>$100*</td>
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<td>Yes (Firefox, Chrome, others)</td>
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<td>800+</td>
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*Source: http://guides.lib.umich.edu/citationmanagement*
## Search completion: Citation mgmt

### Distinguishing Characteristics

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<td><strong>Web-based</strong></td>
<td>No (and yes)</td>
<td>Yes</td>
<td>Yes (Firefox, Chrome, others)</td>
</tr>
<tr>
<td><strong>Database imports</strong></td>
<td>700+</td>
<td>800+</td>
<td>Some (not EMBASE, but YouTube, Amazon)</td>
</tr>
<tr>
<td><strong>Output styles</strong></td>
<td>3700+ (customize)</td>
<td>800+ (customize)</td>
<td>1250+ (customize)</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Unlimited (100000)</td>
<td>Unlimited</td>
<td>Unlimited</td>
</tr>
<tr>
<td><strong>Learning curve</strong></td>
<td>High</td>
<td>Lowish</td>
<td>Low</td>
</tr>
<tr>
<td><strong>File attachments</strong></td>
<td>Yes</td>
<td>Yes (limited space)</td>
<td>Yes (not easy to share)</td>
</tr>
<tr>
<td><strong>Collaborate</strong></td>
<td>Best for single users; Endnote web</td>
<td>Shared account</td>
<td>Public groups</td>
</tr>
</tbody>
</table>

Source: [http://guides.lib.umich.edu/citationmanagement](http://guides.lib.umich.edu/citationmanagement)
Customization:

Most citation management products allow for varying levels of customization. If key elements of articles (such as the reason why they are important to the systematic review) do not appear in the standard citation formation, you can edit/annotate for key data.
Recap

- Spend time developing your search
- Search multiple databases
- Test your searches
- Take notes during process to facilitate reporting
- Manage citations
- Consult an expert searcher

Search again:
- Locate comments on & reviews of studies found
- Find subsequent studies which confirm, refute or refine earlier ones
- Identify authors of studies so their other work can be searched and evaluated